HOW MATH AVOIDANCE INFLUENCES DEGREE COMPLETION FOR BIBLE COLLEGE STUDENTS: A CASE STUDY OF A SMALL, PRIVATE INSTITUTION IN UPSTATE NEW YORK

by

Bonnie Cecile Novak

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

The purpose of this instrumental case study was to describe math perception and avoidance for ministerial undergraduate students at a small, private Bible college in upstate New York. In the research, math avoidance was generally defined as the participants' perception of math, their delay in completing a credit-bearing math course until their senior year or not at all, and their own learning or degree completion as a result. The theories guiding this study were Tinto's Retention Theory/Model of Institutional Departure, Bandura's Social Cognitive Theory, and Estep's Theory of Christian Formation. The central question was: How does math avoidance influence persistence toward degree completion for ministerial students at New York Bible College? Research questions were as follows: (1) How does math remediation influence students' math perception? (2) How does math perception influence students' math avoidance? (3) How are students influenced in math avoidance by faculty, administration, or other revered individuals? Data was gathered from 16 participants through interviews, a focus group, a follow-up written interview, and a reflective journal entry. Data indicated that participants experienced discouragement, a sense of dread, a history of aversion to math at the site, a struggle to understand math, feelings of inadequacy and frustration, and ineffective methods of teachers, all of which led to delay in taking math and questioning of the college's decision to require math as well as relevance of math to career, ministry, and life. Findings also indicated that faculty, tutors, parents, and peers can influence students either positively or negatively to overcome math avoidance, with faculty being the most influential.

Keywords: mathematics, avoidance, retention, higher education, college, perception

Dedication

I dedicate this manuscript to my husband, Karl Novak, who has patiently endured the rollercoaster ride throughout this long, arduous journey. He read my chapters even when he did not want to, just because I asked. He did the laundry and kept the house while I wrote and edited for hours, days, and weeks in the basement.

I would also like to dedicate this manuscript to my colleagues who are math professors, particularly Barbara Tumlinson, who year after year has taught math courses in a community college with determination, dedication, tenacity, and love for her students. I applaud and honor you.

Acknowledgments

Several individuals played key roles in my success of completing this project. First and foremost is my Research Consultant and professor Dr. Lucinda Spaulding. Secondly, are my physical therapists Nadine, Sergio, Linda, and Jenna, who taught me to walk again after my stroke. Thirdly, are my colleagues, students, and church members who became my cheerleaders. Fourthly, are my Chair, Dr. Jennifer Courduff, and my Committee members, Dr. Charlie Colton and Dr. JoAnna Oster, whom I also count as friends.

However, my most supportive fan of all throughout my entire life probably did not live to see me receive this diploma, but will have to view my graduation from Heaven. My Dad (or Daddy, as I called him) died of Parkinson's Disease on March 22, 2015. Although Daddy's backwoods Alabama education left him lacking in spelling, grammar, and reading skills, he determined that my brother, my sister, and I would get the best education our family could afford in the public school system of Columbus, Mississippi. Daddy encouraged each of us in all of our endeavors, academic and otherwise. When I told him I was working on my doctorate, his eyes lit up, and he beamed with pride for me; he asked how my studies were going every time I saw him until the last Friday that I sat by his bedside and watched his comatose body breathe. On Sunday, he breathed his last, and God freed him from his broken body and took him home. From the days when I was three years old dancing and singing for his Lays Potato Chips customers while he restocked the shelves, through my bachelor's and master's degrees and now my doctorate, Daddy always wanted one thing for me—success, and he cheered me on all the way. I thank God for him and Mom, both Godly parents.

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List of Abbreviations

Associate of Applied Science (AAS)

Association for Biblical Higher Education (ABHE)

Association of Baptists for World Evangelism International (ABWE)

Bachelor of Arts (B.A.)

Bachelor of Religious Education (BRE)

Bachelor of Science (B.S.)

College Level Examination Program (CLEP)

Institutional Review Board (IRB)

Math Anxiety (MA)

Master of Arts (M.A.)

Middle States Commission on Higher Education (MSCHE)

New York State Education Department (NYSED)

Practical Bible College (PBC)

Practical Bible Training School (PBTS)

SEND International (SEND is not an abbreviation)

CHAPTER ONE: INTRODUCTION

Overview

Mathematics is necessary for life and ministry as well as a required course for almost every bachelor's degree and most associate's degrees (Association of Baptists for World Evangelism, 2014; Duncan et al, 2007; Joyce, 2010; Kamenetz, 2014; MSCHE, 2014; National Center for Public Policy and Higher Education, 2010; NYSED, 2014; SEND International, 2014; Stewart, 2010; Zimmerman, 2015). Although college students use math almost every day in shopping, playing music, gaming, and doing many rudimentary activities of life, when it comes to taking a math course for credit, many experience anxiety and angst and attempt to avoid the course altogether. Despite a nationwide attempt to remediate students' math skills and the situation in hopes of alleviating this problem, certain college students still demonstrate high levels of math avoidance throughout their college careers (Beilock & Willingham, 2014; *Diploma to Nowhere*, 2008; Helal, Hamza, & Hagstrom, 2011; Legg & Locker, 2009; National Conference of State Legislatures, 2011). The purpose of this case study was to describe math avoidance for ministerial undergraduate students and alumni at a small, private, 116-year-old Bible college in upstate New York. In the research, math avoidance was generally defined as the participants' perception of math, delay in completing a credit-bearing math course until their senior year, preferably the last semester of their final year, or not at all, and their own learning or degree completion as a result (Latiolas & Lawrence, 2009; Lee, 2012; Legg & Locker, 2009; Nadworny & Kamenetz, 2014). In certain cases, the students' own perception of their math ability is viewed as negative by the students themselves, even though this may not be true (Beilock & Willingham, 2014; Niazi, Adil, & Malik, 2013; Zimmerman, 2015). The theories guiding this study were Tinto's Retention Theory/Model of Institutional Departure (Tinto, 1993,

2012) as it explains why college students succeed or fail to complete degree programs, Bandura's (1986, 1997) Social Cognitive Theory as it applies to self-efficacy of adult students, and Estep's (2010) Theory of Christian Formation as it describes the effects that mentoring faculty have on students.

Background

One issue that arises every semester when registration rolls around at New York Bible College (pseudonym) is the three-credit hour mathematics course that all Bachelor of Religious Education (BRE) students are required to pass in order to get the degree (New York State Education Department, 2014). Although Mathematics I is a very basic course and was originally placed in the first semester of the freshman year, then moved to the sophomore year and finally to the fall semester of the junior year where the requirement was changed to a math elective, many students refuse to take Math I or a math elective until their senior year, preferably during the spring semester of that year. In the past, some students have been required to take two remedial math courses prior to enrolling in one required credit-bearing course. The adding of remedial courses to a student's schedule could influence his or her persistence toward completing the degree in a timely manner (Tinto, 2012). The general consensus of many students who are majoring in ministerial related fields has been: Why do I need a math course? I'm going to be a pastor/youth minister/church planter/missionary/etc., and I will have a treasurer (in a large church) to take care of money matters. Nevertheless, every year, 3,000 to 4,000 churches and other Christian ministries close alongside businesses because they cannot complete or adhere to an effective budget (Patsuris, 2002; Stetzer, 2004). Students have the perception that the math course is a waste of time and money for them; that they will never use the lessons that are to be learned; and perhaps if they put off taking the course long enough, it will just go away from the

list of required courses to complete the degrees. Of course, educators know this is untrue (Joyce, 2010; National Center for Public Policy and Higher Education, 2010; National Conference of State Legislatures, 2011; New York State Education Department, 2014; Stewart, 2010). Decision makers also realize that these students live in a global society (Stewart, 2010) where they will be competing and interacting with others who have acquired the necessary skills to be successful in life (Joyce, 2010). Therefore, in order to minister to the world in which they live, these students must pass at least one math course with enough knowledge to survive in their chosen ministerial career and be able to relate to those whom they hope to reach for Christ (ABWE, 2014; SEND International, 2014). However, at New York Bible College, of the seven 2014-2015 missions-related concentration graduates, four postponed taking math until the senior year. According to Administrative Assistant to the Provost N. Saravanapavan, 10 out of the 45 BRE 2014-2015 graduates waited until the senior year to take math. Of those 10, two chose to test out via College-Level Examination Program (CLEP) tests during Christmas break, and two others showed no record of having taken a math course nor enrolling in one for Spring 2015 (e-mail communication, November 25, 2014). This reflects the national average. Nationally, three-fourths of college students who experience math avoidance fail to complete any college program (Bahr, 2012) and 25% of four-year college students avoid math (Beilock & Willingham, 2014). For example, one of my advisees, a BRE counseling senior who has attended the college for four years and passed two remedial math courses, contacted me on Facebook and asked to change her degree program from the BRE to an AAS in order to avoid taking Math I (J. Richards, personal Facebook communication, November 27, 2014).

When the why of math avoidance is mentioned in conversation, the first and most common response and assumption for the cause is math anxiety or math ineptitude. However,

that is not always the case; therefore, one should not assume such. Once, a senior pastoral student sat in my office and told me that even though he is good at math and does not have math anxiety, he avoided taking the math course until the fall semester of his senior year because he could not afford the $100 textbook. He explained that for most of his other courses he could use the texts on reserve in the library or forego reading the textbooks and just take thorough notes in class. However, the math textbook was a necessary purchase in order to do the homework (R. Oliver, personal communication, November 11, 2014). This incident suggests that perhaps finances, in particular the cost of the textbook, could be a factor that influences math avoidance.

Another factor that complicates matters and perhaps adds to the problem is the fact that a number of the Bible college professors never had to take a mathematics course to obtain their bachelor's degrees. These professors earned bachelor's degrees in religious, ministerial or Bible disciplines, and the Bible colleges they attended at that time did not require a math course as part of the general education requirements. Of course, their master's degrees and doctorates were not in math-related fields, so, with the exception of a statistics course or two, math was not required of them in these programs either. This may demonstrate Estep's (2010) Theory of Christian Formation which suggests that underlying attitudes toward certain subjects are caught from those in authority rather than taught in the classroom. Christians who have been a part of ministerial service for any length of time can attest to the fact that ministers need to know math (ABWE, 2014; Joyce, 2010; Patsuris, 2002; SEND International, 2014; Stewart, 2010). Not only do they need to know math and know it well enough to function as a pastor or missionary, but also these future leaders of the flock need to recognize the required math course as an essential ingredient for gaining this necessary math knowledge.

A positive attitude toward the study of mathematics is not something that can be taught by the professor; rather, it is something that must be caught by the students both inside the classroom and in relationships between the faculty and students outside the classroom (Estep & Kim, 2010; Tinto, 2012). This is invaluable to students, and the positive attitude actually needs to go beyond just a resignation to take the course with a smile. This attitude needs to embody desire to take the math, realization that this course is vital to preparation for life in the ministry, and a hunger for the knowledge the course will impart. This is probably the most difficult value to promote simply because it must be done after the student has registered for the class and started, hopefully, attending, per the college's attendance policy as stated in the syllabus (See Appendix B).

New York Bible College (pseudonym) began as a Bible training school in 1900 as a non-accredited institution offering a one-year Bible certificate and a three-year diploma, with both programs composed entirely of Bible courses. From 1900 until 1993, the school neither offered liberal arts/general education courses nor required them for completion of a program. It was during this period that many of the current professors and administrators who are alumni of the school completed undergraduate degrees. In 1985, the school earned accreditation with the Association for Biblical Higher Education (ABHE). Then, in 1993, the institution became a Bible College, earned New York State Education Department (NYSED) accreditation, and was granted authorization by New York State Education Department to grant an Associate of Applied Science (AAS) degree and a Bachelor of Religious Education (BRE) degree. It was at this time that liberal arts/general education courses such as mathematics were added to the curriculum. At first, these courses were added on to the three-year diploma as a senior or fourth year, but by 2004, the liberal arts courses had been moved into the freshman year to match the typical

curriculum of other colleges. This is when math became a required course for degree completion of the BRE. During 2004, the institution changed its name again. In 2005, New York Bible College was accredited by Middle States Commission on Higher Education (MSCHE), and it has maintained all three accreditations.

Situation to Self

I grew up in a Christian home and committed my life to Christ at age five, married a minister at age 17 and attended Bible college with him until I was pregnant with our first child. After being out of school for a number of years, I returned to college and earned a B.A. in journalism and M.A. in English from state universities in the South. I am presently working on an Ed. D. at Liberty University. This will be my first degree from a Christian college. My spiritual journey brought me to New York, where my husband and I planted Lakeshore Baptist Church. In spring 2016, I finished my twelfth year at a local Bible college, where I worked full-time as the Teaching English as a Second Language Concentration Chair and the Liberal Arts Division Chair, among other things. When I first came to the school of ministry, I felt that it needed to upgrade to a Christian liberal arts school, but over the years I realized that it has its niche and should remain true to its origin as a Bible college established in 1900. The college still maintains its distinction as a Bible college, with a focus on Biblical studies. It does not have a liberal arts focus, although liberal arts are required as part of the college's associates' and bachelors' degrees, per the policies of its accrediting entities New York State Education Department and Middle States Commission on Higher Education.

I am passionate about training young men and women to become great ministers of God and sending them out to serve. Presently, I have graduates scattered all over the world. As the Liberal Arts Division Chair, I was concerned about the writing skills and math skills of

underprepared students. I can fix writing issues because that is where my strengths lie, but math is seemingly more difficult to fix in students. I have compassion for them in their struggles, and I can relate to them as I experienced math avoidance in my undergraduate program, waiting until my senior year to take College Algebra I (the one required math course for my major). I have a personal concern for students who have a calling and motivation for ministry but who struggle with math skills, avoidance, and anxiety because I know first-hand that math skills are required to do well in ministry.

As the Liberal Arts Division Chair of the college and a member of the Curriculum Committee at New York Bible College, I had a vested interest in this matter; one of the assumptions was axiological. As a lifelong student who has also experienced math avoidance when I was earning a Bachelor of Arts, I acknowledge that this research is laden with values and that I have certain biases as the researcher (Creswell, 2013). I positioned myself inside the study (Creswell, 2013). Therefore, this study included a discussion of the values which formed the stories of the participants and my own interpretations as well as the interpretations of the participants (Creswell, 2013). The choice for this qualitative design was founded in a primary worldview that is based on a transformative framework and belief that knowledge is not without bias (Creswell, 2013) and that it should be used to improve higher education, people, and, thus, the world. Pragmatism was the paradigm that guided the study. It is disappointing to see young men and women who have a desire to serve Christ enter a higher education school of ministry with hopes of completing a bachelor's degree only to leave college a few years later without that degree because a math course stood in the way. As the researcher, I can be a catalyst for change and improvement of the Bible college where I worked, and if I can make education more attainable for all students who desire to enter the ministry with a bachelor's degree, then I will

possibly have improved the lives of those graduates. Subsequently, because math avoidance is a nationwide issue, the implications of this study could apply to many other colleges (Beilock & Willingham, 2014).

Problem Statement

Some students are entering college hoping to avoid taking a math course; however, they are discovering that they must pass a basic math course to complete degrees (Beilock & Willingham, 2014; Tinto, 1993; Tinto, 2012). According to Beilock and Willingham (2014), 25% of four-year college students and 80% of community college students experience math anxiety leading to math avoidance. Math avoidance poses frustrating problems for administrators in higher education because they realize that they cannot simply remove the math requirement from the degree program without jeopardizing the college's accreditation and credibility (National Center for Public Policy and Higher Education, 2010; MSCHE, 2014; NYSED, 2014). However, at the same time, in a Bible college, decision makers do not want to prevent ministry-focused students from completing four-year programs solely based on a three-credit-hour math course. This problem also makes a difference in how entire college programs are structured for two reasons: (a) Students with math avoidance will try to put off taking the required math course until the senior year; and (b) depending on the nature of their math perception and/or lack of readiness which could be attributed to math anxiety (Ashcraft & Krause, 2007; Jain & Dowson, 2009; Lee, 2012; Standing, 2006), students may be required to take two or more remedial math courses prior to enrolling in one required credit-bearing course, which could influence persistence toward completing the degrees in a timely manner (Tinto, 2012).

Although math anxiety has been studied both quantitatively and qualitatively in secular universities where math has been a part of the curriculum since the founding of the institutions,

there is an empirical gap in the literature where it concerns students of ministry and Bible colleges, particularly those which operated for decades without a math requirement for graduation. While pastors and missionaries need certain math skills for ministries, little has been explored in this area and very little qualitatively in any context.

Purpose Statement

The purpose of this instrumental, single-site case study was to describe math avoidance for ministerial undergraduate students at a small, private, 116-year-old Bible college in upstate New York. In the research, math avoidance was generally defined as the participants' perception of math, delay in completing a credit-bearing math course until the senior year, preferably the last semester of the final year, or not at all, and their own learning or degree completion as a result (Latiolas & Lawrence, 2009; Lee, 2012; Legg & Locker, 2009; Nadworny & Kamenetz, 2014). The theories guiding this study were Tinto's Retention Theory/Model of Institutional Departure (Tinto, 1993, 2012) as it explains why college students succeed or fail to complete degree programs, Bandura's (1986, 1997) Social Cognitive Theory as it applies to self-efficacy of adult students, and Estep's (2010) Theory of Christian Formation as it describes the effects that mentoring faculty have on students.

Significance of the Study

The purpose of this study was to describe how ministerial students enter college with a perception of math that influences avoidance and what professors and administrators can do about it so that these students can graduate in a timely manner. In many cases, math avoidance is associated with math anxiety, which is associated with a lack of math readiness (Ashcraft & Krause, 2007; Jain & Dowson, 2009; Lee, 2012; Standing, 2006). Consequently, many students who experience math avoidance also experience math anxiety and are underprepared in math

skills for the college level (Joyce, 2010; National Center for Public Policy and Higher Education, 2010; Stewart, 2010). However, this is not always the case. This study investigated to what extent math avoidance influences a student's college experience and how closely connected math avoidance is to attrition and degree completion in the small Bible college setting.

Since the focus of the study was on math avoidance at the college level, literature related to this issue was reviewed. Most of the research was quantitative in design, focusing more on correlation, numbers, and percentages than on feelings, behaviors, and perceptions of students; therefore, a qualitative design was chosen to focus on the whys of math avoidance. While math avoidance can be associated with math anxiety and with lack of college readiness, and since remedial education also comes up in almost every discussion about math avoidance, anxiety or readiness, sources dealing with remedial courses were evaluated. Several studies indicated this connection (Ashcraft & Krause, 2007; Jain & Dowson, 2009; Lee, 2012; Standing, 2006). Every year approximately 60% of first-year college students discover that they are not academically prepared for college, particularly in math and English/language arts (National Center for Public Policy and Higher Education, 2010). Six longitudinal studies confirmed that one of the strongest predictors of later achievement in college is math skills, and that early math skills are an even better predictor of success than reading skills (Duncan, et al., 2007). Even Tinto (2012) admitted that students simply being put into remedial courses did not guarantee successful completion of a degree. Other topics that appeared several times in the literature and, therefore, seemed poignant enough to include were gender (Combs et al., 2010; Helal et al., 2011; Jain & Dowson, 2009; Thilmany, 2009), self-efficacy (Bandura, 1986; Jain & Dowson, 2009; Perry, 2004; Standing, 2006), and working memory (Ashcraft & Krause, 2007; Jain & Dowson, 2009; Sparks, 2011) in conjunction with math avoidance.

This study is significant to the site selected for two reasons. First, the college has made several failed attempts to study its math dilemma for years, so this research was needed and timely. Second, this research will help the college in future curriculum design and course offerings. Subsequently, because math avoidance is a nationwide issue, the implications of this study could apply to many other colleges (Beilock & Willingham, 2014). Although math anxiety has been studied both quantitatively and qualitatively in secular universities where math has been a part of the curriculum since the founding of the institutions, there is an empirical gap in the literature where it concerns students of ministry and Bible colleges, particularly those which operated for decades without a math requirement for graduation. While pastors and missionaries need certain math skills for ministries, little has been explored in this area and very little qualitatively in any context.

This study is also of significance to higher education in general and to small, private colleges in particular. Colleges need to consider qualitative as well as quantitative research when redesigning curriculum and math courses. The goal of this research study was to give a voice to invested parties, particularly students and faculty, who have been affected by math avoidance, either in degree completion or in helping others toward degree completion. Although math avoidance has been studied and explored from the angles of math anxiety, math readiness, math remediation, and gender, the majority of the studies have been conducted in large, public universities or community colleges (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Bahr, 2012; Beilock & Willingham, 2014; Combs et al., 2010; Duncan et al., 2007; Finlayson, 2014; Helal et al., 2011; Jain & Dowson, 2009; Latiolas & Lawrence, 2009, Lee, 2012; Legg & Locker, 2009; Sloan, 2010; Sparks, 2011; Standing, 2006; Thilmany, 2009), where serving Christ is not a primary factor or motivation for completion of a degree. It is known from these

studies that math anxiety, self-efficacy, and lack of math readiness play a role in math avoidance, and that gender may or may not have any bearing on math avoidance. It is also known that math anxiety affects self-efficacy and working memory, and that as a result, students avoid math courses, even though at least one is required for degree completion. Researchers Howard (2008) and Koch, Slate, and Moore (2012) have called for more qualitative studies on experiences of students who do not persist in math courses (Cordes, 2014). The significance of this study is that it will begin to fill that gap and provide a catalyst for future qualitative research in this area.

Examining math avoidance among Bible college students, whose motivation is service and ministry, may offer further insight into the perceptions of and attitudes toward math that exist across all college settings (Estep & Kim, 2010). Even though a multitude of articles, books, and studies have been written on math avoidance, a gap in the literature still exists in exploring the inner perceptions of math and the reasons behind the math avoidance in students who otherwise accept and willingly complete all other liberal arts courses in degree completion requirements in a Bible college program. This leaves a gap in the literature as there are very few if any studies exploring others causes for math avoidance, and, until now, none had been conducted at a small, private college of ministry where the emphasis has historically been on Biblical and professional studies and where faculty and other revered individuals play a strong mentoring role in students' spiritual and educational formation. This study will begin to fill that gap. The findings of this study could also be applied to other small college settings, high schools, middle schools, and even elementary schools. The hope is that through this study, one can find some understanding of the students' math avoidance and some better solutions than the cumbersome program of remedial math courses, not only for the sake of the students, but also for

the sake of the college and for other students in similar colleges, particularly as this issue influences retention and degree completion.

Table 1.1

Significance of the Study—Site data matches nation data

At the Site:	Nationally:
25% of the 2015 seniors avoided math until their final year	25% of four-year college students experience math avoidance
Affects curriculum design	75% of college students who experience math avoidance fail to complete a program
Attitude	80% of community college students experience math avoidance
Perception	
Attrition, degree completion	

Research Questions

In this instrumental, single-site case study, the central question was: How does math avoidance influence persistence toward degree completion for ministerial students at New York Bible College? Research questions guiding the study were as follows:

(1) How does math remediation influence students' math perception?

Although a number of studies have been done on math remediation and the influence of remedial math courses on students' math perception (Bahr, 2008; Cordes, 2014; Howard & Whitaker, 2011; Standing, 2006; Tinto, 2012), the conflicting results are inconclusive. Some studies demonstrated that math remediation was a positive influence in students' math perception, while others concluded the opposite.

(2) How does math perception influence students' math avoidance?

Various studies have been done on how math perception influences students' math avoidance, and a number of studies focused on underlying causes of positive or negative math perception (Baloglu & Zelhart, 2007; Bandura, 1986; Beilock & Willingham, 2014; Helal et al., 2011; Jain & Dowson, 2009; Legg & Locker, Jr., 2009; Perry, 2004; Thilmany, 2009). All of the studies demonstrated that math perception does influence students' math avoidance, but results focusing specifically on *how* math perception influences math avoidance have been varied and inconclusive.

(3) How are students influenced in math avoidance by faculty, administrators, or other revered individuals?

Literature supports the concept that students are influenced in math avoidance by revered individuals in their lives (Beilock & Willingham, 2014; Estep & Kim, 2010; Kamenetz, 2014; Perry, 2004; Sloan, 2009; Strauss, 2014). However, *who* those revered individuals are can vary greatly from student to student and from study to study.

Research Plan

This research was conducted with a qualitative design. College educators need to know why many students have math avoidance, how this phenomenon is experienced, and what the institution can do about it so that students can successfully complete a degree program; therefore, a qualitative study is the best method. A case study explores a common issue in its real-world setting (Yin, 2014). Therefore, this approach was selected because I was studying the problem of math avoidance in a single-site case. A case study requires collecting data from varying participants across the bounded system of the single site, including all levels from the top down; therefore, a case study approach provided the depth that was needed to adequately research this problem at this particular site.

I selected a case study design because it allowed me as the researcher to probe deeply into the experiences of the participants within a bounded system as defined by Stake (1995), gain an in-depth understanding of the issue, and provide opportunity for participants to have a voice in offering solutions to this problem in this setting and other similar settings. I considered using a phenomenological approach to this research because math avoidance transcends all colleges and is prevalent in schools below the university level as well. However, the uniqueness of the setting fit better with a case study. This uniqueness rests in the fact that New York Bible College started out as a Bible institute and graduated students for 93 years without any liberal arts or math requirements. Seven out of fifteen resident professors plus the college president are graduates of the institution. The president and three of those seven completed degrees at the college without a math requirement. All the other regionally accredited Christian liberal arts or Bible colleges in the state required math as part of the associate's and bachelor's degrees from the beginning. So, I have questioned whether or not this uniqueness plays a role in fostering the math avoidance among the students. Only through deep case study research would the answer to this question be found. In order to give the participants a voice and a sense of buy-in, participants were called co-researchers, as suggested by Moustakas (1994); consequently, the term or title gave the participants a sense of empowerment in their desire to make a difference at the site and in other settings (Creswell, 2013). I chose a qualitative study design because this design is founded in a primary worldview that is based on a transformative framework and belief that knowledge is not without bias (Creswell, 2013) and that it should be used to improve higher education, people, and, thus, the world. An instrumental case study design allowed the researcher to investigate a real-life, contemporary issue through detailed data collection involving various sources of information and report the case's themes (Creswell, 2013), gain an in-depth understanding of the

issue, and provide opportunity for the participants to have a voice in offering solutions to this problem in this setting and other similar settings.

Delimitations

I selected a case study approach because I wanted to study math avoidance in this particular school (Yin, 2014). I studied how students' interaction with math such as signing up for a math course, taking a math assessment, and/or experiencing math in any way influenced persistence in four-year degree completion. A purposeful sample from among students and alumni was invited and selected to participate based on volunteerism. Faculty participants were invited and selected based on their own math experiences and experiences with struggling math students; math professors were asked to participate. The 16 participants were all over the age of 18, current students and faculty of the college; alumni were a mixture of both BRE graduates and AAS graduates. All participants were required to sign a Consent Form (See Appendix A). I limited the groups as follows: (a) Current student participants were limited to main campus students who identified themselves as expressing math avoidance or who expressed an interest to participate; (b) Alumni participants were limited to those who avoided Math I until the senior year, took an alternative course other than Math I, or failed to complete the four-year degree because of math avoidance; (c) Faculty participants were limited to the school's two math professors, any Bible professors who were not required to take a math course for a bachelor's degree, and the professor who has experience overseeing struggling students. The decision to limit the study to one small, private college was based on three reasons. First, this was a convenience setting for me. Second, the college has made several failed attempts to study its math dilemma for years, so this research was needed and timely. Third, this research will help the college in future curriculum design and course offerings. Since the participants were

scattered geographically, I used technology and online resources such as a digital voice recorder, Skype, and Go-to-Meeting to gather data.

Summary

Chapter 1 introduced the problem which will be explored in this qualitative case study—math perception and avoidance at New York Bible College. This chapter offered background information on the college and the problem and discussed the situation to self of the researcher. It also presented the problem statement, purpose statement, significance of the study, research questions, research plan, and delimitations and limitations of the study.

Colleges need to consider quantitative as well as qualitative research when redesigning curriculum and math courses. The goal of this research study was to give a voice to invested parties, particularly students, alumni, and faculty, who have been affected by math avoidance, either in degree completion or in helping others toward degree completion. Bandura (1986), Estep (2010), and Tinto (2012) provided the theoretical framework for this study and are key in clarifying and intersecting self-efficacy (Bandura, 1986), spiritual formation (Estep, 2010), and degree completion (Tinto, 2012).

CHAPTER TWO: LITERATURE REVIEW

Overview

The problem of math avoidance, which has permeated higher education across all genres for decades, appears to be on the increase, posing problems for administrators and students alike. The purpose of this instrumental case study was to describe math avoidance for undergraduate students at a small, private Bible college in upstate New York. Most of the research I found was quantitative in design, focusing more on numbers and percentages than on feelings and perspectives of students, teachers, and tutors. Since math avoidance can be associated with math anxiety and/or lack of college readiness, several sources that analyzed these issues were evaluated. Since remedial education also comes up in almost every discussion about math avoidance, anxiety, or readiness, sources dealing with remedial courses were evaluated too. Two other topics that appeared several times in the literature and, therefore, seemed poignant to include were self-efficacy and working memory in conjunction with math avoidance. As these issues affect student performance, academic capability, and retention, they needed to be included in the review.

Theoretical Framework

Since this study focused on students' perceptions of math—performing math operations, taking math courses, avoiding math courses—and how math avoidance may affect degree completion, three theories were studied: Tinto's (1993) Theory of Individual Departure from Institutions of Higher Education and his follow up book, *Completing College: Rethinking Institutional Action* (2012), Estep's (2010) Theory of Christian Formation, and Bandura's (1986) Social Cognitive Theory (See Figure 2.1).

Vincent Tinto (1993), in his Theory of Individual Departure from Institutions of Higher Education, posited that both social and academic integration into the college community are vital to the persistence of students. He contended that a student can become deeply involved in the social aspects of the college, surrounded by peers, but still leave without completing a degree because that student lacks the ability to become an accepted, competent member of the academic society of the college (Tinto, 1993). Tinto (1993, 2012) emphasized the important role that faculty play both inside and outside the classroom in the retention of students. Tinto (2012) acknowledged that regardless of years, time, and money spent by institutions on disconnected efforts to retain students, most of these actions marginally address students' educational lives and neglect the main area, the one and sometimes only place, where students and faculty connect with each other and participate in formal learning situations: the classroom. As a result, even though institutions have invested in remedial courses, tutoring services, and a host of social events, retention of students remains an issue. Tinto (2012) advised colleges and universities that if these institutions of higher education want to significantly increase retention and graduation, they must focus efforts and finances on improving the classroom experience, especially for students who have a history and background prone to failure. Christian education theorist, J. R. Estep (Estep & Kim, 2010) echoed Tinto, emphasizing that the resolution to the problem of retention and completion most often occurs as students interact with faculty and staff inside and outside the classroom in settings where mentoring relationships are intentionally formed. Both Tinto (2012) and Estep (2010) put an emphasis on faculty and positive classroom experiences as the key to student perseverance and retention on to graduation as well as healthy development into self-reflective, mature adults, and Bandura's (1986, 1997) emphasis on self-efficacy as the key to student success implied that faculty interaction with students can either build or destroy

that self-efficacy (See Table 2.1). Tinto (2012) contended that simply placing students in remedial courses did very little to guarantee retention, but actually completing a course led to students' ultimate success. Moreover, Tinto (2012) found that students' sense of how strongly the college supported their academic, as well as personal and social needs was the most powerful predictor of increased academic proficiency during the initial year (See Table 2.2).

Table 2.1

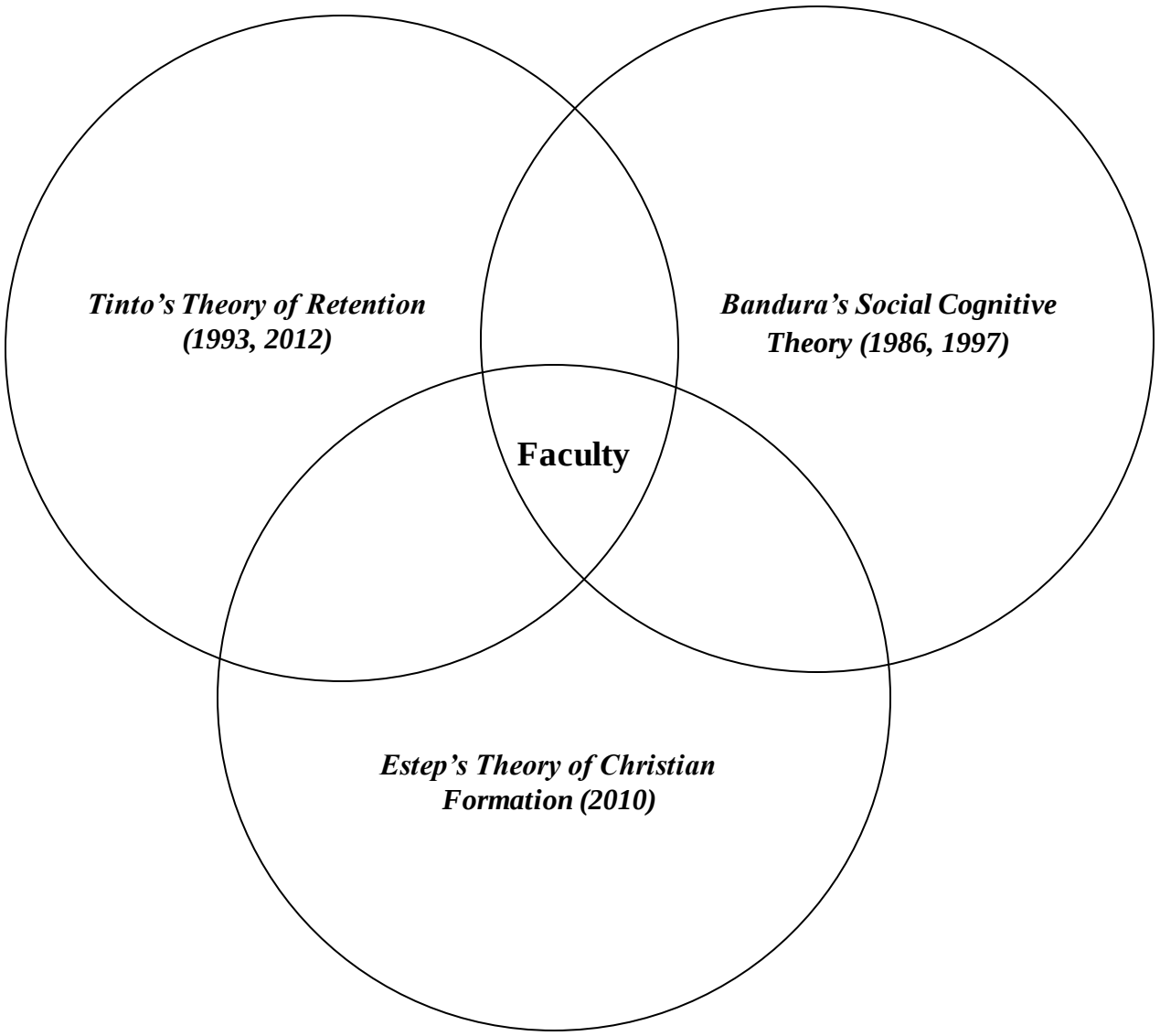
Three Theories and the Role of Faculty in Retention of Students

Tinto (2012)	Bandura (1997)	Estep (2010)
• Builds relationships inside and outside the classroom	• Raises or lowers self-efficacy of individual students	• Mentors spiritual formation of students
FOUNDATION = Relationship with students (NOT credentials)		

Table 2.2

The Three Theories and the Research Questions

Central Q: How does math avoidance influence persistence toward degree completion for ministerial students at New York Bible College?	
RQ 1 How does math remediation influence students' math perception?	Tinto (2012)
RQ 2 How does math perception influence students' math avoidance?	Bandura (1986)
RQ 3 How are students influenced in math avoidance by faculty, administration, or other revered individuals?	Estep (2010)



- Tinto's theory emphasizes the important role that faculty play inside and outside the classroom in retention of students.
- Bandura's theory emphasizes the role of the student's self-efficacy in success in academics. Who influences that self-efficacy? Who can and should expect and encourage students to succeed? According to Tinto (2012): Faculty
- Estep's theory emphasizes the intentional interaction and cultivation of mentoring relationships with faculty in Christian formation.
- So, what do these three theories have in common? At the heart of student success is a mentoring, caring faculty (or just one faculty member) who influence student retention, success, and Christian Formation.

Figure 2.1. Synthesis of Three Theories: Tinto, Bandura, Estep

Related Literature

In the big picture, math avoidance is permeating educational institutions on all levels from elementary to high schools, to colleges and universities, not only in the United States, but also around the world in nations such as Turkey, India, Canada, and Spain (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Beilock & Willingham, 2014; *Diploma to Nowhere*, 2008; Kamenetz, 2014; Latiolas & Lawrence, 2009; Legg & Locker, Jr., 2009; Standing, 2006). Current literature focuses on common causes for math avoidance such as math anxiety, lack of college readiness, and low self-efficacy, not math avoidance itself. Most studies are quantitative and have been done in large, public universities or community colleges (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Bahr, 2012; Beilock & Willingham, 2014; Combs et al., 2010; Duncan et al., 2007; Finlayson, 2014; Helal et al., 2011; Jain & Dowson, 2009; Latiolas & Lawrence, 2009, Lee, 2012; Legg & Locker, 2009; Sloan, 2010; Sparks, 2011; Standing, 2006; Thilmany, 2009). This leaves a gap in the literature as there are very few if any studies exploring other causes for math avoidance, and, until now, none had been conducted at a small, private college of ministry where the emphasis has historically been on Biblical and professional studies and where faculty and other revered individuals play a strong mentoring role in students' spiritual and educational formation. This study will begin to fill that gap.

Table 2. 3

Research Questions, Theories, Literature, and the Gap

RQs	Theories	The Literature	The Gap
RQ 1	Tinto	Math Anxiety, College Readiness, College for All, Working Memory, Remedial Math	Small college studies
RQ 2	Bandura	Math Anxiety, Self-efficacy, Working Memory	Qualitative studies of other causes for math avoidance
RQ 3	Estep	College for All, College Readiness, Self-efficacy, Solutions	Spiritual formation's role in math avoidance

Math Anxiety

In order to analyze math avoidance in light of math anxiety, one must first define and discuss math anxiety because it appears quite frequently in the literature. Math anxiety is more than just disliking math (Sparks, 2011); it is an actual state of tension, panic and/or helplessness connected with doing anything which involves numbers or mathematical problem solving (Helal et al., 2011). It has been described as an incurable disease which can cause paralysis and mental disorganization (Helal et al., 2011), a bona fide anxiety reaction that includes symptoms of nausea, stomachache, a blank mind, extreme nervousness, deafness to the teacher, sensitivity to noise or deafness to noise, inability to concentrate, and negativity (Jain & Dowson, 2009). Study after study (Thilmany, 2009; Baloglu & Zelhart, 2007; Helal et al., 2011; Jain & Dowson, 2009; Perry, 2004) described math anxiety in terms of emotional responses that manifest themselves in severe physical reactions which disable otherwise intelligent, capable students. These reactions can be so severe that they send a student to the hospital. Because emotion is connected to

learning (Inglis, 2014), the emotions that accompany math anxiety must be considered in the issue of math avoidance.

Math anxiety can be broken down into three categories: Math Course Anxiety, Math Test Anxiety, and Numerical Test Anxiety (Baloglu & Zelhart, 2007). Basically, math anxiety can range from slight nervousness to a complete meltdown, and it can be triggered by anything from having to crunch a few numbers to signing up for a math course. Math anxiety leads to avoidance behaviors which range from solving problems quickly on a math test in order to end the anxiety-inducing task (Legg & Locker, Jr., 2009) to avoiding college math courses and math-laden careers.

Table 2.4

Math Anxiety Categories, Triggers, Symptoms, and Behaviors

Categories	Triggers	Range of Symptoms	Range of Behaviors
Numerical Test Math Test Math Course	Crunch numbers Take a math quiz Sign up for a math course	Slight nervousness Physical sicknesses Complete meltdown	Rush through math tests Avoid math courses Avoid math-laden careers

Various causes for math anxiety which results in math avoidance have been suggested, and they range from having a bad math teacher in early grades (Helal et al., 2011; Moodley, Adendorff & Pather, 2015; Tyre, 2016) to signing up for a math course in college (Baloglu & Zelhart, 2007). Other causes explored were overemphasis on rote memory, little connection of the math content to real life, angry behavior from teachers, gender bias, communication and language barriers, and quality of instruction (Helal et al., 2011; Moodley et al., 2015; Tyre, 2016), a student's fear of failure, embarrassment, or inadequacy, especially when exacerbated by an insensitive math teacher (Moodley et al., 2015; Perry, 2004; Tyre, 2016), and student attitude,

lack of persistence, self-doubt, lack of confidence, and a lack of perceived usefulness of mathematics (Jain & Dowson, 2009; Moodley et al., 2015; Tyre, 2016). Age, gender, socioeconomic status, nurture, nature, and media have all been considered as possible causes for math anxiety (Beilock & Willingham, 2014; Jain & Dowson, 2009; Helal et al., 2011; Duncan et al., 2007; Combs et al., 2010). Beilock and Willingham (2014) even reported a link between the behavior of teachers and the performance of their students (Moodley et al., 2015) along with negativity from parents and peers as causes for math anxiety leading to math avoidance.

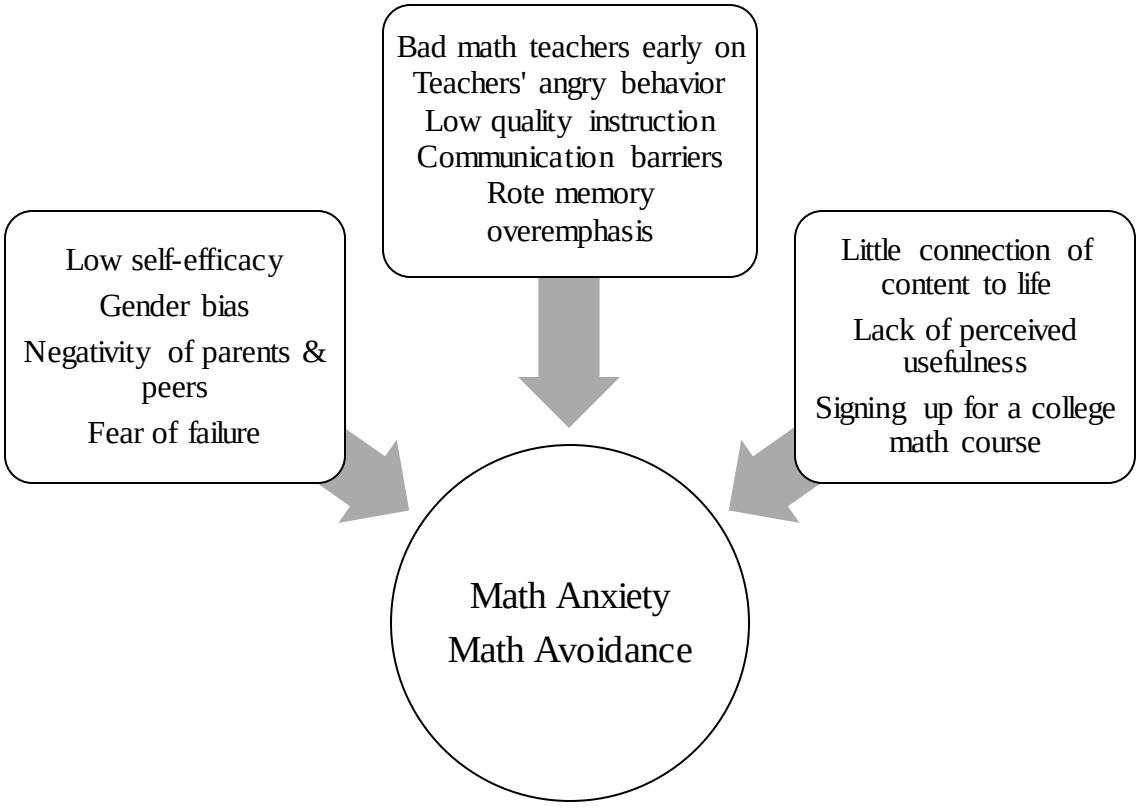


Figure 2.2. Causes of math anxiety leading to math avoidance.

Sloan (2009) identified nine causes of math anxiety as follows: parental influences, negative school experiences, methodology of former mathematics teachers, low math achievement, test anxiety, lack of confidence, negative attitudes, mathematics avoidance, and mathematics background (See Table 2.5). Some of the latest studies have suggested that even though math may be the secret to success in school from first grade all the way through college, math anxiety may begin as early as kindergarten or preschool (Kamenetz, 2014; Moodley et al., 2015; Strauss, 2014; Tyre, 2016). Perry (2004) noted that almost every student has had some positive experience with math, and this should be used to remind the student that he or she can be successful in math. Too many variables have been suggested for this matter to be conclusive. I hope that this study, because it was qualitative instead of quantitative, better unveiled some causes of math anxiety which leads to math avoidance and added to the literature.

Table 2.5

Nine Causes of Math Anxiety

1. Parental influences	4. Low math achievement	7. Negative attitudes
2. Negative school experiences	5. Test anxiety	8. Math avoidance
3. Methodology of former math teachers	6. Lack of confidence	9. Math background

Although initially thought to be limited to the Western culture, math anxiety is prevalent globally. While one study indicated that two-thirds of adults in the United States fear and loathe math (Jain & Dowson, 2009), other studies have unearthed math anxiety in middle school aged students in India, in a cross-cultural study done in Turkey, and in university students in Spain, South Africa, and Canada (Jain & Dowson, 2009; Moodley et al., 2015; Standing, 2006; Thilmany, 2009). Likewise, Beilock and Willingham (2014) found in their study that students in

every researched country of the world experienced math anxiety, and that 25% of four-year and 80% of community college students have math anxiety.

While some studies reported a higher percentage of math anxiety and, consequently, math avoidance in women (Helal et al., 2011; Jain & Dowson, 2009; Thilmany, 2009), the study of Baloglu and Zelhart (2007) demonstrated that math anxiety did not vary by gender. Sparks (2011) attributed a difference in gender to a bias fostered by a teacher with high math anxiety who told the class that boys were good at math, and girls were good at reading. A study by Ashcraft and Krause (2007) reported the highest math anxiety among elementary school teachers above all other majors, regardless of gender, whereas the study by Helal et al. (2011) showed that math anxiety was not significantly different among diverse majors. These contradictory studies were beneficial to this study as this is a common issue among college students, and with the qualitative approach I was able to delve deeper than the quantitative studies have and hopefully resolved some of the discrepancies in the literature.

College Readiness

One of the factors that may cause math anxiety leading to math avoidance in college students is a lack of college readiness or unpreparedness in this subject (Cordes, 2014). Several studies indicated this connection (Ashcraft & Krause, 2007; Jain & Dowson, 2009; Lee, 2012; Standing, 2006). Every year approximately 60 percent of first-year college students discover that they are not academically ready for college, particularly in math and English/language arts (National Center for Public Policy and Higher Education, 2010). Six longitudinal studies confirmed that one of the strongest predictors of later achievement in college is math skills, that early math skills are an even better predictor of success than reading skills, and that achievement in math is a good predictor of whether students stay on track toward completion of a two-year or

four-year degree (Duncan et al, 2007; Kamenetz, 2014; Lee, 2012; Strauss, 2014). These findings were relevant to this study, since the study led to some of the same conclusions about math avoidance being connected to lack of college readiness as well as the importance of math skills for college success.

College for All

During the past 40 years, there has been a global move from *college for some* to *college for all*. This concept of *college for all*, fueled through federally subsidized grants and loans for middle-and low-income students, has opened the door and driven a higher number of underprepared students into colleges with open admissions policies such as New York Bible College (Bankston III, 2011; Cordes, 2014; *Diploma to Nowhere*, 2008; Toby, 2009). Even some universities--for example, several Virginia and North Carolina universities--with historically high admissions policies have lowered the standards in order to accept more students (Botelho, 2015; *Diploma to Nowhere*, 2008). The entrance of underprepared students into college has perpetuated the problem of what to do with these students in order to close the gap between the initial academic level and the level where they need to be in order to successfully complete college (Bankston III, 2011; Cordes, 2014; *Diploma to Nowhere*, 2008; Tinto, 2012). This is particularly true in math and writing skills (Cordes, 2014; *Diploma to Nowhere*, 2008; Tinto, 2012). Because writing is necessary for all subject areas, it cannot be avoided; conversely, because most associate's and bachelor's degrees require only one credit-bearing math course, it is much easier for these students to avoid math for a significant period of time in college completion.

Self-efficacy

Math anxiety leading to math avoidance has been correlated with self-efficacy. Several studies reported that high self-efficacy lowered math anxiety while low self-efficacy raised math anxiety (Bandura, 1986; Cordes, 2014; Jain & Dowson, 2009; Perry, 2004; Standing, 2006). Several studies linked math anxiety with a feeling of math impotence (lack of self-efficacy) in students, who then chose math avoidance even though these students were capable of doing well in the courses; this negativity continued on even after these students became teachers (Akin & Kurbanoglu, 2011; Moodley et al., 2015). This results in the promulgation of more math anxiety as many teachers who experience math anxiety will pass it on to their students (Finlayson, 2014; Moodley et al., 2015); this can happen without the teachers' realization because math anxiety, as part of spiritual formation, is most likely caught, not taught (Estep & Kim, 2010; Inglis, 2014; Kessler, 2000). This connection between self-efficacy and math anxiety resulting in math avoidance made an interesting part of this study.

NCLB, ESSA, and Common Core

When President George W. Bush signed the No Child Left Behind Act of 2001, the American public applauded his efforts to close the achievement gap between high performing and low performing students (Jahng, 2011). Parents everywhere supported this initiative, thinking it would ensure high academic standards and quality curriculum nationally, and that these standards would be assessed yearly through standardized tests (Groen, 2012; Jahng, 2011), which would assure that there were no discrepancies across the curriculum and all children would be educated equally, closing the gap on the higher level. What parents did not foresee was what has actually happened. NCLB's yearly testing has completely changed the paradigm of the classroom and the teaching approach of teachers so that now, instead of simply teaching the

material and content and hoping that students do well on the tests, teachers are actually teaching to the tests (Groen, 2012; Levine & Levine, 2012). Gone are the days of holistic teaching and learning; gone are the days of learning through play or the arts or music; if the subject matter cannot be tested by a standardized test, then it is usually removed from the school's program (Groen, 2012; Levine & Levine, 2012). Even non-religious educators are recognizing that the lack of spiritual formation in the classroom is negatively affecting students in all areas of life and academics (Kessler, 2000). To make matters worse, teachers are spending much of their time teaching students how to take math and reading tests (Groen, 2012; Levine & Levine, 2012). This is discouraging and disheartening for new teachers who enter the field having been trained to recognize learning styles and multiple intelligences and to differentiate teaching to accommodate the variety of students in their classrooms only to discover that they do not have time to utilize their knowledge and skills because NCLB mandated that they focus all the class time and efforts on preparing students for the yearly tests. Did NCLB fulfill the expectations of the nation? Did NCLB produce a higher percentage of high school graduates who were prepared for the academic rigors of college, particularly in language arts and math? No, if anything, NCLB has increased the number and percentage of underprepared students entering college, especially in writing skills and math (Botelho, 2015; Cordes, 2014; Corona, 2015; Foundation for Excellence in Education, 2015; Madigan, Stotsky, & Wurman, 2010; Milgram, 2010; Milgram & Stotsky, 2010; Mulcahy, Maccini, Wright, & Miller, 2014; Pioneer Institute, 2015; Stotsky, 2015; Stotsky & Wurman, 2010a, 2010b; Wurman & Stotsky, 2010; Wurman &Wilson, 2012). Added to the problem, NCLB has done this at the expense of lunch breaks, recess, play time, art, music, social studies, and science without any improvements or benefits (Cordes, 2014;

Milgram & Stotsky, 2013; Mulcahy et al., 2014; Oliver, 2015; Schroeder, 2014; Stotsky, 2013; Truthinamed, 2013).

Under the next Presidential administration, matters were complicated even more with mandates to community colleges to increase graduation rates before 2020 by 5 million students (Cordes, 2014). How can these colleges increase graduation rates without lowering academic rigor while being flooded with underprepared students? Almost all colleges have designed and implemented a system of remedial and/or developmental courses for these students in order to get them through a program (Cordes, 2014). However, research has shown that a disturbingly high number of students who are forced to enroll in non-credit, remedial math courses fail to complete college programs (Bahr, 2008, 2012; Tinto, 2012).

After NCLB failed to fulfill its promises, President Obama's Race to the Top introduced Common Core curriculum into the school systems across most of the states (Oliver, 2015), and the Every Student Succeeds Act, signed into law on December 10, 2015, tweaked and reinstated NCLB, but did not remove Common Core (U.S. Department of Education, 2015). The Common Core math curriculum set off a firestorm of complaints, frustration, angst, and protests by parents, teachers, and administrators alike. In their frustration and disdain for the Common Core math, parents flooded the social media with photos of their children's math problems. Children who had started school with a positive attitude toward math were coming home with a negative attitude toward it. Children who excelled at math before Common Core was introduced were now bad at math to the point of needing tutors. Parents who had college degrees in a math-related field could not figure out how to help their own children with the homework, and parents who had no college or held a degree in a field not heavy in math were clueless in how to help their children do the homework, so all these parents hired tutors in order to make sure that their

children passed math in the elementary grades. Children who previously had done well at math but were now struggling under Common Core changed from excitedly doing math homework as soon as they arrived home to dreading the homework, procrastinating in doing the homework, and crying when parents demanded that they complete the math homework. Many of these children became embarrassed that they needed a tutor in order to understand their own homework. Some of these children had tutored their peers in math and helped the peers with homework under the previous curriculum. Now under Common Core, these peer tutors needed tutors themselves in order to understand the math concepts and content enough to pass (Corona, 2015; Foundation for Excellence in Education, 2015; Garelick, 2012; Garland, 2014a, 2014b; Goodall & Johnson-Wilder, 2015; Mulcahy et al., 2014; Oliver, 2015; Pantziara & Philippou, 2015; Pioneer Institute, 2015; Strauss, 2014a, 2014b; Torres, 2014; Tyre, 2016).

Exacerbating the problem with Common Core math are the fear and anxiety that the curriculum breeds in parents and teachers, which are then passed on to the students. Research has shown that math anxiety in parents and teachers can be transmitted students even without the conscious awareness of the parent or teacher (Beilock & Willingham, 2014; Goodall & Johnston-Wilder, 2015; Moodley et al., 2015). Consequently, a teacher or parent can subtly and inadvertently influence the self-efficacy and spiritual formation of a student concerning math without saying a word, and by doing so affect the student's completion of a college degree (Bandura, 1986, 1997; Estep & Kim, 2010; Tinto, 1993, 2012).

The repercussions of this Common Core math curriculum dilemma have been many. First, it has almost completely obliterated the self-efficacy of many children who started school confident and motivated in math skills (Main, 2012; Moodley et al., 2015; Oliver, 2015; Strauss, 2014a, 2014b; Tyre, 2016). Second, it has led to a number of parents opting to take their children

out of the over abundant testing because of the test anxiety that it generates (Corona, 2015; Main, 2012; Mulcahy et al., 2014; Oliver, 2015; Strauss, 2014a, 2014b). Third, the outcry from parents in several states has been so severe that five states either refused to adopt or rescinded the adoption of Common Core, and others are considering doing the same (Hart, 2014; McDonnell & Weatherford, 2013; Oliver, 2015; Pioneer Institute, 2015). Fourth, the combination of NCLB, ESSA, and Common Core tripled the number of standardized tests students take during the P-12 school years (Corona, 2015; Main, 2012; Mulcahy et al., 2014; Oliver, 2015). Consequently, this multiplied the test anxiety in students to the point that the companies which print the tests added into the instructions for administering each test a paragraph detailing what to do if a student vomits on his or her test booklet (Oliver, 2015). In other words, this assumes that each year across the nation, each time these tests are administered, a certain percentage of students are going to vomit on their tests as a natural outcome of test anxiety associated with the yearly testing, and yet schools continue to administer these tests to students. Fifth, instead of raising the bar so that students are prepared to enter four-year colleges, Common Core's math standards are actually designed to prepare students only for entrance into community colleges and remedial math courses, closing the gap at the lower level. Research into the Common Core math curriculum indicated that students lag as much as two years behind in math concepts and skills. Under Common Core, Algebra I is deferred to the ninth or even tenth grade rather than eighth grade, as it was scheduled in the old curriculum, and Euclidean geometry is taught using an un-tested experimental method that has not been supported by research and has actually been rejected by certain other countries in the world where it was tried out (Foundation for Excellence in Education, 2015; Madigan, Stotsky, & Wurman, 2010; Milgram, 2010; Milgram & Stotsky, 2010, 2013; Pioneer Institute, 2015; Stotsky, 2015; Stotsky, 2013; Stotsky & Wurman, 2010a,

2010b; Truthinamed, 2013; Tyre, 2016; Wurman, 2014; Wurman & Stotsky, 2010; Wurman & Wilson, 2012).

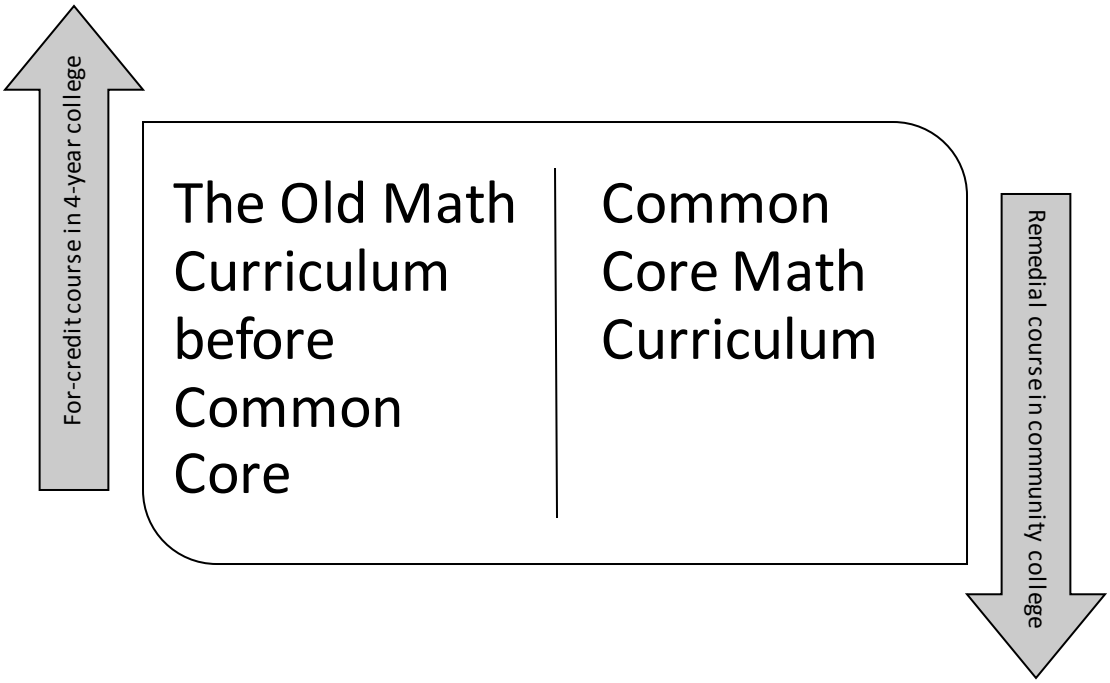


Figure 2.3. College readiness in the old math curriculum versus Common Core.

Subsequently, research revealed that the Common Core math curriculum, rather than encouraging and preparing students for science, technology, engineering, and mathematics fields, is actually discouraging students from STEM and is failing to prepare students for science, technology, engineering, and math degrees in college and highly sought-after careers in those fields (McGroarty & Robbins, 2012; Milgram & Stotsky, 2013; Pioneer Institute, 2015; Stotsky, 2013; Truthinamed, 2013; Tyre, 2016; Zimmerman, 2015).

The ramifications of the Common Core math curriculum could be devastating for all institutions of higher education. The combination of NCLB's abundant testing and Common Core's confusing math curriculum is cultivating a generation of students with low self-efficacy,

high test anxiety, high math anxiety, and a lack of college readiness except for remedial courses at community colleges or non-selective four-year colleges (Foundation for Excellence in Education, 2015; Madigan, Stotsky, & Wurman, 2010; Main, 2012; Milgram, 2010; Milgram & Stotsky, 2010, 2013; Oliver, 2015; Pioneer Institute, 2015; Stotsky, 2015; Stotsky, 2013; Stotsky & Wurman, 2010a, 2010b; Strauss, 2014a, 2014b Truthinamed, 2013; Wurman, 2014; Wurman & Stotsky, 2010; Wurman & Wilson, 2012; Zimmerman, 2015).

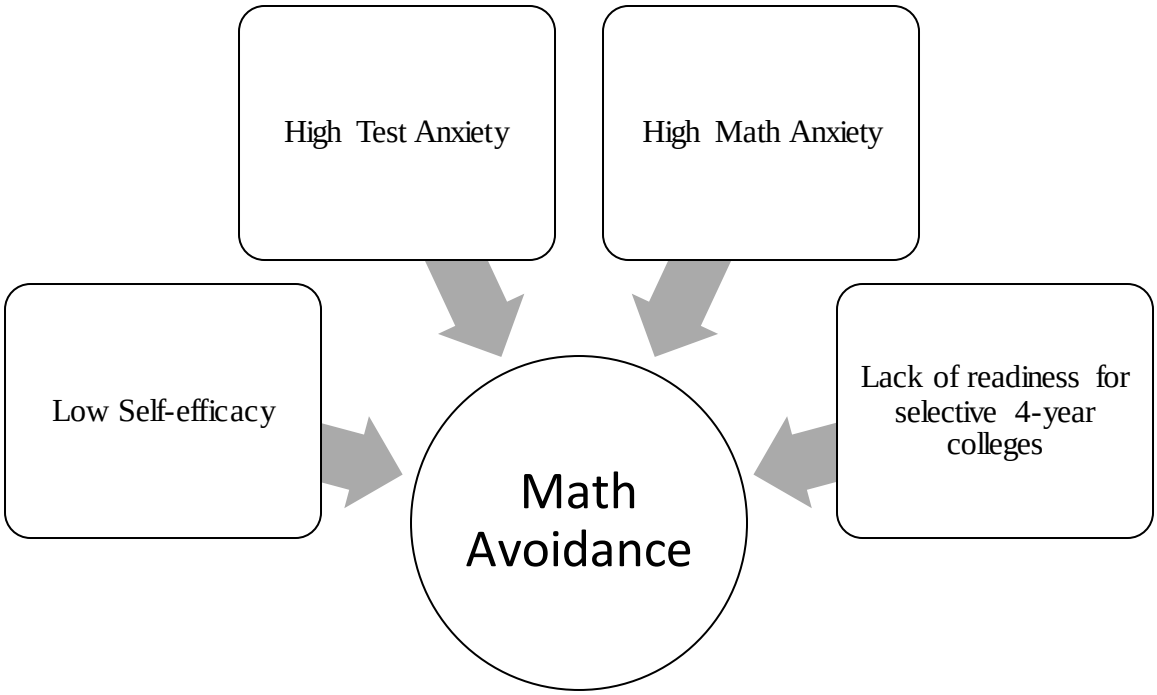


Figure 2.4. Ramifications of Common Core math curriculum in college-bound students.

With this reality, it is no surprise that math avoidance permeates every new cohort of freshmen entering colleges each fall (Akin & Kurbanoglu, 2011; Helal et al., 2011; Jain & Dowson, 2009; Legg & Locker, 2009; Moodley et al., 2015; Niazi, Adil, &Malik, 2013; Pantziara &Philippou, 2015; Roskes, Elliot, Nijstad, & DeDreu, 2013). College students enrolled in developmental math courses identified a specific moment in their lives during pre-school,

kindergarten, elementary, middle school, or high school math education where they had a negative experience with math, and it changed their self-efficacy and perception of their math ability to the point that the ability to learn new math concepts was thwarted (Howard & Whitaker, 2011; Moodley et al., 2015; Tyre, 2016).

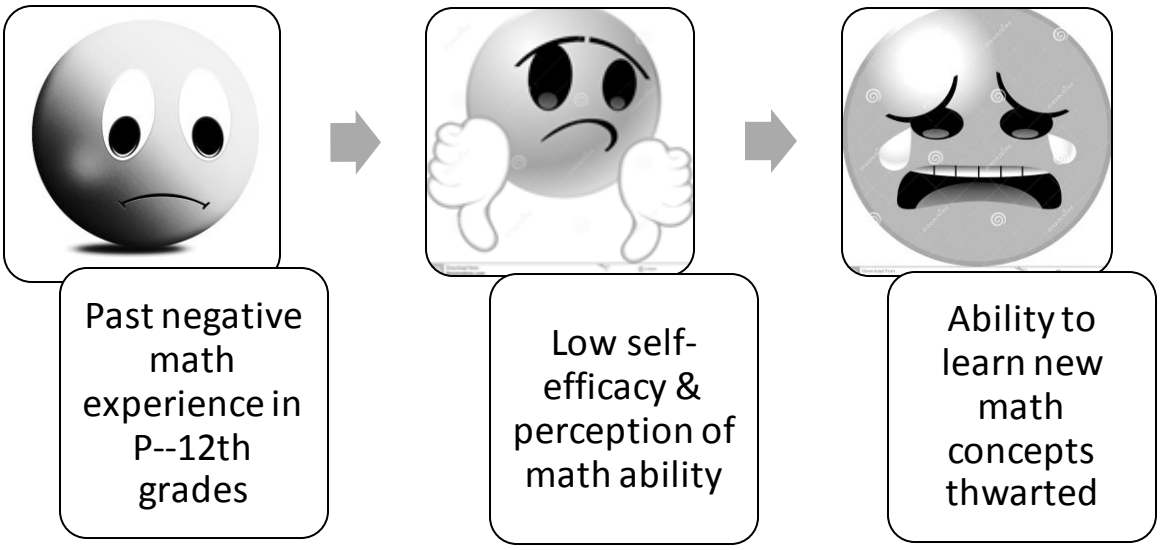


Figure 2.5. Past negative math experience affects future ability to learn.

Consequently, with the Common Core math curriculum in place, experiences like those described by the developmental math students (Howard & Whitaker, 2011) are on the rise across the nation. In June 2015, *Stop Common Core NYS* (Shah, 2015) released a 13-page report that chronicled the experiences of students and teachers in New York State who had just completed the Common Core Regents math exam, which counts as 20 % of students' grades and can determine whether a student passes or fails a course. Proctors described scenarios where the highest number of students on record experienced symptoms of math anxiety ranging from

crying to vomiting to panic attacks. Students expressed feelings of victimization, failure, unfairness, demoralization, hopelessness, worthlessness, and helplessness. Teachers expressed the same feelings and added a fear that these tests will create and multiply disdain for math and math anxiety among all students, even those who used to love math. Overall, students, teachers, and parents decried these Common Core math Regents exams for extinguishing every bit of self-efficacy in math that once existed in the students (Bandura, 1997; Shah, 2015). One teacher implied that if Common Core continues in New York, in three years, when these high school students enter college, the need for remedial math will be fathomless (Shah, 2015). Since the site of this study draws most of its students from New York State, this reality bears major implications for the future of the math curriculum and math avoidance at the college, and all other colleges in the state.

Now that research is surfacing and uncovering these issues which result in math avoidance, is there hope or a possibility that states and school districts will reject the Common Core math curriculum for a different curriculum that will actually prepare students for college-level math courses, raise the students' self-efficacy, lower math anxiety, and lessen math avoidance?

The answer is likely no, not because the decision-makers think the Common Core curriculum is better for students, but because the states and other entities have already invested billions of dollars in this curriculum which was backed and designed by big corporations like Pearson, and these companies are already profiting from the arrangement and the likelihood that Common Core will become a national curriculum (AccountabilityWorks, 2012; Eitel & Talbert, 2012; McGroarty & Robbins, 2012; Oliver, 2015; Pioneer Institute, 2015; Stotsky, 2015; Wurman, 2014; Wurman & Stotsky, 2010; Wurman & Wilson, 2012). Stotsky (2015) and

Milgram (2010; Milgram & Stotsky, 2010) revealed and expressed concern over the fact that none of the three Common Core grade-level math standards writers had any experience in developing or teaching math in the K-12 levels, and of the two who did have a mathematics background of any kind, one was a physics professor at Bennington College and the other a math professor at the University of Arizona (Pioneer Institute, 2015). Because the Common Core curriculum was not designed by K-12 math educators and is not research-based (Garland, 2014; McGroarty & Robbins, 2012; Milgram, 2010; Pioneer Institute, 2015; Stotsky, 2015; Wurman, 2014), much of the curriculum ignores new research and innovative teaching methods such as utilizing music, incorporating movement, encouraging self-directed learning, and approaching teaching like a coach. These integrative methods could actually help students grasp the concepts, retain the information, and develop the skills like critical thinking and problem solving that they need to be successful in college and careers (Griffin, 2014; Inglis, 2014; Lazar, 2014; Nilson, 2014; Orlando, 2014; Schroeder, 2014; Tyre, 2016; Zimmerman, 2015).

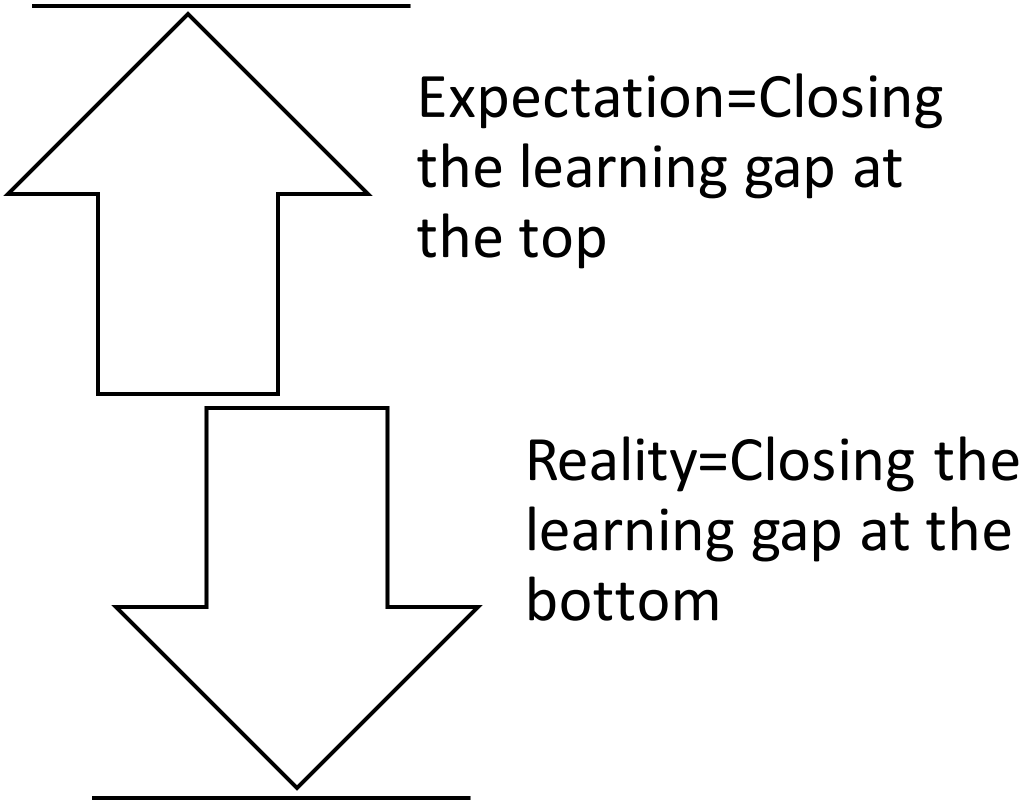


Figure 2.6. Common Core Math: What parents expected versus what they got.

With this scenario becoming the reality in public schools and certain private schools across the nation, colleges and universities must prepare themselves for the inevitable results. Math avoidance is not going to go away. Math avoidance is not going to decrease. On the contrary, math avoidance will likely increase with every new cohort of entering freshmen. Consequently, questions arise. How are four-year colleges and universities going to deal with massive math avoidance? Will students be forced to first attend a community college so that they can acquire the necessary math skills they will need to pass a credit-bearing math course in order to complete a bachelor's degrees? Will adding more layers of remedial math courses help? What are some other potential options? This study was designed to answer some of these questions. From 2010—2014, 75% of the students in the fall cohorts entering New York Bible College came from state or state-approved private schools, 43% from New York State public schools and

32% from schools outside New York State (Registrar, email communication, September 30, 2015); therefore, at the site of this case study, a faith-based institution of higher education, though it might be assumed that the majority of the student body comes from homeschools or Christian schools, in reality a high percentage comes from public school backgrounds.

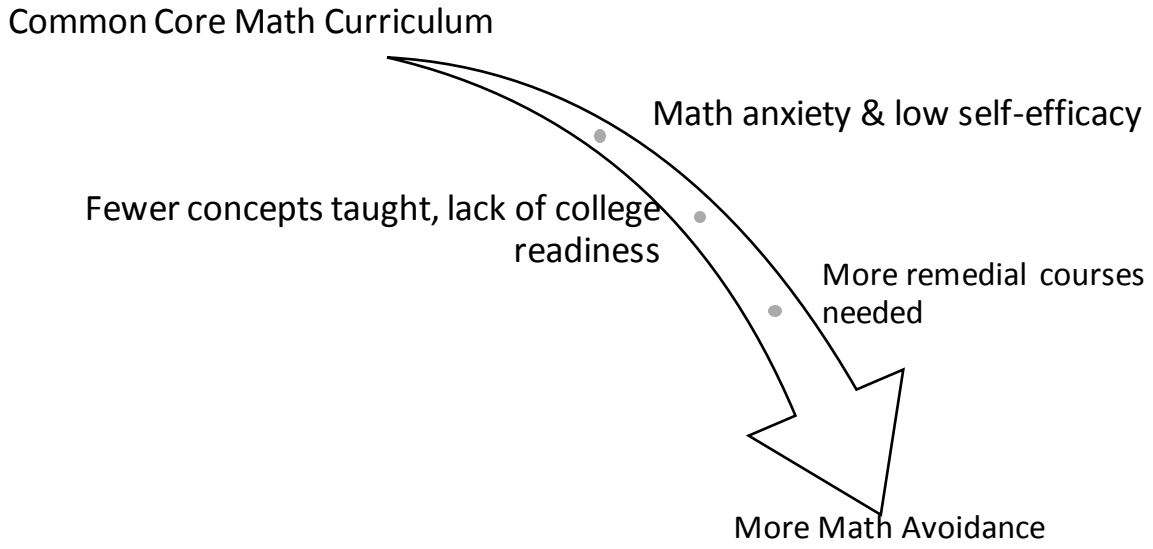


Figure 2.7. Common Core and math avoidance.

Remedial Math

The most commonly used method in colleges to deal with math avoidance, math anxiety and math unpreparedness is to require remedial math. Some students are so unskilled in math that they have to take two non-credit courses before they can enroll in one credit-bearing course. With 34% of adults enrolling in at least one remedial course (50% in some states) at the cost of about $2.3 billion each year, (National Conference of State Legislatures, 2011), remedial math is costly (Cordes, 2014). Compounding the issue is the fact that several studies have shown that only 27 percent of students enrolled in remedial math complete degrees (National Conference of

State Legislatures, 2011), and the majority do not remediate successfully (Bahr, 2008; Cordes, 2014). More students require remedial assistance with math than with any other subject, but the stigma of being placed in lower groups and the realization of the extra number of math courses they will have to take in order to complete a program discourage remedial students so much that more than 81.5% do not finish, many because their defective math skills are a result of math anxiety (Bahr, 2008; Standing, 2006). If a student already has math anxiety, and the college requires that student to take more instead of fewer math courses, would that not be detrimental to the health of that student? Could it be that many of the students forced into remedial math courses are suffering more from math anxiety than from math unpreparedness or lack of college readiness? This was explored in this study, as I desired to find a solution to the math dilemma at New York Bible College. The participants in the study willingly offered some alternative ideas for dealing with this.

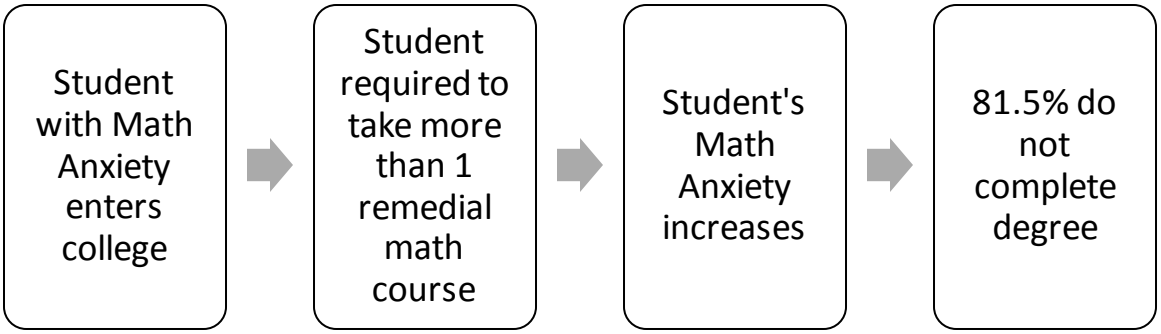


Figure 2.8. Math anxiety, remedial courses, and college completion.

Working Memory

One unanticipated correlation that appeared in several studies was the correlation between math anxiety and working memory. As mental energies are directed toward surviving math courses, working memory for other tasks and courses is compromised. Therefore, students conserve working memory by avoiding math. (Ashcraft and Krause, 2007). Several studies reported that math anxiety affected working memory by robbing it, causing performance across the board to suffer and that math anxiety influenced cognitive processing in all subjects and affected problem solving (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Beilock & Willingham, 2014; Jain & Dowson, 2009; Legg & Locker, 2009; Sparks, 2011; Zimmerman, 2015). This had interesting implications for this study because if math anxiety leading to math avoidance impedes learning performance and thus problem solving and critical thinking skills needed for career preparation (Jain & Dowson, 2009; Zimmerman, 2015) across all the curriculum, then it is imperative that New York Bible College deal with this problem, that the decision makers find a solution for these students who desire to be pastors, missionaries, youth ministers, worship leaders, etc. To achieve anything short of this mark is to fail the Lord in the responsibility of preparing these young men and women to serve Him. Otherwise, the college is doing the students a disservice by taking their money or putting them in debt through college loans and then not providing the scaffolding, mentoring, and spiritual formation they need to succeed (Bandura, 1997; Estep & Kim, 2010; Inglis, 2014; Kessler, 2000; Tinto, 2012; Zimmerman, 2015).

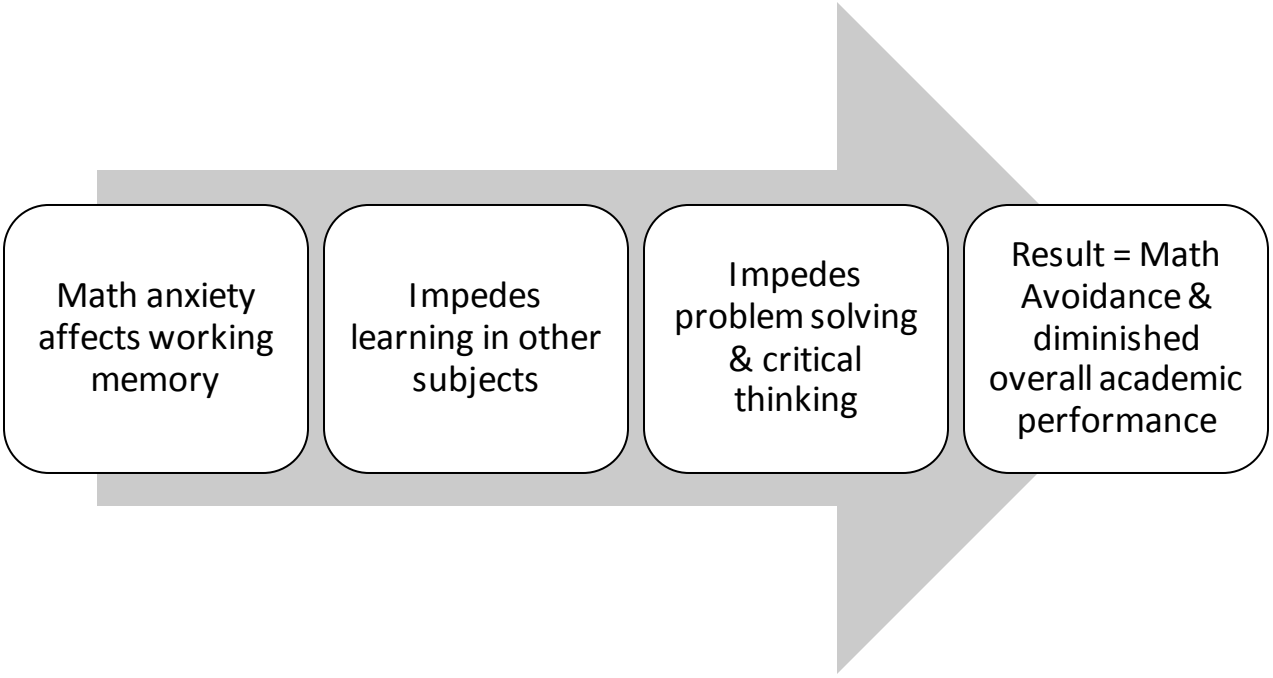


Figure 2.9. Math anxiety impedes student performance and leads to math avoidances.

Solutions to Math Avoidance

Colleges of all disciplines across the world have been seeking solutions to the math avoidance dilemma. Some of these solutions are quite the opposite of what one would expect. For example, one study found that enrolling students in a math methods course proved to be instrumental in reducing math anxiety among teacher candidates (Sloan, 2010). Other studies among college students have demonstrated that computer-assisted, interactive, self-directed math courses have been successful in getting students through a math requirement (Escudier, Newton, Cox, Reynolds & Odell, 2011; Griffin, 2014; Hu, 2014; Nadworny & Kamenetz, 2014; Spradlin, 2009; Tonge, 2012; Tyre, 2016). Assessment and Learning in Knowledge Spaces (ALEKS) is one such program that has proven to be successful in retention, higher pass rates, and attitude changes toward math, as evidenced in several studies (DeLucia, 2014; Dennis, 2014; Gallagher, 2014; McGraw-Hill, 2014a, 2014b, 2014c, 2014d, 2014e, 2014f, 2014g; Moore, 2008; Rivera,

Davis, Feldman, & Rachkowski, 2013; Tonge, 2012). A more creative approach suggested using music and movement, thus engaging the whole brain, to teach math (Kessler, 2000; Lazar, 2014; Levintin, 2007; Tate, 2012). Another innovative solution suggested by the literature included offering a variety of math courses tailored to the students' various interests. Titles included The Secrets of Mental Math, The Joy of Mathematics, Change and Motion, How Music and Mathematics Relate, What Are the Chances?, and The Mathematics of Games and Puzzles (The Great Courses, 2014). A key component in addressing and resolving the problem of math avoidance is going to be changing the students' perceptions of math and attitude toward the math requirement.

Table 2.6

Solutions to Math Avoidance

Teaching Approaches	Courses
Math Methods	The Secrets of Mental Math
Computer Assisted	The Joy of Mathematics
Interactive	What are the Chances?
Self-directed	The Mathematics of Games and Puzzles
Music	How Music and Mathematics Relate
Movement	Change and Motion

Howard and Whitaker (2011) discovered that if a developmental math student experiences a positive turning point or learning event in a remedial math course, the student's perception of learning math concepts will completely change, and the student will be successful in acquiring the math knowledge and skills needed to complete college (Cordes, 2014; Moodley et al., 2015; Tyre, 2016). Perhaps positive math experiences can be accomplished by giving students more rather than fewer options to choose from for the math elective. Additionally, graduating ministers who have math prowess could lead to churches and Christian corporations

staying open instead of thousands closing due to poor financial management (Patsuris, 2002; Stetzer, 2004).

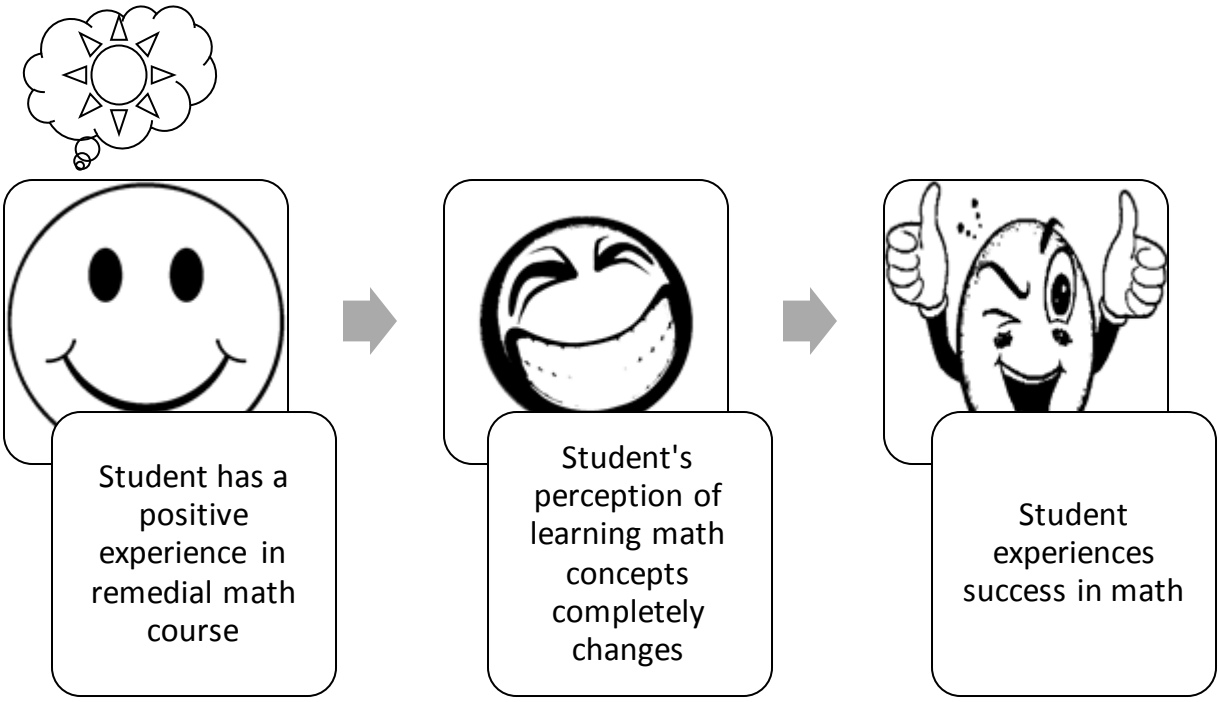


Figure 2.10. Positive experience in remedial math course changes student's math ability.

Summary

Regardless of its cause—math anxiety, low self-efficacy, lack of readiness, math avoidance among Bible college students becomes an obstacle in the path toward completion of degrees (Bandura, 1986; Estep & Kim, 2010; Tinto, 2012). While math anxiety affects self-efficacy and working memory and plays a role in math avoidance, math anxiety is not the only cause of math avoidance in Bible college students. Students who are good at math still avoid it (Akin & Kurbanoglu, 2011; Moodley et al., 2015; Tyre, 2016). This means that even students who are confident and competent in math skills will sometimes avoid math courses. For example, some students who made As and Bs in high school math and who scored high in math

on the SAT or ACT will avoid taking a required math course until the senior year of college. I, the researcher, was one of those students. The question still remains: Why? Why do Bible college students, who have a desire to serve Christ as pastors, missionaries, youth ministers, and teachers, allow one liberal arts math course requirement to intimidate them and halt degree completion, therefore, preventing them from achieving their goals?

Although math avoidance has been studied and explored from the angles of math anxiety, math readiness, math remediation, and gender, the majority of the studies have been conducted in large, public universities or community colleges (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Bahr, 2012; Beilock & Willingham, 2014; Combs et al., 2010; Duncan et al., 2007; Finlayson, 2014; Helal et al., 2011; Jain & Dowson, 2009; Latiolas & Lawrence, 2009, Lee, 2012; Legg & Locker, 2009; Sloan, 2010; Sparks, 2011; Standing, 2006; Thilmany, 2009), where serving Christ is not a primary factor or motivation for completion of a degree. It is known from these studies that math anxiety, self-efficacy, and lack of math readiness play a role in math avoidance, and that gender may or may not have any bearing on math avoidance. It is also known that math anxiety affects self-efficacy and working memory, and that as a result, students avoid math courses, even though at least one is required for degree completion. Researchers Howard (2008) and Koch, Slate, and Moore (2012) have called for more qualitative studies on experiences of students who do not persist in math courses (Cordes, 2014).

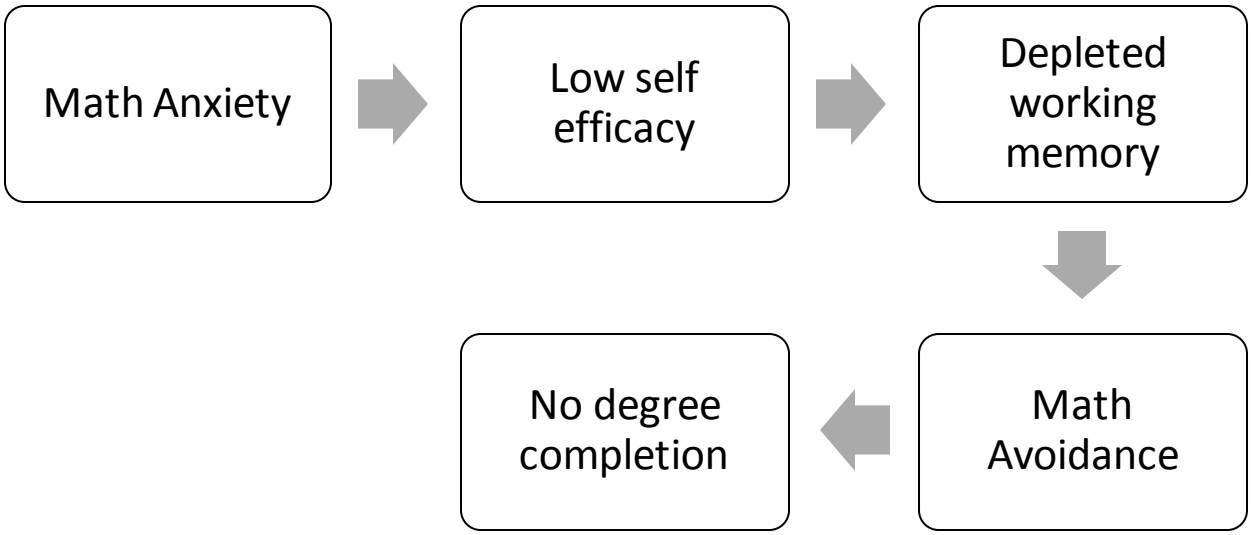


Figure 2.11. How math anxiety leads to math avoidance and lack of degree completion.

Examining the whys for math avoidance among Bible college students, whose motivation is service for Christ, offers further insight into the perceptions of and attitudes toward math that exist across all college settings (Estep & Kim, 2010). Even though a multitude of articles, books, and studies have been written on math avoidance, a gap in the literature still exists in exploring the inner perceptions of math and the reasons behind the math avoidance in students who otherwise accept and willingly complete all other liberal arts courses in degree completion requirements in a Bible college program. This leaves a gap in the literature as there are very few if any studies exploring others causes for math avoidance, and, until now, none had been conducted at a small, private college of ministry where the emphasis has historically been on Biblical and professional studies and where faculty and other revered individuals play a strong mentoring role in students' spiritual and educational formation. This study will begin to fill that

gap. The findings of this study could also be applied to other small college settings, high schools, middle schools, and even elementary schools.

CHAPTER THREE: METHODS

Overview

This instrumental case study was conducted at a small Bible college in upstate New York. The purpose of this study was to describe math avoidance for ministerial undergraduate students at a small, 116-year-old Bible college in upstate New York. As it was an instrumental, within-site case study, the detailed, in-depth data came from multiple sources of information gathered from the participants. A case study investigates a common issue in its real-world context (Yin, 2014) and is a methodology: a type of design in qualitative research that may be an object of study, as well as a product of it (Stake, 1995). Therefore, this approach was selected because the study focused on the issue of math avoidance in a single-site case with the hope of producing a solution to the problem. Data collection included interviews, an online focus group, and two documents—(a) a follow-up written interview in which the participants were asked to give advice for navigating the math requirement to rising students, and (b) a reflective journal entry in which participants made recommendations and suggestions for improving the math situation at the site. Creswell (2013) recommends using varied sources of information so that the data collection in the case study is extensive. Use of multiple sources of data collection insures thick, rich, descriptive data, a key component of a qualitative study. Throughout this study, various levels of checks were implemented to ensure the project's trustworthiness.

Design

This research was conducted with a qualitative design. A case study is recommended as a good approach when the researcher has a clearly identified case of which he or she desires to offer an in-depth understanding (Creswell, 2013). College educators need to know why many students have math avoidance, how this matter is experienced, and what the institution can do

about it so that students can successfully complete a degree program; therefore, a qualitative study was the best method. A case study investigates an issue in its real-world context (Yin, 2014) and is a methodology: a type of design in qualitative research that may be an object of study, as well as a product of it (Stake, 1995). I chose a qualitative study design because this design was founded in a primary worldview that is based on a transformative framework and belief that knowledge is not without bias (Creswell, 2013) and that it should be used to improve higher education, people, and, thus, the world. Therefore, I selected this approach because I was studying the problem of math avoidance in a single-site case with the hope of producing a solution to the problem. The site is a 116-year-old, small Bible college in upstate New York where math avoidance occurs. A case study requires collecting data from varying participants across the bounded system of the single site, including all levels from the top down; therefore, a case study approach provided the breadth and depth that was needed to adequately research this issue at this particular site.

I considered a transcendental phenomenological approach within a bounded system because math avoidance is a wide-spread phenomenon, and the participants would be limited to one group type (students). Accordingly, math avoidance transcends all colleges and is prevalent in schools below the university level as well. Data collection would have been quicker because I would have had fewer participants to interview and from which to process data. However, I reconsidered it upon the advice of my research consultant and classmates in EDUC 919 and instead decided that a case study would better suit the chosen site and would allow me to probe broader and deeper at the same time.

I briefly considered a narrative approach because data collection would be quicker and easier from just one participant, and it would provide the depth that this study required.

However, that approach would not give me the breadth from the variety of facets that this study needed. I also examined ethnography and grounded theory because they are qualitative approaches, but I did not consider either of these because neither of these designs was a good match with this study.

I selected a case study design because it allowed me as the researcher to probe deeply into the experiences of the participants within a bounded system as defined by Stake (1995), gain an in-depth understanding of the issue, and provide opportunity for participants to have a voice in offering solutions to this problem in this setting and other similar settings. I considered using a phenomenological approach to this research because math avoidance transcends all colleges and is prevalent in schools below the university level as well. However, the uniqueness of the setting fit better with a case study. This uniqueness rests in the fact that New York Bible College started out as a Bible institute and graduated students for 93 years without any liberal arts or math requirements. All the other regionally accredited Christian liberal arts or Bible colleges in the state required math as part of the associate's and bachelor's degrees from the beginning. Therefore, I have questioned whether or not this uniqueness plays a role in fostering the math avoidance among the students. Only through deep case study research was the answer to this question be found. In order to give the participants a voice and a sense of buy-in, the participants were called co-researchers, as suggested by Moustakas (1994); consequently, the term or title gave the participants a sense of empowerment in a desire to make a difference at the site and in other settings (Cresswell, 2013). I chose a qualitative study design because this design is founded in a primary worldview that is based on a transformative framework and belief that knowledge is not without bias (Creswell, 2013) and that it should be used to improve higher education, people, and, therefore, the world. An instrumental case study design allowed me, the researcher, to gain

an in-depth understanding of the issue, and provide opportunity for the participants to have a voice in offering solutions to this problem in this setting and other similar settings.

Therefore, I selected a case study approach because I studied math avoidance at a single site where math avoidance is a problem. I examined how students' interaction with math, such as signing up for a math course, taking a math assessment, and/or experiencing math in any way influenced perception of math, avoidance of math, and persistence in degree completion. I selected a case study design because it allowed me to draw deeply from a multiplicity of sources and a variety of participants, understand the complexity of the case, identify issues and provide opportunity for the participants to have a voice in offering solutions to this problem in this setting and other similar settings.

Table 3.1

Methodologies Considered

Methodology Considered	Characteristics of Method	Decision	Reason
Quantitative	Quick, Numbers based Data collection fairly simple	Rejected	Lack of depth, Lack of details and rich descriptions, Lack of potential solutions I am uncomfortable with this method
Phenomenology	Qualitative, Data Collection from only one group (students) Deep, rich description Essence	Rejected	Lack of breadth needed I am comfortable with this method
Narrative	Qualitative Data collection from only 1 participant Simple, quicker and easier data collection Deep, rich description	Rejected	Lack of breadth needed Does not offer variety of data needed to thoroughly research the case I am comfortable with this method
Ethnography	Qualitative	Rejected	Design does not match the study
Grounded Theory	Qualitative	Rejected	Design does not match the study
Case Study	Qualitative Holistic In Context Rich descriptions	Selected	Offers breadth, depth, and possible solutions I am comfortable with this method

Yin (2014) explained that a case study of a single site can offer just as much data as a multiple-site case study, that the more the researcher's questions seek to explain whys, the more relevant the study can be, and that when there is a yearning to understand a complex social issue holistically in a real-world context, case study research is the best choice of design (pp. 2-4). I also selected the design based on the paradigm of pragmatism, which focuses on the outcome of the research. In other words, I wanted to discover and offer a solution that works to solve the problem.

I rejected a quantitative design because it would fail to provide the in-depth understanding, possible solutions, and detailed data with rich descriptions that a qualitative design offers.

Research Questions

In this instrumental, single-site case study, the central question was: How does math avoidance influence persistence toward degree completion for ministerial students at New York Bible College (pseudonym)? Research guiding questions were as follows:

(1) How does math remediation influence students' math perception?

(2) How does math perception influence students' math avoidance?

(3) How are students influenced in math avoidance by faculty, administration, or other revered individuals?

Setting

The location for this study was New York Bible College, a small, non-denominational Bible college in upstate New York, located near the city of Binghamton, New York (population 48,000). The college has an enrollment of about 350 students and a current retention rate of 33%, and with open admissions, about 10% of the students or more come underprepared for college

work, particularly in math. The college is a school of ministry, designed to prepare students to be pastors, missionaries, youth ministers, worship leaders, and various other types of church leaders as well as leaders in the secular world of education and business. It offers only one four-year degree—a bachelor of religious education (BRE) with a major in Biblical studies. Students may choose one or more of eight concentrations—Christian counseling, Christian ministries, intercultural ministries, music/worship leader, organizational leadership, pastoral studies, teaching English as a second language, and youth ministry. The college is approximately 55% male and 45% female, but that ratio changes slightly with each new academic year, however, still maintaining around a 50:50 ratio. The college is a small, private 116-year-old institution. It existed for 93 years (from 1900—1993) as a Bible institute with no liberal arts/general education courses in the curriculum. In order to maintain anonymity for the purposes of this study, the pseudonym New York Bible College was used.

Participants

The type of sample for this study was purposeful, and sampling procedures included convenience and snowballing, which means that participants could recommend other participants whom they know who have experience with math avoidance. A purposeful sample from among students and alumni were invited and selected to participate based on self-identification. Faculty participants were invited and selected based on their own math experiences and interaction with students. The participants were all over the age of 18, current students and faculty of the college, and a mixture of alumni--both recent BRE graduates and AAS graduates, which was needed to supplement the small student sample size. All participants were required to sign a Consent Form (See Appendix A). I limited the groups as follows: (a) Current student participants were limited to main campus students who identified themselves as expressing math avoidance or expressed

an interest in participating in the study; (b) Alumni participants were limited to those who avoided Math I until the senior year, took an alternative course other than Math I, or failed to complete a four-year degree because of math avoidance; (c) Faculty participants were limited to the school's two math professors, any Bible professors who were not required to take a math course for a bachelor's degree, and professors who have worked closely with struggling students. The decision to limit the study to one small, private college was based on three reasons. First, this was a convenience setting for me. Second, the college has made several failed attempts to study its math dilemma for years, so this research was needed and timely. Third, this research will help the college in future curriculum design and course offerings. The criteria for participants were New York Bible College current students and alumni who have experienced math avoidance, faculty, particularly the current math professors and other faculty who graduated from the college when there was no math requirement. These included volunteers and those purposely selected by the researcher. Alumni were included because of the small sample size of students available at this site, and because they are some of the most influential individuals in recruitment of students. Many students choose this college based on recommendations from pastors, parents, grandparents, or other alumni whom the students hold in high regard. Inclusion of alumni informs Research Question 3 and aligns with Estep's (2010) part of the theoretical framework. Inclusion of faculty informs Research Questions 1, 2, and 3, and aligns with Bandura's (1986) and Tinto's (2012) parts of the theoretical framework. Alumni participants may or may not have completed the bachelor's degree. The sample size was 16 participants, 13 Students/Alumni and three Faculty. This number proved adequate in order to reach maximum variation which became evident when recurring themes emerged, and in order to look at the issue from all perspectives, identify themes, and reach the breadth and depth that this

study needed to successfully answer the research questions (Bandura, 1986, Creswell, 2013; Estep, 2010; Stake, 1995; Tinto, 2012; Yin, 2014). Participants ranged in ages from 19 to 72, with 10 males and six females. Of the participants, 11 were Caucasian, four were African-American, and one was an international student of Eastern European descent. Pseudonyms were used for individuals, and I assigned the participants' pseudonyms. I was the sole researcher for this study.

Table 3.2

Table of Participants

# Participant Type	Gender	Age	Ethnicity	Rank
10 Students	4 F, 6 M	6 @ 19-21 3 @ 22-24 1 @ 25-27	6 Caucasian 3 African-American 1 Lithuanian	2 Freshmen 3 Sophomores 1 Junior 4 Seniors
3 Alumni	1 F, 2 M	25-27	2 Caucasian 1 African-American	1 AAS 2 BRE
3 Faculty	1 F, 2 M	51-72	3 Caucasian	1 Adjunct 2 Full-time

Table 3.3

Alignment of Theories, Research Questions, and Data

Theory	RQs	Data Needs	Data Source	Triangulation	Data Analysis
Bandura	*RQ1 *RQ2	*Why *Self-efficacy	*Students *Alumni	*Interviews *Focus Group *Follow-up Written Interviews	*Coding for themes *Matrix
Tinto	*RQ2	*How *Degree Completion	*Students *Alumni *Faculty	*Interviews *Focus Group *Reflective Journal Entry	*Coding for themes *Matrix
Estep	*RQ3	*Who *Spiritual formation	*Students *Alumni *Faculty	*Follow-up Written Interviews *Reflective Journal Entry	*Coding for themes *Matrix

Procedures

Prior to collecting any data, I sought Institutional Review Board (IRB) approval by Liberty University and site approval. Participants were elicited purposefully through convenience sampling and snowballing, which means that participants could recommend other participants whom they know and who share the same issue. Data was gathered through the use of individual semi-structured interviews, a focus group via Go to Meeting online, follow-up written interviews asking what advice participants would give to incoming students, and reflective journal entries recommending suggestions for improving the math program and offerings at the college. All interviews were audio recorded and transcribed then coded personally by me. All electronic files are locked and password-protected. I purchased a new

Hewlett-Packard laptop solely dedicated for research data and dissertation usage. Any paper files or documents are kept in a locked filing container.

The Researcher's Role

I was the human instrument in this case study, and I collected and analyzed extensive forms of data from a multiplicity of participants within this single site. At the time of the study, I was employed at the institution that served as my research site. .

All of the Bible college students must pass a credit-bearing math course in order to complete a bachelor's degree. The hope is that through this study, one can find some understanding of students' math avoidance and some better solutions than the cumbersome program of remedial math courses presently in place, not only for the sake of the students, but also for the sake of the college and for other students in similar colleges, particularly as this issue influences retention.

In light of Tinto's (2012) retention theory, I focused on why students avoid math courses that are required for completion of degrees and what actions a small private college can take to retain students and help them persist in successfully completing degrees. I positioned myself in the study (Creswell, 2013). As an undergraduate student, I struggled with math avoidance; even though I was academically prepared and capable of earning high grades in mathematics, I waited until my senior year to take the one required math course (college algebra) for my B.A. and substituted a computer course for the second math requirement. As a result, I am aware that my own struggle may have influenced how I approached this topic and analyzed data. Consequently, I purposely utilized my journalism training to approach the topic and analyze data objectively. Therefore, this study included a discussion of the values that formed the stories and my own interpretation as well as the interpretations of the participants (Creswell, 2013).

Data Collection

After IRB and site approval, participants were recruited, and data collection began. To start, I conducted individual semi-structured interviews with each participant. Each category of participants had its own set of questions so that all sides and perspectives of the case could be studied. I also collected data via a focus group using Go-to-Meeting online software. The last form of data collection was a written follow-up interview and a reflective journal entry by the participants. In the follow-up interview, participants were asked what advice they would give to rising students about navigating the math course requirement for the BRE. The reflective journal entry were recommendations to the provost about math course designs and suggestions of what the college can do to help students meet the math requirement and change the perceptions about the math requirement so that they can persist in degree completion. Since this is a case study, data collection took many forms, was gleaned from a variety of participants, looked at the issue from many perspectives, focused on how students experience math avoidance in relation to the college experience and persistence in degree completion, and offered some solutions to the math avoidance problem (Creswell, 2013; Tinto, 2012).

Table 3.4

Interview Questions and RQs Alignment

Theory	RQ	Interview Question
Bandura	RQ 1	Question 2
		Question 5
Tinto	RQ 2	Question 3
		Question 4
Estep	RQ 3	Question 6

Interviews

Only one type of oral interview was conducted throughout this study. I met with each participant once for approximately one-hour or less, in an individual, semi-structured interview.

Some interviews were conducted using Skype, email, or cell phone for participants who were geographically located too far away to meet face-to-face. Each category of participants—students (See Table 3.4), alumni (See Table 3.5), and faculty (See Table 3.6)--had its own set of questions so that all sides and perspectives of the case could be studied. Stake (1995) insisted that the interview is the main road to gleaning maximum information, and explained that the interviewer must be open to forming non-scripted questions on the basis of what needs to be discovered (Stake, 1995). Therefore, the questions in Tables 3.4--3.6 were only be a starting point from which many other questions arose.

Table 3.5

Open-ended Interview Questions for Students (n = 10)

Questions

1. What is your name, assigned pseudonym, age, gender, and ethnicity?
2. What are your ministry goals, concentration, and academic status (matriculated student, non-matriculated student, freshman, sophomore, junior, senior, etc.)?
3. What has been your experience(s) with math? Tell me your story about math.
4. Have you taken your math elective yet? Why or why not?
5. How did/does math avoidance influence your persistence in completing your degree? Why would you avoid taking math?
6. Describe your experience(s) with remedial math courses.
7. Describe any influence by faculty, administration, pastors, chapel speakers or any other revered individual in your life on your perception of math and the avoidance of it.
8. What could the college do to help students who experience math avoidance complete their degrees?
9. Is there anything else of significance about this experience that you want to share?

Table 3.6

Open-ended Interview Questions for Alumni (n = 3)

Questions

1. What is your name, assigned pseudonym, age, gender, and ethnicity?
2. What are your ministry goals and academic status (BRE graduate, non-graduate alumnus, position, career, current ministry, etc.)?
3. What is your experience with math? Tell me your story about math.
4. What math skills do ministers and missionaries need? What skills do you wish you had learned in Bible college?
5. How did math avoidance influence your persistence in completing your degree? Why would you avoid taking math? How did you persist anyway?
6. Describe your experience(s) with remedial math courses.
7. Describe any influence by faculty, administration, pastors, chapel speakers or any other revered individual in your life on your perception of math and the avoidance of it.
8. What could the college do to help students who experience math avoidance complete their degrees?
9. Is there anything else of significance about this experience that you want to share?

Table 3.7

Open-ended Interview Questions for Faculty (n = 3)

Questions

1. What is your name, assigned pseudonym, age, gender, and ethnicity?
2. What are your ministry goals and position at the college (faculty, advisor, concentration chair, etc.)?
3. Have you ever experienced math avoidance? Tell me your story about math.
4. In your opinion, what math skills do ministers and missionaries need?
5. How did math avoidance influence your persistence in completing your degree?
6. Why would you avoid taking math?
7. Was math required for you to complete your bachelor's degree? What is your perception of requiring bachelor's of religious education students to pass a math course?
8. Describe your experience(s) as a professor with teaching any math course, enrolling students in math courses, and/or helping students get through math courses.
9. Describe any influence by faculty, administration, pastors, chapel speakers or any other revered individual in your life on your perception of math and avoidance of it.
10. What could the college do to help students who experience math avoidance complete their degrees? What can you as a professor do?
11. Is there anything else of significance about this experience that you want to share?

Student Questions 1 and 2 documented the participant's name, pseudonym, and demographics. Questions 3 through 5 provided details and descriptions of the case (Stake, 1995). Questions 4 and 5 were designed to explore math perception of the participants and the influence of math avoidance on degree completion, retention, and performance across the curriculum.

Retention literature indicates that math avoidance experiences influence degree completion, retention, self-efficacy, and overall academic performance (Ashcraft & Krause, 2007; Bandura, 1997; Helal et al., 2011; Jain & Dowson, 2009; Perry, 2004; Sparks, 2011; Standing, 2006; Tinto, 2012).

With the recent emphasis on remedial math courses, Question 6 was included to explore how these courses affect students' math avoidance and the perception faculty have of remedial courses. While some retention literature suggests that these courses are beneficial (Tinto, 2012), other literature demonstrates that these courses are actually detrimental to persistence in degree completion (Bahr, 2008; National Conference of State Legislatures, 2011; Standing, 2006).

Question 7 was designed to probe for answers to Research Question 3 (Estep, 2010).

Questions 8 and 9 were designed to give the participant a sense of buy-in, empowerment, and reciprocity to engage in crafting a solution to the problem and a plan of action for reform that could improve the institution and lives of future students there (Creswell, 2013). Tinto (2012) repeatedly stressed the importance of student, faculty, and administrator engagement in retention and persistence toward degree completion.

Table 3.8

Demographic Question in Formal Responses

Question	Rational	Prior Research	Research Questions	Theoretical Framework
Student 1-2: What is your name, assigned pseudonym, age, gender, ethnicity, ministry goals, concentration, and academic status (matriculated student, non-matriculated student, freshman, sophomore, junior, senior, etc.)?	Purposeful Sampling Data Triangulation	Combs et al. (2010) Duncan et al. (2007) Helal et al. (2011) Stake (1995) Yin (2014)	Central Question (CQ) RQ 3	Bandura (1997) Tinto (1993, 2012)
Alumni (optional) 1-2: What is your name, assigned pseudonym, age, gender, ethnicity, ministry goals, and academic status (BRE graduate, non-graduate alumnus, position, career, current ministry, etc.)?	Purposeful Sampling Data Triangulation	Combs et al. (2010) Duncan et al. (2007) Helal et al. (2011) Stake (1995) Yin (2014)	CQ RQ 3	Bandura (1997) Tinto (1993, 2012)
Faculty 1-2: What is your name, assigned pseudonym, age, gender, ethnicity, ministry goals, and position at the college (faculty, advisor, concentration chair, etc.)?	Purposeful Sampling Data Triangulation	Combs et al. (2010) Duncan et al. (2007) Helal et al. (2011) Stake (1995) Yin (2014)	CQ RQ 3	Bandura (1997) Tinto (1993, 2012)

Table 3.9

Formal Response Questions

Research Question (RQ)	Formal Response Question	Prior Research	Theoretical Framework	Provisional Codes	Data Source
RQ 2 RQ 3	Q 3 What has been your math experience?	Beilock & Willingham (2014) Cordes (2014) Howard & Whitaker (2011)	Bandura (1997) Estep (2010)	Self-efficacy Spiritual formation	Interviews
RQ 1 RQ 2	Q 4 Students: Have you taken math yet, why or why not? Alumni & Faculty: What math skills do ministers & missionaries need?	Joyce (2010) Kamentz (2014) Latiolas & Lawrence (2009) Stewart (2010)	Bandura (1997) Tinto (2012)	Self-efficacy Degree completion	Interviews
CQ (Central Question) RQ 2	Q 5 Students: How does math avoidance influence degree completion? Why would you avoid math? Q 5-7 Faculty	Akin & Kurbanoglu (2011) Helal et al. (2011) Niazi et al. (2013)	Bandura (1997) Tinto (2012)	Self-efficacy Degree completion	Interviews
RQ 1	Q 6 Students: What is your experience with remedial math? Q 8 Faculty	Cordes (2014) Howard &Whitaker (2011)	Bandura (1997) Tinto (2012)	Self-efficacy Degree completion	Interviews
RQ 3	Q 7 Students: Has your math perception been influenced by any revered individual in your life? Q 9 Faculty	Beilock & Willingham (2014) Cordes (2014) Howard & Whitaker (2011)	Estep (2010) Tinto (2012)	Spiritual formation Degree completion	Interviews
CQ RQ 2 RQ 3	Q 8 Students: What can the college do to help students with math avoidance complete their degrees? Q 10 Faculty	Cordes (2014) Escudier et al. (2011) Nadworny & Kamenetz (2014) Spradlin (2009)	Bandura (1997) Tinto (2012)	Self-efficacy Degree completion	Interviews Focus Group Follow-Up Interviews Reflective Journals
CQ RQ 1 RQ 2 RQ 3	Q 9 Students: Is there anything else of significance that you want to share? Q 11 Faculty	Cordes (2014) Howard & Whitaker (2011)	Bandura (1997) Estep (2010) Tinto (2012)	Self-efficacy Spiritual formation Degree completion	Interviews Focus Group Follow-Up Interviews Reflective Journals

Focus Group

Data was also gathered via a focus group using Go-to-Meeting online software. Creswell (2013) recommended using a focus group to gather data. Since the participants were geographically scattered on Spring Break, an online focus group worked better than an onsite group. Actually, because many of all ages are already using social media to interact with each other and among these groups, students, alumni, and faculty felt quite comfortable interacting in this environment and were free to open up and express themselves fully and deeply there than they would have in person sitting in a room together. The Go-to-Meeting option, while providing a private, face-to-face online group meeting, is limited by its synchronous nature in that all participants must be available and log on at the same time. The Go-to-Meeting option required a transcriptionist to record the words of the participants. The questions to ask the focus group were determined after the individual interviews, based on the data gathered and issues that emerged (Stake, 1995).

Table 3.10

Focus Group Questions

Starting Questions
1. What is your perception of the math requirement for a bachelor's degree at this college?
2. Why do students at this college avoid math?
Questions that Arose
1. Why are students at NYBC avoiding math? Why are they running away from it?
2. Did you (the researcher) experience resistance to math at OCC (a community college where I previously worked)?
3. What can NYBC do to help new incoming students to get prepared with less anxiety to take math?
4. What about Music Math?

Documents--Follow-up Written Interviews and Reflective Journal Entries

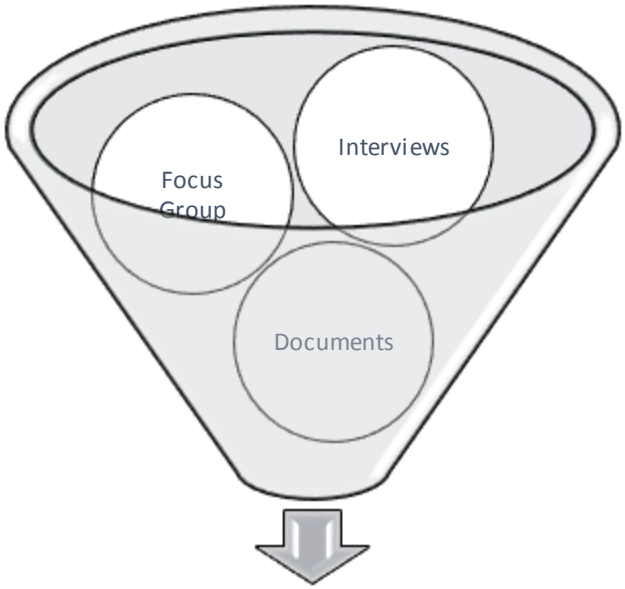
Participants were asked in a follow-up interview via email to write what advice they would give to rising students who have not transferred in or completed the required math course about navigating the math course requirement for the four-year degree. This data gathering tool provided deep insight into what students who have avoided math, alumni, and faculty are thinking as students approach the math requirement and how students manage to cope. Participants were also asked to write a reflective journal entry of recommendations to the provost about math course designs and suggestions of what the college can do to help students meet the math requirement so that they can persist in degree completion. The script for these documents was sent to each participant as an attachment in MS Word format (See Appendix O). These written documents hopefully offered some viable solutions to the math dilemma of the college from all perspectives, empowered the participants, and gave the alumni and students a voice in the assertions and lessons learned from the case (Creswell, 2013). It also promoted academic engagement, another key to retention (Tinto, 2012). Creswell (2013) recommended journaling as a viable means of collecting data, and these documents provided the same means of data collection as a journal, only in a more concise manner.

Data Analysis

In order for this study to be thorough, a multiple-step process of gathering data, analyzing data, and drawing conclusions based on the data was conducted. Creating and following an organized method helped me to ensure the accuracy of the findings. After IRB approval, data was collected and analyzed. The individual semi-structured interviews were audio recorded using a personal Sony digital voice recorder, transcribed by a colleague, who signed a confidentiality

agreement, and me and then coded for themes. Participants were informed that a colleague would help transcribe the interviews.

All transcripts from interviews and focus groups and the two documents written by the participants were analyzed using Stake's (1995) and Yin's (2009) recommendations which included seeking a plethora of moments from the data, looking for themes and patterns that emerged across the categories of data collection. Yin (2009) suggested building a table to show the relationship between two categories. Stake (1995) suggested using a matrix to plan which methods of data collection would be used for each category and to keep track of the data. I used a matrix, per Stake's (1995) suggestion. After analyzing the data for patterns (Stake, 1995) and categorizing them into themes, I developed natural generalizations (Creswell, 2013) that others can learn from the case (See Appendix P).



Data Collection (1-2 months)

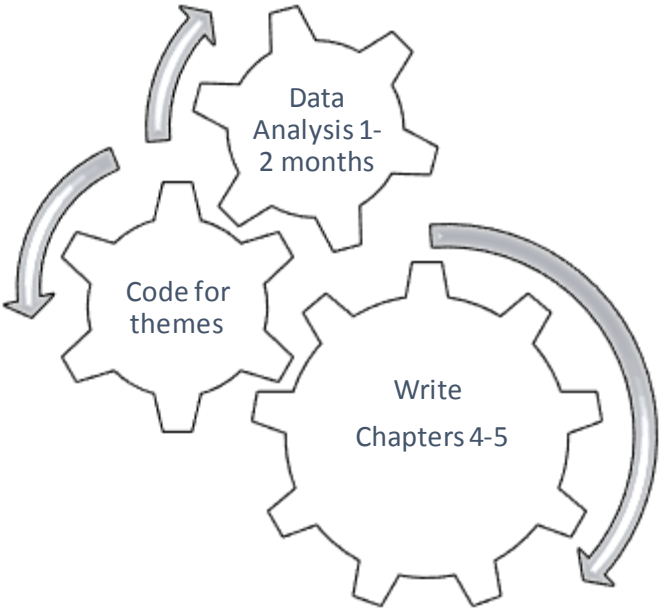


Figure 3.1. Research Process Flowchart details the three data sources (interviews, focus group, letters) in Data collection, then the process of Data Analysis and the final step of writing Chapters four and five.

Trustworthiness

The following measures were used to ensure trustworthiness of this study: triangulation, member checks, peer debriefing/review, bracketing, and thick, descriptive data. These measures were derived from methodologists Yin (2014) and Stake (1995) with an added influence from my journalism background. All of these together addressed accuracy, reliability, confirmability, and transferability of the study.

Since the study was conducted in the college where I taught, I needed to have several systems in place in order to ensure the trustworthiness of this study. Also, since I did want to guard against false conclusions, I also depended on colleagues and participants to help me check for accuracy (Stake, 1995; Yin, 2014). In an attempt to validate themes and perspective, I collected data from several resources. These included individual interviews, an online focus group, a follow-up interview asking one question—What advice would you give to rising students about navigating the math requirement?, and a reflective journal entry of recommendations to the provost about math course designs and suggestions of what the college can do to help students meet the math requirement so that they can persist in degree completion. By collecting from several sources and many perspectives and comparing data, using triangulation, I was able to affirm valid themes and achieve maximum variation and synthesize the results.

In order to ensure accuracy as I drew conclusions, I had the participants check the transcripts of their own interviews and read the final report. I also asked for input on conclusions drawn and for submission of their own conclusions. I wanted the participants to feel ownership in this study. This increased the reliability of the study so that I, as the researcher, could correct any errors made in transcription or in analyzing the data and writing the report.

In an attempt to report accurately on the occurrence of and issues involved in math avoidance in the participants, I had a colleague who holds two master's degrees from sister universities read the study and verify the data analysis. Grumpy (pseudonym) was also a good source to confirm math avoidance in certain of the participants as he is also an adjunct faculty member who teaches Liberal Arts courses. I had him read my notes to make sure that I have not misinterpreted anything. This increased the reliability of the study through verification from a disinterested party (Creswell, 2013).

In order to discern how and in what way my own personal understandings and biases clouded the results and conclusions of the study, I reflected upon my personal experiences with math avoidance, as described in The Researcher's Role (p. 68), and bracketed myself out of the study. This was important for ensuring that the results and recurring themes were derived from the participants and not from my own understandings and perspective. Many perspectives of this problem must be explored, not just mine. Bracketing, even though it is mainly associated with phenomenology, can also apply to a case study because it attempts to ensure objectivity and let the voices of the participants be heard as they contribute to the knowledge of this national and organizational issue (Yin, 2014).

Creswell (2013) emphasized the importance of using a variegated group of procedures so that the researcher can paint an in-depth picture of the case. Thick, descriptive data increased the transferability of this study. This single-site case study was conducted at a small, private, 116-year-old Bible college in upstate New York. Participants were selected from the current student body, alumni, and faculty.

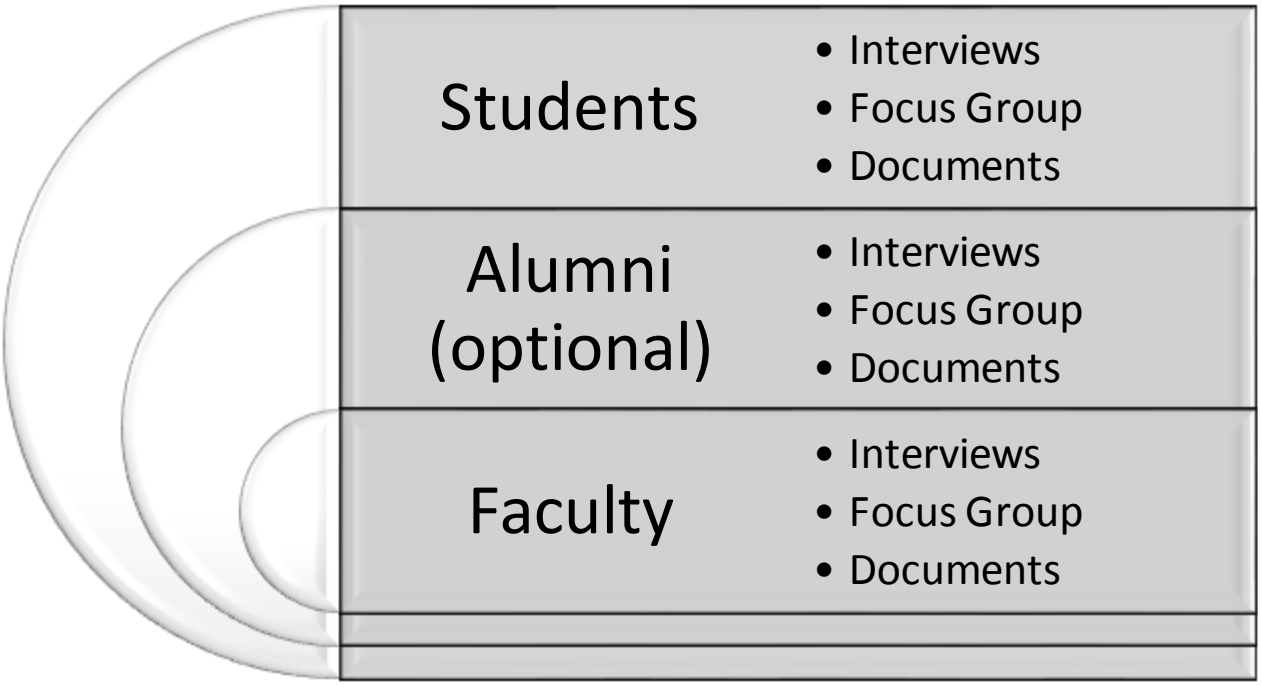


Figure 3.2. Flowchart of Participants and Data Collection.

Ethical Considerations

Ethical considerations were addressed. First of all, in order to comply with federal regulations and Liberty's requirements, no data was gathered until this study had IRB and site approval. In order to safeguard anonymity, pseudonyms were used for the site as well as for the participants. To guarantee security of data, all electronic files have been saved as password-locked files and all hardcopy files have been locked in a file drawer of a cabinet to which only the researcher has access.

Since this study was conducted at the college where I worked, I made sure that personal influence was removed. I did this by selecting participants only among students whom I did not teach in my concentration or advise, graduates of the college, non-graduated alumni, and faculty.

Participants were not coerced into participating in this study. Each participant received an informed consent letter/form (Appendix A) and was given the opportunity to sign or decline. Per the recommendation of the IRB, I used the Liberty University template.

Summary

Chapter Three described the methods that were used to conduct this qualitative instrumental case study. This study was conducted at a small Bible college in upstate New York. As it was an instrumental, within-site case study, the detailed, in-depth data came from multiple sources of information gathered from the participants. Data collection included interviews, a focus group, and two documents from the participants.

This chapter detailed the design, research questions, setting, participants, procedures, researcher's role, and each means of data collection. Three tables provided the starting questions for the semi-structured interviews. Other means of data collection included a focus group and documents written by participants—a follow-up written interview with advice to incoming students and a reflective journal entry of advice to the provost. This chapter also described the data analysis that was used as well as the means for maintaining trustworthiness. Ethical considerations were also discussed.

CHAPTER FOUR: FINDINGS

Overview

This chapter presented the results of this study from data collected via semi-structured participant interviews, a focus group, and follow-up written interviews and reflective journal entries submitted by participants. The findings of the interviews, focus group, and written documents collected for this study showed the perceptions and opinions about mathematics at the target college from the viewpoint of faculty, current students, and recent alumni. The purpose of this case study was to describe math perception and avoidance for undergraduate students at a small, private Bible college in upstate New York. Data was presented according to the themes generated. Themes were synthesized with the research questions guiding this study. Finally, a summary of these findings and conclusions drawn from the data was presented.

Participants

This instrumental, within-site case study was conducted at a small Bible college in upstate New York with 16 participants—10 students, three recently graduated alumni, and three faculty. Participants ranged in ages from 19 to 72, with 10 males and six females. Of the participants, 11 were Caucasian, four were African-American, and one was an international student of Eastern European descent. Following are portraits of each individual participant using the pseudonyms.

Table 4.1

Demographics of Participants

Pseudonym	M/F	Age	Race	Rank	Concentration/ Career	Math Experience
Anna	F	22	Caucasian	Senior	Counseling	Tested out of remedial Delayed it until junior year Passed Math I online
Christy	F	19	Caucasian	Sophomore	Counseling	Tested out of remedial Took Math I 1 year early
Dani	F	24	Caucasian	Senior	Worship leadership/Music	Took 2 remedial courses Delayed Math I until 2nd semester of senior year
Kevin	M	20	African-American	Freshman	Christian Ministries	Tested out of remedial Is delaying taking Math I as long as he can
James	M	21	African-American	Sophomore	Organizational Leadership	Tested out of remedial Passed Math I already
Wayne	M	22	Caucasian	Junior	Pastoral	Completed requirement at previous school Took 1 remedial course Passed Algebra I with a D Retook Algebra I and passed with A's &C's
Anthony	M	21	African-American	Sophomore	Organizational Leadership	At previous school: Took 1 remedial course Passed math with non-transferable D At NYBC: Currently taking Math I
Ava	F	20	Caucasian	Senior	Creative Arts/ Drama	Tested out of remedial Passed Math I in 1st semester of freshman year
Larry	M	20	Lithuanian	Freshman	Undecided	Tested out of remedial Has not taken Math I because not on schedule for freshmen
Mitch	M	27	Caucasian	Senior	Organizational Leadership	Tested out of remedial Passed Math I in 2007
Ellen	F	27	Caucasian	Alumna, AAS	TESL/Retail Clerk	Took 2 remedial courses Failed Math I twice Passed Music Math

Michael	M	26	African-American	Alumnus, BRE	Youth Ministry/Youth pastor	Took 1 remedial course Failed Math I freshman year Passed Math I senior year
Jonathan	M	25	Caucasian	Alumnus BRE	Organizational Leadership/ Christian School Leader	Took 2 remedial courses Failed Math I Passed Music Math
Dr. Avery	F	52	Caucasian	Faculty	Math Adjunct	Hated math in elementary Loved math from 9th grade on
Dr. Cameron	M	72	Caucasian	Faculty	Pastoral & Christian Ministries Chair	Math major in high school Thinks math should be required for BRE
Dr. Rogers	M	51	Caucasian	Faculty	Music/Worship Leadership Chair	Hated math and math teachers from high school on Avoided Math I until senior year of BRE Loved teaching Music Math

Anna

Anna is a 22-year-old female Caucasian senior at New York Bible College. Her concentration is counseling, and her ministry goal is to work with women. Although Anna tested well enough on the diagnostic to forego remedial courses, she avoided taking her college math course until her junior year.

Christy

Christy is a 19-year-old female Caucasian sophomore whose concentration is counseling. Her ministry goals are to minister to those in emotional and spiritual need as a counselor. Christy, who enjoys math and tested out of the remedial courses, is currently taking her math elective because it fit in well with her schedule.

Dani

Dani is a 24-year-old female Caucasian senior in the worship leadership/music general program. Her ministry goal is to work as a music teacher and/or music therapist. Dani delayed attending college for two years after high school, tested low on the math diagnostic, and took two remedial courses prior to enrolling in the math elective. She is currently taking her required math elective in the last semester of her senior year and must pass it in order to graduate on time.

Kevin

Kevin is a 20-year-old African-American freshman in the Christian ministries concentration. His ministry goals are to be a basketball coach and start a basketball ministry for inner city youth. He has always struggled with math and has not taken his math elective yet because it is not offered to freshmen at NYBC unless requested, and since Kevin says he tends to avoid things he does not enjoy, he has not hurried to take his math course.

James

James is a 21-year-old African-American sophomore in the organizational leadership program. His ministry goals are still being developed. Although James was not a fan of math in high school, he says he has gotten much better at math in college. When he entered NYBC, James tested out of the remedial courses and has already taken and passed his math elective.

Wayne

Wayne is a 22-year-old Caucasian male junior in the pastoral concentration with an emphasis in Biblical Hebrew. His ministry goals are to preach sermons and write books. He was homeschooled, knew the basics of math and was quite confident in it, even though he was not always the best at it, until high school math like algebra and trigonometry overwhelmed him and did not make sense to him. He finished high school taking consumer math, but did not do well on

the placement test when he entered a local community college, which landed him in a remedial algebra class. After passing the remedial course with top honors, he barely passed College Algebra I with a D and had to retake it in order to finish his degree there. However, under a different teacher, Wayne made mostly A's and successfully completed the course. When he came to NYBC, Wayne transferred in his math course, so he did not have to take any more math, which made him happy and proud that he had accomplished this task and freed himself from math. However, his attitude toward math began to change this year as he helped a 20-year-old special needs student with math in a summer school program.

Anthony

Anthony is a 21-year-old African-American male sophomore in the organizational leadership program. He is uncertain about his ministry goals, but plans to be involved in some type of ministry. Although he enjoyed math and was good at it when he was younger, math became more difficult for him in high school, and he began to perceive it as annoying. Anthony took remedial math at his previous school and passed a credit-bearing math course with a D, so it did not transfer. He is currently enrolled in his math elective at NYBC, but hates it, has not done his best, admits he could do better, and views the math course as annoying.

Ava

Ava is a 20-year-old Caucasian female senior in the creative arts/drama emphasis program. Her goal is to use musical theater as a ministry. Ava was homeschooled, and although math was never her favorite subject, she could succeed at it until she started taking Algebra I in high school, at which time she struggled because math became difficult for her to understand. However, her mom hired a retired math teacher to tutor Ava, and she began to succeed in her math courses, finished high school, and tested out of remedial math for college. She took her

math elective in her first semester at NYBC because she wanted to get it done and out of the way.

Larry

Larry is a 20-year-old freshman from Lithuania who has not yet chosen a concentration nor decided on ministry goals. Although math was his favorite subject at first and he actually likes math a lot, when math became harder for him in high school, Larry did not like it so much. He has never taken a remedial course and has not yet taken his math elective at NYBC because it is not on the schedule for freshmen. He said he might try to avoid the math elective if it was calculus or some other really hard course.

Mitch

Mitch is a 27-year-old Caucasian male senior in the organizational leadership program whose ministry goal is to become an interpreter for the Deaf. He actually enjoyed math as a younger student, but that changed in high school. Because Mitch has special needs, he had to choose between utilizing the resource room and enrolling in accelerated math, and because he chose to continue with resource room, he was placed in a much slower moving math program and felt that his teacher looked at him with a jaundiced eye even though he did well in the class. Mitch completed his college math elective in 2007.

Ellen

Ellen is a 27-year-old Caucasian female alumna of the Teaching English as a Second Language concentration who graduated with an AAS. Because of a learning disability, Ellen has struggled with math all her life. At NYBC, she took two remedial math courses and failed Math I twice, but she was able to successfully complete Music Math as her math elective. She currently works as a clerk at Dollar General.

Michael

Michael is a 26-year-old African-American male 2015 BRE graduate of the youth ministry concentration. His ministry goals are to be a full-time youth pastor, honor Christ, and bring young people to Christ. He currently serves voluntarily as a youth pastor in a small suburban church, works part time as an assistant basketball coach at a SUNY community college, and works full-time at an inner city agency designed to keep middle and high school students on track and in school until they graduate. Michael failed college math his freshman year, avoided retaking it until his senior year, but passed the course with a 94 in his senior year.

Jonathan

Jonathan is a 25-year-old Caucasian male BRE graduate of the organizational leadership program. He currently serves as the Assistant Athletic Director, Fundraising and Event Coordinator for a large Christian school in North Carolina. His ministry goal is to one day be an Athletic Director of a large Christian school. Jonathan almost did not complete his bachelor's degree because of the math requirement. He took two remedial courses and failed Math I. Then the college offered Music Math, and even though he still struggled in Music Math, he enjoyed it and passed, calling it his "saving grace." In his current job, he says he uses math every day.

Dr. Avery

Dr. Avery is a 52-year-old Caucasian female faculty who holds a master of education in curriculum design and instruction with a content area of mathematics. She serves NYBC as assistant to the registrar, an academic advisor, and math adjunct, teaching three math courses: Foundations of Math (remedial), Math I, and Math II. She hated math in elementary and middle school because of the emphasis on memorization of facts but began loving math in ninth grade algebra because of math's sensibleness and challenge of puzzle solving. Math does not come

easily to her, and people do not look at her and consider her a math whiz, but she likes math and can handle herself even though she is not fast.

Dr. Cameron

Dr. Cameron is a 72-year-old Caucasian male faculty who holds a doctorate of ministry and serves as Academic Dean, student advisor, and chair of the pastoral and Christian ministries concentrations. He was a math major in high school, and math came naturally for him as he made extensive use of it in his contracting business. Math was not required for his bachelor of arts in history degree, but he thinks math should be required for a bachelor's degree in light of the necessity for math skills for basic living obligations and requirements.

Dr. Rogers

Dr. Rogers is a 51-year-old Caucasian male faculty who holds a master's of theology and is currently working on his Ph.D. A 2008 BRE graduate of NYBC, Rogers serves as an academic advisor and chair of the music/worship leader program. His ministry goal is to come alongside students as they journey to realize their potential in Christ, including personal and professional goals. High school geometry and trigonometry were difficult for Rogers because he was not allowed to solve math problems unless he used the formal rules even though he was able to answer correctly. This frustrated and discouraged him and caused feelings of animosity between him and his math teachers. Consequently, he avoided college math until the first semester of his senior year. Dr. Rogers was a key creator of Music Math at NYBC, alongside another colleague.

Results

Research Question # 1: *How does math remediation influence students' math perception?*

The three methods of data collection—interviews, focus group, and documents—indicated that for the most part and historically, math remediation at NYBC has evoked discouragement, a sense of dread, and an aversion to math. In other words, math remediation at NYBC has produced the opposite results desired and has negatively influenced students' math perception. Conversely, data collected from participants suggested that creating a positive atmosphere and presenting remedial math with a positive approach, possibly with food, could bring about change in students' math perception and thus lead to success in remedial courses and influence a positive perception of math in the NYBC students.

For the sake of anonymity, each participant was given a pseudonym after he or she had volunteered to participate in the study and had signed and submitted the informed consent form. The pseudonyms given were gender specific to indicate a female student or alumna, male student or alumnus, male faculty or female faculty. Data from participants was presented as a combination of direct quotes and paraphrases, depending on which was deemed more effective by the researcher. Concerning remediation, four key themes emerged—discouragement, sense of dread, history of aversion to math, and a positive approach.

Discouragement

Participants varied greatly in personal experiences with remedial math from having failed two remedial courses, to struggling through and passing one to two courses, to not having to take a remedial course at all. These courses that are designed to prepare or remediate a student for the credit-bearing math course actually seem to frustrate and discourage the underprepared math students, influencing students' math perception in the opposite direction from that which is

desired. Ellen said that after failing two remedial courses, she almost gave up on her degree. Kevin said that remedial courses made math seem like another language to him. Wayne and Dani both indicated that their experience with math remediation influencing their math perception was determined by the faculty who taught the courses. Jonathan's comment captured the consensus of thought toward remedial courses: "They do not work. . . . The word 'remedial' carries a lot of baggage. Most teachers who teach those courses refer to us or think we are dumb or stupid."

Of the three faculty participants, only one weighed in specifically on remedial math, and the one theme that emerged was a necessity to streamline the process. According to Dr. Avery, the college used to have a three-step remediation process, and the remedial courses crammed three years of high school math into two semesters before a student was deemed ready for Math I. When Dr. Avery took over the math at NYBC, she changed that to one remedial course and one college level course—Math I, and she modified the remedial course so that it only covers the specific math skills needed to be successful in Math I. Dr. Avery echoed Jonathan's perception that the faculty makes the difference. She commented,

> A perfect example is my husband. He doesn't have to be taught a thing. It just comes to him math wise. When he was working with a remedial bunch, he was stymied, "What do you mean you don't get it?" And he would explain it the same way over again not coming at the problem from another side. When I came to help him and they understood, he asked me, "How did you do that?"

Table 4.2

Remedial Math Courses Experiences/Perception

Participant	Group	Experience/Perception
Ellen	Students/Alumni	Failed 2
Kevin	Students/Alumni	Passed 1/Math like another language
Wayne	Students/Alumni	Passed 1/Faculty made difference
Dani	Students/Alumni	Passed 2/Faculty made difference
Jonathan	Students/Alumni	Failed 2/They do not work
Dr. Avery	Faculty	Taught 2/Streamline and teach only basics needed for Math I success

Sense of Dread

Participants described a sense of dread toward remedial courses. Dani explained, "I dreaded math coming into New York Bible College. . . . I delayed starting college because of health problems. I did not pass the placement test, and I was not excited about having to take remedial math."

Dr. Avery added, "Avoiding something distasteful is natural; essentially this strategy is a survival mechanism. Many students come to our college with a history of distasteful math experiences and deficits."

Eight other participants including Dr. Rogers conveyed a personal sense of dread toward remedial math courses. Kevin explained, "Math is something I do not enjoy. . . . If I start math all over again after not doing it for a long time, it is like another language to me."

History of Aversion to Math

Participants described the college's history of student aversion to math. This emerged during the focus group. Dr. Cameron said,

> We used to think it would be best for students to take math earlier. Entering freshmen took a placement test; then they could take Math I their freshman year, or if they needed a remedial course, they could take Math I their sophomore year. There was such an aversion to math, that NYBC moved it out of the associate's degree and into the bachelor's degree. That is why it's in the third year. We wanted students to have opportunity to get adjusted to college before having to face a difficult course for many of them. This also makes it possible to earn an associate's without a math requirement. A student can choose math in an associate's degree as an elective.

Positive Approach

Participants addressed remediation in the interviews and documents. Dani recommended in her Reflective Journal entry that the college have the "math remedial courses viewed in a positive light, not just as a requirement for Math I." In the interview, Christy said, "Perhaps attitude would need to be changed. To look at it more as a practical opportunity instead of a requirement."

Both Dr. Rogers and Dr. Avery addressed remedial math courses. Dr. Rogers recommended that the college provide a "positive classroom environment with food" in the remedial math courses. Dr. Avery's advice to students was to "not postpone taking the remedial class or Math I." Her recommendation to the college was to "streamline the math sequence" of the remedial courses and maintain one remedial course which "only covers the specific math skills needed to be successful in Math I" as opposed to the previous sequence of courses which "used to cram three years of high school math into two semesters before a student was deemed ready for Math I."

Research Question #2: *How does math perception influence students' math avoidance?*

Data collected from the interviews and focus group indicated that NYBC students' math perception does influence math avoidance, exacerbating it. Data revealed a struggle to understand math, feelings of inadequacy and frustration, failure from ineffective teacher methods, perception that the college's current math course is not relevant to the students' career needs, thus a questioning of the college's decision to include math as a liberal arts course requirement, and a purposeful delay in taking the course. Data collected from the documents suggested that the college could improve this situation by offering multiple math course options, providing more available resources to help students succeed, and advising students to make wise choices in navigating the math course requirement and completing degrees.

Struggle to Understand Math

While the majority of participants struggled with math or hated math at some point in their lives or throughout the school experience from elementary on, three of the 16 participants actually expressed a love for math.

A common thread in this area was a struggle to understand math, which led to a bad or even traumatic experience with math. Fourteen of the 16 participants specifically described this. Ava commented,

> When I entered high school and started taking Algebra I, I struggled a lot. It was difficult for me to understand, and I often had to work very hard to succeed at it. . . . Geometry I liked a little better than Algebra . . . I was generally able to understand and succeed at it, though it took me a while sometimes. . . . Algebra II went fairly well . . . I did not take a math course after that until coming to college, where I enrolled in Math I. . . . This math

> course seemed very odd to me, and sometimes I felt I never really understood the concepts.

Jonathan stated,

> I have always struggled with math. Even with multiplication, when I was young I was told I could never do it. I was always in the classroom getting tutored in math when my friends were outside playing. I felt like I was in trouble for not knowing math. Then we went into fractions, division, and then we launched into pre-algebra and algebra, and I was lost like a kid in the wilderness.

Similarly, other participants described their struggles to understand math. For Ellen, it was all her life. For Dani, it was on and off throughout her schooling. However, for seven of the participants who experienced this issue, the struggle began when they encountered high school math.

Although Dr. Cameron personally had never struggled with math, he acknowledged his awareness of this real struggle in students. Dr. Cameron commented,

> I discovered that many students with math avoidance tendencies did not have a good experience in previous high school math courses. . . . Nor did students receive proper tutoring in understanding math. They were just passed to get them through school and "let math become someone else's problem."

Both Dr. Avery and Dr. Rogers had personally experienced a struggle with and disdain for math at some point in their schooling. For Dr. Avery, it was during elementary school. She explained,

> Most people enjoy elementary school math because they enjoy manipulatives. I don't remember any of that. I just remember worksheets. When in elementary and middle

> school I hated math because of the stress put upon the memorization of facts. It seemed like all I ever did was "dittos."

For Dr. Rogers, his bad experience and struggle with math began in high school and extended into college. He explained,

> High school geometry and trigonometry were difficult. I was not allowed to solve math problems unless I used the formal rules, even though I was able to answer correctly. . . . It was quite devastating! Even if I answered the question correctly, I often failed tests. That was extremely frustrating and discouraging. As an adult learner, much of the anxiety and frustration still carried over—25 years later!

In addition to a struggle to understand math, feelings of inadequacy and frustration were also a common theme.

Feelings of Inadequacy and Frustration

Nine of the 16 participants described feelings of inadequacy and frustration which in some led to a fear of failure. For Wayne, these feelings went back to his high school math days when he began to study algebra and trigonometry and the letters in math did not make sense to him: "Often, I would save my hard math for when my Dad got home from work." Dani explained that her frustration correlates with her understanding or lack thereof: "I have found that I love math once I understand it, and that doesn't seem to happen as much as I would like. I get frustrated." James attributed his feelings of inadequacy and frustration to there being "so many extra things to learn that if you make one slip up, you can get an entire problem wrong." Michael's feelings of inadequacy affected his decision to put off taking college math until his senior year: "I thought the people around me would make fun of me because I wasn't the best math taker." Both Ellen's and Jonathan's feelings of inadequacy and frustration contributed to a

fear of failure and specifically the possibility of never completing a college degree. Jonathan explained,

> I have always hated failing. I'm not afraid of it. I just want to succeed. And I know I can't succeed in math. I knew I had to do math. I just did not know how. I never thought I would get my degree because of math.

Dr. Avery's feelings of inadequacy and frustration mirrored those of Ellen and Jonathan in that they translated into a fear of failure. Dr. Avery explained,

> Part of the reason I avoided beginning a graduate degree in math education was because I was afraid of failing. Although I like to solve problems, I am not particularly fast. I was afraid that I would not be able to keep up in graduate school. . . . I just didn't have the confidence. People didn't look at me and say, "There's a math whiz."

Dr. Rogers said, "As a young adult, I avoided math out of frustration. Math teachers in general seemed more concerned with the process than the answer. I felt at the time that I did not see the world as others do." Rogers explained that even when he answered questions correctly, because he did not follow the teacher's exact prescribed process, he often failed tests. He said, "That was extremely frustrating and discouraging."

Additionally, ineffective methods used by teachers was a common theme among the participants. These ineffective methods influenced the math perception of the participants, which in many led to math avoidance. Twelve of the 16 participants described the influence of ineffective methods in their perception of math or others' perception of math.

Ineffective Methods of Teachers

Ineffective methods described by participants varied somewhat. For Mitch, a special needs student, it was low expectations, as he explained,

> Going into ninth grade I had to decide to either opt out of special education totally and drop resource room and not be able to take accelerated math. I elected to continue with resource room, and, therefore, I was stuck with a much slower moving high school math program. . . . I felt that I would have thrived more in a more accelerated program.

For James, it was too high expectations, as he stated,

> People in my family have always been good at math. I have never been really bad at math, but I have been better at doing it in my head than putting it down on paper. . . . My last [high school] math teacher had a negative effect on me. Her teaching strategy was not helpful. She didn't really teach us. She expected the high stream math group I was in to know everything from the beginning.

Others described the ineffective methods used by college math teachers. Michael said, "My first math teacher at the college (NYBC) made math really difficult and didn't explain it well." Dani said that because of ineffective methods in her first remedial course, she "learned little" but in her second remedial "being challenged to not only write the equations and explain them helped me." Wayne described his first experience in college Algebra I:

> The class began all right, but the teacher was dull and put us all to sleep. Literally, the only thing I remember from it was that a kid got kicked out of the classroom because he got caught sleeping. I ended the class with a D.

Anna had a hard time keeping up with the pace of the teacher in a traditional classroom. She explained, "My brain just doesn't work that way, and it takes a long time to understand mathematical equations and concepts. . . . I avoid math because I have such a hard time understanding it." She finally took her required college math elective online because in class she "began to fall behind."

Although Dr. Cameron did not speak from personal experience, he did express his experience related to advising students and getting them into a math course. Dr. Cameron noted that many students with math avoidance tendencies had bad experiences in high school math courses.

For Dr. Avery and Dr. Rogers, it was personal. Dr. Avery recalled her elementary math as "being a chore" filled with "boring lectures, unapproachable professors, drill and kill" methods. Avery described her experience with ineffective methods of some of her teachers: "I had some teachers who were not encouraging at all. One would not answer any of your questions and would say, 'That's a dumb question.'" For Dr. Rogers, his experience with the ineffective methods used by his math teachers affected him for life. Besides the inflexibility of teachers who would not allow him to solve math problems unless he used "the formal rules," Rogers added,

> I remember attending the after school math tutorial in high school. The prize pupils were there with me and a few others. I was there to get help, and the teacher told me to sit over to the side and do my problems, while the teacher focused their attention on the prized students. I just sat there and worked on my homework. I could have done that at home. So, I never went back to that after school session!

In addition to a struggle with understanding math, feelings of inadequacy and frustration, and ineffective methods used by math teachers, perception that a college math course is not relevant or beneficial to life or ministry goals was a key theme. All 16 participants weighed in on this theme.

Relevance

Relevance was a key subtheme addressed by participants in both the interviews and focus group.

Kevin, Mitch, Anthony, James, and Ava articulated that they felt math is not necessary for their careers, and therefore it was a "waste of time" to take the math elective. Ava said,

> I would avoid taking math as far as is in my ability because I do not enjoy it, and I do not feel that most of it will be beneficial to my life. I have a calculator on my phone that can take care of most of my daily mathematical needs, and I see no good reason to not avoid taking a math class.

Wayne captured the sentiment of many of the NYBC students concerning the relevance of a math course in completing a BRE. He said,

> Students at a Bible college tend to place math at a very low priority since they are usually going into some kind of ministry, and they do not think that math has any practical importance for them. . . . As we observed, we use math in many ways in our daily lives without being aware of it. Thus, clearly it is more valuable than we realize.

When asked by Dr. Cameron during the focus group, "What can NYBC do to help new incoming students to get prepared with less anxiety to take math?," Wayne replied, "Having math courses that deal with practical issues making them relevant to their lives." Dani confirmed Wayne's idea in her description of the math course that she was currently taking: "The ministry examples of math usage helped me a lot to overcome my extreme difficulty in seeing and extracting the needed math exercise from a word problem." Dani offered her own answer to Dr. Cameron's question: "Remind students that the principles and patterns of math are created by God, and as such they are not scary. God made it, so it must have importance."

Wayne added, "I think that they [the college] should make math easier, or focus on the stuff that we need in regular life. . . . I wish I had been taught how to do taxes." Dani concurred,

"Make it more fun, or even better, more practical. In Math I the material is closely connected to real life, and the assignments line up with that truth."

Anthony felt that the teachers at the college should be more proactive about "providing more specific facts about why students need math. . . . I think they could do more in helping students to understand how math could help them in the future." Jonathan, who thought he would never be able to finish his degree because of math, said that he uses "division, multiplication, and adding every day" in his ministry: "Truly you do need math every day. It truly has helped me in my job with the budgets that come through my desk." Consequently, although the prevailing perception among NYBC students is that a math course is irrelevant to their career fields, quite the opposite is true.

Dr. Cameron noted this perception among NYBC students and addressed it: "My experiences here relate to advising students and getting them into a math course. Many did not see the relevance of such a course if 'I'm going to be a pastor.'" Conversely, Cameron added,

> Pastors and missionaries need basic math skills; the kind you would use in everyday life situations. One primary area would be basic addition, multiplication, division, and subtraction skills. How to do percentages should also be factored into a course. One should also have some exposure to budgeting, not just personal but budgeting for businesses and organizations like churches and agencies.

While pursuing his BRE at NYBC, Dr. Rogers was one of those students who did not see the relevance. He described his perception about the math requirement:

> Before taking the course, I felt it was a huge waste of my time. . . . Certainly, part of my frustration as a student centered on the needlessness of the math requirement. When I came to NYBC, I knew that a BRE did not require math, but NYBC was looking to make

> the BS transition, so math stayed in there as a requirement. I stayed with an old program that required more total credits in order to avoid taking another math. My attitude was "I will not take two maths—out of the question!"

In addressing the issue of relevance from a faculty perspective Dr. Rogers added,

> As schools continue to look at math for the general students, they need to think about the human flourishing issue so that they don't just teach algebra because this is what's required, but we couch the matter of math in terms of what do they need for life? There are things in geometry that apply to staging and lighting. There's wonderful stuff for us to engage with. One of the questions that I hear repeatedly is, "Why do I need this?" Rarely do I hear an answer. We need to say, "You need this because . . ." This answer will avoid antagonism. A life skills math course will easily answer that question—how to balance your checkbook, how to do a spreadsheet . . . Yeah, I think those are good moves. . . . This is a generation that wants to understand the usefulness and practicality of it.

Dr. Avery explained the issue of relevance from her perspective:

> Ministers and missionaries need to be able to handle money wisely. They also need to be able to use math as a tool in construction, plotting trends, cooking, and simply as brain exercise. I think overall problem solving. Unfortunately, the math for cooking and construction is not college level. Things that students need like how to balance your checkbook—that's not college level rigor. . . . They don't understand tax forms. They don't know where these numbers come from. They get into trouble with credit card debt. I can cover some of that, but it can't be the basis of a college math course. Algebra is very helpful for plotting trends of attendance or project where you're going to be growth

wise or financially. Can we expect to be able to buy pews, etc. So that would be good. And that is college level.

Dr. Rogers addressed the subtheme of relevance from the perspective of offering suggestions. He said, "The names of the different math courses don't tell a student much if anything about what the math is used for. Maybe if you had How to Do Your Taxes Math, etc., some of the anxiety might be removed."

Table 4.3

Math Perception as Reported by Participants

Subtheme	Number Reporting
Struggle to understand	14
Feelings of inadequacy & frustration	9
Ineffective methods of math teachers	12
Irrelevance of the college's math course	16

Questioning the College's Decision

Students questioned the college's decision in choosing math as a liberal arts requirement. Wayne said, "It seems that the college has math courses because they are required by the accrediting organizations rather than because they benefit the students." Dani explained the change in her perception toward math while at NYBC:

> When I came to NYBC, I was dreading math . . . since math and I were not friends, it was not on my radar. . . . I personally was overthinking the whole math thing: Oh my gosh, they are going to have us doing pre-calculus! Part of it is overthinking the whole thing, assuming it is going to be all the parts of math I have problems with. I had a lot of trouble in Math, but now I understand it, and I am enjoying it, and I may find a way to take Math II although it isn't required for my concentration. . . . It seems that some students like math and despise English while others like English and avoid math.

Faculty participants addressed the question of the college selecting a math course as one of the liberal arts requirements. Dr. Cameron explained why NYBC selected math as a liberal arts requirement:

> With regard to Middle States and possibly New York State, they did not specify math. They do specify what New York State calls liberal arts. And out of all of the choices available to us, we chose math as one of the liberal arts courses because we thought that a college graduate should have some math knowledge and skills in order to make it through life because math is critical throughout life. So, that did enter into the planning for general education courses. In order for a student to have a well-rounded education, we thought math was a needed subject. We also felt our public schools were not doing a good job in preparing the students in both math and English. There's some carry over from high school into college. . . . Some students are so afraid of math that they psychologically are convincing themselves, "I can't do it!"

Dr. Rogers added,

> As I'm listening to students talk, I'm wondering if they have experienced any failures in math outside of the classroom. "I screwed up my bank account and lost $1,000, etc." We feel that our students are coming in ill-prepared. Maybe they tested poorly coming in for whatever reason, but they don't actually have problems with using math adequately outside of the college situation. What are the actual shortcomings, if any? . . . What happens in real life when there is no class and the anxiety that comes with it? Maybe the disconnect is a fear of math as a subject rather than math in all contexts.

Delay

Another subtheme, delay in taking the one required math course, was addressed by participants. Even Christy, who has always enjoyed math and is currently taking her math elective expressed, "I did not really avoid math, but I was not in a terrible hurry to take it. I suppose some people are not fond of math so they might have put it off."

Both Wayne and Dani weighed in on the theme of delay. Wayne wondered if students' fears are amplified by the college's decision to wait until the fall semester of the junior year to schedule the math requirement. He said,

> When it has been a long time since the last high school math course was taken, the fear of having to face math again may be intensified. If the student goes in earlier, they may remember more from their prior math courses.

Dani explained her decision to delay taking the math requirement even longer:

> I took math my senior year motivated by the fact that I simply had to pass it. I like to do the hard things last because of the additional motivation of it being late in the game. Also, students often have a lighter credit load toward the end, and thus will have more time to spend on a more difficult subject.

Dr. Rogers explained his perspective on why NYBC students delay taking the math requirement even beyond the scheduled time of the fall semester of the junior year. He said,

> Students seem to delay math for a lot of reasons. They come in with a desire to pursue a specific field of study, and they do not want to spend time taking courses that do not pertain to that field. So they will try to avoid courses like math in order to take courses that they like, that pertain to their interests. They will put off courses they do not like and do not want to take, often until their senior year.

Multiple Math Options

The subtheme of multiple math options was addressed by participants. Eight participants suggested multiple math course options as a means of changing math perception among NYBC students and thus influencing math avoidance. Anna recommended that the college "keep the online math program and offer more, multiple math options." Wayne and Anthony suggested that the college "offer concrete life skills math" and "offer useful math for the students' futures," respectively. Larry recommended that NYBC should "make it an easy course because we are in Bible college, and I don't think math should be a class that students worry about passing. Their mind set should be on Bible classes." Dani suggested that the college schedule the math course at "a better time . . . earlier in the day and not after a meal, so the minds are fresh." Ellen captured the thoughts of the group:

> The college should have multiple math options for students who struggle with math or have math anxiety. No one math class works for everyone. If students are given different options then they would be more willing to take math and be less anxious about taking math.

Dr. Rogers recommended that the college offer Music Math as an option. Dr. Avery wrote, "My recommendations to the provost and the college would include offering Math I every semester to insure smaller class sizes and to limit scheduling conflicts."

Wise Choices

The subtheme of wise choices by students was addressed by nine participants. Participants offered advice to incoming students for making wise choices in navigating the math requirement at NYBC. Anna recommended that students "take math online." Ellen, Kevin, and Wayne suggested that students "choose a light semester" to take the math course. Christy, Kevin,

and Ellen all agreed that students should not postpone taking the math requirement. Kevin explained,

> You might as well get it over with because you can only run from your problems for so long. The key to completing it and finding success in it is . . . not to be lazy. If a man wants to see his paycheck he must work for it. No work, no paycheck.

Larry advised students to not worry and to take the math at NYBC "because the college does provide good helps." Dani's advice for making wise choices was to "go out and try." She explained,

> Take the placement and do your best. If you ended up struggling and having poor results then at least you know you can get help and eventually succeed. If you decide to, *that* is the key. If you approach math with the thought that you will not understand and fail, then that will be your result. You've already made the decision for yourself. So my advice is to keep trying and not give up. Math can be fun.

Dr. Rogers suggested that students choose "a light semester" in which to take the math course requirement. Dr. Avery recommended that incoming students "not postpone taking the remedial class or Math I."

More Available Resources

Participants addressed the subtheme of the college having more available resources. However, there was some disagreement on this theme between Students/Alumni and Faculty participants.

Anna recommended that the college "Give students more resources to assist them in their math studies, such as specific math tutors." Wayne recommended that NYBC hire more math teachers because "Some instructors teach in a different way than how others learn. Having

another teacher helps to bridge this gap." He added, "Remove MyMathLab (a required Pearson purchase). Many students cannot afford it and it just isn't necessary as many math teachers still print out their homework assignments." He also described the dilemma and frustration of his sister (also a student at NYBC) with the software: "My sister used it, got the right answer, but the computer counted it wrong because of an extra space in the answer. The computer would make a mistake and affect your grade."

Only Dr. Avery weighed in on the subtheme of the college providing more available resources. However, her ideas were in disagreement with Wayne's. Dr. Avery recommended that the school increase its use of Pearson resources, "whether verbally or in providing financing for Pearson access." She explained,

> Certain students have the opportunity to purchase access to Pearson using the school credit card and then having that amount added to their school bill. Students are also allowed to use their College Dollars to purchase Pearson access. This practice helps to legitimize the choice of using this tool, and helps the students' attitude about paying for it.

Dr. Avery also recommended that the college consider offering free math textbooks for all students. She explained,

> This would remove the temptation for students to borrow from the Reserved shelf in the Library or muddle through without a copy of the textbook for a class. By adding a sufficient amount to tuition, the school could help students focus on learning rather than on coming up with cash for books. This would eliminate a stressor at the beginning of every semester and mollify the math students because they do not want to spend money on a math book.

Research Question #3: *How are students influenced in math avoidance by faculty, administration, or other revered individuals?*

Data collected from the interviews, focus group, and documents indicated that students are indeed influenced in math avoidance by revered individuals, that the influence may be advertent or inadvertent, intentional or unintentional, and that the influence may be negative or positive. Data from interviews and the focus group revealed both negative and positive turning points in the math experiences of participants: negative influence by faculty, parents, and peers; positive influence by faculty, tutors, parents, and peers; influence of intimidation felt by adult learners; and influence of the classroom environment. Combined, these data indicated that students are influenced in math avoidance by faculty, administration, or other revered individuals. Data collected from all three methods—interviews, focus group, and documents—demonstrated that of the revered individuals mentioned, only tutors positively influenced students in math success and, consequently, in overcoming math avoidance. The same data also showed that faculty, depending on whether or not they are friendly, open, and approachable, can influence students in math avoidance either positively or negatively.

Data for Research Question #3 was mainly collected from two sources: the participants' descriptions of math experiences and a direct question in the interviews—*Describe any influence by faculty, administration, pastors, chapel speakers, or any other revered individual in your life on your perception of math and avoidance of it*. Whether inadvertently or directly, all 16 participants weighed in on this matter. Some data were obtained when participants described their story of math experiences. Other data came from the direct question, and more data emerged from a question that asked for suggestions for what the college could do to help students with math avoidance complete degrees.

Table 4.4

Math Avoidance Influence by Revered Individuals

Subtheme	Number Influenced
Turning point negative	8
Turning point positive	6
Turning points negative, then positive	3
Negative influence of revered person(s)	12
Positive influence of revered person(s)	15

Negative Turning Point

With the exception of Ellen, Jonathan, Kevin, and Dani, who struggled with math all the way through school, most of the participants started with positive experiences in math throughout elementary school but hit a negative turning point in middle school or high school math. For Anna, the negative turning point came in third grade, but for the other seven participants who described this theme, the negative turning point came in high school. Christy was the only exception as she has "always enjoyed math and appreciated the practical side of it" from elementary through high school and on into college math. Wayne described his negative turning point:

> Growing up, I was homeschooled. I knew the basic forms (addition, subtraction, multiplication, and division) and was quite confident. . . . As I got older, I began to learn higher math, such as algebra and trigonometry. I was okay with the triangles, but the letters were mind-numbingly awful for me. None of it made sense. Often I would save my hard math for when my dad got home from work. He was a college math professor.

> However, it would always end with me being more confused and sometimes getting upset with my dad.

Larry said, "At first math was my favorite subject. In high school as math got harder, I didn't like it so much." Michael explained, "Earlier in my math experience, I was good at multiplying and dividing, etc., but when I got to algebra and geometry, I had trouble." Anthony added,

> When I was younger, I enjoyed math. I was good at it, but as I got older, it became more annoying, more difficult. In high school, I did okay with it. In college, I haven't done the best with it. I'm taking my math elective now. . . . I hate it because it's annoying.

For Ava, the negative turning point was traumatic:

> I was always okay at arithmetic and was even doing advanced material in elementary school. Not that I enjoyed it, but I could succeed at it. When I entered high school and started taking Algebra I, I struggled a lot. It was difficult for me to understand, and I often had to work very hard to succeed at it. There were many tears.

Consequently, for some, that negative turning point influenced their perception of math for life.

Positive Turning Point

Conversely, others described a positive turning point in their math experiences. This was the case for Ellen, Jonathan, James, and Dani. For Ellen and Jonathan, that positive turning point came when NYBC offered music math, and they took the course as the math elective. Ellen said, "I enjoyed the music aspect of the class as well as the many interactive aspects. The music director, one of the teachers of the class, was very helpful in changing my perception on math." Jonathan added that the music math course "made math fun. It was my saving grace. I still struggled, but I enjoyed it and passed. Math carries a stigma; music is fun. Together it changed my perception on education." For James, the positive turning point came in college: "In high

school, I was not a fan of math . . . but since I got to college I've gotten much better at math." Dani also discovered a positive turning point in college:

> I have found that I love math once I understand it . . . When I comprehend the mathematic material then I excel, I feel confident. . . . I'm learning math, knowing I'm learning math, and I enjoy going to the class every time.

Three of the participants experienced first a negative turning point and then later a positive turning point that brought them to success in math as well as a positive perception of it. This was the case for Wayne, Ava, and Michael. Wayne's first positive turning point came when he took consumer math in his senior year of high school and did well. His second positive turning point came when he retook Algebra I at the community college with a different teacher. He said, "I actually liked it better. In the beginning I got all A's." This course transferred in to NYBC as his math requirement, and as he explained, "I was finally freed of math." A third positive experience occurred during Wayne's college internship in which he worked as a special education teacher assistant helping a 20-year old guy with math. Wayne explained, "That changed my attitude toward math." Ava's positive turning point came in high school when her mother hired a former math teacher to tutor Ava in Algebra I. Ava said, "She was able to explain it in a way that I was able to understand, and by the end of the year I was able to succeed at Algebra I with fairly few problems." Because of her Algebra I foundation, "Algebra II went fairly smoothly." Then she enrolled in Math I her first semester at NYBC and passed successfully. Michael's positive turning point came much later. After struggling through high school algebra and geometry, then a remedial college math class, then failing Math I during his sophomore year at NYBC, Michael retook Math I as a senior and passed it. Michael explained, "I learned a lot about math in college that I never learned in high school because a teacher took

her time and helped me and brought me a long way, even to where I got a 94." Michael's success in math changed his perception toward it. He expressed his feelings: "It was very awesome!"

For Dr. Avery, her first turning point came in ninth grade algebra when she "fell in love with the sensibleness of math" and began to love "solving the puzzle by finding the value of x." This changed her opinion of math "from being a chore to being a puzzle. College math presented the same enticing challenge to me," she said. Her second positive turning point came when she was hesitating to pursue a graduate degree in math education as an older adult learner. Dr. Avery said, "The Academic Dean got in my face one day and said, 'You're not too old. You've got plenty of time ahead of you to do something different with your life, so do it.'" For Dr. Rogers, the positive turning point came when he was asked to develop and pilot a music math course at NYBC. He explained,

> It is almost ironic to have been asked to teach a math course given my own predilection to avoid math. Approaching the class from the teaching side has been a lot of fun. Knowing what I know about education and teaching, I knew that some of the things that have happened to me in math classes would be unacceptable in a class I taught—to tell a student that they are stupid in class, to snicker or laugh at the way they solved a problem. We changed the language of math in the class.

According to Dr. Rogers, the music math course was "designed to help students achieve their math requirement by combining the subject they hate with one they love." Becoming a math teacher himself changed the attitude and perception of Dr. Rogers toward math: "In hindsight, I see the value in terms of life skill. . . . When the goal of education is human flourishing, having a math requirement makes perfect sense."

The theme of negative influence(s) by a revered person or persons was addressed by 12 participants. For the majority of the participants, the revered person or persons were faculty/teachers. For most participants, the negative influence in perception toward math was directly administered. For others, it was more subtle, indirectly and unintentionally the result of comments made by faculty, parents and/or peers.

Negative Influence: Faculty

For Jonathan, the negative influence came from the faculty of his remedial courses: "Most teachers who teach those courses refer to us or think we are dumb or stupid. Those words hurt coming from your teacher. Those teachers tend to give up on you more easily than in a regular class." For Mitch and James, the negative influence came from a high school math teacher. Mitch explained, "She looked at me with a jaundiced eye even though I did well in the class. My high school math teacher was not helpful." For Wayne and Michael, a negative influence came from the college credit-bearing math faculty.

For both Dr. Avery and Dr. Rogers, it was math teachers. For Dr. Avery, it was during her elementary years: "I had some teachers who were not encouraging at all. One would not answer any of your questions and would say, 'That's a dumb question.' I try not to think on those too much, but they are always there." For Dr. Rogers, the negative influence of high school math teachers affected him throughout life to the extent that he avoided college math until he was 40 years old and a senior at NYBC. The negative effect continues today. Dr. Rogers said,

> Very quickly I developed some antagonistic relationships with my math teachers that would never change. I have held that anxiety that math teachers are pretty much jerks. Still today when I enter a math class those feelings remain. I start out thinking, "I hate the professor." I already think we are going to do battle and I'm coming in prepared for that.

> So my thought is always, "Can I like this person? Can we even be human together? Or is he/she going to look down on me because I can't do this simple skill?"

Negative Influence: Parents

Four of the students/alumni—Kevin, Larry, Dani, and Ava--described a negative influence by parents, though unintentional, indirect, and usually subtle. Kevin said, "My parents always tell me some people just naturally struggle with math." Both Larry and Dani said that their parents were not "good at math" or had "struggles with math." Dani explained, "As my mother was teaching me math, she would say that she was struggling with it too. 'We can struggle with it together' was the mantra, especially when I got to advanced math in high school." Ava expressed a different perspective:

> My mom is actually fairly good at math. It was one of her favorite subjects in school. She has always encouraged me to just push through it and get done what needs to get done, even if I do not enjoy it. And that the sooner I can get it done and done well, the sooner I can move on to things that I do enjoy.

Professors, peers, and/or parents, whether intentionally or unintentionally, directly or indirectly, obviously or subtly, advertently or inadvertently, have negatively influenced the participants' perception of math and avoidance of it.

Negative Influence: Peers

Four out of 10 students/alumni mentioned peers as a negative influence on perception of math. Michael said, "My friends said I should avoid math and maybe take it at a different college." Mitch, Wayne, and Anthony also expressed peer influence as a factor in their perception of math. Wayne explained, "Literally everyone I know has said to me that I won't need algebra in the real world. That has always given me a strong disdain for math in general."

Anthony added, "Everybody seems to agree that math is not good. . . . everybody agrees that it's annoying and they try to stay away from it."

Positive Influence

Conversely, those same revered individuals—faculty, parents, or peers—can foster a positive perception of math that influences students in overcoming math avoidance and toward actually taking and succeeding in a math course. Fifteen of the participants weighed in on this theme. Combined, the majority of positive influencers mentioned were faculty (11), followed by tutors (seven), parents (four), and peers (one). Although all three Faculty participants described a positive influence in students' perception of math, the breakdown among the four categories was different from the Students/Alumni as follows: faculty (three), tutors (one), parents (zero), peers (zero). None of the Faculty group mentioned parents or peers in the discussion of positive influence by a revered individual. Several of the participants mentioned more than one positive influencer. Thus, the breakdown of the numbers do not match the total number of participants. See Table 4.5 for the breakdown.

Table 4.5

Positive Influence of Revered Individuals

Revered Individual	Number Mentioning Influence
Faculty/Teachers	12
Tutors	7
Parents	4
Peers	1

Positive Influence: Faculty

Eleven of the participants described an experience with a faculty member who became a positive influence in the participant's perception of math. For Christy, it was all her teachers. She noted, "All the math teachers I've had have been supportive and creative. I believe that helps my perception of math." James said his first high school math teacher "had a really positive effect" on him. For Anna, it was her online math professor and the flexibility of the modality which made it easier for her to succeed "because there were many ways for me to learn the concepts." Dani experienced a positive influence from her second remedial course professor. She explained,

> I learned more in that class because it was more of a lecture. The professor would let us know what we had to do, and then when I was on Moodle, I would say, "OK, I have these." It gave me more confidence because she challenged us to write things on the board after she taught it. . . . She made us explain how we got the answer whether our answer was right or wrong. She would guide us and be encouraging either way.

Under Wayne's second college Algebra I professor, he passed math and "actually liked it better." Michael's math professor of his senior year was the positive influence that made him successful in the course. He explained,

> She knew that I struggled in math, and she took a special interest in me. She told me she was going to stick with me and help me to be successful in math. She would always help you, and her office was always open. . . . She made me want to keep trying and never give up. It helped me to have somebody by my side who kept pushing me along.

For Jonathan and Ellen, the music math professor was the positive influence in their lives. Both said, "He made the math class fun." Ellen explained that the ability of the professor to make music math fun helped the students with fears of math like herself to "realize their ability to do math even though it is scary for them." Jonathan added, "It's all in the teachers . . . Almost every teacher (at NYBC) believed in me and told me, 'You will do it.' I still struggled, but I enjoyed it (math) and passed."

For Dr. Avery, the positive faculty influence was personal and started with her ninth grade algebra teacher who "presented math clearly and interestingly" and changed Avery's perception of math as well as planted in her a desire to model this teacher in her own classroom. Positive influences continued with two college professors. Dr. Avery explained,

> I was also encouraged by NYBC's previous math adjunct to begin my master's in math. As I subbed for her on numerous occasions, she would nudge me by saying, "You can do this. It is within your grasp." This was very encouraging.

As she was pursuing her graduate degree in her early 50s and expressed concern about not being a math expert, one of her graduate school professors told her that her personal struggles with math would actually make Dr. Avery a better math teacher because she would be sensitive to the

needs of students who do not "get it from the first explanation" and would "have the tool set to come through the back door and explain it a different way." The positive influence and examples of these faculty determined Dr. Avery's approach as a math teacher. Avery emulates her ninth grade teacher in her own classroom. She explained,

> I try to be as friendly as I can. I keep things light and breezy in the classroom. . . . I differentiate the instruction for all learning types, allow time for reflection, tap into previous learning—all strategies for leveling the instructional field so that every student has the potential to succeed.

Dr. Avery has an open door policy of encouraging students to come to her office or email her with any problems they encounter while doing the math. Avery said she will drop whatever she is doing in order to work with them and will answer email questions as soon as possible. She added, "This policy gives them hope because someone is putting their problems at the top of the priority list. . . .I root for the students in such a way that they can tell someone is in their corner." She also turns her own mistakes, computational or otherwise, into teachable moments by "pointing out that mistakes happen to everyone; don't be discouraged when they happen to you; you're in good company."

For Dr. Rogers, the positive faculty influence occurred at two points in his life: when he took his math elective at NYBC as a 40-year-old adult learner, and when he became the music math teacher. These experiences changed his perception of math as well as math teachers. Dr. Rogers explained,

> I was greeted with a "Hello"--very respectful. . . . On homework assignments, I would get "Wonderful work." . . . I rarely was called to the board. The expectation was that I knew how to do the work, but others needed to go to the board to receive help.

As a music math professor, Dr. Rogers said he does not give tests but "I offer opportunities to demonstrate a student's understanding. We do not solve math problems; we seek to explain why the sonority acts the way it does." Rogers saw a parallel between his vocal students and his math students. He explained,

> In math, I see students struggle with the subject in the same manner I see them struggle with singing. It is not uncommon to hear someone say, "I can't sing." And more often than not, they are parroting what someone in their life has said and by extension, convinced them to be true. One of the more popular statements I hear is "I can't do math." It makes me wonder who in their life spoke those words of death into them?

Rogers said his approach as a math professor is to "couch the course in terms of skills that are necessary for everyday life" and "have a positive attitude myself, to model one who can joyfully approach the subject." He explained,

> They walk in the door defeated. So, we approach math from that understanding. We are not coming from a neutral place. We are coming from an utterly defeated place. We are going to go up. There's no other direction to go. We change the language. . . . We do a fun final project . . . So, these are students who entered the semester saying, "I can't pass math." And you walk away utterly amazed at what they can accomplish when they are told they can. . . . To see the lights come on and the eyes open up—That's exciting!

Rogers described several success stories of his students, particularly on the final projects, and told of them saying, "Yes, I can do this." He said, "It was a joy to be a part of that, to see them pass, having done the thing they thought they could never do."

Although Dr. Cameron did not experience a personal positive influence from a teacher or faculty, he addressed this theme: "I think professors, and perhaps this should happen in

Orientation, need to show the relevance of all courses that fall into the category of liberal arts. This is where most students resist math."

Wayne specifically addressed this subtheme in his recommendations to the college and the provost. He wrote,

> Have a regular session in which the math teacher spends time with the students outside of the classroom to help with any questions they may have. Have a conference of sorts in which the teacher reviews everything that the final will be on. This can be done on a morning when school is not regularly in session with donuts and coffee provided.

Larry indicated that NYBC already "does provide good helps" and that "professors are always willing to help so that students will not have trouble with math."

Dr. Avery explained that one strategy for improving the math atmosphere on campus is "for the professor to be nice." She elaborated,

> Avoiding something distasteful is natural; essentially this strategy is a survival mechanism. Many students come to our college with a history of distasteful math experiences and deficits. But like acquiring a taste for a grown-up delicacy, motivation to take that first bite of something scary is necessary. My job is to present math in such a way that students are willing to let go of previous assumptions and trust the college to feed them something good; beautiful, useful, manageable math.

According to Dr. Avery, this also includes letting her students know that if they come to her office with a problem, "I will drop what I am doing in order to work with them." Dr. Rogers recommended that the college's math faculty maintain a positive, approachable demeanor, always encouraging students. In his own teaching of Music Math, he explained, "We are not allowed to say, 'I can't do math.' We walk slowly and often say, 'I can do that!'"

Positive Influence: Tutors

The second most prevalent positive influencers mentioned were tutors. Seven of the participants described the positive influence of tutors in changing students' perception of math, leading to success in completing a math course. Ava and Anna both had personal tutors who helped them to succeed in high school algebra and other upper level math courses, which led to success in the college math course. James, Larry, Anthony, and Kevin weighed in on this theme and recommended that the college hire more tutors. James and Larry agreed that "actual math tutors" instead of general studies peer tutors would be most beneficial. Anthony explained that professional math tutors "could do more in helping students to understand how math could help them in the future." Kevin said, "Hire more tutors so that instead of avoiding math students will receive assistance in facing their problems."

Five of the participants mentioned tutors in the recommendations to the provost and college. Kevin was the only one who recommended having "mandatory tutors" for all students taking the math course. Anna recommended that the college hire peer tutors who are "specific math tutors" and that students "have someone be on stand-by in case they need tutoring for certain concepts." Dani recommended "having encouraging tutors," though she did not specify whether these should be peers or professionals. She described them as "people specifically in love with math and sharing that with those they are helping." Wayne recommended that the college invest in hiring "more tutors other than students and make them more available to students."

Dr. Cameron echoed Wayne's sentiment that the college should hire professional tutors as opposed to peer tutors "because the relevance could be factored into the tutoring based on the life experience of the professional versus the life inexperience of a peer due to their age."

Dr. Cameron was the only Faculty participant who broached the theme of tutors as a positive influence in students' perception of math. He said, "I think professional tutoring as opposed to peer tutoring might be more successful for the struggling student." Cameron believes that "the life experience of the professional versus the life inexperience of a peer due to their age" would pose a stronger positive influence in students' perception of math and the avoidance of it.

None of the Faculty group mentioned parents or peers in the discussion of positive influence by a revered individual.

Positive Influence: Parents

Four of the participants mentioned parents as a positive influence in perception of math. Christy's mom is very good at math and uses math daily in her current job: "Because of this, I think I always saw math as sort of fun." Anthony's dad "kind of liked math," and James said, "People in my family have always been good at math." Michael added, "My parents always told me that math is very important."

Positive Influence: Peers

Only one participant mentioned any positive influence toward math perception by peers. James explained, "My peers had a positive influence on me. They would try to help me."

Table 4.6

Positive Faculty Influencers

Participant	Faculty Influencer
Christy	All math teachers
James	First high school math teacher
Anna	College online math professor
Dani	Second college remedial math professor
Wayne	Second college Algebra I professor
Michael	Second college Math I professor
Jonathan	Music math professor
Ellen	Music math professor
Dr. Avery	9th grade teacher, 2 college professors
Dr. Rogers	College Math I professor, himself as music math professor

Math Intimidation

Dani was the first participant to express concern for adult learners in the perception of math. She said, "The adult learners who come in, after much time has passed since their last math class, are probably even more intimidated" than the traditional-aged students who do not pass the math placement test and are thus required to take remedial math.

Dr. Rogers followed up Dani's statement and explained, "Knowles says that adult learners need to be told *why* they are required to take a certain subject matter."
Both groups agreed that non-traditional aged adult learners enrolling in NYBC have already developed a pre-conceived perception of math and are influenced by that perception to avoid math prior to starting the bachelor's degree program.

Classroom Environment

The subtheme of classroom environment was addressed by all Focus Group participants. Wayne explained how the classroom environment created by faculty could positively influence students toward overcoming math avoidance: "It's all about incentive . . . Also maybe if students

can see some practical use out in the future, that will provide an incentive to work harder to learn math." He also suggested having a "dedicated math lab with tutors solely focused on math" as part of the classroom environment. Based on her recent positive experience with a math faculty, Dani added, "Emphasize to them that they are not the only one who struggles with math. Many people do. Thus, they won't feel so isolated."

Dr. Rogers suggested changing the environment in the math class to make it more relaxed by providing "food, coffee, etc." He said, "I wonder if the adult learner mindset is happening earlier, would changing the classroom environment help with the students' attitudes toward math?" At this point, Dr. Cameron weighed in and said, "I was wondering about the music math." To which Dr. Rogers replied,

> Music math was interesting. Music math as the name inspires interest right away. Students ask, "What is this math?" It is actually difficult math. It's not algebra. It's exponents, it's logarithms, using set theory, permutations. It's fascinating that it is more difficult, but they seem to have an easier time with it because it connects with something they can play with. They can hear it. They can see it. You can throw it on an oscillator and you can literally watch the math happen. In one class we took a student and scanned his face. We pulled out wave forms and actually played his face. . . . Here are students who think they can't pass algebra, but they end up in more difficult math without realizing it. They have a good time. Final projects have included building a pan flute and a derivation of Mozart's Chance game. The student could create a chance song every time. Maybe it's arbitrarily useless, but confidence building. It's one of the classes that I don't think would work well with a larger class size. It may not be a viable option because of this limitation.

Table 4.7

Research Question 3 Subthemes Breakdown

Subtheme	Fraction Addressing
Sense of dread	2/4
NYBC history of math aversion	2/4
Question college's decision	4/4
Students' delay taking math	3/4
Relevance of the college's math course	3/4
Adult learners' math intimidation	2/4
Classroom environment	4/4

Table 4.8

Research Question 3 More Subthemes Breakdown

Subthemes	Number Addressing
Positive approach & atmosphere	3
Multiple math options	8
Students' wise choices	9
More available resources	3
Tutors	5
Friendly faculty	4

Summary

Chapter Four presented the results of this study from data collected via semi-structured participant interviews, a focus group, and follow-up written interviews and reflective journal

entries submitted by participants. The findings of the interviews, focus group, and written documents collected for this study showed the perceptions and opinions about mathematics at the target college from the viewpoint of faculty, current students, and recent alumni. The purpose of this case study was to describe math perception and avoidance for undergraduate students at a small, private Bible college in upstate New York. Data was presented according to the themes generated. Subthemes were synthesized with the research questions driving this study. Each of the three research questions are restated in the following text and include the combined findings from all three data collection methods for this study.

The three methods of data collection—interviews, focus group, and documents—indicated that for the most part and historically, math remediation at NYBC has evoked discouragement, a sense of dread, and an aversion to math. In other words, math remediation at NYBC has produced the opposite results desired and has negatively influenced students' math perception. Conversely, data collected from both Students/Alumni and Faculty groups suggested that creating a positive atmosphere and presenting remedial math with a positive approach, possibly with food, could bring about change in students' math perception and thus lead to success in remedial courses and influence a positive perception of math in the NYBC students.

Table 4. 9

Research Question 1 Data Summary

Data Collection Method	Subtheme(s)
Interviews	Discouragement
Focus Group	Sense of Dread
	History of Aversion
Documents	Recommended:
	Positive Approach to Math

Data collected from the interviews and focus group indicated that NYBC students' math perception does influence math avoidance, exacerbating it. Data revealed a struggle to understand math, feelings of inadequacy and frustration, failure from ineffective teacher methods, perception that the college's current math course is not relevant to the students' career needs, thus a questioning of the college's decision to include math as a liberal arts course requirement, and a purposeful delay in taking the course. Data collected from the documents suggested that the college could improve this situation by offering multiple math course options, providing more available resources to help students succeed, and advising students to make wise choices in navigating the math course requirement and completing degrees.

Table 4.10

Research Question 2 Data Summary

Data Collection Method	Subtheme(s)
Interviews	Struggle to Understand Math Feelings of Inadequacy & Frustration Teacher's Ineffective Methods Irrelevance of College's Math Course
Focus Group	Questioning College's Decision Delay in Taking Math Irrelevance of Math to Career/Life
Documents	Recommendations: Multiple Math Options More Available Resources Wise Choices by Students

Data collected from the interviews, focus group, and documents indicated that students are indeed influenced in math avoidance by revered individuals, that the influence may be advertent or inadvertent, intentional or unintentional, and that the influence may be negative or positive. Data from interviews and the focus group revealed both negative and positive turning points in the math experiences of participants: negative influence by faculty, parents, and peers;

positive influence by faculty, tutors, parents, and peers; influence of intimidation felt by adult learners; and influence of the classroom environment. Combined, these data indicated that students are influenced in math avoidance by faculty, administration, or other revered individuals. Data collected from all three methods—interviews, focus group, and documents—demonstrated that of the revered individuals mentioned, only tutors positively influenced students in math success and, consequently, in overcoming math avoidance. The same data also showed that faculty, depending on whether or not they are friendly, open, and approachable, can influence students in math avoidance either positively or negatively.

Table 4.11

Research Question 3 Data Summary

Data Collection Method	Subtheme(s)
Interviews	Turning Point—Negative or Positive
	Negative Influence—Faculty, Parents, Peers
	Positive Influence—Faculty, Tutors, Parents, Peers
Focus Group	Adult Learners Intimidation
	Classroom Environment
Documents	Recommendations:
	Tutors
	Friendly Faculty

In designing this instrumental, within-site case study, three theories were studied: Tinto's (1993, 2012) Theory of Individual Departure from Institutions of Higher Education, Estep's (2010) Theory of Christian Formation, and Bandura's (1986, 1997) Social Cognitive Theory. Results from data collected in this case study supported the synthesis of the three theories, particularly that math faculty play a key role in influencing student retention, success, and Christian formation in math courses.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Overview

This chapter contains a summary of the findings of research for this instrumental, within-site case study. Chapter Five also includes interpretations of these findings and the relation to past and contemporary research on the topic of math avoidance. Suggestions for future research on this topic will be made, based on the summaries and connected interpretations. The limitations and strengths of this study will also be discussed, and final conclusions will be drawn and delineated.

Statement of the Problem

As explained in Chapter One of this document, some students are entering college hoping to avoid taking a math course; however, they are discovering that they must pass a basic math course to complete degrees (Beilock & Willingham, 2014; Tinto, 1993; Tinto, 2012). According to Beilock and Willingham (2014), 25% of four-year college students and 80% of community college students experience math anxiety leading to math avoidance. Math avoidance poses frustrating problems for administrators in higher education because they realize that they cannot simply remove the math requirement from the degree program without jeopardizing the college's accreditation and credibility (MSCHE, 2014; National Center for Public Policy and Higher Education, 2010; NYSED, 2014). However, at the same time, in a Bible college, decision makers do not want to prevent ministry-focused students from completing the four-year programs solely based on a three-credit-hour math course. This problem also makes a difference in how entire college programs are structured for two reasons: (a) Students with math avoidance will try to put off taking the required math course until the senior year; and (b) Depending on the nature of their math perception and/or lack of readiness which could be attributed to math anxiety (Ashcraft &

Krause, 2007; Jain & Dowson, 2009; Lee, 2012; Standing, 2006), students may be required to take two or more remedial math courses prior to enrolling in one required credit-bearing course, which could influence persistence toward completing degrees in a timely manner (Tinto, 2012).

Although math anxiety has been studied both quantitatively and qualitatively in secular universities where math has been a part of the curriculum since the founding of the institutions, there is an empirical gap in the literature where it concerns students of ministry and Bible colleges, particularly those which operated for decades without a math requirement for graduation. While pastors and missionaries need certain math skills for ministries, little has been explored in this area and very little qualitatively in any context.

Review of Methodology

This instrumental case study was conducted at a small Bible college in upstate New York. The detailed, in-depth data came from multiple sources. A case study investigates a common issue in its real-world context (Yin, 2014) and is a methodology: a type of design in qualitative research that may be an object of study, as well as a product of it (Stake, 1995; Yin, 2014). Therefore, this approach was selected because the study focused on the issue of math avoidance in a single-site case with the hope of producing a solution to the problem.

In this instrumental, single-site case study, the central question was: How does math avoidance influence persistence toward degree completion for ministerial students at New York Bible College (pseudonym)? Research questions were as follows:

(1) How does math remediation influence students' math perception?

(2) How does math perception influence students' math avoidance?

(3) How are students influenced in math avoidance by faculty, administration, or other revered individuals?

Data collection included interviews, an online focus group, and two documents. Yin (2014) recommended using varied sources of information so that the data collection in the case study is extensive. Use of multiple sources of data collection insures thick, rich, descriptive data, a key component of a qualitative study. Throughout this study, various levels of checks were in place to ensure the project's trustworthiness.

Summary of Findings

In this section a summary of the findings is presented. This summary is based on the results of data collected for each of the three research questions investigated in this study.

Research Question # 1: *How does math remediation influence students' math perception?*

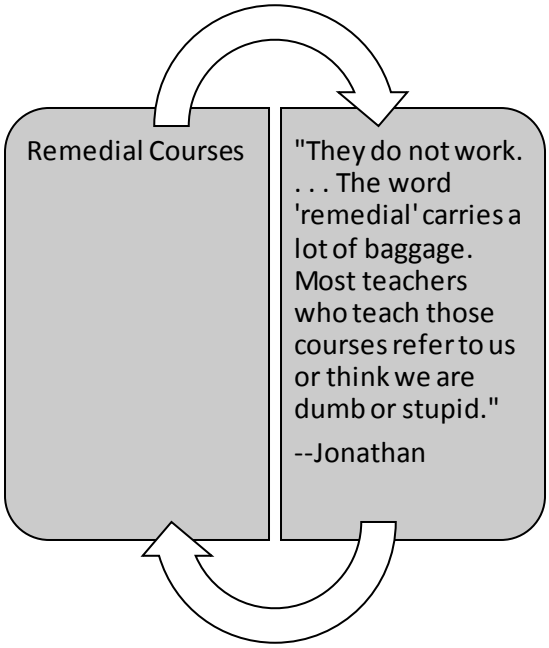


Figure 5.1. Students' perception of remedial courses.

The three methods of data collection—interviews, focus group, and documents—indicated that for the most part and historically, math remediation at NYBC has evoked discouragement, a sense of dread, and an aversion to math. In other words, math remediation at

NYBC has produced the opposite results desired and has negatively influenced students' math perception. Conversely, data collected from both Students/Alumni and Faculty groups suggested that creating a positive atmosphere and presenting remedial math with a positive approach, possibly with food, could bring about change in students' math perception and thus lead to success in remedial courses and influence a positive perception of math in the NYBC students.

Research Question # 2: *How does math perception influence students' math avoidance?*

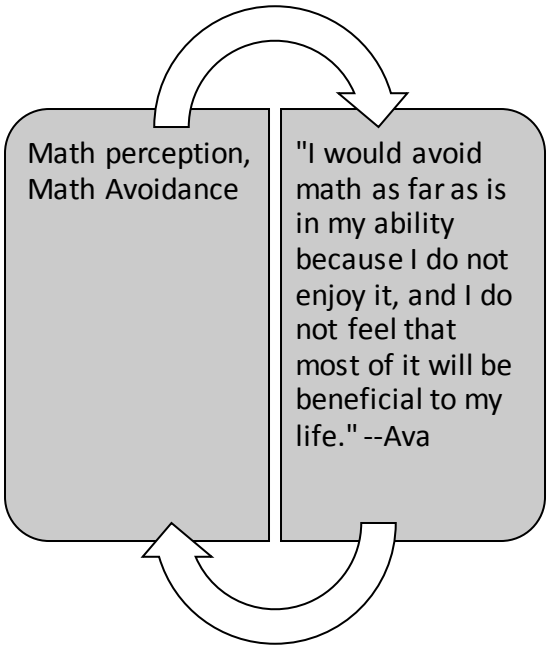


Figure 5.2. Math perception influences math avoidance.

Data collected from the interviews and focus group indicated that NYBC students' math perception does influence math avoidance, exacerbating it. Data revealed a struggle to understand math, feelings of inadequacy and frustration, failure from ineffective teacher methods, perception that the college's current math course is not relevant to the students' career needs, thus a questioning of the college's decision to include math as a liberal arts course requirement, and a purposeful delay in taking the course. Data collected from the documents

suggested that the college could improve this situation by offering multiple math course options, providing more available resources to help students succeed, and advising students to make wise choices in navigating the math course requirement and completing degrees.

Research Question # 3: *How are students influenced in math avoidance by faculty, administration, or other revered individuals?*

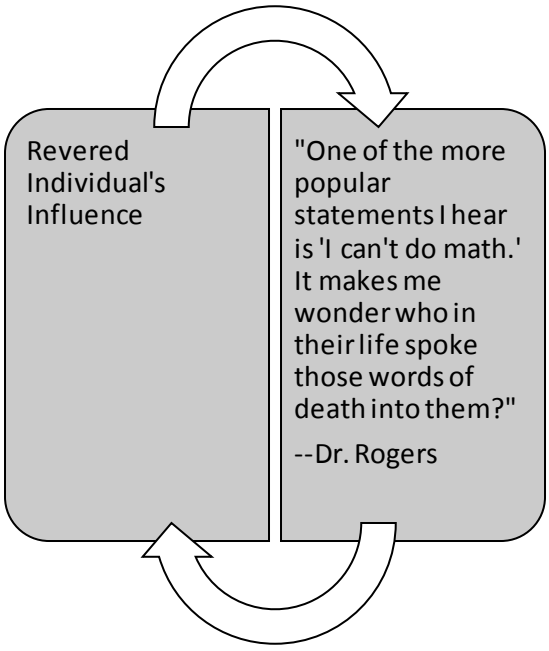


Figure 5.3. Revered individual's influence on student's math avoidance.

Data collected from students, alumni, and faculty through the interviews, focus group, and documents indicated that students are indeed influenced in math avoidance by revered individuals, that the influence may be advertent or inadvertent, intentional or unintentional, and that the influence may be negative or positive. Data from interviews and the focus group revealed both negative and positive turning points in the math experiences of participants; negative influence by faculty, parents, and peers; positive influence by faculty, tutors, parents, and peers; influence of intimidation felt by adult learners; and influence of the classroom

environment. Combined, these data indicated that students are influenced in math avoidance by faculty, administration, or other revered individuals. Data collected from all three methods demonstrated that of the revered individuals, only tutors positively influenced, but did not negatively influence students in math success. The same data also showed that faculty, depending on whether or not they are friendly, open, and approachable, can influence students in math avoidance either positively or negatively. This mirrors previous research (Beilock & Willingham, 2014; Estep & Kim, 2010; Pantziara & Philippou, 2015; Tinto, 2012).

Discussion

Colleges of all disciplines across the world are seeking solutions to the math avoidance dilemma. Some of these solutions are quite the opposite of what one would expect. Studies among college students demonstrate that computer-assisted, interactive, self-directed math courses have been successful in getting students through a math requirement (Escudier, Newton, Cox, Reynolds & Odell, 2011; Griffin, 2014; Hu, 2014; Nadworny & Kamenetz, 2014; Spradlin, 2009; Tonge, 2012; Tyre, 2016). A more creative approach suggested using music and movement, thus engaging the whole brain, to teach math (Kessler, 2000; Lazar, 2014; Levintin, 2007; Tate, 2012). Another innovative solution suggested by the literature included offering a variety of math courses tailored to the students' various interests (The Great Courses, 2014). Titles included The Secrets of Mental Math, The Joy of Mathematics, Change and Motion, How Music and Mathematics Relate, What Are the Chances?, and The Mathematics of Games and Puzzles (The Great Courses, 2014). A key component in addressing and resolving the problem of math avoidance is changing the students' perceptions of math and attitude toward the math requirement.

Howard and Whitaker (2011) discovered that if a developmental math student experiences a positive turning point or learning event in a remedial math course, the student's perception of learning math concepts will completely change, and the student will be successful in acquiring the math knowledge and skills needed to complete college (Cordes, 2014; Moodley et al., 2015; Tyre, 2016). Positive math experiences can be accomplished by giving students more rather than fewer options to choose from for the math elective.

Regardless of its cause—math anxiety, low self-efficacy, lack of readiness, math avoidance among Bible college students becomes an obstacle in the path toward completion of degrees (Bandura, 1986; Estep & Kim, 2010; Tinto, 2012). While math anxiety affects self-efficacy and working memory and plays a role in math avoidance, math anxiety is not the only cause of math avoidance in Bible college students. Students who are good at math still avoid it (Akin & Kurbanoglu, 2011; Moodley et al., 2015; Tyre, 2016). This means that even students who are confident and competent in math skills will sometimes avoid math courses. For example, some students who made As and Bs in high school math and who scored high in math on the SAT or ACT will avoid taking a required math course until the senior year of college. I, the researcher, was one of those students. This study explored the question: Why? Why do Bible college students, who have a desire to serve Christ as pastors, missionaries, youth ministers, and teachers, allow one liberal arts math course requirement to intimidate them and halt degree completion, often preventing them from achieving their goals?

Although math avoidance has been studied and explored from the angles of math anxiety, math readiness, math remediation, and gender, the majority of the studies have been conducted in large, public universities or community colleges (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Bahr, 2012; Beilock & Willingham, 2014; Combs et al., 2010; Duncan et al.,

2007; Finlayson, 2014; Helal et al., 2011; Jain & Dowson, 2009; Latiolas & Lawrence, 2009, Lee, 2012; Legg & Locker, 2009; Sloan, 2010; Sparks, 2011; Standing, 2006; Thilmany, 2009), where serving Christ is not a primary factor or motivation for completion of a degree. It is known from these studies that math anxiety, self-efficacy, and lack of math readiness play a role in math avoidance, and that gender may or may not have any bearing on math avoidance. It is also known that math anxiety affects self-efficacy and working memory, and that as a result, students avoid math courses, even though at least one is required for degree completion. Researchers Howard (2008) and Koch, Slate, and Moore (2012) called for more qualitative studies on experiences of students who do not persist in math courses (Cordes, 2014).

Examining the whys for math avoidance among Bible college students offered further insight into the perceptions of and attitudes toward math that exist across all college settings (Estep & Kim, 2010). Even though a multitude of articles, books, and studies have been written on math avoidance, a gap in the literature still exists in exploring the inner perceptions of math and the reasons behind the math avoidance in students who otherwise accept and willingly complete all other liberal arts courses in degree completion. This leaves a gap in the literature as there are very few if any studies exploring other causes for math avoidance. Until now, none have been conducted at a small, private college where the emphasis has historically been on Biblical and professional studies. This study has begun to fill that gap. The findings of this study could also be applied to other small college settings, high schools, middle schools, and even elementary schools.

This study confirms previous research as discussed in Chapter 2, but also expands, extends, and offers some novel contributions to it.

Remedial Math

Results from this study confirm the previous research of Bahr (2008) and Standing (2006), which demonstrated that the stigma of being placed in remedial courses actually evoked discouragement in students already struggling with math, thus heightening the sense of dread and aversion to math. This study also confirms previous research which indicated that a positive math experience in a remedial course, as suggested by Dani, changes a struggling student's perception of math and leads to that student's success in math (Cordes, 2014; Howard & Whitaker, 2011).

Subsequently, this study extends on previous research. Dr. Avery's description of a streamlined remedial process entailing only one course which simply covers the basic skills students need to pass a credit-bearing math elective, rather than trying to cram four years of high school math into a one-semester remedial course, and Dr. Rogers's suggestion and Wayne's agreement that the remedial math course be done with food and coffee diverge from previous research, but offer some novel solutions to the problem.

Self-efficacy and Math Avoidance

Results of this study confirm previous research exploring the causes of math anxiety which typically leads to math avoidance (Baloglu & Zelhart, 2007; Beilock & Willingham, 2014; Combs et al., 2010; Cordes, 2014; Duncan et al., 2007; Helal et al., 2011; Jain & Dowson, 2009; Perry, 2004; Standing, 2006), with the exception that in this study, age, gender, and socioeconomic status does not appear to make a difference. Causes such as a struggle to understand math, feelings of inadequacy and frustration, ineffective teacher methods, and perception that the college's required math course is irrelevant to the students' careers mirror previous research on math anxiety leading to math avoidance (Berninger & Wolf, 2016; Hacker,

2016; Stansbury, 2016; Zalaznick, 2016). Anna's and Ellen's recommendations to offer multiple math course options in a variety of modalities confirm previous research suggesting the same, as does Dr. Avery's idea of offering more sections of Math I and keeping the class size small (DeLucia, 2014; Dennis, 2014; Escudier et al., 2011; Gallagher, 2014; Griffin, 2014; Hu, 2014; Nadworny & Kamenetz, 2014; Rivera et al., 2013; Spradlin, 2009; Tonge. 2012), and Dr. Rogers's insistence on music math as a choice is confirmed by previous research as a viable option (Kessler, 2000; Lazar, 2014; Levintin, 2007; Tate, 2012; The Great Courses, 2014). Recommendations by Anna, Wayne, and Dr. Avery that the college provide more available resources to help math students succeed also confirm previous research (Bandura, 1997; Estep & Kim, 2010; Inglis, 2014; Kessler, 2000; Tinto, 2012; Zimmerman, 2015). The advice of choosing a light semester to take math, made by Dr. Rogers and echoed by Ellen, Wayne, and Kevin, confirms previous research on working memory and math anxiety (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Beilock & Willingham, 2014; Jain & Dowson, 2009; Legg & Locker, 2009; Sparks, 2011; Zimmerman, 2015).

Concurrently, this study extends on previous research in the issue of students' perception that the content of the college's required math course has little connection to real life (Helal at al., 2011). Relevance of math in the context of a BRE in Bible and theology with a concentration in a chosen ministry field became a major bone of contention in this study. Wayne, Anthony, and Dr. Rogers extended on the previous research by suggesting that the college's math course consist of concrete life skills content, like how to do taxes or budget, that is "useful for the students' futures." Dr. Rogers's idea of removing the word *math* from the names of all math courses and renaming the courses based on the life skills in which they are couched offers a novel contribution to the overall study of math anxiety and avoidance. Larry's recommendation

that the college make the math course content easy because for students in a Bible college math should not be a course "that students worry about passing" since "their whole mindset should be on Bible classes" is a novel contribution to the overall field of study as it addresses the niche of Bible colleges and schools of ministry. Probably the most unique contribution to this field of study is the interaction between Wayne and Dr. Cameron in the focus group concerning the college's decision to choose math as a liberal arts course. When Wayne stated his assumption that NYBC chose a math course based on requirements of the college's accrediting organizations instead of what would best benefit the students, Dr. Cameron freely explained that the college's decision was not based on Middle States and NYSED requirements, but on the realization that math is "critical for life" and a "well-rounded education" and that the knowledge and skills are needed by ministers and missionaries. Wayne thanked Dr. Cameron for this clarification. The novel contribution is the realization that a student and a faculty can engage in a conversation outside the classroom about a contentious issue and clarify a misperception that the student and other students have held for quite some time. This event endeared Dr. Cameron to Wayne.

Math Avoidance and Influence of Revered Individuals

Results of this study confirm previous research which identified the influence of revered individuals such as teachers, parents, and peers among the causes of math anxiety and avoidance (Beilock & Willingham, 2014; Kamenetz, 2014; Perry, 2004; Sloan, 2009; Strauss, 2014). Seven of the 16 participants relayed stories of how they were negatively influenced in math experiences by teachers, ranging from elementary to college. This included two faculty participants, Dr. Avery and Dr. Rogers. On the other hand, 11 (eight Students/Alumni & all three faculty) conveyed stories of positive influence by math teachers. Therefore, the positive influence of teachers was greater than the negative in this case study, which was surprising, given the overall

aversion and animosity toward math which pervades the school. While none of the Faculty group reported influence by parents, four Students/Alumni did. For Kevin, Larry, and Dani, their parents' attempts to help by admitting their own struggles with math, actually unintentionally and inadvertently negatively influenced these students in math avoidance. Conversely, four Students/Alumni—Christy, Anthony, James, and Michael—related stories of parents who influenced them positively in the perception of math, which positively affected math avoidance, even though Anthony and Michael still struggled through the college math course.

Results from this study also confirm the previous research noting peers as a negative influence in students' perceptions of math (Beilock & Willingham, 2014) and thus math avoidance. While none of the Faculty group reported peers as an influence, four of the Students/Alumni described the negative influence of peers in the perception and avoidance of math. Only one, James, diverges from previous research as he described a positive influence in math perception by peers, which led to his lack of math avoidance.

In previous research, math tutors were rarely mentioned, but when they were, it was in a positive light as a positive influence in math perception and avoidance (Cordes, 2014; Tinto, 2012). Results of this study both confirm and extend on previous research in this area. Nine participants (eight Students/Alumni and one Faculty) described tutors as key positive influencers in navigating students through math courses and away from math avoidance. James, Larry, Anthony, and Wayne agreed with Dr. Cameron that these tutors should be "professional math tutors" instead of peer tutors because the life experiences of the professionals would add credence to the math experience of the students as the professionals would be able to address the issue of the relevance of the math course.

Relevance

In previous research, math avoidance because of perceived irrelevance and uselessness of a math course was rarely mentioned (Helal et al., 2011; Jain & Dowson, 2009). Conversely, in this study, relevance of the math course emerges as a major theme and influence of math avoidance. Across all three sources of data collection, among all 16 participants, relevance of the college's math course arose as a major point of discussion. Dr. Rogers seemed to think that at the marrow of this bone of contention is what Malcolm Knowles (1997) argued—that adult learners of this generation need to "be told *why* they are required to take a certain subject," and that *why* cannot just be "because you need it to complete your degree." As expressed by Dani, Wayne, Kevin, Mitch, Anthony, James, Ava, and Dr. Rogers in their own personal math experiences of completing the BRE, these adult learners would have approached the math course requirement with a more positive attitude if they had really understood *why* the math course was needed for their career in ministry and relevant to their lives.

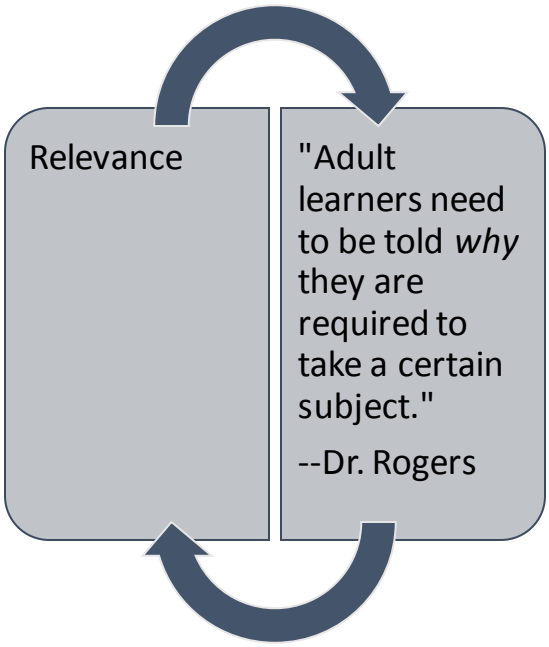


Figure 5.4. Relevance of a math course.

In this overwhelming emphasis and focus on relevance of the math course, this study diverged from previous research. A novel contribution that this study added to the field was the discussion of classroom environment, in particular, Dani's suggestion that math professors remind students "that principles and patterns of math are created by God and are not scary." This approach related to Estep's (2010) Theory of Christian Formation. The recommendations of Dr. Rogers that math courses be taught with food and coffee and that music math be made available as a math elective, though not novel, were interesting and reinforced Bandura's (1997) Social Cognitive Theory.

Relationship to Theoretical Literature

As stated in Chapter 2, Tinto (2012) advised colleges and universities to focus efforts and finances on improving the classroom experience. Estep (2010) emphasized the intentional cultivation of mentoring relationships between faculty and students, and Bandura (1997) implied that faculty interaction can either raise or lower the self-efficacy of individual students. Therefore, at the heart of student academic success is a mentoring, caring faculty who influence student retention, success, and Christian formation. This study both confirmed and extended on the synthesis of these three theories—Tinto (2012), Estep (2010), and Bandura (1997). Jonathan summed it up for the participants: "It's all in the teachers."

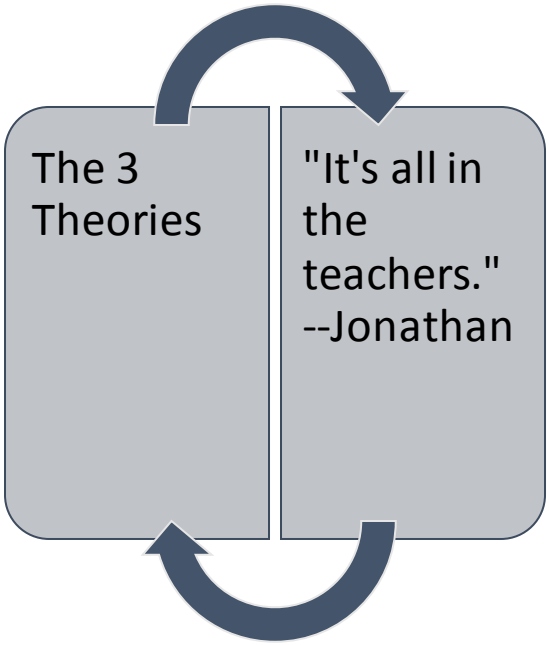


Figure 5.5. Relationship to theoretical literature.

In a recent Gallup study at Purdue University about the six college experiences that best prepare students for the real world, findings revealed that three of those six experiences centered on relationships with professors: one who created excitement about learning, one who cared, and one who was a mentor encouraging goals and dreams (Buchanan, 2016). This study extended on the theoretical literature as well as the recent Gallup research, demonstrating that it is *not* the credentials but it *is* the relationship with the students that makes the difference. As Dani noted, having a "professor with similar sympathy" for her struggles in math helped her to succeed in the course. Because Michael's senior year math professor made him "want to keep trying and took time" to help him outside the classroom, he passed with a high grade and "learned a lot." From the Faculty perspective, Dr. Avery described one of her strategies for improving the classroom environment and the overall math atmosphere on campus as the professor being "nice" and cheering for her students "in such a way that they can tell someone is in their corner." Dr.

Cameron carried the importance of caring faculty even further by suggesting that math faculty could actually address and adequately answer the relevance question early on, during Student Orientation. This would resolve the relevance issue for students, according to this faculty.

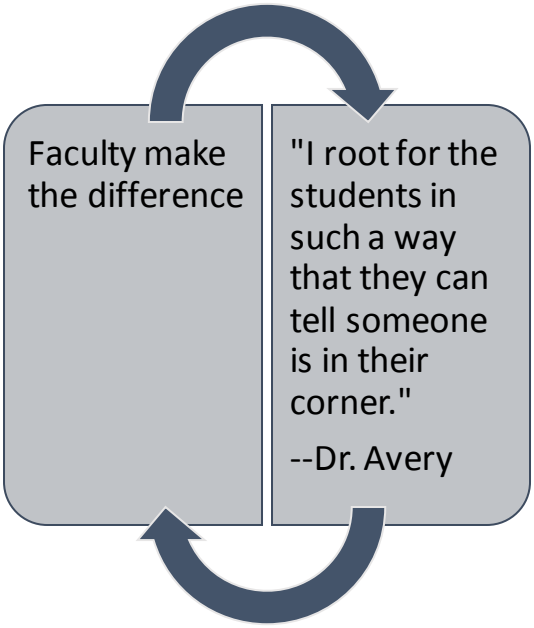


Figure 5.6. Faculty make the difference.

Implications

It is apparent from this study that the primary issue underlying math avoidance at the target school is perception that the math course is irrelevant to preparation for students' chosen fields and/or careers of ministry. The evidence supports this statement in that this theme emerged repeatedly through all three methods of data collection and from both groups of participants. This issue of relevance appears to be exacerbated by the influence of revered persons and by previous negative math experiences sometimes caused by lack of knowledge, skills, and/or college readiness. Although parents, peers, and tutors were named as influencers in this arena, teachers emerged as the most influential of all revered persons, whether negative or positive.

The target school mirrors other colleges and universities with respect to the math avoidance issue. As delineated earlier in this document, math avoidance is a world-wide problem across all academic levels from elementary to college (Akin & Kurbanoglu, 2011; Ashcraft & Krause, 2007; Beilock & Willingham, 2014; Kamenetz, 2014; Latiolas & Lawrence, 2009). The target school in this study experiences similar problems with regard to math avoidance. Some of these problems include lack of college math readiness, perception that a math course is not relevant to the students' life goals, and negative influence toward math by a revered person or persons. To overcome the math avoidance issue at the target school, these and other obstacles will need to be addressed.

The following four items are recommendations that should, given time, greatly alleviate the math avoidance problem for the target school as well as for other similar schools. This problem did not develop overnight, and it will not be resolved overnight, or even in one academic year. However, over time and with these recommendations, the math avoidance issue can be greatly diminished. These recommendations have been developed through literary research performed for this study and through data collected while doing the project itself. It is my intent and hope that the four recommendations will be valuable to colleges similar to the target school as well as elementary through high schools and universities which are not similar to the target school.

Recommendation #1: Remedial Math

For this study, semi-structured interviews were conducted which included a question about remedial math to the Students/Alumni group. Although a direct question about remedial math was not included in the Faculty group questions, Dr. Avery addressed it. Focus group and

written documents questions did not directly ask about remedial math; however, it emerged in both methods of data collection.

According to Bahr (2008) and Standing (2006), 81.5% of students required to take more than one remedial math course never complete degrees. Concurrently, the more intense the remedial courses' content, the less likely underprepared students are to complete them (Cordes, 2014; Duncan et al., 2007).

To improve students' math perception of and attitude toward remedial math, decision makers should follow Dr. Avery's advice to keep it simple and require only one remedial course which covers just the specific math skills needed to succeed in Math I, the current math elective most commonly offered at the target school. Decision makers should also consider implementing the advice of Dr. Rogers to change the classroom environment so that it is welcoming and relaxed with food and beverages.

Recommendation #2: Perception of Relevance

In this study, relevance of a math course in a BRE program permeated all three methods of data collection. Although none of the questions in any of the data collection methods specifically asked about relevance, this matter found its way into every method of data collection and was mentioned by all 16 participants. Consequently, the perception that a math course is not relevant to a bachelor's degree in Bible and theology with a concentration in a chosen field of ministry is certainly at the forefront of students' minds. Therefore, it would behoove decision makers of the target school to address this issue head on, to proactively speak to the matter as early as possible in the students' college experience. As Dr. Cameron suggested, having math professors show the relevance of the math course and explain "why you need this" to students during orientation prior to the first day of the semester would certainly lay the foundation in their

minds. Then, hiring professional math tutors, instead of peer tutors, as recommended by Wayne, James, Larry, Anthony, and Dr. Cameron, would build on that foundation throughout the students' college experiences with math because the tutors would add relevance from real life examples, per Dr. Cameron's suggestion. Decision makers should also consider the idea of Dr. Rogers to couch math courses in life skills and creatively name the courses accordingly. This would accomplish two things: (1) Students would feel less intimidated to enroll in a math course; (2) Students would perceive the chosen math course as relevant to their lives, careers, and ministries.

Recommendation #3: More Options

In order to accommodate the various math needs and learning styles of its students, the target school should offer more math course options. Granted, the school is small, so two to three options per semester should adequately suffice. Per Dr. Rogers's suggestion, the school should bring back Music Math (See Appendix N for course description), which proved successful in getting several struggling students including Ellen and Jonathan through the math elective. A description of Music Math by Dr. Rogers is found in Chapter 4. As Ellen observed, "No one math class works for everyone." As noted in Chapter 2, previous research supports Music Math as a viable option (Lazar, 2014; Levintin, 2007; The Great Courses, 2014), and new research has emerged which links higher math scores with music participation (Eason & Johnson, 2013).

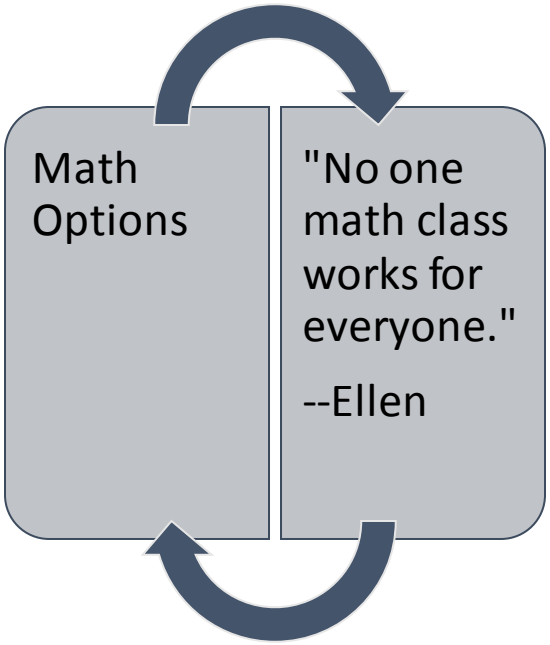


Figure 5.7. Math options are needed.

The school should also take Dr. Avery's suggestion to offer Math I, the current default math elective, every semester and keep the class size small, no larger than 15:1 student to teacher ratio, an idea which is also supported by research (Cordes, 2014; Tinto, 1993, 2012).

Another option would be for the Curriculum Committee to switch the math elective on the status sheet to a liberal arts elective. This would satisfy NYSED requirements for the BRE (See Appendix M) while giving the math professor academic freedom to design math courses that would better meet the specific needs of the target school's students, and could include courses such as How to Do Taxes, Math for Ministry, or Budgeting and Finance for Leaders, as suggested by Wayne, Ava, Dani, and Dr. Cameron. This would accomplish Dani's recommendation to "make it practical, connected to real life" and would make it much easier for the math professor(s) to convince students of the relevance of a math course in orientation, as Dr. Cameron suggested. This option would also contribute to keeping the class sizes small, per Dr.

Avery's recommendation. If this option is chosen, the math course would no longer be a BRE degree requirement, but the advisors could highly recommend a math course for students and nudge them in that direction. This would only work for the BRE, but not for a Bachelor of Science, if the college decides to add one to its degree offerings.

Recommendation #4: Revered Persons

In this study, the two main types of revered persons who influenced students positively toward overcoming math avoidance were teachers and tutors. This was surprising, as the researcher anticipated that pastors might be among the key influencers, but pastors were not even mentioned. Nor were facilities stated as having any influence on student success. Even in the discussion of classroom environment, the focus was on the faculty rather than the facilities. This is the opposite of the target school's present focus, as the school has cut back on faculty and on adjuncts and part time faculty hours while investing in remodeling a recently acquired chapel and 10 large rooms three blocks away.

Contrariwise, the target school should allocate its money toward hiring and keeping quality, caring faculty and professional math tutors, not toward buying and renovating buildings. Previous and recent research has shown that having faculty who care and who spend time inside and outside the classroom interacting with and developing relationships with students is a key factor in student retention, degree completion, and actual learning (Buchanan, 2016; Estep & Kim, 2010; Sadler & Sonnet, 2016; Tinto, 2012). Subsequently, selecting the right faculty for the job goes beyond credentials. It has more to do with the philosophy of the teacher, with the ability of the teacher to empathize with struggling students, and with the teacher's projection of a positive attitude into the classroom environment, as suggested by Dani, Michael, Ellen, Jonathan, Dr. Avery, and Dr. Rogers.

Moreover, the target school, and all other colleges for that matter, should give the math professors academic freedom to design courses that best meet the needs of the students to prepare them for the workforce, without unnecessarily shackling the professor with state-dictated parameters that determine what is and what is not college-level math (See Appendix M). Dr. Avery addressed this dilemma by focusing on the NYSED requirements in the course description and integrating practical life skills and ministry-related math into the curriculum. Hacker (2016) explained how Toyota collaborated with Northeast Mississippi Community College to similarly, but more freely, prepare a workforce in mathematics specific to the job needs (p. 42).

Additionally, the target school should hire professional math tutors to work with the struggling, underprepared students. These could be graduates who hold a bachelor's or master's degree in math or a math-related field or professionals who work in a math-related career. The hiring of professional math tutors was one recommendation upon which both groups of participants, Students/Alumni and Faculty, agreed, as suggested by James, Larry, Anthony, Wayne, and Dr. Cameron. Mandatory tutors for all math students, as suggested by Kevin, would also be a good recommendation to consider, as this would greatly diminished the stigma associated with needing a tutor. Because the target school has open admissions, it tends to draw a high percentage of underprepared students who have a heart for ministry and a desire to complete the BRE. Therefore, it would behoove the target school to make it a priority to invest in tutors and more scaffolding for underprepared students, per the data collected from this case study. Conversely, instead of moving toward a stronger tutorial program replacing peer tutors with professionals, the target school during the 2015-2016 Academic Year has not only cut the budget funding the peer tutoring program but also cancelled an entire four-hour night shift when tutors were available to students. Then, at the end of the Academic Year, the target school

announced that, due to budget constraints, it was dissolving the position of Director of Student Support Services, which oversees the Academic Success Center and the peer tutors. The decision was reversed later with a newly hired director lacking in credentials and experience.

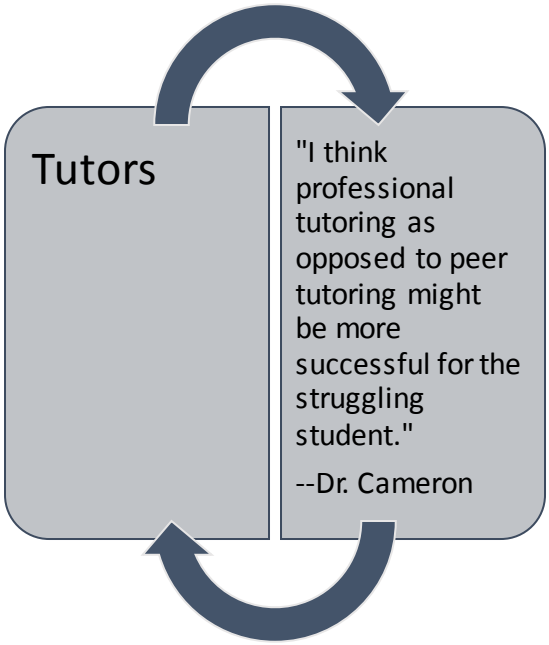


Figure 5.8. Professional tutors versus peer tutors.

Limitations

Limitations of this study included the small size of the college where the study was conducted, the type of college because it is a niche group—a college of ministry/Bible college, and potentially the lack of variety in the ethnicity of participants. Other limitations were the small sample size and the fact that the study was conducted at a single site instead of multiple sites. Participants were limited to those who officially consented to be a part of the research. Another limitation were the geographical distances among participants, especially the alumni. This limited some face-to-face interviews and the focus group to an online venue.

This study was limited in that its focus was on a single target school. Transferability of results may be limited to other similar schools. The target school is a small (350 students) niche

Bible college in upstate New York. This college existed for many years from its founding as a Bible institute without liberal arts courses and may or may not represent other Bible colleges or other private or state colleges in the United States.

This study was also limited by the number of Faculty participants who took part in the study. My intent was to interview five Faculty, but only three participated in the study. Another limitation was the number of participants who completed the Follow-up Written Interview and Journal Entry. While all 16 completed the interviews, only 11 completed the written documents. The focus group was intentionally kept small for logistics purposes, with only five participants invited, but only four participated, two students and two faculty.

Finally, the design of this study being a single-site case study was also a limitation in that more qualitative data collected from several similar Bible colleges could provide a broader base and even richer data to add to the research. I made the decision to limit the study to the target school because of convenience as well as the need and request by decision makers to study math avoidance at this site.

Recommendations for Future Research

As this study was limited to one small, private Bible college in upstate New York, it might be useful to duplicate this research in similar schools. By replicating this study in colleges similar to the target school, results could be compared and contrasted from school to school and from state to state.

This study was conducted using qualitative research measures. Future research could include more quantitative measures as well as more in-depth inquiry on students' perception of faculty: what *really* makes the difference? Why do some students succeed in a subject under one

teacher but fail under another, even though both faculty have equal credentials and training? This topic could be explored across all content areas, or just math.

From this study arose the cry for professional tutors as opposed to peer tutors. This would be another area for future research using both quantitative and qualitative measures. Correlation studies could demonstrate and compare the academic success of students with peer tutors versus those with professional tutors. Phenomenological studies across several colleges could explore why students request professional tutors rather than peer tutors.

Finally, future research is needed on higher education liberal arts math course requirements of all state departments of education. What content makes a math course acceptable as a college-level liberal arts math course? What content is not considered acceptable? Why? Who are the decision makers, and why? These questions need to be explored, and inquiry needs to be made.

Summary

As stated earlier in this document, math avoidance is a common problem across all colleges and cultures, and even extends down into elementary, middle, and high schools. Despite all the education reforms, mandates, and administrative efforts, math avoidance is on the rise across the board. This issue is not resolving itself. Consequently, educators and decision makers need to become informed on this matter and seek solutions to it.

The target school currently has a math professor who is aware of the math avoidance issue and is proactively attempting to resolve it at that site. Over the past two years since Dr. Avery took over the math courses at the target school, the school has experienced a change in perception and a more positive overall attitude toward the math course requirement. It has also seen math avoidant students like Dani and Michael achieve success in math.

In closing, it is the hope of this researcher that the knowledge gained through the process of this study will be used to improve the math perception and avoidance at the target school. However, based on previous and current decisions being made by the administration and the board of trustees, I doubt that this study will even be read by many of the powers-that-be. On the other hand, the few decision makers who do read it may be benefited by it, and thereby, students may reap the results of those benefits.

As administrator of a Christian school years ago, my husband used to say, "Give me the right person in the right position, and that teacher will be successful" (K. Novak, personal communication, August, 1997). He recognized the fact that what makes good teachers is something beyond credentials and training. As a result, sometimes he chose teachers with associate's degrees above certain ones with master's degrees. As Jonathan said, "It's all in the teachers." If nothing else is learned from this study, it is the researcher's hope that this point is driven home: The most effective means of dealing with math avoidance is to find the right faculty and keep them. Whether that teacher is an adjunct, full time, or part time, the school needs to recognize the jewel it has and do whatever it takes, financially or otherwise, to keep that faculty member.

Change takes time. Changing the mindset of educational institutions and entities takes long-term, well-thought-out planning and much reiteration before implementation takes place. It is my intent to be a catalyst for change in moving the target school toward a more positive perception of math and less math avoidance among its students.

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APPENDICES

Appendix A
College Consent Form

CONSENT FORM

Title of Study: How Math Avoidance Influences Degree Completion for Bible College Students: A Case Study of a Small, Private Institution in Upstate New York
Principal Investigator's Name: Bonnie Novak
Liberty University
School of Education

You are invited to be in a research study of math avoidance at College. You were selected as a possible participant because you are a student (or an alumnus) of College who has identified yourself as having experienced math avoidance or you are a faculty member who is involved or interested in the math avoidance issue at College. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Bonnie Novak, a Doctoral student of the School of Education at Liberty University.

Background Information:
The purpose of this study is to understand math avoidance and to find out why this issue occurs in college students and seek to discover what college professors and administrators can do to help students overcome or deal with this issue. The procedure will be a qualitative case study design and will last for one entire academic semester.

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

- You will be interviewed individually, and the interview will be audio recorded. This interview will last about one hour.
- Five of you will be selected for an online focus group, which will be conducted via Go-to-Meeting and last about one hour.
- You will be tasked with a follow-up written interview, which should take no more than 30 minutes to complete.
- You will be tasked with a reflective journal entry, which will also take about 30 minutes to complete. Individuals involved in the data collection will be the principal researcher and the participants, who will be considered co-researchers.

Do not hesitate to ask any questions about the study either before participating or during the time that you are participating. Your name will not be associated with the research findings in any way, and your confidentiality will be maintained.

Risks and Benefits of being in the Study:

There are no major risks to participation. There is only a minor risk of returning to stressful memories regarding math.
The participants will not receive any direct benefits.

Compensation:
You will not be compensated monetarily for participating in this study.

Confidentiality:
Your name will not be associated with the research findings in any way, and while I will assure confidentiality on your end, because of the nature of focus groups, I cannot assure that each member involved will keep all information

shared confidential. However, I will emphasize the importance of doing so. Pseudonyms will be used to ensure participants' confidentiality. The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely and only I will have access to the records. All data will be stored on a locked, password-protected computer dedicated solely to this study, and all files with personal data will be locked. Digitally recorded files will be uploaded to the computer and then immediately erased from the digital voice recorder. Only I will have access to these files. I will share them only with the colleague designated to help transcribe the recordings. This colleague will have signed a confidentiality agreement. Data must be retained for 3 years before being destroyed. Data will be retained for 3 years. After the 3 years has expired, all data will be wiped (deleted) from the computer and its memory.

Voluntary Nature of the Study:

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

How to Withdraw from the Study:

If you choose to withdraw from the study, please contact Bonnie Novak at email address bcnovak@liberty.edu or phone number 315-572-1501. Should you choose to withdraw, data collected from you, apart from focus group data, will be destroyed immediately and will not be included in this study. Focus group data will not be destroyed, but your contributions to the focus group will not be included in the study if you choose to withdraw.

Contacts and Questions:

Do not hesitate to ask any questions about the study either before participating or during the time that you are participating. You may ask any questions you have now. If you have questions later, contact Bonnie Novak (me) at 315-572-1501 or bcnovak@liberty.edu. You may also contact my advisor Dr. Jennifer Courduff at jlcourduff@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than me, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Lynchburg, VA 24502 or email at irb@liberty.edu.
You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.
I consent to being audio recorded as part of this study (Check the box if you agree) ☐

Signature: _____ Date: _____

Signature of Investigator:_____ Date: _____

Date: February 1. 2016
Sincerely,
Bonnie Novak, Principal Investigator

Appendix B

Mathematics 1011 Syllabus

College
Math 1

Math

SYLLABUS MATH 1011

Professor 1
Office Hours by appointment

Professor 2
Office Hours
M-F 9am-Noon

Spring 2015
January 13 – May 9

DESCRIPTION OF COURSE

This course is the first course of a two-course sequence designed to provide an interdisciplinary approach to quantitative literacy, critical thinking and the relevance of mathematics in society. Prescribed topics include analysis of propositions, assumptions and inductive and deductive arguments, the basic principles of counting, the laws of probability and introductory descriptive and inferential statistics. Computer technology will be used throughout the course to explore these concepts and to prepare a presentation on a related topic in the student's field of study. Prerequisite: Pass math placement exam with at least 80% accuracy or successful completion of Functional Mathematics course.

COLLEGE MISSION STATEMENT

The College is a Bible-centered higher education institution committed to making an impact upon the world for Jesus Christ by the fostering of Christian character and the equipping of students with the knowledge, competencies and skills needed in an ever-changing world for service and leadership within the church, Christian organizations and society.

This course encourages students to learn skills in the areas of logic, mathematical business operations such as budgeting, loans, banking and general problem solving skills. Therefore, *Mathematics I* demonstrates linkage to the College mission by equipping students with the knowledge, competencies and skills needed in an ever-

changing world for service and leadership within the church, Christian organizations and society..

OBJECTIVES

Liberal Arts Objectives

1. To enhance students speaking, listening and writing skills for effective communication.
2. To provide students with a broad understanding of the history of man, religion and culture.
3. To instruct students in the development of a healthy lifestyle.
4. To give students a general knowledge of the scientific and quantitative aspects of the complex world created by God.
5. To introduce students to the creativity reflected in different forms of artistic expression.

Professional Ministry Objectives

1. To encourage students to make a commitment to obey the Great Commission.
2. To provide students with experience in local church-related ministry.
3. To equip students with the skills for effective communication of the gospel of Jesus Christ.
4. To help students develop leadership skills for church-related ministry.
5. To encourage students to demonstrate Christian maturity and integrity.

Information Literacy Standards

1. The information literate student determines the nature and extent of the information needed.
2. The information literate student accesses needed information effectively and efficiently.
3. The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
4. The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.
5. The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.

Math 1 demonstrates the above objectives as follows:

1. Liberal Arts Objectives 1 & 4– To enhance a student's ability to create and follow logical arguments.
2. Professional Ministry Objectives 4 & 5 – To provide students with skills in the areas of budgeting, money management, banking and loan management.

3. Information literacy standards 1,2, 3, & 4 – to enhance a student's ability to understand mathematical reasoning and to follow mathematical procedures to produce a specific result.

STUDENT LEARNING OUTCOMES

Upon completion of this course, each student will:

A. The student will develop the ability to apply math and algebra skills to real world situations using set theory, counting methods, probability theory and logic study
B. The student will enhance his/her critical thinking skills and problem solving techniques by studying problem-solving strategies, reviewing mathematical principles and providing inductive/deductive reasoning arguments
C. The student will utilize technology with and for the application of mathematical concepts and complete a statistical study
D. The student will improve his/her understanding of mathematical concepts and how they are relevant to real world situations through use of theory, methods and principles covered throughout the semester

ASSESSMENTS OF STUDENT LEARNING OUTCOMES

The students will demonstrate their proficiency in business mathematical reasoning through homework assignments, projects and testing.

A. The student will develop the ability to apply math and algebra skills to real world situations using set theory, counting methods, probability theory and logic study through completing the homework assignments.
B. The student will enhance his/her critical thinking skills and problem solving techniques by studying problem-solving strategies, reviewing mathematical principles and providing inductive/deductive reasoning arguments through completing the projects.
C. The student will utilize technology with and for the application of mathematical concepts and complete a statistical study through successfully completing the assignments.
D. The student will improve his/her understanding of mathematical concepts and how they are relevant to real world situations through use of theory, methods and principles covered throughout the semester through successfully completing the tests.

COURSE EVALUATION AND ASSIGNMENTS

Students will be evaluated using the following criteria:

a. Homework 60%
b. Tests 40%

COURSE SCHEDULE

Weekday	Date	Notes
Tues	Jan 13	Introduction
Thurs	Jan 15	Chapter 4-1
Tues	Jan 20	Chapter 4-2
Wed	Jan 21	**All Chapter 4 Homework Due at Midnight**
Thurs	Jan 22	Chapter 4 Test
Tues	Jan 27	Chapter 7-1
Thurs	Jan 29	Chapter 7-2
Tues	Feb 3	Chapter 7-3
Wed	Feb 4	**All Chapter 7 Homework Due at Midnight**
Thurs	Feb 5	Chapter 7 Test
Tues	Feb 10	Chapter 8-1
Thurs	Feb 12	Chapter 8-2
Tues	Feb 17	No Class
Thurs	Feb 19	Chapter 8-3
Tues	Feb 24	Chapter 9-1
Thurs	Feb 26	Chapter 9-2
Tues	Mar 3	Chapter 9-3
Wed	Mar 4	**All Chapter 8 and 9 Homework Due at Midnight**
Thurs	Mar 5	Chapter 8 and 9 Test
Tues	Mar 10	No Class
Thurs	Mar 12	Chapter 10-1
Tues	Mar 17	Chapter 10-2
Thurs	Mar 19	Chapter 10-3
Mon	Mar 23	**All Chapter 10 Homework Due at Midnight**
Tues	Mar 24	Chapter 10 Test
Thurs	Mar 26	Chapter 11-1
Tues	Mar 31	No Class
Thurs	Apr 2	No Class
Tues	Apr 7	Chapter 11-2
Thurs	Apr 9	Chapter 11-3
Mon	Apr 13	**All Chapter 11 Homework Due at Midnight**
Tues	Apr 14	Chapter 11 Test
Thurs	Apr 16	Chapter 12-1
Tues	Apr 21	Chapter 12-2
Thurs	Apr 23	Chapter 12-3
Tues	Apr28	Chapter 13-1
Thurs	Apr 30	Chapter 13-2
Mon	May 4	**All Chapter 12 and 13 Homework Due at Midnight**
Tues	May 5	Chapter 12 and 13 Test

Thurs	May 7	Re-Test Day

GRADING SCALE

Grading Scale Points

		Scale	Percentage	Points
A	**95-100**	*(94.50 - 100.00)*	*(945 - 1000)*	
A-	**92-94**	*(91.50 - 94.49)*	*(915 - 944)*	
B+	**89-91**	*(88.50 - 91.49)*	*(885 - 914)*	
B	**86-88**	*(85.50 - 88.49)*	*(855 - 884)*	
B-	**83-85**	*(82.50 - 85.49)*	*(825 - 854)*	
C+	**80-82**	*(79.50 - 82.49)*	*(795 - 824)*	
C	**77-79**	*(76.50 - 79.49)*	*(765 - 794)*	
C-	**74-76**	*(73.50 - 76.49)*	*(735 - 764)*	
D+	**71-73**	*(70.50 - 73.49)*	*(705 - 734)*	
D	**68-70**	*(67.50 - 70.49)*	*(675 - 704)*	
D-	**65-67**	*(64.50 - 67.49)*	*(645 - 674)*	
F	**0-64**	*(0.00 - 64.49)*	*(0 - 644)*	

ATTENDANCE POLICY

Assignments - One week late: -10%. Two weeks late: -20%. After this allotted time, no assignments will be accepted unless approved by the professor with advanced notice of extreme circumstances. Students are expected to attend all classes regularly. Attendance at all sessions of a course is expected and required. There are no excused absences. All absences for any reason (college sponsored activities, illness, family emergencies, cuts) are counted as absences without consideration for the reason. After a student exceeds the permitted absences in a course, points will be deducted from the final grade. The number of points deducted is at the discretion of the instructor. Generally, a failing grade will be given to a student who is absent for more than 20 percent of the course (6 absences). The maximum number of absences allowed is 6 absences. Tardiness, stepping out and leaving early will be noted. Missing 15 minutes of a class counts as an absence. Three tardies will count as one absence. In cases of extenuating circumstances or excessive absences, the student may make a written appeal to the Academic Affairs Council.

-

ACADEMIC INTEGRITY

1. Definition of Academic Dishonesty

- Plagiarism is one form of academic dishonesty. Plagiarism shall include the submission of quoted or paraphrased ideas without proper documentation, submission of the work of others as one's own work, and reuse of one's own work without instructor authorization.

- Academic dishonesty shall also include the receiving or giving of aid in connection with a quiz or examination.

2. Penalties for Academic Dishonesty

- Whenever a student is found guilty of any kind of academic dishonesty, the instructor must report this in writing to the student and to the Registrar's Office. The report will become part of the student's record. The Registrar will determine if any other such offenses already exist in the student's record in order to assist the instructor with grading penalties.

- The penalty for academic dishonesty related to a quiz or examination is at the discretion of the faculty member involved. Generally, a failing grade for the quiz or exam will be given.

- It is recognized that there are various levels of plagiarism.

    - Minimal plagiarism recognizes that the student has been careless or forgetful in acknowledging the sources for various statements. At the discretion of the instructor, the student may be granted an opportunity to rewrite or correct the submitted assignment and will receive a lower grade.

    - When the plagiarism is substantial (determined by the instructor), the student may, at the instructor's discretion, receive a grade of zero (0%) for the paper, or be required to rewrite the paper with at least a letter grade reduction for the assignment. The second offense of substantial plagiarism in any course will result in failure for the course. A third offense of substantial plagiarism in any course will result in disciplinary action which could result in academic dismissal.

    - In cases of complete or nearly complete plagiarism (determined by the instructor, but understood as flagrant, blatant, glaring), the student will receive a failing grade for the course for the first offense. There is no opportunity to redo the assignment. A second offense of complete plagiarism in any course will result in disciplinary action which could result in academic dismissal.

3. Appeal Process for Academic Dishonesty

- The student may appeal academic dishonesty penalties to the Academic Affairs Council. The decision of this Council may be appealed to the Provost, whose decision is final.

- If one of the Council members is the instructor who reported the plagiarism, the Provost will appoint an alternate faculty representative during that particular appeal.

4. Transcript Notation

- If a student is dismissed because of plagiarism, that action will be recorded on the student's transcript as "Academic Dismissal."

TEXTBOOKS AND MATERIALS REQUIRED

Text: Business Math 10/E by Cheryl Cleaves, Margie Hobbs and Jeffrey Noble, ISBN-13 9780133011203

Other requirements:

Calculator

Also required is a TI-30 Multiview calculator available through the bookstore or at most retailers carrying back-to-school supplies. Make sure to get the multiview version of the calculator (it usually has a gray body with a white cover and is not single colored blue or pink) as there are several calculators with the number 30 in the name and other ones will not be as useful to the course.

Online access

Course ID for this course is colton59726

We will be using the Pearson computer-assisted web site support for the material in the text. All homework and grading will be done via the web site, so it is essential that students have access to this tool.

The online access is available in several ways:

- Pearson provides access without payment for 14 days after registration. This allows the student time to work with the web tools while they acquire the access with either of the two methods described below. At the end of the 14 days, the student will be cut off from the course unless access is secured.
- If you purchase a new copy of the text, there will be a cardboard folder in the package with the book or a scratch off inside the front cover of the book that has an access code that will allow the student to access the web tool.
- You can purchase the online access with a credit card or a Paypal account. The online access is somewhat cheaper than the text and online together, so students may elect to use just the online text if they prefer. The e-text on the web site is identical to the hardcopy version.

ACCESS TO CAMPUSSIS & MOODLE

- Learners are required to have access to CampusSIS (formerly ABHE) with their Davis email address as the primary email address. Students should check their Davis email daily as communication to students is through their Davis email account.

- Learners are also required to be able to log into Davis Moodle. Some instructors / courses will require that assignments (papers, presentations etc.) will be submitted electronically through Moodle.

REQUIRED SOFTWARE

- Learners are required to use the academic software that is provided by the institution for submission of assignments (e.g. MS OFFICE). Assignments submitted via other software (e.g. Open Office) will not be accepted.

Appendix C

Recruitment Letter

Date: January 30, 2016

[Potential Participant's Name]

College

[redacted]

Johnson City, NY

13790

Dear [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 Doctor of Education degree. The purpose of my research is to understand how math avoidance influences persistence toward degree completion for Bible college students, and I am writing to invite you to participate in my study.

Participants must be current main campus students, faculty, or alumni of the College who identify themselves as having experienced math avoidance or have a vested interest in those who have experienced math avoidance. Participants must be 18 years of age or older and willing to participate. Participants will be interviewed individually, participate in a focus group, write student recommendations for navigating the math requirement in a follow-up interview, and journal suggestions for helping students meet their math requirement. It should take approximately 4 hours to complete the procedures listed. Participation will be completely voluntary, but will be kept confidential. Participants will be audio-recorded, but confidentiality will be maintained.

To participate, contact me to schedule an interview: Bonnie Novak, bcnovak@liberty.edu, 315-572-1501 (call or text), or mail to Bonnie Novak, [redacted] College, [redacted] Johnson City, NY 13790.

A consent document will be given to you at the time of the interview. Please sign the consent document and return it to me at the time of the interview.

Sincerely,

Bonnie Novak

Principal Investigator

Appendix D

Site Permission Request Letter

Date: January 21, 2016

[redacted]
Provost
College
[redacted]
Johnson City, NY 13790

Dear Dr. Marlett:

As a graduate student in the School of Education at Liberty University, I am conducting research as part of the requirements for a Doctor of Education degree. The title of my research project is *How Math Avoidance Influences Degree Completion for Bible College Students*, and the purpose of my research is to conduct a case study to describe math perception and avoidance for ministerial undergraduate students.

I am writing to request your permission to conduct my research at the College, contact students and faculty of the College to invite them to participate in my research study, and utilize student records.

Participants will be asked to contact me to schedule an interview. 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.

Thank you for considering my request. If you choose to grant permission, respond by email to bcnovak@liberty.edu. For education research, school permission will need to be on approved letterhead with the appropriate signature.

Sincerely,

Bonnie Novak

Doctoral student in the School of Education at Liberty University

Appendix E

List of Counselors

List of Local Area Counselors

1. Living Free Counseling - 607.239.5766

311 Garfield Ave, Endicott, NY 13760

2. Calvary Community Church - 607.729.7777

780 Harry L Dr., Johnson City, NY 13790

3. Mary Reeves, LMFT

Abide in the Vine Counseling Center
1277 Taylor Rd
Owego, NY 13827

Appendix F

Email Sent by the College to All Main Campus Students and Selected Faculty

Dear Student,
A Liberty University doctoral student is conducting research on math avoidance at the College. If you hate math or have math avoidance for any other reason and would like to be a part of this study, please read the attached Recruitment Letter and respond.
Thank you.

Sincerely,
College

Appendix G

Confidentiality Statement

I, _____ (name of colleague), solemnly swear that I will keep in confidentiality all information, interactions, and transcriptions to which I am privy in this research study.

Date:_____

Name/signature:_____

Confidentiality Statement

I, [redacted] (name of colleague), solemnly swear that I will keep in confidentiality all information, interactions, and transcriptions to which I am privy in this research study.

Date: 02/27/2016

Name/signature: [redacted]

Appendix H

Site Approval Letter

DAVIS COLLEGE

PURSUE GOD

Liberty University Institutional Review Board
Liberty University
1971 University Blvd.
Lynchburg, Virginia 24515

February 19, 2016

Re: IRB Application Novak 2414

Bonnie Novak, a faculty member of Davis College and a doctoral student in the School of Education at Liberty University has requested to collect data from faculty, alumni and students at Davis College for her dissertation research. As Davis College does not at the present have an IRB, I requested that several of our faculty members and staff review the IRB documents for this proposed research that have been filed with Liberty University. As you are aware, there were a few concerns that we initially had regarding this research and Bonnie has made adjustments in the methodology of her data collection.

Please consider this letter as documentation that Davis College has approved of the proposed research. We pray God's blessing on her as she completes this important step in her educational journey.

Sincerely,

[redacted]

Keith E. Marlett, Ph.D.
Provost

[redacted]

Appendix I

Liberty IRB Approval Email

Dear Bonnie,

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

Your IRB-approved, stamped consent form is also attached. This form should be copied and used to gain the consent of your research participants. If you plan to provide your consent information electronically, the contents of the attached consent document should be made available without alteration.

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

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

Sincerely,

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

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Appendix J

IRB Stamped Consent Form

The Liberty University Institutional Review Board has approved this document for use from 2/22/16 to 2/21/17 Protocol # 2414.022216

CONSENT FORM

Title of Study: How Math Avoidance Influences Degree Completion for Bible College Students: A Case Study of a Small, Private Institution in Upstate New York
Principal Investigator's Name: Bonnie Novak
Liberty University
School of Education

You are invited to be in a research study of math avoidance at the College. You were selected as a possible participant because you are a student (or an alumnus) of the College who has experienced math avoidance or you are a faculty member who is involved or interested in the math avoidance issue at College. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Bonnie Novak, a Doctoral student of the School of Education at Liberty University.

Background Information:
The purpose of this study is to understand math avoidance and to find out why this issue occurs in college students and seek to discover what college professors and administrators can do to help students overcome or deal with this issue. The procedure will be a qualitative case study design and will last for one entire academic semester.

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

- You will be interviewed individually, and the interview will be audio recorded. This interview will last about one hour.
- Five of you will be selected for an online focus group, which will be conducted via Go-toMeeting and last about one hour.
- You will be tasked with a follow-up written interview, which should take no more than 30 minutes to complete.
- You will be tasked with a reflective journal entry, which will also take about 30 minutes to complete. Individuals involved in the data collection will be the principal researcher and the participants, who will be considered co-researchers.

Risks and Benefits of being in the Study:
There are no major risks to participation. There is only a minor risk of returning to stressful memories regarding math.

The participants will not receive any direct benefits.

Compensation:
You will not be compensated monetarily for participating in this study.

Confidentiality:
Your name will not be associated with the research findings in any way, and while I will assure confidentiality on your end, because of the nature of focus groups, I cannot assure that each member involved will keep all information shared confidential. However, I will emphasize the importance of doing so. Pseudonyms will be used to ensure participants' confidentiality. The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely and only I will have access to the records. All data will be stored on a locked, password-protected computer dedicated solely to this study, and all files with personal data will be locked. Digitally recorded files will be uploaded to the computer and then

immediately erased from the digital voice recorder. Only I will have access to these files. I will share them only with the colleague designated to help transcribe the recordings. This colleague will have signed a confidentiality agreement. Data must be retained for 3 years before being destroyed. Data will be retained for 3 years. After the 3 years has expired, all data will be wiped (deleted) from the computer and its memory.

Voluntary Nature of the Study:

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

How to Withdraw from the Study:

If you choose to withdraw from the study, please contact Bonnie Novak at email address bcnovak@liberty.edu or phone number 315-572-1501. Should you choose to withdraw, data collected from you, apart from focus group data, will be destroyed immediately and will not be included in this study. Focus group data will not be destroyed, but your contributions to the focus group will not be included in the study if you choose to withdraw.

Contacts and Questions:

Do not hesitate to ask any questions about the study either before participating or during the time that you are participating. You may ask any questions you have now. If you have questions later, contact Bonnie Novak (me) at 315-572-1501 or bcnovak@liberty.edu. You may also contact my advisor, Dr. Jennifer Courduff at jlcourduff@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than me, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Carter 134, Lynchburg, VA 24502 or email at irb@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

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

I consent to being audio recorded as part of this study. (Check the box if you agree.) ☐

Signature: _____ Date: _____

Signature of Investigator: _____ Date: _____

Date: February 1. 2016
Sincerely,
Bonnie Novak, Principal Investigator

Appendix K

Novak Approval Letter from IRB

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

February 22, 2016

Bonnie Novak
IRB Approval 2414.022216: How Math Avoidance Influences Degree Completion for Bible College Students: A Case Study of a Small, Private Institution in Upstate New York

Dear Bonnie,

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

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

Sincerely,

[redacted]

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

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Appendix L

Email Confirming that College Participant Recruitment Letters Sent

From: Sandra Conklin
Sent: Tuesday, February 23, 2016 8:51 AM
To: Bonnie Novak
Subject: emails are out!

Hi Bonnie,

The emails have been sent out to students about your study. There were 150 students who received an email from me and I forwarded the email with an additional message to the 5 requested faculty members. ☺ If you want copies of the emails for your records let me know.

Sandra Conklin
Director of Student Support Services
College
[redacted]
Johnson City, NY 13790
607.729.1581 ext.339
Fax: 607.797.5773
www.davisny.edu

Appendix M

NYSED Policy on Liberal Arts and Sciences

Policy Statement on Liberal Arts and Sciences

This guidance is intended to assist institutions of higher education in New York State in meeting the requirements of the Rules of the Board of Regents, Section 3.47 (c), Requirements for Earned Degrees, Undergraduate degrees:

"Undergraduate degrees shall be distinguished, as follows, by the minimum amount of liberal arts content required for each degree. The required liberal arts core shall not be directed toward specific occupational or professional objectives."

Degree	Minimum Proportion of Content	Minimum Number of Credits
Associate in Arts (AA)	3/4	45
Associate in Science (AS)	1/2	30
Associate in Applied Science (AAS)	1/3	20
Bachelor of Arts (BA)	3/4	90
Bachelor of Science (BS)	1/2	60
All other undergraduate baccalaureate degrees (BBA, BE, BFA, BPS, BTech, etc.)	1/4	30

The liberal arts and sciences comprise the disciplines of the humanities, natural sciences and mathematics, and social sciences.

A. Examples of course types that are generally considered within the liberal arts and sciences:
    1. Humanities:
        - English—composition, creative writing, history of language, journalism, linguistics, literature, literature in translation, playwriting
        - Fine arts—art appreciation, history or theory
        - Foreign languages—composition, conversation, grammar, history of the language, literature of the language, reading, translation studies

- Music—music appreciation, history or theory
- Philosophy—comparative philosophy, history of philosophy, logic, schools of philosophy
- Religion—comparative religion, history of religion
- Theater—dramatic interpretation, dramatic literature, dramaturgy, history of drama, playwriting

2. Natural sciences and mathematics:
    - Natural sciences—anatomy and physiology, biology, chemistry, earth science, geology, physics, zoology
    - Mathematics—calculus, mathematical theory, statistics
    - Computer Science—broad survey/theory courses
3. Social sciences:
    - Anthropology, cultural studies, economics, geography, government, history, political science, psychology, sociology
    - Criminal justice—introductory and broad survey courses
    - Communications—interpersonal communication, mass communication, public speaking, speech and rhetoric

B. Examples of course types that are generally not considered within the liberal arts and sciences:
    - Agriculture
    - Business—administration, finance, human resources, management, marketing, production
    - Computer applications (e.g., word processing, database, spreadsheet), programming (e.g., specific languages)
    - Health and physical education
    - Home economics
    - Education and teaching methods
    - Library science
    - Music—studio, performance, practice courses—voice, instrument, direction, conducting
    - Office technologies and practice
    - Performing and related arts—acting, costume design, dance, direction, lighting, production, scene construction, sound production

- Specialized professional courses in such fields as accounting, architecture, dental hygiene, dentistry, engineering, law, medicine, nursing, nutrition, pharmacy, podiatry, veterinary medicine
- Studio art—drawing, painting, ceramics, sculpture
- Technology/technician fields—construction, data processing, electrical, electronics, graphic arts, mechanical, medical, refrigeration repair
- Television and radio production
- Theology—pastoral counseling, ministry

Appendix N

Music Math Course Description

MATH 1031 Music Mathematics I

+MUSC 1031 Music Mathematics I

M, L, 3 credit hours

This course is a designed to allow each student to be confident and competent in his/her knowledge of using mathematics skills in life. This course will explore the dynamic relationship between mathematics and music. The applicable mathematical and musical concepts will be developed as the need arises. Musical topics to be considered include basic music theory (rhythm, pitch, scales, intervals, chords, progressions), non-standard tunings and scales, the overtone series, and twelve-tone music. The mathematical topics to be studied include graphs, trigonometry, logarithms, equivalence relations, modular arithmetic, group theory, rational and irrational numbers, and symmetry. The integration of technology into mathematics will also be addressed throughout the semester. This course is offered as a substitute for the mathematics requirement plus a general education elective for those who want to take two mathematics courses.

Prerequisite: Pass math placement exam with at least 80% accuracy or successful completion of Foundations in Mathematics course with at least a grade of C; completion of Computers and Their Applications course; or at the discretion of the Mathematics Professor and the General Education Division Chair.

Appendix O

Follow-up Interview and Reflective Journal Entry Script

Follow-up Interview and Reflective Journal Entry

Please answer the following 2 questions:

1. What advice would you give to incoming students who have not transferred in or completed the required math course requirement at College?
2. Please write a list of recommendations to the provost and suggestions to the college about math course designs and what the college can do to help students meet the math requirement so they can finish their degree.

Appendix P

Matrices of Themes

Matrix of Themes—16 interviews

Theme	RQ	Theory	Participants
Hated math, Struggled with math, Confused, upset Bad experience *Annoying, more difficult	RQ2	Bandura	Dr. Avery (Elementary) Ellen (all life) Anna (3rd grade & on)—slow, but understands Dani (on & off) Wayne (higher math) Kevin (always, esp. Algebra) Larry (High School-harder) Ava (Elementary okay but could succeed; H.S. struggled, many tears) Dr. Cameron (of students: pre-college) Dr. Rogers (H.S., college) *Anthony (H.S., college) James (H.S.; not bad but "Not a fan") Mitch (put in slower course in H.S.; would have preferred accelerated math) Michael (H.S. had trouble in Algebra, geometry) Jonathan (always, even when young; told could never do it, felt in trouble for struggling; H.S. lost, impatient teacher; college math prof worse, disaster)
Loved problem-solving, sensibleness of math Enjoyed math, math as fun, Confident, excels Came naturally	RQ2	Bandura	Dr. Avery (High school) Christy (E—H.S.) Dani (loves it when understands) Wayne (Elementary) Larry (Elementary-favorite subject) Dr. Cameron (major in H.S.) Anthony (elementary-enjoyed) James (better in college) Mitch (enjoyed pre-H.S.) Michael (good in pre-H.S.) Jonathan (Music math—struggled, but enjoyed & passed)
Turning point (negative or positive)	RQ2 RQ3	Bandura Tinto	Dr. Avery (9th grade positive; Academic Dean positive) Ellen (Music math positive) Dani (when understands it) Wayne (higher math negative; worked in SPED school=positive) Larry (H.S.—got harder)

			Ava (H.S. got difficult; tutor made succeed) Dr. Rogers (positive developing music math, now—life skill) Anthony (H.S. more difficult) James (College—better) Michael (senior year college positive) Jonathan (Music math)
Fear of failure	RQ2	Bandura	Dr. Avery Ellen Jonathan (hated failing)
Feeling inadequate Frustrated	RQ2	Bandura	Dr. Avery Dani (Remedial 1) Wayne (dad) Ava (H.S.) Dr. Rogers (H.S.—BRE) James (too many extra things to learn, 1 slip up=entire problem wrong) Michael (thought others would make fun of me) Jonathan (want to succeed; never thought would get degree because of math)
Unapproachable faculty, Boring, dull teacher	RQ3	Tinto Estep	Dr. Avery Dr. Rogers (ignored, marginalized) Wayne (Algebra I prof) Mitch (H.S. teacher jaundiced eye toward him) Jonathan (remedial profs give up on students, stereotype as dumb or stupid—those words hurt coming from your teacher)
Cumbersome, boring, drill and kill methods, ineffective methods Not made relevant (negative)	RQ2	Tinto	Dr. Avery (elementary) Ellen (elementary-college) Anna (3rd grade-college) Dani (Remedial 1) Wayne (D in Algebra I) Larry (hard to understand) Dr. Rogers (formal rules) Dr. Cameron (of students' pre-college experiences) Anthony (kind of math taking not really needed) James (last H.S. teacher expected him to know everything, did not teach) Mitch (H.S. teacher) Michael (first college prof made it difficult, didn't explain)
Many methods, other methods, modalities Approach (positive)	RQ2	Tinto Estep	Dr. Avery (9th grade+) Ellen (music math) Anna (online) Dani (Remedial 2, Math I; make fun)

			Wayne (Algebra I, different teacher) Ava (Tutor for H.S.) Dr. Rogers (music math) James (first H.S. math teacher; better in head than on paper) Michael (senior year prof took special interest, office always open, came alongside to make successful—passed with an A) Jonathan (Music math, encouraging prof changed my perception)
Relevant, useful math (real world) Everyday life situations	RQ2	Tinto Bandura	Dr. Avery (associate concepts with real world or ministry) Christy (make it a practical opportunity) Dani (make it practical, connected to real life) Wayne (focus on stuff we need in regular life, how to do taxes) Kevin (Math does not play a big role in the field I am pursuing) Dr. Cameron (percentages, budgeting for business, organizations) Dr. Rogers (couch in life skills) Ava (more practical, applicable to life; finances, budgets for leaders) Anthony (be proactive, provide specific facts about why students need math) Jonathan (helped me in my job with budgets, I use math every day)
Give students hope, encouragement, positive faculty, revered person's influence	RQ2 RQ3	Bandura Tinto Estep	Dr. Avery (9th grade teacher; be nice, root for my students) Christy (mom) Ellen (Music math teacher) Anna (HS Algebra tutor, DOL prof) Dani (Remedial 2 teacher, prof with similar sympathy) Wayne (passed Algebra I with A's & C's) Dr. Cameron (Profs show relevance in Orientation—why you need this) Dr. Rogers (as prof in music math) Anthony (be proactive, provide specific facts about why students need math) James (People in family good at math; peers positive) Michael (parents: math important; senior prof—made me want to keep trying, took time and helped me, learned a lot) Jonathan (Music math prof—It's all in the

			teachers—almost every teacher believed in me)
Negative influence by revered person	RQ2 RQ3	Bandura Tinto Estep	Wayne (Everyone—peers, parents--I know says I won't need Algebra I, upset dad—college math prof) Dani (mom: we'll struggle together) Kevin (parents: some people struggle) Ava (Mom good at math, encouraged to push through, get it done so can move on) Larry (Parents not good at math) Dr. Rogers (All math teachers for him; students parrot "I can't do math"—Who spoke these words into their life?) Anthony (Dad liked; "Everybody" says not good, annoying, stay away) James (last H.S.math teacher) Mitch (H.S. teacher; peers) Michael (friends:take it at a different college; freshman & soph. years prof) Jonathan (missed recess while tutored for math)
Remedial process	RQ1	Tinto	Dr. Avery (Streamline it) Ellen (failed 2x, almost gave up on degree) Dani (2 courses, struggled through) Wayne (2 courses, completed with honors) Kevin (Math like another language to me) Anthony (took at previous college, D from previous college did not transfer) Michael (failed 1 course in freshman year) Jonathan (teachers think you are dumb or stupid; these courses don't work)
Taking math early	RQ2	Bandura	Christy Wayne (take ASAP) Ava (glad it's over) Anthony (Taking now because required) James (freshman year)
Not in a hurry to take math course (Avoidance) Reasons, perception	RQ2	Tinto Bandura	Christy (expressed) Anna (junior year) Dani (senior year, last semester) Ellen (senior year) Kevin (not offered to freshmen, avoid things I do not enjoy) Larry (if Calculus, other hard course) Ava (Do not feel it will be beneficial to my life; see no reason to not avoid it; do not enjoy) Dr. Rogers (senior year—thought huge waste of my time, needlessness) Dr. Cameron (students do not see relevance as

			pastor, missionary; not required for his BA; thinks should be required for basic living) Anthony ("Everybody" says stay away) James (waste of time, not necessary after school) Mitch (not necessary for my career) Michael (senior year passed—had failed in sophomore year, not comfortable doing math; needed it to graduate) Jonathan (never thought I would get my degree because of math)
Modality made difference	RQ2	Tinto	Anna (succeeded online, fell behind on campus) Mitch (succeeded in self-taught course on computer)
Resources for those who struggle	RQ2	Tinto Bandura Estep	Anna (offer online, have resources & tutors available) Wayne (Make resources cheaper—MyMathLab) Kevin (Hire more tutors) Larry (more tutors) Dr. Cameron (professional tutors—adds relevance, real life examples) Dr. Rogers (Music math, couch in life skills) Ava (Finances course, budgets) Anthony (tutors—could better help students understand) James (actual math tutors; have different levels, lower streams available) Mitch (have prescribed course above elementary algebra level) Michael (make struggling students feel as comfortable as possible) Jonathan (Music math; choose teachers who encourage; know your students; math has a stigma—pair it with something fun)

Advice to Students	**RQ**	**Theory**	**Participant**
Don't postpone taking math courses Choose a light semester *Take it here	RQ2	Tinto	Dr. Avery Kevin Ellen Wayne *Larry
Take it online	RQ2	Tinto Bandura	Anna
Get a tutor, someone to help	RQ2 RQ3	Tinto Bandura Estep	Anna Kevin Larry (Profs willing to help)

Don't be lazy Decide to try and not give up	RQ2	Tinto Bandura	Kevin Dani

Recommendations to college provost	**RQ**	**Theory**	**Participant**
Math tutors	RQ2 RQ3	Tinto Estep	Kevin (mandatory) Anna Wayne (professional) Dani (encouraging)
Keep online options	RQ2	Tinto Bandura	Anna
More resources	RQ2 RQ3	Tinto Bandura	Anna Dr. Avery (Pearson)
More, multiple Math options, *Concrete life skills **Useful math for future ***Easy course	RQ2 RQ3	Tinto Bandura Estep	Anna Ellen (no one math class works for everyone; options=more willing to take math, less anxious) *Wayne (methods of teachers vary) Dani (better time of day) **Anthony ***Larry (mind should be on Bible classes)
Math 1 every semester, smaller class size, limit scheduling conflicts	RQ2	Tinto Bandura	Dr. Avery Dani (better time of day)
Free textbooks *Affordable, user friendly tools	RQ2	Tinto Bandura	Dr. Avery *Wayne
Positive remedial light, positive math atmosphere	RQ1	Bandura	Dani
Math teacher time outside of classroom	RQ2 RQ3	Tinto Estep	Wayne

Focus Group Themes

Themes	**RQ**	**Theory**	**Participant**
PERCEPTION of MATH at NYBC Seems that college chooses math courses because they are required by accrediting organizations rather than profit students *Find it pretty easy, no big deal, now I understand and am enjoying it Dr. Cameron--NYBC chose math as a LA course because is critical for life, well-rounded education, knowledge & skills needed, public schools not doing a good job in math, some carry over from H.S.	RQ2	Bandura Tinto	Wayne *Dani (may take Math II, even though not required) --Dr. Cameron #Dr. Rogers

--Some so afraid psychologically, convince themselves "I can't do it!" Dr. Rogers: #I Wonder if they have experienced failures in math outside the classroom in real life, maybe they don't actually have problems using math outside of the college situation; maybe the disconnect is math as a subject rather than math in all contexts, tested poorly			
Some like math hate English, others like English avoid math;	RQ2	Bandura	Dani
Wayne: I wonder if fears amplified by waiting a long time before math course required, maybe should take it earlier, would remember more Dr. Rogers: *Some students delay math because they desire to pursue a specific field of study and do not want to spend time taking courses that do not pertain to their field, so they avoid courses like math to take courses that they like, that pertain to their interests, they put off courses they do not like or do not want to take until their senior year Dani--I took math my senior year motivated by the fact that I simply HAD to pass it; I like to do the hard things last because of the additional motivation; also students often have a lighter credit load toward the end and thus have more time to spend on a more difficult subject	RQ2	Tinto Bandura	Wayne *Dr. Rogers --Dani
HISTORY: We used to think it would be best for students to take math earlier. Entering freshmen took a placement test, could take Math I freshman year or if needed remedial course could take Math I sophomore year; there was such an aversion to math, NYBC moved it out of associate's degree & into bachelor's –that is why it's in the third year; we wanted students to have opportunity to get adjusted to college before having to face a difficult course for many of them, also makes it possible to earn an associate's without math requirement, a student can choose math in associate's as an elective *Dreaded math coming into NYBC, delayed starting college because of health problems; did not pass placement, not excited about having to take remedial math	RQ1 RQ2	Tinto Bandura	Dr. Cameron *Dani
Dani: Adult learners: after much time has elapsed since last math class feel more intimidated? Dr. Rogers: *Knowles says "Adult learners need to be told WHY they are required to take a certain	RQ2 RQ3	Bandura Estep	Dani *Dr. Rogers

subject.			
Dr. Rogers: Relevance: The names of the different maths do not tell a student anything about what that math is used for Dani: *I was personally overthinking the whole math thing, "they are going to have us do pre-calculus" assuming it was going to be all the parts of math I have problems with Wayne: --Students at NYBC tend to place math at a very low priority since they are going into some type of ministry, they do not think math has any practical importance for them Dani: *The ministry examples of math usage helped me overcome my extreme difficulty in seeing and extracting the needed math exercise from a word problem Dr. Rogers: Maybe a "How to do your taxes math" would remove some of the anxiety Wayne: --We use math in our daily lives without being aware of it; it is more valuable than we realize	RQ2	Bandura Estep	Dr. Rogers *Dani --Wayne
Recommendations for NYBC to help incoming students get prepared with less anxiety: Wayne: Math courses that deal with practical issues relevant to their lives; Wayne: Dedicated Math Lab with tutors focused solely on math Dr. Rogers: --How to do your taxes math Dani: *Remind them that principles and patterns of math are created by God and not scary; God made it so it must have importance Dani: *Emphasize that they are not alone in their struggle with math so they won't feel isolated Wayne: Provide an incentive to work harder to learn math, practical use in the future Dr. Rogers: --Change the classroom environment to relaxed with food, etc. --Music math inspires interest, builds confidence, involves them in difficult math (set theory, exponents, logarithms, permutations) without realizing it, they see it, hear it, play with it, watch the math happen, have a good time, but may not work with a larger class	RQ2	Bandura Tinto	Wayne --Dr. Rogers *Dani