STUDENT PERCEPTIONS OF LEARNING INTRODUCTORY MATHEMATICS IN AN ONLINE ENVIRONMENT IN HIGHER EDUCATION

by

Jamie Lynn Brooks

Liberty University

A Dissertation Presented in Partial Fulfillment
Of the Requirements for the Degree
Doctor of Education

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APPROVED BY:

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ABSTRACT

The purpose of this transcendental phenomenological study was to describe the essence of student perception of learning introductory mathematics courses in an online environment at the college level. The central research question was, “What are the lived experiences of students who have completed introductory college mathematics courses in the online learning environment?” The phenomenon described was that of the beliefs and attitudes of the students who participated in introductory mathematics courses on the college level. The ideas explored were if students believe they learn effectively in this environment and how they believe they can best learn. Student beliefs and attitudes about learning online mathematics were defined as student perception. Thus, the central research question addressed the lived experiences of students who have completed introductory college mathematics courses in the online learning environment. The theory guiding this study was Bandura’s social learning theory. The specific part of this theory as it related to the study is that of self-efficacy. Data was obtained through interviews, questionnaires, and focus group discussions. Eleven students who had completed an introductory mathematics course in a college online environment were selected for this study using criterion sampling. Data was coded and emerging themes were identified. The findings of this study show that students who participate in learning introductory mathematics in the online environment in higher education desire the flexibility and convenience of the online schedule but want the connectedness to instructors offered in the traditional setting. The goal of this study was to provide information to college administrators and instructors in order to improve the teaching of introductory college mathematics courses in the online environment.

Keywords: Blended learning, online learning, face-to-face learning, self-efficacy
Dedication

This paper is dedicated to my son, Dylan Thomas Brooks. He inspires me to work to my full potential. It is in everything that I do that I work to be an example for him. He always encouraged me to complete my degree. It is my hope that he will realize that we are never too old to stop learning. There were many times in which I took my work to hockey practices and piano lessons so that I could accomplish my dream without missing the important things in Dylan’s life. This paper is a product of the love and encouragement between a mother and son.
Acknowledgments

This dissertation would have not been possible without the way in which the Lord directed my life. I had always wanted to pursue my doctorate degree in education, but as a working mother, I was not able to visualize that as a reality. After 12 years of teaching high school, I became ill without an official diagnosis. After being told I had Lupus, Rheumatoid Arthritis, or worse due to bloodwork results, I knew I needed to step back from some area of my life. Knowing that stepping back from motherhood was not an option, I decided an educational sabbatical was the best decision. This way, students and fellow faculty members would not need to worry about a health issue with me, and I could slowly complete my degree.

The next year, my mother became ill and passed away. I was unsure of many things in life, but I knew somehow the Lord would guide me. While I decided to not go back to work full time, I remained dedicated to completing my degree. Three years later, my own illness became worse. However, it was during this time that the Lord send me a wonderful physician and healer, Dr. Lisa Hildenbrand who deserves an acknowledgment because I am sure she saved my life. After two surgeries in May of 2016, I was on my way to recovery. Within a few months, I was energized to begin working again. Soon, I went back to teaching full time and was able to put even more energy into my research.

I appreciate the assistance provided from my dissertation chair, Dr. Carol Gillespie, who has been supportive and encouraging since our first discussion. I also appreciate the assistance provided from Dr. James Swezey, who has been there during the difficult moments and helped me to persevere to complete my work.
# Table of Contents

ABSTRACT .....................................................................................................................................3  

Dedication ..................................................................................................................................4  

Acknowledgments ....................................................................................................................5  

List of Tables ..........................................................................................................................11  

List of Abbreviations .............................................................................................................12  

CHAPTER ONE: INTRODUCTION ............................................................................................13  

Overview ..................................................................................................................................13  

Background ................................................................................................................................14  

  Historical ..................................................................................................................................14  

  Social .......................................................................................................................................15  

  Theoretical ...............................................................................................................................16  

Situation to Self ..........................................................................................................................17  

  Ontological Assumptions .........................................................................................................18  

  Epistemological Assumptions .................................................................................................18  

  Axiological Assumptions .........................................................................................................20  

  Social Constructivism .............................................................................................................20  

Problem Statement ....................................................................................................................21  

Purpose Statement .....................................................................................................................22  

Significance of the Study ...........................................................................................................23  

Research Questions ..................................................................................................................26  

Definitions ..................................................................................................................................28  

Summary ....................................................................................................................................29
Focus Groups .......................................................... 72
Data Analysis ........................................................... 73
Transcription ............................................................ 74
Horizontalization ..................................................... 74
Cluster for Meaning ................................................ 74
Coding ................................................................. 75
Descriptive Analysis ............................................... 75
Trustworthiness ....................................................... 76
Credibility ............................................................... 76
Dependability and Confirmability ......................... 76
Transferability ......................................................... 77
Ethical Considerations ............................................ 77
Summary ............................................................... 77

CHAPTER FOUR: FINDINGS ............................................. 79
Overview ............................................................... 79
Participants ............................................................ 80
Tami ................................................................. 81
Nikki ................................................................. 82
Angela ................................................................. 83
Dave ................................................................. 83
Pam ................................................................. 84
Haley ................................................................. 84
Richard .............................................................. 85
List of Tables

Table 1: Participant Information ................................................................................................... 80
Table 2: Themes by Participant .................................................................................................... 91
List of Abbreviations

Self-regulated learning (SRL)
Self-efficacy (SE)
Online learning environment (OLE)
Massive Open Online Course (MOOC)
Aleks (Assessment and Learning in Knowledge Spaces)
CHAPTER ONE: INTRODUCTION

Overview

Over the years, many colleges have utilized online learning as a means for content delivery. Some courses use online learning as a small part of the overall delivery of content for a specific course. Most colleges have at least some courses offered in a fully online environment. Some colleges and universities have degree programs that can be completed without the student ever stepping into a traditional classroom. Online courses are very popular because they are affordable and accessible (Dobbs, Del Carmen, & Waid-Lindberg, 2017). However, there is concern that the quality of education does not meet the same standards provided in the face-to-face learning environment (Bowen, 2013). Bantum (2013) found that campus-based students were more likely to complete courses than the online students. Thus, there is a concern about the effectiveness of online courses. Exploring student perception can help educators and administrators gain insight into how the students could be better served in this area. In addition, many courses offered online are prerequisite courses or introductory courses. The goal of this study was to understand the beliefs and perceptions students have about completing introductory mathematics courses in the college online environment.

This chapter provides a background of the ideas that surround learning introductory college mathematics in the online environment. This is followed by the situation to self, in which I discuss the motivation to delve into the perception college students have about learning introductory mathematics in the online environment. This includes ontological, epistemological, and axiological assumptions as well as the paradigm. The problem statement and purpose statement follow. Next, the significance of the study is given to describe the focus of the study.
Research questions and subordinate questions show how the methodology was developed in this phenomenological study.

**Background**

Online learning has been researched in various capacities including comparing learning environments and at various levels in education (Khan, Everington, Kelm, Reid, & Watkins, 2016). Some studies have compared online learning environments to traditional learning environments (Albalawi, 2015). Some studies have researched the perceptions students have towards learning in different environments (Hung & Chou, 2014; O’Rourke, Main, & Cooper, 2014; Palmer & Holt, 2010). However, there is a gap in the literature pertaining to the specific idea of learning introductory mathematics courses in the online learning environment. Furthermore, most of the studies found on the topics of either learning online or learning mathematics online are quantitative in nature (Huston & Minton, 2016). Since a major purpose of education is to make sure students learn effectively, it is important to understand the beliefs and attitudes students may have towards learning introductory mathematics in the online environment at the college level. Capturing the essence of the experience of students who have participated in learning in this environment may lead educators and administrators to an understanding of how students may be better served. The following sections help to develop an understanding of the beginning of online learning. The sections show how online learning has changed over the years and provide an understanding as to why it is important to learn how students perceive learning introductory college mathematics in the online learning environment.

**Historical**

Distance education emerged before the use of computers. Students could learn by mail correspondence and television before the idea of online learning was considered a possibility.
Cable television was a means of course delivery in the 1970s and 1980s. Smarty (2010) stated that online learning dated back to the 1960s when the first virtual classrooms were being created. Students were able to listen to lectures via a television or an audio device (Smarty, 2010). In the years that followed, the internet came into existence and universities began to use computer networking. In the 1980s, online courses began to emerge. By the 1990s, online course delivery replaced other methods of distance education. Students liked the accessibility of the online learning environment. Today, students can complete entire degree programs without ever receiving face-to-face instruction.

Because there has been so much growth in online education in both 4-year and 2-year institutions (Dobbs et al., 2017), it is important to study specific courses that are delivered in the fully online environment. This dissertation focused on introductory mathematics courses in higher education. Because there has been a rapid growth in online delivery in the last decade (O’Rourke et al., 2014), the student perception of learning mathematics in this environment provides helpful, current information. O’Shea, Stone, and Delahunty (2015) reported that there has been attention given to the study of the traditional, on-campus student experience, but very little given to the online student experience.

**Social**

Factors such as jobs, children, physical location, and responsibilities can make being a traditional student nearly impossible (Wilkes, Simon, & Brooks, 2006). Students of all ages are looking for educational programs that fit the needs of a busy schedule. Therefore, an online environment is extremely appealing to students. In the early stages, those using the internet were mostly men (Yukselturk & Bulut, 2009), but recent findings show that the gender gap is not as great as it once was. Stay-at-home parents as well as working parents desire to attend various
programs. They want programs that offer the ability to achieve their dreams while not allowing their parenting or their careers to suffer. There are confident online learners of both genders (Yukselturk & Bulut, 2009). More than five million students over the age of 25 are currently enrolled in college in general (Duverge, 2016). The online environment appeals greatly to adult learners. Being familiar with the history of the development of online learning will help in the discovery of how students perceive learning introductory mathematics in the online environment on the college level in the present day.

Theoretical

Malcolm Knowles contributed to the field of education by describing the adult learning theory (Bates, 2009). This theory is important to the research of online learning because it states that although learners begin as being dependent, they move to being self-directed. Many students in an online learning environment are self-directed adults. Another important aspect of this theory connected with online learning is that adults learn better in a problem-centered environment as opposed to a subject-centered environment. Adult learners do not need constant instruction (Duverge, 2016). The adult learning theory does not support the constant instruction of the traditional classroom. Adults use past experiences to help them learn and are active learners (Harrison & Holler, 2007). Knowles (1989) reminded those in education that effective learning occurs when the information is relevant. Students should be engaged and active. Instruction should involve problem-based learning and be learner-centered.

Albert Bandura’s (1977) social learning theory guided the theoretical framework for this study. Boeree (2006) provides the steps involved in Bandura’s modeling process as attention, retention, reproduction, and motivation. Students will not be motivated unless there is some type of reinforcement. In an online course, reinforcement may be the grade a student receives or pure
intrinsic motivation. Students who possess high self-efficacy may have received a good grade in a previous online course or be intrinsically motivated because of a core belief in themselves that they will perform well. Self-efficacy is a part of Bandura’s social learning theory and is a recurring idea in the review of literature. Cho and Heron (2015) found that grades correlate positively with motivation and self-efficacy. Alqurashi (2016) states that self-efficacy beliefs can motivate a person to take on challenges instead of avoiding them. If people have doubts about performing well in the online environment, they will be less likely to take those courses. If a student has high self-efficacy, the student will be more relaxed. Students who are confident in the online environment will be more relaxed and are more likely to obtain higher grades in an online mathematics course (Cho & Heron, 2015).

**Situation to Self**

I have taught mathematics in various capacities over the past 18 years. I have 15 years of experience teaching on the high school level and seven years of experience teaching in higher education. In addition, I have experience teaching mathematics on the middle school level. My experience includes teaching in the traditional environment and in the online environment. A few years ago, I began to tutor various levels of mathematics. I observed that many students who came to me for assistance were struggling with learning mathematics in the online environment. This occurred with students who were taking introductory mathematics courses in higher education. It seemed that these students were able to understand the concepts better if they had a little time each week face-to-face with me. I began to explore the idea of blended learning environments for introductory mathematics courses. I found research on comparing the learning environments including the traditional face-to-face environment, the online environment, and the blended environment. Although my original interest was in the blended
environment and its comparison to the other environments, I began to develop more interest in
the student perception of learning. I wanted to explore how students believe they learn best.
Because online mathematics courses were offered at each institution in which I was teaching, I
knew I had an opportunity to explore how students perceive learning introductory mathematics
courses in those environments. I saw this as an opportunity to learn from the students. This
could be a way to provide information to instructors and college administrators to enhance
student learning. I wanted to contribute to this area of education, so my focus narrowed to
extploring student perception of learning introductory mathematics courses in the online
environment in higher education.

**Ontological Assumptions**

Although I believe some students can be successful learning introductory college
mathematics in the online environment, I also believe that many students would benefit from
some face-to-face interaction to learn the concepts. College students may have very different
beliefs and perspectives about learning introductory mathematics online. Some students may
have had positive experiences with online learning, while other students may have had negative
experiences with online learning. Each student who participated in the study brought his or her
own realities into the study. I kept the central phenomenon in mind as I remembered that the
participants have different past experiences that are perceived as realities.

**Epistemological Assumptions**

Creswell (2013) describes the epistemological assumption as a means for the researcher
to get close to the participants involved in the study. This held true for the present study, which
was conducted at the colleges in which the participants are currently or were recently enrolled.
The questionnaires and interviews took place on the campuses of the student participants. The
focus group discussions took place via conference calls. Although I have not been an instructor of the students in the study, I have been an instructor at each institution involved in the study. Therefore, I am very familiar with the college atmosphere. Because I have been both a student and an instructor in the online environment, I have not only had a closeness to the colleges involved in the study, but a closeness to the experience of the online learning environment. I brought my own lived experiences to this study, as did the students who participated in the study. Through the methodological process, particularly the interviews, I was able to be close to the participants. I learned everything I could about their experiences of learning introductory mathematics courses in the college online environment.

As the students have lived the experience of learning introductory mathematics in the online college environment, they each have a view of how it has contributed to their overall experience as being students in higher education. Through the experience of learning introductory mathematics in the college online environment, the students have developed attitudes and beliefs about what they liked or did not like about the experience. They hold perceptions about learning in the online environment and the teaching methods used by the instructor (Ye & Singh, 2017). Students also hold internal beliefs about how their own technological abilities and intrinsic motivation to manage time may contribute to success in an online course (Lee & Martin, 2017; Marchand & Gutierrez, 2011). There are many factors that could contribute as to why a student may or may not be successful learning introductory college mathematics in the online environment. Therefore, it was important for me as the human instrument to respect each student’s experience of learning introductory mathematics in the online college environment. My own beliefs and perceptions may be different than the students who participated in the study.
Axiological Assumptions

In this study, I report my own biases and discuss my values. I developed personal values pertaining to learning introductory mathematics courses in the college environment when I tutored students who were taking such courses. I found that the students earned better grades when they received some face-to-face interaction each week. Therefore, I have a belief that students should receive some face-to-face interaction to perform well. It was my personal responsibility to bracket my own beliefs and values to truly learn from the participants and report their experiences in a non-biased manner.

Social Constructivism

The paradigm guiding this study was that of social constructivism. Through social constructivism, people aim to find an understanding of the world around them (Creswell, 2013). In social constructivism, the researcher does not begin with a theory. Instead, the researcher discovers and develops a theory based on what the participants report about the experience being studied (Creswell, 2013). I utilized social constructivism because the questions in the questionnaires, interviews, and focus groups were open-ended. I used broad questions to allow the participants to describe the meaning of the experience of learning introductory mathematics courses in the online college environment as it related to each of them. I sought understanding of the college online learning environment through the views of my participants. I asked broad, open-ended questions to gain this understanding. The students I interviewed provided a description of the experience they had in a specific class and allowed me to construct an interpretation of what they reported to have experienced. While I had a guiding theory of the social learning theory, I remained open to emerging concepts. In addition, I remembered that my own background and experience with online learning and teaching could contribute to how I
interpreted what the participants in my study said about their experiences of learning introductory mathematics in the online college environment. I did my best to interpret the research in my descriptions of the experiences of the participants.

**Problem Statement**

The perceptions of some teachers and some learners show that online learning can have very limited learner-learner interaction (Borup, 2016). Less interaction can lead to a lack of social connectedness. This lack of social connectedness has been reported as a reason some students do not perceive themselves as successful in an online learning environment (Slagter van Tryon & Bishop, 2012). Students want to feel connected to the courses they take. Feeling connected socially may be extremely difficult in an online mathematics course. Many students do not have a positive attitude towards learning introductory mathematics courses online and prefer a blended environment for course delivery (Abdulla, 2012). The lack of positive feelings about learning mathematics in the online environment could be because students do not believe they can be successful learning mathematics online. Students are more willing to enroll in online courses if they possess high self-efficacy (Badri, Al Rashedi, Yang, Mohaidat, & Al Hammadi, 2014). In fact, there is a positive correlation between computer self-efficacy and prior experience in online learning (Alqurashi, 2016). Finally, students may lack the motivation to self-regulate their learning in the online learning environment (Cho & Heron, 2015). The research falls short pertaining to the student perception of learning introductory mathematics in the college online environment. There is some research concerning student success in online courses. There is a gap in the literature specific to the student perception of learning introductory mathematics courses in higher education.

Many students enroll in introductory mathematics courses to suit the needs of their lives
and schedules. An exploration of student perception of learning mathematics through this delivery method provides insight to those who educate introductory mathematics students in the online environment. Currently, there is no research giving a voice to students who participate in online introductory mathematics courses in higher education. The problem is that some students are successful learning introductory college mathematics courses in the online environment, while others are not.

**Purpose Statement**

The purpose of this transcendental phenomenological study was to describe the essence of the student perception of learning introductory mathematics courses in an online environment on the college level (Moustakas, 1994). Introductory mathematics courses are college-level courses that prepare students to take courses at a level higher than college algebra. The phenomenon described is that of the beliefs and attitudes of the students who participate in introductory mathematics courses on the college level. The ideas explored include a) if students believe they learn effectively in this environment and b) how they believe they can best learn. Student beliefs and attitudes are defined as *student perception* (Abdulla, 2012; Bouck, Pei-Lin, & Satsangi, 2016; Kim, Kim, & Karimi, 2012; Kuo, Belland, & Kuo, 2017; Slagter van Tryon & Bishop, 2012; Patrick, Howell, & Wischusen, 2016). The theory guiding this study was the social learning theory of Dr. Albert Bandura (1977). The social learning theory supports the idea that people observe the way they should act in certain environments and learn to act accordingly (McLeod, 2016). In an online learning environment, students observe and learn what behaviors are acceptable. A specific part of how the social learning theory relates to the study is that of self-efficacy. Bandura (1977) said that self-efficacy affects how much effort and persistence a person will contribute to being successful at an undertaking (Schunk, 1995). Students who
believe they will perform well learning college mathematics in an online environment are more likely to do so. When students possess self-efficacy, they will persist and put more effort into learning. In this study, those students who reported to possess self-efficacy were not necessarily those students who reported to be successful in learning in the online environment (Alqurashi, 2016).

**Significance of the Study**

This study contributes to the larger body of literature that addresses student perception of learning introductory mathematics in the college online environment because there is very little research in the area specific to introductory mathematics in higher education. There is also very little research specific to student perception of learning such courses in this environment. There have been studies conducted that have compared the online environment to the traditional environment (Huston & Minton, 2016). Other studies have compared traditional, online, and blended environments for content delivery (Albalawi, 2015; Yang, Yoon, & Watson, 2015). These studies mentioned have provided insight as to why students and teachers may like or dislike the online learning environment as compared to other learning environments. This dissertation contributes to this area of research because it remains specific to the subject of introductory mathematics. The online environment is the only environment studied, and the study only included students who have participated in these courses on the college level. Narrowing the subject provides information that teachers and administrators can use when they create these online courses.

Current research also provides information about how self-efficacy may contribute to success in online learning (Alqurashi, 2016; Badri et al., 2014; Marchand & Gutierrez, 2011; Yukselturk & Bulut, 2009). Yukselturk and Bulut (2009) found that self-efficacy has been
provided as an explanation for success in the online learning environment. Through the methods of gathering data in this study, self-efficacy is not mentioned in the questionnaires, interviews, or focus groups. However, it was interesting to discover that the theme of self-efficacy was not as prevalent in the study conducted. The findings in this study add to the current research because it contributes by studying an area that has not yet been a part of the research.

Another area that has been studied relating to the online learning environment is that of student perception. Student perception is the focus of the study conducted. It is the theme of the central research question and it is what makes this study a qualitative study. Student perception of online learning has been studied (Dobbs et al., 2017; Hung & Chou, 2014, O’Rourke et.al, 2014, Otter et al., 2013; Palmer & Holt, 2010; Watters & Robertson, 2009; Welsh, 2014; Wilkes et al., 2006). Hung and Chou (2014) conducted a study that focused on student perceptions of learning two different introductory courses in the blended and online learning environments. The results of that study showed that blended teaching is becoming more popular and that the role of the instructor needs more attention in each learning environment. The research of the study conducted contributes to the literature by examining information from students about their perceptions. Participants in the study were also able to voice views about the role of the instructor. Keeping the study focused on one introductory course specific to college mathematics is a method in which this dissertation contributes to the current research.

The present study adds to the current research by examining student perspectives of learning introductory mathematics in the online college learning environment. Research in this area may give insight on teaching online mathematics courses for instructors and administrators. Research is not current with regards to student perceptions of learning online college courses specific to introductory mathematics courses. Gaining an understanding of the student
perceptions of learning mathematics online could help instructors prepare the courses to meet student needs. Understanding the lived experience of students who have completed introductory online mathematics courses on the college level could provide information to colleges to help create the online format for these courses. This study examines the idea that some students who take introductory mathematics courses may also need additional help through tutoring or face-to-face interaction. The study also shows that there may be a trend of learning in a blended environment. This could be beneficial to the design of introductory college mathematics courses.

The stakeholders of this study are the college administrators and the online instructors. The study is significant to the administrators and the instructors because it provides valuable information about how students perceive learning mathematics in the online college environment. Once administrators understand how students perceive learning mathematics in the online environment, courses can be developed and administered to meet the needs of the students. More student satisfaction can lead to higher retention and higher enrollment.

There have been some quantitative studies conducted on the effectiveness of online courses. Huston and Minton (2016) found a higher completion rate for face-to-face instruction when compared to online instruction for intermediate algebra courses. Because this study explored the student perception of learning in the online environment, insight was examined as why completion rates could be different. This provides a practical contribution to the area of online learning for those who create online courses. In addition to this idea, the significance of the study remains important because participation in online learning is growing (Dobbs et al., 2017; Huston & Minton, 2016). The study is important to colleges and universities because gaining student perspectives of what methods work best can help administrators create more
effective online courses in introductory mathematics. O’Rourke et al. (2014) found that students like the online delivery for flexibility, but some content is better delivered in the face-to-face environment. The results of the study conducted could improve the online experience for the students because the instructors could have the opportunity to understand how students best learn in the online environment in higher education (O’Shea et al. (2015) found that learners struggle because of low technology skills, time management, and motivation. Delving into student perception contributed to the field of online learning by searching for why students have these concerns and what instructors and administrators can do to improve instruction via this mode of content delivery. In summary, the results could be used on a wider scale as the study could be applied at other universities.

**Research Questions**

A central research question (CRQ) and three sub-questions (SQ) were used in this transcendental phenomenological study.

**CRQ:** What are the lived experiences of students who have completed introductory college mathematics courses in the online learning environment?

The purpose of the CRQ is to capture the essence of learning introductory mathematics courses in the online college environment. The purpose of the sub-questions is to aid in understanding how students perceive learning introductory mathematics courses in the online college environment. For the purposes of this study, introductory mathematics courses are defined as those mathematics courses that are either remedial or prerequisites for mathematics courses that will be used as credit towards a degree.

**SQ1:** What is the student perception of being a successful learner of introductory mathematics in the online college learning environment?
Gaining insight on the student perspective was the overall goal of this phenomenological study. Dobbs et al. (2017) examined student perception of online learning without being specific to introductory mathematics courses and included students who had not participated in online learning. This research question provides insight by focusing on those students who have participated in learning introductory mathematics in the online environment. The goal of this question was to gather information that may be used as a means of assistance to those instructors and administrators who develop and teach online courses.

**SQ2:** How do students believe that self-efficacy contributes to success for learning introductory mathematics courses in the online college environment?

In the review of literature, an occurring theme concerning success in online courses in general was that of self-efficacy. This shaped the theoretical framework of the study and the use of Bandura’s (1977) social learning theory. Yukselturk and Bulut (2009) found a positive relationship between self-efficacy and online learning. If students believe they will perform well, they will. Alqurashi (2016) found that self-efficacy is one of the most important aspects of learning in an online environment. Some of the interview questions were formed with this research question in mind. The interview questions do not use the term *self-efficacy*. However, it is noted in the review of literature that it was an idea that was mentioned frequently in past research. Therefore, it was interesting to discover to what extent this theme developed in the study conducted.

**SQ3:** What academic or character traits do students perceive as helpful for succeeding in learning introductory mathematics in the online learning environment in higher education?

The main idea of this subordinate research question was to uncover those traits that the students believe they possess to make them successful in introductory online mathematics
courses on the college level. This is a research question that focuses on the student perspective. Whether or not the students report to possess such qualities actually do possess such qualities remain irrelevant to the study. The entire study focuses on the student perspective. This question is one that helps in gaining insight into the student perspective. Badri et al. (2014) said that there were personal factors that could influence the success of students participating in online courses. Marchand and Gutierrez (2011) found that there was an emotional role involved in learning in the online environment. This dissertation focused on student perception. Therefore, this research question brings together the ideas of the personal and emotional factors the students report in order to learn introductory mathematics effectively in the online environment.

**Definitions**

1. **Self-efficacy** – The belief of having the ability to achieve a certain task or goal (Alqurashi, 2016).
2. **Self-regulated learning** – A systematic effort of a student to manage the learning process to achieve goals (Cho & Heron, 2015).
3. **Intrinsic goal orientation** – A disposition to master content (Cho & Heron, 2015).
4. **Student engagement** – The effort and commitment students give to their learning (Khan et al., 2016).
5. **Traditional learning environment** – An on-campus, face-to-face learning environment (Wilkes et al., 2006).
6. **Online courses** – Courses without traditional, face-to-face instruction offered through use of the internet (Wilkes et al., 2006).
7. **Self-directed learner** – A student who takes the initiative to learn (Bates, 2009).

**Summary**

There are various reasons that some students are successful in online learning while others are not. There may be a lack of learner-learner interaction, a lack of social connectedness, or low self-efficacy. Students need to be motivated and self-regulated in to perform well in the online learning environment. There is very limited research pertaining to the student perception of learning introductory mathematics courses in the college online environment. This phenomenological study aimed to assist in closing that gap in the literature.

The purpose of this transcendental phenomenological study was to describe the essence of the student perception of learning introductory mathematics courses in an online environment on the college level. The goal was to capture the essence of the student perception of learning in this environment. Emerging themes provided meaningful data for the administrators and instructors associated with creating and teaching these courses.
CHAPTER TWO: LITERATURE REVIEW

Overview

The purpose of this chapter is to ground the transcendental phenomenological study in prior research and theory that is pertinent to gaining insight on the student perception of learning introductory mathematics in the online environment in higher education. This chapter includes a review of literature found through a search for studies conducted on student perspectives of learning introductory mathematics in an online environment. The main search was for studies that were conducted with a specific focus on learning introductory mathematics courses in the college online environment. This main search included looking for studies that were focused on the student perspective, as the study conducted is qualitative in nature. When the specific idea of learning introductory mathematics in the online college environment appeared to become exhausted, related topics became a part of this study. These topics included learning mathematics in higher education in general and learning in online environments other than in higher education. This search helped to identify some broader topics that were then identified and grouped to form an organization of the literature review. This is the reason that other content areas and levels of education are included in the review of the literature. In addition to the inclusion of other content areas and levels of education, the idea of self-efficacy was a theme found in many articles. Because the idea of self-efficacy stems from Bandura’s (1977) social learning theory, the theoretical framework was easily identified. Self-efficacy is an important aspect that relates to learning mathematics in the online environment. This connection to the theoretical framework is discussed in the first section of this chapter. The second section of this chapter concentrates on the literature related to online learning, learning mathematics online, the instructor’s role in online learning, student attitudes and perceptions of online learning,
comparisons of different learning environments, self-efficacy in the online learning environment, and emotions associated with online learning. It was determined that after review, there is a gap in the literature as there are very few articles that focus on the student perception of learning introductory online mathematics courses in higher education. As stated, there has been research conducted on learning in the online environment and learning mathematics at various levels. There has not been as much research that has been conducted specific to learning introductory mathematics in the online college environment. In addition, many of the studies that were done have been quantitative in nature. The goal of this study was to gain the perspective of the students who learn introductory college mathematics in the online environment. Therefore, the study was qualitative in nature. A qualitative study of this topic can be of great aid to those who create and instruct students who take introductory mathematics in the online college environment. Administrators and instructors could use such information as they create, prepare, and teach courses. Colleges could use the students’ perspective to make sure needs are met. This may help to increase retention rates and passing rates. Therefore, the setting for a qualitative study about learning introductory mathematics in the online environment was determined to be of value as it provided a need for the focus of this transcendental phenomenological study.

**Theoretical Framework**

The guiding theory for this study is the social learning theory (Bandura, 1997). McLeod (2016) described the four processes within this theory: attention, retention, reproduction, and motivation (McLeod, 2016). Individuals pay attention to or observe a behavior. Next, they retain in their minds the behavior in which they observed. Third, they reproduce the behavior they observed. Finally, if motivation is present, the observers will imitate the behavior. This
social learning theory began with Bandura’s Bobo doll study (Boeree, 2006). In this study, children observed a woman punching an inflatable clown-like creature while shouting at it. After the observation, the children were able to be in a similar situation with a similar figure. In this situation, the children repeated the behavior in which they observed. When the children were placed in an environment with a similar clown-like creature, the children punched the creature and shouted at it. From this experiment, the study grew as Bandura varied the experiment by adding in rewards and punishments (Boeree, 2006). Through these experiments, the children were exposed to watching a woman beat up a live clown. Therefore, it was shown that the children would repeat the observed behavior whether it happened with an object or a live person. Again, the children who observed the beating proceeded to imitate that behavior. This is what led to the discovery of the social learning theory and the four-step modeling process of Bandura (1977) outlined above.

Social learning theory is also referred to as the social cognitive theory (Mulhollem, 2009). As the theory grew and was further examined, ideas of human agency were found to be factors of the theory (Mulhollem, 2009). Human agency focuses on how an individual can regulate his or her actions and produce desired behaviors. There are obvious connections with the evolution of the social learning theory and the social cognitive theory. In addition to the ways in which they have evolved, there is a connection of the idea of human agency and Bandura’s ideas. Within the concept of human agency is Bandura’s idea of self-efficacy (Mulhollem, 2009). Self-efficacy is belief in one’s self. If a person believes he or she can achieve something, the achievement is more likely to happen. As the review of literature was conducted, this idea was one that reoccurred. This idea is the most important part of the guiding theory for this study as it appeared throughout much of the literature on the topic of online
learning and learning mathematics in the online environment. Therefore, if a student believes he or she can be successful learning mathematics in the online environment, then that student is more likely to be successful in learning mathematics in the online environment.

As other theories were considered in the review of literature, there was only one theory that was found to be most appropriate for this study, social learning theory (Bandura, 1997). There were two other theories that were considered. The adult learning theory (Knowles, 1989) was considered because of the relation to learning in higher education. In this theory, it is said that adults are self-directed learners and that students take an initiative to learn (Bates, 2009). This dissertation pertains to adult learners because it was conducted in the realm of higher education. Although some students may take college courses in their high school years, most of the students in higher education are in their adult years of life. The summary of the adult learning theory is that while learners may begin as being dependent on others to learn, as children become adults, they become more internally motivated and therefore, more self-directed in learning (Bates, 2009). This theory was explored because the study focused on learning mathematics online in higher education and used adult participants.

The other theory examined was the multiple-intelligence theory (Gardner, 1993). The multiple-intelligence theory states that intelligence could be measured in ways not limited to IQ including intrapersonal, interpersonal, logical-mathematical, naturalist, spatial, bodily-kinesthetic, linguistic, and musical learning styles. Watrous-McCabe (2005) applies this theory to online learning. Therefore, those who are involved in online learning should consider the idea that different intelligences exist and affect the different methods in which students may learn. This theory was explored because it is important for online instructors to remember that there are multiple ways in which people learn (Watrous-McCabe 2005). In addition, it was considered
because perhaps there may be certain types of intelligences which fit best for learning introductory mathematics in the online college environment. Finally, there are many online activities that can be worked into an online course that will appeal to various types of learners.

While the adult learning theory and the multiple-intelligence theory each have some connection to learning mathematics in the online environment, it was found that the social learning theory was most connected to the student perception of learning introductory mathematics in higher education (Bandura, 1997). The goal of this dissertation was to examine the perceptions of students who take introductory mathematics courses in the online environment in higher education. Therefore, the social learning theory with the branch of self-efficacy became the theory which had the most relation and value to the study to be conducted. The social learning theory connected best with the search for gaining student perceptions of learning introductory mathematics in the online college environment. Students have perceptions of why some succeed while others do not in the online learning environment. In addition, the idea of self-efficacy was found throughout much of the research previously conducted on similar topics. If students believe they will be successful learning mathematics in the online environment, they are more likely to be successful in learning mathematics in the online environment (Peters, 2013). Therefore, the main guiding theory of this study was the social learning theory with special attention given to the idea of self-efficacy.

**Related Literature**

After the initial search of student perceptions of learning introductory mathematics in the online college environment, it was determined that there was not much literature on the specific topic (Wolff, Wood-Kustanowitz, & Ashkenazi, 2014). Therefore, the review of literature continued with a broader topic of online learning. This search helped form the outline for this
chapter. In the first section, concerns of online learning that came up in the review of literature are noted. There are ideas in the literature as to why online learning may work for some students, but not for others. Next, the review of literature continues to narrow to a more specific concept of learning mathematics in the online environment. There is some literature pertaining to learning mathematics in the online environment (Huston & Minton, 2016). Some of this research may not relate to higher education, but it was considered in the search because of the overall student perception. Next, the role of the instructor in the online learning environment is considered. Examination of the role of the instructor leads to the student perception of learning in the online environment. Following the role of the instructor is the attitudes students may have towards learning. As the search of attitudes and perceptions of learning mathematics online was continued, it was determined that students have attitudes towards learning in all types of environments (Lee & Martin, 2017). This examination of attitudes and perceptions gave entrance to examining a comparison of learning environments. Students have attitudes and perceptions of learning in all environments (Marchand & Gutierrez, 2012), but this study kept a focus on the online learning component with comparisons as deemed necessary. As students have attempted earning in different environments, the concept of self-efficacy appeared in the review of literature (Peters, 2013). The concept of self-efficacy appearing numerous times reinforced the idea that the theoretical framework was chosen appropriately for this specific study. Therefore, self-efficacy is examined on its own as it connects back to the theoretical framework of the proposed study. Because self-efficacy shows an emotional component (Villavicencio & Bernardo, 2016), the final area of research for this topic is that of the emotional aspect students have towards learning in various environments.
Online Learning Concerns

There is much literature related to online learning in general (Torain, 2009). While this study focused on the specific aspect of learning mathematics in the online environment in higher education, online learning has become available at many levels of education and in many different content areas. One of the first areas that researchers studied with respect to online learning is to determine why students would desire to take courses online. Students have different reasons that they desire learning in an online setting. Students say that usefulness and ease are reasons that they would use online learning whether it be as a supplement to a course, as part of a course, or the entire course itself (Badri, Al Rashedi, Mohaidat, & Al Hammadi, 2014). Online courses can fit the busy schedules of many adult learners who want to pursue a degree without interrupting work life or family life. Many students are involved in online courses due to their work schedules. Some students engage for professional development, while others are required to take certain courses through the workplace. These individuals need the convenience of the online classroom. Massive Open Online Courses (MOOCs) have emerged to meet these needs (Milligan & Littlejohn, 2017). Individuals involved in MOOCs report that the involvement is due to interest, opportunity, or a connection to a career (Milligan & Littlejohn, 2017). However, Bowen (2013) brought up the idea that there is concern that the quality of online learning does not match the quality of learning in a face-to-face environment. There are studies that compare online learning to traditional learning. It has been found that there is no significant difference in student learning when comparing the two learning environments (Cavanaugh, Gillan, Kromrey, Hess, & Blomeyer, 2004; Rapposelli, 2014; Torain, 2009). While educational technology can increase engagement in online learning, retention in the online learning environment is reported to be lower than retention in the face-to-face environment.
This finding is important because if there is no significant difference in student learning (Cavanaugh et al., 2004; Rapposelli, 2014; Torain, 2009), but retention is lower (Khan et al., 2016), it is possible to consider that students who drop out of online learning courses do so because they are not performing well or adapting to the learning environment.

In addition to the concern of quality of learning in the online environment, there is also a concern with the retention of students. As mentioned above that retention can be an issue in the online learning environment (Khan et al., 2016), MOOCs have a high dropout rate (Ericksson, Adawi, & Stohr, 2016). Reasons for this could be due to a lack of interest in the course. If a course is a requirement for the workplace, then the students in that class did not choose to be in the course. It may be viewed as an inconvenience or such students may not be interested in the course. When students lose interest, they lose the motivation needed to keep focus. Research has shown that students who enjoy the course are more likely to finish (Ericksson et al., 2016). This challenge would then fall upon the role of the instructor to help hold the interest of students who may not fully want to be in the course. The role of the instructor in the online learning environment will be examined later in this chapter. This finding reinforces the idea that student perspective is important and that the examination of what makes a course enjoyable from the student perception should be considered.

Blended or hybrid learning is also found in literature related to online learning with a trend towards learning environments which are partly online and partly face-to-face (Albalawi, 2015). Horn (2010) says that the term *hybrid learning environment* is not clearly defined and should be researched with respect to online learning in general. Hybrid learning can be described as a college program in which some courses are offered online while others are offered in the traditional face-to-face classroom. Hybrid learning can also be described as one course
that is offered partially online and partially in the face-to-face learning environment. In addition, the term hybrid learning has also been referred to as *blended learning*. Connecting the idea of hybrid or blended learning may be an idea that emerges in the research of this study. Therefore, these findings in the literature are important. There are hybrid courses offered at the institutions which are a part of this study. However, the research phase of the study only focused on those students in courses which were offered fully online. Future implications may direct studies to examine student perceptions of learning in a hybrid learning situation. This study may also be able to be replicated in such an environment. There is some literature available in this area, but the student perspective of learning has opportunity to be examined. For the purposes of this study, hybrid or blended learning environments will be defined as those learning environments in which content delivery is conducted partly online and partly in a traditional face-to-face setting.

Another concern with regards to online learning is a desire to make the online environment feel more like a traditional classroom environment (Slagter van Tryon & Bishop, 2012). One of the most common aspects of online learning is the discussion board. The discussion board can be a tool to help make the online environment feel more like the face-to-face environment. This is due to the interaction between the students with the instructor and with each other. However, it was found in a study conducted with a K-12 population that the students who used the discussion board in the online learning environment perceived it to not be helpful in achieving their goals with regards to learning (Kim et al., 2012). Some discussion boards may strive to promote more of a face-to-face feel, but students may still experience a lack of social connectedness. This lack of social interaction could be why some students are either successful or not successful in the online learning environment (Slagter van Tryon & Bishop, 2012).
It is important to remember that all types of students are can learn in the online environment. Therefore, it is necessary to compare responses with regards to gender differences. One must consider if men and women have different perceptions about learning in the online environment. Yukselturk and Bulut (2009) researched the idea of how instructors might manage gender differences in the online learning environment. It was found that there was no difference between men and women in the online environment with respect to motivational beliefs or achievement. Just as both genders can benefit from the online learning environment, individuals who fall into the categories of being deaf, hard of hearing, or English language learners are willing to pay for captioned online courses (Yabe, 2016). The online environment has the potential to meet the needs of specific learners in various populations. This is a positive finding as a goal of this dissertation was to gain insight from a student perspective as to whether specific needs are accommodated.

The review of literature supports the need for this study with attention to developmental mathematics courses. For the purposes of this study, developmental mathematics courses are also referred to as introductory mathematics courses. Such courses are those in which students are placed into by testing or by meeting prerequisites. Many of these courses are designed to sharpen and enhance algebra skills to prepare students for more rigorous mathematics courses. It has been determined that in the New York Community College system, over 60% of students do not test high enough on placement exams to avoid developmental mathematics courses before being able to take the course required for the intended major (Trenholm, 2009). In addition, only about half of the freshmen pass the developmental mathematics course on the first attempt (Trenholm, 2009). Online pre-algebra and online elementary algebra were courses shown to have more success than the same subjects offered in the traditional environment. This finding
supports a need to review how students perceive learning in the online environment and how instructors and administrators may learn for such perceptions and better serve the students.

**Learning Mathematics in the Online Environment**

An important part of the job of administrators in higher education is to assess the classes and programs offered in order to make appropriate changes when necessary. One course that receives attention in this regard is College Algebra offered in traditional and online settings. Universities are always looking at methods to use to increase the student success in such a course (Graham & Lazari, 2018). Student success rates are important because they relate to retention rates. High student retention is what helps universities stay in business. Many times, students must take developmental mathematics courses before they are able to enroll in College Algebra. Therefore, gaining insight relating to the student perceptions of participating in such courses is useful to the universities.

Accuracy of placement is an important facet of learning introductory mathematics in community colleges. Some colleges require placement testing, while other colleges place students in courses based on grades earned in prerequisite courses. Findings show that community colleges can improve in the accuracy of placing students into mathematics courses (Ngo & Kwon, 2014). If students are placed in a class in which they already know the material, they are more likely to be successful no matter the learning environment. In addition, many community colleges are accepting students who need remedial courses (Bahr, 2012). A remedial mathematics course can be particularly difficult to learn in an online environment. At the community college level, it was found that students who take an online course are less likely to take another online course in the future because the experience is not positive (Huntington-Klein, Cowen, & Goldhaber, 2017). These individuals are also less likely to obtain a degree. Of five
different content areas, mathematics was the content area in which students were least likely to take another online course (Huntington-Klein et al., 2017). Analysis shows that the online format does not motivate students to continue and persevere in the manner that a traditional face-to-face environment would.

This dissertation focused on students who have completed introductory mathematics courses in the online college environment. However, not all students who begin such a course, complete the course. Therefore, another aspect of online mathematics courses to be considered is that of the completion rate of the students. Huston and Minton (2016) compared the completion rates of students taking online Intermediate Algebra courses in either the online environment or the face-to-face environment. Intermediate Algebra is considered a developmental mathematics course and it is usually the course that precedes College Algebra. Therefore, the connection of courses is once again reinforced. In the Intermediate Algebra course, the completion rate in the face-to-face environment was higher than the completion rate in the online environment. This result is important with regards to the study conducted. The study conducted also focused on introductory mathematics such as an Intermediate Algebra course. It also includes perceptions of students who take these courses at the community college level. Huston and Minton (2016) did a quantitative study using a two-way ANOVA to find these results. This dissertation was qualitative in nature and focused on the student perception. A qualitative study provided meaningful data as students were given a voice to discuss their perceptions as to why they believe the completion rates in the two environments are different.

The connection of playing games online and learning mathematics online also exists. This could prove to be an important component as to why some students are better suited for learning mathematics in the online environment. There seems to be an overall desire for people
to learn mathematics in the online environment as internet searches for games relating to mathematics have been on the rise (Zhang, 2014). While playing mathematics games and good performance in a math class do not necessarily correlate, attention can be given to the fact that there is a desire for students to learn in this way. Students are searching for ways to use technology to help increase their knowledge of mathematics. It appears that an increase in internet searches for math games shows that students are looking for a method that could make learning mathematics more fun. Instructors can use this information as they attempt to meet the needs of the students and as they create courses. This information suggests that students desire to use the internet to understand mathematics. There is a need for student satisfaction with the effectiveness of the instructor (Ye & Singh, 2017). If instructors can connect with students by helping them learn through the game-like activities on the internet, students may be able to find learning mathematics in the online environment more enjoyable.

The idea of connectivity is important to learning mathematics in the online environment (Lovell & Elakovich, 2016). In one of the more recent and similar studies relating to this dissertation, it was found that students who had some face-to-face classroom work in groups had an increase in feelings of connectedness (Lovell & Elakovich, 2016). Originally, it was determined that students frequently register for courses involving technology, but the completion rates for developmental mathematics courses were low. This sparked curiosity as to how to meet the needs of the students while helping them succeed in developmental mathematics courses in the online environment. It seems that it could be a goal of college instructors and administrators to help students feel connectedness yet meet their desire to include technology. In this community college located in a rural setting, it was found that a completely online environment was not the best choice for developmental mathematics courses. The best option could be to
meet the technological needs of the students by offering the course online while including some face-to-face classroom activities to meet the needs of social connectedness of the students (Lovell & Elakovich, 2016). This brings back the idea of hybrid or blended learning environments which were discussed previously in this chapter. Online learning meets many needs of the students, but a desire for social connectedness remains. This social connectedness refers to the relationships between the students and the instructor as well as the relationships between the students and the other students enrolled in the course.

**The Role of the Instructor in Online Learning**

The role of the instructor of the online mathematics courses was a consideration in this study. Student satisfaction in the online environment is dependent upon how responsive instructors are to general concerns and to the needs of the students (Franklin, 2014). Not only should the interaction between the instructor and the learner be considered, there is also a need for learner-learner interaction that the online instructor must facilitate (Borup, 2016). The days of teacher-centered instruction in which a teacher provides lectures have passed. Currently, through online learning and discussion boards, the instructor must come up with methods that facilitate interaction between the students. Not only does this enhance learning, it gives more of a traditional classroom feel to the online environment. Although students are not able to have face-to-face conversations, they can write ideas in a discussion board setting and reply to one another. Students can interact with one another and know others are present. The online instructor needs to provide opportunities for the learners in the classroom to communicate with and interact with one another to enhance the learning experience. The online instructor can provide feedback and guide the students in the online discussions.
Perceptions of the instructors and the perceptions of the students differ greatly when it comes to teaching and learning in the online environment. One of the biggest differences in perception is that of the amount of time an instructor puts into preparing and teaching an online course (Otter et al., 2013). Students do not think that instructors need to spend a lot of time when teaching online courses. Students only view the end result of an instructor setting up an online course by viewing it on a computer device and participating in the course. The students do not observe how the course was set up or is monitored by the instructors. However, the instructors generally spend more time in preparing for and teaching in the online environment when compared to the traditional face-to-face environment. It can be a challenge for instructors to make sure students are grasping concepts when the instructors are not able to observe the faces and expressions of the students.

The instructor must also be sensitive to the different types of learning styles and the multiple intelligences that exist in the online environment (Harrison & Zoller, 2007). This can be a difficult task for instructors in an online environment. Following the adult learning theory and the multiple-intelligences theory described in the theoretical framework section, Harrison and Zoller (2007) found that there are different types and levels of learning. Each of these types and levels require a different kind of instruction. Keeping the instruction learner-centered and problem-based can be the best type of learning environment for adult learners (Harrison & Zoller, 2007). As the research delves deeper into the role of the instructor, there is another connection to the adult learning theory. Hiemstra and Sisco (2011) state that self-directed learning is part of humans’ natural development. This finding is one of the reasons the adult learning theory was a possibility for the theoretical framework for this transcendental phenomenological study. However, there is a connection here to the chosen theoretical
framework of Bandura’s (1977) social learning theory. The adult learning theory includes the idea of self-directed learning. Self-directed learners are those learners who possess self-efficacy. When students believe that they can be successful in the online learning environment, they will have the persistence to direct their own learning and strive for excellence. Colleges and universities are working towards this model of self-directed learning. Therefore, the role of the instructor becomes more of a facilitator of learning instead of the being the center of a classroom. Instead of being the center of attention, the instructor takes a step back and provides various vehicles for students to acquire the needed knowledge on a concept. This method is applicable in the online learning environment. Hung and Chou (2014) bring up this idea as they note that traditional face-to-face instruction is thought of as a teacher-centered environment while the online environment is thought of as a student-centered environment. There is an increase in the popularity of blended learning because students have some need for face-to-face instruction and social interaction (Hung & Chou, 2014). The online component meets the need of a flexible schedule, while the face-to-face component meets the need for social connectedness.

Marino (2012) authored a dissertation about social presence in the online learning environment. That study demonstrated that instructors who showed immediacy behaviors to the needs of the students were viewed in a more positive way by the students in the online classroom (Marino, 2012). These immediacy behaviors include timely responses to emails and posting grades soon after assignments are submitted. The present study also included the idea of how the instructor can impact the student perception of learning in the online environment. Instructors showing immediate concern are thought of as better instructors than those who do not according to the students (Marino, 2010). This can be easier to accomplish in a face-to-face setting than in an online setting because instructors can immediately reply to a student question. In the online
environment, students considered quick responses to emails an immediacy behavior that was favorable (Marino, 2012). Showing immediacy behaviors in an online environment is much more challenging than showing such behaviors in the traditional environment. In a traditional environment, a student can raise his or her hand and have a question answered on the spot. If there is a personal concern or a grade concern, a student can simply stay after class and address the concern with the instructor. Such issues would await a return email or phone call in the online environment. When instructors can address similar issues in a prompt manner in the online environment, students are more satisfied with the course and the instructor. A purpose of Marino’s (2012) study was to learn how instructors can establish a social presence in the online environment. It was determined that when instructors establish immediacy and intimacy in the online learning environment, the students feel a social presence (Marino, 2012). Therefore, an important role of an online instructor is to establish a social presence to meet the needs of the students.

Instructors may also have feelings of anxiety or apprehension when teaching online courses (Samuel, 2014). These feelings can affect the students they teach because students are able to sense when an instructor is not well-prepared or relaxed about the content being taught in a course. One may think that it would be difficult for students to know when an instructor is having anxiety in online environment because expressions cannot be seen visibly. However, students have reported that they can sense when online instructors are apprehensive (Samuel, 2014). Even in the absence of being able to observe body language or facial expressions, students can sense an instructor’s apprehensiveness. Therefore, it is important for instructors to be confident. Samuel (2014) suggests that online instructors select learning systems that specialize in mathematics so that less time can be spent on developing the curriculum and more
time can be spent on working to get the students engaged in learning. Samuel (2014) also suggests the use of the Smart Pen and tools that help the students become more connected in the learning process. The ideas of engagement and connectedness are themes that continued to emerge in the review of the literature.

**Student Attitudes and Perceptions of Online Learning**

Students have a need to feel cared for to have a sense of satisfaction (Welsh, 2014) in educational settings. Students are most satisfied in an environment in which instructors are caring, show empathy, and provide feedback (Welsh, 2014). Perceptions of learning in the online environment can vary between instructors and students. Welsh (2014) conducted a study in which College Algebra students and instructors showed big differences in perceptions. The teachers believed the students were learning effectively, but the students did not believe they were. There were five online learning classes examined, but the College Algebra course showed the biggest difference in perceptions (Welsh, 2014). Palmer and Holt (2010) found that the student perception of online learning increased in satisfaction over time. Not all students have participated in online learning. Dobbs et al. (2017) found that students who had not taken courses in the online learning environment believed that traditional learning environment courses were easier. These students also believe that more learning takes place in the traditional face-to-face classroom setting. In addition, the students who had taken online courses in the past viewed online learning in a more positive way than those students who had not participated in online learning (Dobbs et al., 2017).

Wilkes et al. (2006) found that the perceptions of faculty members were more negative than the perceptions of students with regards to online learning environments. Perceptions may differ depending on the level of the students. Watters and Robertson (2009) noted that graduate
students found the online learning environment to be more effective than the traditional learning environment. O’Shea et al. (2015) found that students in the online environment wanted to be treated as important as the face-to-face learners. Therefore, they perceived that they were not currently treated in the same way as the face-to-face learners. Students do believe they can gain expertise with regards to learning mathematics in the online environment by using tools to help them improve their skills. Students will use technology if they perceive it to be useful (Zogheib, B, Rabaa’I, A., Zogheib, S., & Elsaheli, A. 2015). If there is software provided to the students to enhance the learning experience, students will use it if they believe it will contribute to success in the course. Patrick et al. (2016) found that both faculty and students believe active learning techniques are useful and effective. These techniques can be used in any learning environment. Albalawi (2015) examined teaching in three different learning environments: the traditional environment, the online environment, and the blended environment. No significant difference was found with respect to learning when all three learning environments were compared. Students who have initial hesitance to take an online mathematics course may be more likely to take an online mathematics course after they have taken at least one online mathematics course (Abdulla, 2012). If students experience success in an online class at least once, they are more likely to enroll in another online course in the future because they have gained previous self-efficacy in that learning environment.

Students desire to be satisfied with learning college mathematics in the online environment. It has been found that this satisfaction is connected to the students being given clear guidelines with respect to assignments, being given clear feedback from the instructions, being provided with timely responses to emails, being notified of grades promptly, and having an
instructor who is clearly knowledgeable in the content area being taught (Lee, 2014). These ideas connect to the immediacy actions referred to earlier in this chapter.

Dobbs et al. (2017) explored the idea of student perception in the online environment, but the study was quantitative in nature and was not specific to introductory mathematics courses. Dobbs et al. (2017) included students who had participated in online courses and students who did not participate in online courses. It was found that students who had experience with online courses viewed such courses in a more positive way than those who did not. The focus of this phenomenological dissertation of introductory mathematics courses only included those students who completed an online course. Hung & Chou (2014) also conducted a study of student perceptions of instructors’ roles in blended and online environments. Hung (2014) showed that the role of the instructor needs special attention. The present dissertation provided ideas of the role of the instructor from the student perspective. However, blended learning environments were not included as the study remained specific to online learning environments. It is through this idea that the role of the instructor and the student perceptions are connected to one another.

Students who learn in the online environment show a desire to connect socially. Blogging may a way for students who take online courses to connect socially with one another (Kuo et al., 2017). Blogs not only establish a sense of community, but they can increase self-efficacy with regards to learning in the online environment. This shows that many components in the review of literature connected to one another. In this instance, the idea of connecting socially to other students shows to be helpful with self-efficacy in the online learning environment. Students are more satisfied with online courses in which there is much interaction (Song, 2010). There appears to be a discrepancy in the review of the literature with respect to the social component of the discussion board as Lee and Martin (2017) found the discussion
board to be one of the least pleasurable aspect of online learning for some students. Other
studies showed that students perceive learning online as an enlightening and wonderful
experience (O’Rourke et al., 2014). Overall, it appears that perceptions of students and
instructors differ from each other. It also appears that the perceptions of students differ when the
learning in the online environment is considered. It is important that instructors remember this
as they create and administer courses in the online environment.

Comparisons of Learning Environments

Throughout the review of literature, many studies have been found that compare different
types of learning environments including face-to-face, online, and blended. There are also
studies which have focused on a single type of learning environment. Bantum (2013) studied the
effectiveness of the delivery methods of online and face-to-face delivery in college English
classes. Students who were in face-to-face settings were more likely to complete the courses
than the students who were in the online setting. Graham and Lazari (2018) found that students
who had College Algebra in the online setting scored better on a departmental final than those
students who had the same course in the traditional setting at the community college level.
Flipping classrooms is a technique in education that has been used across various content areas
(Boucher, 2013). In this setting, the students receive their instruction via a video prepared by the
teacher as the “homework” is completed in the classroom. In this setting, there is a blend of
technology and face-to-face interaction. This environment lends thought to the idea of the
perceived sense of community examined by Yang et al. (2015). It is a marriage of the online
learning environment and the face-to-face learning environment. While Yang et al. focused on
the gender differences in online learning, it was determined that a sense of community was a
component that students desired no matter the learning environment. If the classroom is flipped
or if the learning environment is a blended environment, the students can use self-directedness to learn. Duverge (2016) states that adults use past experiences and critical reflection to help them learn. The hands-on approach provided in a flipped learning environment allows time for students to use critical thinking and problem-solving skills (Boucher, 2013).

The online courses that were a part of this study each have capabilities of technological use. Technology can be used as a component to enhance a face-to-face course instead of being used as a delivery for the entire course. Instructors have many options with regards to the use of technology in any learning environment. Davidson and Petrosko (2015) found that students who took a Basic Algebra course at a community college were more likely to persist in environments in which the instruction was traditional in nature but had an online component. Again, the idea of using some technology with some face-to-face instruction has been found in the literature. This finding supports the idea in the literature that blending face-to-face learning and online learning is perceived in a positive manner by students.

Research has also been conducted to determine which method of delivery students prefer when seeking help. It was found that students prefer face-to-face interaction above technological resources when seeking help (Reeves & Sperling, 2015). Students liked talking to an instructor before class, after class, during class, or via email when needing assistance. This connects once again to the idea of immediacy. This is important to consider when instructors design online courses. Many online courses are set up to direct students to use a program such as MyMathLab (Graham & Lazari, 2018), while students would prefer to just talk with an instructor. MyMathLab is a program in which students are not instructed, but complete problems for practice to aid in learning. It was also found that the students who received higher grades were more likely to seek help via an instructor while lower performing students sought assistance
through technology (Reeves & Sperling, 2015). The higher performing students may have the self-efficacy and confidence to talk to an instructor while the lower performing students may not. In addition, while students can look at solutions to missed practice problems, they may still have questions as to how or why to solve certain problems that could only be asked of an actual person.

The review of literature shows that there have been more quantitative studies than qualitative studies conducted when comparing learning environments. Wolff et al. (2014) suggests that the research is lacking pertaining to comparisons of learning environments at the community college level. In a study that analyzed test scores at the community college level, it was determined that the mode of delivery was not significant in student scores for a 16-week environmental biology course (Wolff et al., 2014). It is important to note that in this study the students were able to choose the delivery method and the instructor taught both the online and the face-to-face courses. Even in traditional learning environment, there is a trend towards using technology. Many schools are replacing handheld textbooks with digital textbooks. The students do not necessarily support the movement towards digital textbooks (Bouck et al., 2016). A school that replaced traditional textbooks with digital textbooks found resistance by students who missed having a physical textbook in their possession (Bouck et al., 2016). In summary, some students may prefer receiving traditional instruction in face-to-face environments with handheld books. As the trend in education moves toward a more digital classroom, this is important to consider.

Another area to consider is how students want to seek help from an instructor. It was determined that students are more likely to seek help face-to-face instead of through technology when face-to-face interaction with an instructor is available to them (Reeves & Sperling, 2015).
This face-to-face interaction may include visiting an instructor during office hours or just asking questions before and after class. In addition to this preference, it was also found that it is the higher performing students who seek help face-to-face while the lower performing students use online interaction with the instructor and use of the discussion board (Reeves & Sperling, 2015). Of course, these ideas are limited to those courses that offer at least some instruction in the face-to-face learning environment. However, it does support the idea that many of the higher performing students prefer face-to-face interaction for learning.

This trend toward the digital classroom begins before college. Therefore, research has examined different age groups with respect to online learning. Middle school students demonstrated equal mathematical success in the online learning environment and in the traditional face-to-face learning environment (Edwards, Rule, & Boody, 2017). Perhaps the exposure to the online environment at younger ages creates potential for success once those students attempt similar courses on the college level.

**Self-efficacy in the Online Learning Environment**

A recurring theme found in the review of literature is that of self-efficacy in the online learning environment. Not only has this theme provided the theoretical framework for the study, it provided an opportunity to address self-efficacy later in the methodology section. Because the theme of self-efficacy has emerged so frequently in the review of literature, it was interesting to learn if students agreed with such findings as they voiced their ideas, emotions, and perceptions of learning introductory mathematics in the online learning environment. None of the questions in the methodology section led the students in this direction. Students who have completed an online introductory mathematics course in the college environment were able to have a voice to provide the researcher with a pure student perspective of the phenomenon.
If individuals believe they cannot be successful in a course or learning environment, then they are less likely to perform well (Alqurashi, 2016). A positive correlation was found between computer self-efficacy and prior experience in online learning (Alqurashi, 2016). Therefore, it is also important to consider if there may be a difference between mathematics self-efficacy and computer self-efficacy when it comes to learning introductory mathematics in the online college learning environment. Perhaps it makes a difference as to whether or not a student in such an environment needs to possess self-efficacy in one or both areas of computer self-efficacy and mathematics self-efficacy. This is not intended to disregard the general idea of self-efficacy, but to consider that there are possibly different areas to consider when the theme is discussed. Students may have self-efficacy with regards to mathematics. Students may have self-efficacy with regards to learning in the online environment. There are also students who may have self-efficacy in both areas mentioned or in neither area mentioned.

Self-efficacy was found to be the main predictor of student achievement in online mathematics at a virtual high school (Kim et al., 2012). Students who have higher self-efficacy with respect to mathematics have been reported to also have higher achievement in mathematics (Peters, 2013). One of the best studies found in the review of literature which relates to the purpose of the study conducted surveyed 229 college students who were taking an online mathematics course in one of four levels in higher education. Once again, it was found that grades correlated positively with motivation and self-efficacy (Cho & Heron, 2015). Those students who believed that they would perform well are the students who obtained the better grades. It should also be mentioned that boys report higher mathematics self-efficacy than girls (Peters, 2013). However, those differences are not seen in achievement in mathematics. Though the study of the 229 college students who were taking the course in higher education was
quantitative in nature, it supports the idea that students who feel more relaxed and confident are more likely to make good grades (Cho & Heron, 2015). Feeling relaxed seems to be a key component in obtaining success in online mathematics courses. Whether the student is male or female or possesses self-efficacy could even be less important than the student feeling relaxed.

Cho and Heron focused on remedial mathematics courses which are much like the introductory mathematics courses that were the focus of this dissertation. Their study is one of a few that researched student perceptions of learning mathematics in the online learning environment.

There is a positive relationship between self-efficacy and performance in online education (Yukselturk & Bulut, 2009. Another study, which compared the learning environments, found that the climate of the classroom did not determine if the students would have self-efficacy with respect to mathematics (Peters, 2013). Reviewing quantitative results such as this provide justification for the need to explore the student perceptions of learning online mathematics in higher education from a qualitative standpoint. It is important to determine if student perceptions support the test scores and grade results conducted in similar quantitative studies.

Lovell and Elakovich (2016) found that a means for increasing self-efficacy in the online learning environment for developmental mathematics courses was to provide a face-to-face classroom component. This is another example of the positive correlation between success rates in such courses and self-efficacy. There is not much literature available as to how face-to-face interaction can increase in the online learning environment. Tools such as FaceTime or Skype could be utilized. Instructors could also provide videos of lessons so that students are able to see an instructor instead of working on computer-based programs. In summary, it does appear that self-efficacy in the online learning environment is increased with some type of human
interaction. Self-efficacy also appears to be one of the main predictors of success with learning introductory mathematics in the online learning environment in higher education.

**Student Emotions Associated with Online Learning**

This dissertation remained open to gaining insight of the emotions involved with learning introductory mathematics in the online learning environment in higher education. The overall goal of the study was to understand how students perceive learning introductory mathematics in the online learning environment. Emotions and perceptions have been found to occur simultaneously in the review of literature on the topic (Artino, 2012). In the search for student perception of online learning, the role of student emotions was a topic prevalent in the literature. The literature shows that students are emotionally connected to learning. For mathematics in general, it was found that when students experienced enjoyment and pride in a mathematics course, they had higher self-efficacy and higher self-regulation (Villavicencio & Bernardo, 2016). Not only does this finding make connections on the emotional level, it relates back to the earlier finding of the importance of students having self-efficacy in order to learn introductory mathematics in the online learning environment. An emotional presence exists with inquiry with respect to online learning (Stenbom, Hrastinski, & Cleveland-Innes, 2016). When students are inquisitive, emotions are involved. They care about what they may or may not understand. When that connection is a positive one, positive results prevail. Artino (2012) conducted a literature review that examined nine different articles about how emotions can affect learning in the online environment. While Artino (2012) summarized each article found, the true conclusion was that there was much more research that needed to be conducted to examine emotions in online learning environments. In addition, Artino mentioned the perspectives of the students and the teachers. This is important because not all literature takes into consideration that the
emotions of the instructors affect the emotions of the students. Then, Artino described that these perspectives relate to motivation and achievement. Artino found a gap in the literature relating to student emotion in the online environment. The review of literature mentioned the connection between emotions and student perspectives. Once again, the emphasis has been made on the connection between emotions and perspectives. This finding aided in confirmation of the gap in the literature of this dissertation. It is important to consider the emotions involved in online learning as students do not necessarily want what university administrators believe students want (Ramlo, 2016). A study such as this provides that insight as students were given a voice in which to state what they desire in an online introductory mathematics course. Ramlo (2016) found that students desire to be in a classroom with a “real” teacher and interacting with peers to learn. In fact, some students feel so strongly that they say they would transfer to another university if all courses were offered online (Ramlo, 2016). This finding supports earlier research that shows that students have a desire for their online courses to have more of a traditional type experience. In fact, this can even relate back to the idea that some students are best suited for a blended or hybrid learning environment when it comes to learning introductory mathematics in the online learning environment.

Therefore, administrators should consider the emotional component of student learning before decisions are made concerning what they believe the students want. Kim and Hodges (2010) developed an emotion control treatment to study how students would respond to such treatment in a remedial online mathematics course. These authors first define academic emotions as those that are related to pride, shame, success, and failure (Kim & Hodges, 2010). If a student feels hopeless, that student will not be motivated to perform well in an online college mathematics course (Kim & Hodges, 2010). If a student has a fear of failure, that student will be
reluctant to participate in an online course (Kim & Hodges, 2010). Some students may have failed in previous academic courses and connect that emotion to learning in the online setting. These ideas connect back to the theme of self-efficacy. Those students who have a connection to emotions of succeeding in the online environment will be more likely to perform well in the online environment (Alqurashi, 2016). There are other negative emotions such as anxiety that emerge in the review of literature. In summary, motivation can be optimized through emotional control (Kim & Hodges, 2010).

Marchand and Gutierrez (2012) studied how hybrid and online learning in higher education had influenced emotional responses from the students at various institutions. These authors mention that previous research on emotions in education has been centered around the traditional learning environment and not so much in online or hybrid education. Thus, there is another confirmation for a gap in the literature pertaining to student perceptions of learning online mathematics in higher education. Marchand and Gutierrez (2012) agree with Ramlo (2016) that there is not enough research literature that examines the role of emotion in online learning. An emerging theme of anxiety and frustration does reappear (Marchand & Gutierrez, 2012). Anxiety and frustration are emotions that will certainly affect learning in any environment. More research in this area could shed light on how online instructors can prepare and decrease such emotions in the online learning environment.

**Summary**

The theoretical framework shows how the social learning theory of Bandura (1977) shaped the research for this phenomenological study. The specific concept of self-efficacy appears throughout the review of literature. Supporting theories of the adult learning theory and the multiple-intelligence theory also appear in the review of the literature. However, the main
theoretical framework of the social learning theory and self-efficacy remained as it became most prevalent in the review of the literature. After establishing the theoretical framework, various concepts or themes pertaining to learning in the online environment appeared. First, there is a concept of learning in the online environment in general. It is noted that there is little research done in this area specific to mathematics. Some results show no significant difference with respect to learning environments, while other studies show significant results. Next, there is emphasis on the role the instructor has for student learning in the online environment. Students seem to have perceptions and attitudes about the role the instructor should play in the online learning environment. Further research in this area could prove to be very valuable to those who create and teach in the college online learning environment. There is also some valuable research pertaining to student attitudes and perceptions of online learning in general. Some students are anxious or frustrated about learning in the online environment while others believe they will succeed. Research specific as to why students possess these attitudes and perceptions can also be of great value to those involved with creating and teaching courses in the online learning environment. Some comparisons of learning environments were examined to help determine what are best practices for student learning in any environment. It was determined that comparisons of learning environments have been conducted in the past, but mostly have been done so on the quantitative level. Research in the qualitative realm can provide useful information for future implications for online learning. The theme of self-efficacy appeared throughout the literature even if it was a sub-section of a different topic. Finally, the emotions of the students were examined throughout the review of the literature. The idea of examining emotions of the students came from research in the areas of their attitudes, perceptions, and belief in one’s self. The gap in the literature is evident because there was little to no qualitative
research conducted that relates to student perception of learning college mathematics in an online environment. Therefore, the goal of this dissertation was to capture the essence of students who have participated in online college courses specific to introductory mathematics.
CHAPTER THREE: METHODS

Overview

The purpose of this study was to describe the lived experiences of students who have completed online introductory mathematics courses on the college level. This included students who have completed those online mathematics courses, which are remedial or prerequisite courses for a college algebra course. A phenomenological approach was used to capture the essence of the experience of participating in such courses from the student perspective. This methods chapter includes a description of the research design, the central research question, the subordinate questions, the setting, the student participants, implications for future study, and the role of the researcher.

Design

The study was qualitative in nature because the goal was to capture the essence of the lived experiences of the students who have participated in online introductory mathematics courses on the college level. The design of the study was that of transcendental phenomenology. Phenomenology involves placing biases and prejudgments aside so that the researcher can concentrate on gaining a true perspective of those participants in the study (Moustakas, 1994). A qualitative approach was chosen as the approach for research because while there have been some quantitative studies conducted on comparing learning environments, there have not been many, if any, qualitative studies conducted that focus on the student perception of learning introductory mathematics in the online college environment. Transcendental phenomenology was appropriate for this study because it was important for the researcher to bracket out previous experiences with online teaching and learning and consider emerging themes that developed from the research. Transcendental phenomenology was selected for this study because it was
important that each experience of each student was considered in its own experience in all aspects of data collection (Moustakas, 1994). In this study, each student provided his or her account of a personal experience with learning introductory mathematics in the online college environment. It was the duty of the researcher to provide an accurate summary of these accounts as each student experienced the course.

Moustakas (1994) stated that Edmund Husserl was one of the first who worked with “subjective openness” (p. 25). Husserl was criticized and laughed at by many, but Moustakas (1994) applied this idea to research and transcendental phenomenology. Because the purpose of this study was to gain insight on the student perspective of learning introductory college mathematics in the online environment, this research design, which promotes openness, was appropriate. It was necessary to remain open to the perspective of the students while remaining unbiased and nonjudgmental.

The phenomenological approach is also described by Creswell (2013) as one that is specific to one central idea. The idea being explored in this study was that of the student perception. There have been very few qualitative studies specific to student perception of introductory mathematics in the college online environment.

The design for the study was appropriate because the hope was to capture the essence of the student perspective of what it is like to participate in an online introductory mathematics course on the college level. Moustakas (1994) tells us that the purpose of a phenomenological study is to gain insight into the perspective of the participants who have experienced the phenomenon. This study focused on students who have completed online introductory mathematics courses and used a transcendental phenomenological approach to conduct
interviews with students in which they described the experience of participating in the courses from their perspective.

**Research Questions**

**CRQ:** What is the lived experience of students who have completed introductory college mathematics courses in the online learning environment?

**SQ1:** What is the student perception of being a successful learner in an introductory mathematics course in the online college environment?

**SQ2:** How do students believe that self-efficacy contributes to success for learning introductory mathematics courses in the online college environment?

**SQ3:** What academic or character traits do students perceive as helpful for succeeding in learning introductory mathematics in the online learning environment in higher education?

**Setting**

There were two separate institutions of learning involved in this study. One was a community college and the other was a branch campus of a larger university. Both educational institutions are just a few miles apart, in an area with a population of 132,733. The people who live in this area are mostly white and are between the ages of 19-64. Only 14.7% of the people in this area have a bachelor's degree or higher. The median household income is $40,511 (United States Census Bureau, 2018).

Both sites were selected for the study because they both offer online introductory mathematics courses. The first site was Coal Town Community College (a pseudonym). This is a community college known for programs in the medical field such as x-ray technology, dental hygiene, ultrasound technology, and nursing. This site was selected because I am a former teacher with the college and have a connection to the school. I am also very familiar with the
curriculum. Therefore, I knew that the college has offered introductory online mathematics courses. The second site selected was Steel City University (a pseudonym). This site was chosen because of the connections I have made by being an adjunct instructor since 2005. I was not instructing at the site when the study was conducted. However, I am familiar with the curriculum and was aware that introductory mathematics courses are offered online. I am also a colleague of the professors who are instructors of the online mathematics courses at this school. I believe that including a community college as well as a university provided the opportunity to gain differing perspectives.

Participants

The goal was to have 10 to 15 participants in the study. Eleven students who have completed an online introductory mathematics course at either school were selected for the study. This was done through purposive sampling as the characteristics of the population chosen was selective to those students who had completed the online course (Crossman, 2017). A purposive sample is one in which the characteristics of the population of the study is considered (Crossman, 2017). In this study, the characteristic of the chosen population was that the participants were students who had completed an introductory mathematics course in the online higher education environment. The age, gender, and other demographic characteristics were different between the students, but the constant was that they had all completed an introductory mathematics course at one of the two schools. This means that all students participating in the study completed a course on the level of college algebra or below in the online environment in higher education.

The completion of the course was confirmed with each school. The grade received in the course was not needed, as the hope was to gain the perspective of all types of learners. A
passing grade was confirmed with the professors. In addition, most of the students chosen for the study were enrolled in programs at the schools. This provided for convenience of contacting the students for the interviews.

**Procedures**

Approval from both institutions as well as Institutional Review Board (IRB) approval was obtained prior to conducting the study. Conditional IRB approval from the doctoral granting institution was obtained first. One of the participating institutions required that I complete the IRB approval through their college as well. The second participating institution granted me a letter of approval to conduct research. After I submitted my approval from the participating institutions, I received full approval from the doctoral granting institution to begin research. The research phase began immediately after receiving this approval. The eliciting of the participants was done by placing flyers on boards and in the hallways at each institution (Appendix D). To entice students to participate, gift cards were offered as compensation. This offer was given at both the community college and the university. Students also spoke to each other about the study. Many learned through word of mouth about the study. The teachers of the courses at each of the institutions also promoted participation in the study. The names of the students willing to participate were confirmed with both colleges to ensure that they met the requirements for the study. It was confirmed that the students willing to participate in the study had passed the course.

Next, appointments were scheduled with the participants. Communication for scheduling time to complete the questionnaire and interview occurred via text message. Each of the participants completed the informed consent before any type of data collection took place. This was the first procedure to occur at each meeting. Next, the study moved to the phase of
implementing questionnaires. The questionnaire contained only open-ended questions. The exact open-ended questions were given at each educational institution.

Face-to-face interviews were conducted with each participant. A list of open-ended questions was put together before the interviews took place. However, the student being interviewed was able to speak freely or ask questions as needed throughout the interview process. Audio recording was used for each interview. Participants agreed to the audio recording prior to the interview. After the interviews were completed, transcripts were created. These transcripts were shown to each participant for member checking purposes. Face-to-face interviews may work as a method to confirm or deny what a student may have said in response to an open-ended question in a questionnaire. Some students may have been more open with true responses in written form while others may have been more open to responses in a face-to-face environment.

Finally, focus group discussions took place via conference calls. There were two separate focus group discussion containing between two and four participants in each. In this setting, students were prompted by questions and encouraged to discuss the questions and answers with each other. Thoughts, ideas, and perceptions were shared between the participants. The participants were prompted with questions, which led to a discussion between the group members. This third means of gathering data helped to open the minds of students to perceptions of other students. The researcher was able to observe discussions to gather data that was later compared with the data gathered in the questionnaires and face-to-face interviews. These three means of gathering data helped to allow for ideas and themes to emerge. Some students were more likely to write how they feel. Others were more comfortable discussing ideas in a face-to-
face interview setting. Still, others were most vocal in a group setting because they were able to recall perceptions they had once they heard them voiced by others.

**The Researcher's Role**

I assumed the role of the human instrument throughout the study and strove to put aside any biases (Moustakas, 1994). The researcher simply collected the data and allowed the participants in the study to tell the story. Although a researcher may have connections or personal experience with the area of study, the researcher must step back and allow the participants to be the ones who formulate the true experience of the phenomena. I have personal connections to the schools in this study. I was an adjunct instructor at the community college from 2014 to 2016. I was also an adjunct instructor at the branch campus of the university from 2005 to 2017. I am a professional acquaintance with the faculty and staff at both schools. In addition, I have a connection to the topic and to the students because I have personally tutored students who participated in online mathematics courses at the community college. Although I have experience and connections with the schools, I was able to remain open to all comments and responses of the participants and practiced the true sense of transcendental phenomenology. The students I have personally tutored in the past were not a part of this study because I wanted to remain truly open to experiences with students. I did not have a student-teacher connection with previously. I believe that online courses in mathematics will continue to be offered for introductory mathematics courses in the future. A goal of this study is to provide information on how to create courses more conducive to student learning.

**Data Collection**

In qualitative studies, many methods of collection of data are needed to establish a rich, thick description of the findings of the study (Creswell, 2013). After IRB approval was obtained,
the students who took part in the study signed consent forms. There were three different types of methods of data collection that were used for this study. One method of data collection was the use of questionnaires. Students were asked open-ended questions about their experience in the introductory college mathematics course in the online environment. Also, face-to-face interviews took place. Open-ended questions were asked again, but the questions were different from the ones asked in the questionnaire. The purpose of using these two methods of data collection was to gather as many responses as possible. Some students may have been more comfortable writing about their perspectives, while others may have felt more at ease in a face-to-face setting. Finally, focus group discussions were used as a data collection method to give students an opportunity to discuss perspectives with one another.

**Questionnaires**

Providing open-ended questions to participants via a questionnaire can allow them to express beliefs in their own words (McLeod, 2014). This can allow for rich qualitative data to be obtained. Data was obtained through answers to open-ended questions in a questionnaire in this study. The questions were presented in a logical order and allowed for the participants to completely express their feelings. Questionnaires with open-ended questions can produce results that were not expected and can make the study more original (Dudovskiy, 2017). The questions that were used in this method of data collection are as follows:

1. What did you like most about taking an introductory college mathematics course in an online learning environment?
2. What did you like least about taking an introductory college mathematics course in an online learning environment?
3. Tell me why you believe you had a successful/unsuccessful experience completing your introductory college mathematics course in an online learning environment.

4. Tell me why you felt connected/unconnected to your online teacher of introductory mathematics.

5. Tell me why you felt connected/unconnected to the other students in your online introductory mathematics course.

6. In general, what are your thoughts on online education?

7. Why would you recommend/not recommend taking introductory mathematics courses in an online environment to other students?

8. Tell me why you had a positive/negative experience of learning mathematics in the online environment.

Because interviews were also used as a means of data collection, the interview questions were purposely different than the questions used in the questionnaire. This allowed the participants the opportunity to voice various beliefs and ideas they had about learning introductory mathematics in the online college environment.

The first two questions provided a means for the participants to speak openly about the likes and dislikes of the learning environment. Question 3 was included to search for specific traits that students think they should have to be a successful student in the online learning environment. Traits of being a successful online learner was a theme which occurred in the literature. However, I was careful to not use words that would lead the participant in the direction of a response. It was important to do this to capture the true student perspective. Another theme that occurred in the literature was the theme of connectedness. The next two questions provided an opportunity for the participants to write whether they felt connected or
unconnected to the instructor and the other students. There was opportunity to elaborate on this idea. I was sure to include both sides as some students may have felt a sense of connection while other may have not. Question 6 focused on online learning in the general sense. The final two questions focused on the overall experience of learning introductory mathematics courses in an online environment.

**Interviews**

Students who completed an online introductory mathematics course were interviewed in a face-to-face setting. Open-ended questions were asked to gain insight into the student perspective of what it was like to be a participant in the online course. Creswell (2013) states that conducting interviews is one of the best methods for collecting data in a phenomenological study.

**Standardized Open-Ended Questions**

1. Tell me about yourself.

2. What is your educational background?

3. What are your thoughts on online education?

4. What are your thoughts about learning introductory mathematics in the online environment?

5. What practices do you think are helpful for students who learn mathematics in the online environment?

6. What are your personal beliefs about learning mathematics in the online environment?

7. How would you describe your experience of learning mathematics in the online environment?

8. How would you describe your relationship to your online instructor?
9. What traits do you believe students should possess in order to be a successful learner of mathematics in the online environment?

10. What traits do you believe instructors should possess in order to be successful teachers of mathematics in the online environment?

11. If you have participated in face-to-face traditional learning, how would you compare the online experience to the traditional experience?

12. How could the online experience of learning introductory mathematics on the college level be improved?

The first five questions seek to understand the personal background and experiences of the participants. Question 6 opened a means for the participants to begin to provide perceptions about online learning in general. The next four questions seek to gain understanding of student perceptions of learning in the online environment that are specific to introductory mathematics courses. Question 11 provided the participants the opportunity to speak about the relationship between the instructor and student in the online learning environment. Question 12 allowed the participants to voice ideas about qualities believed to make a student successful in the online learning environment. The next question focused on the instructor and provided the opportunity for the participant to say what an instructor could do to make online courses more effective. Question 14 is the only question that allowed for a comparison of online learning versus traditional learning. There is more literature on comparing learning environments than there is in gaining student perspective of learning mathematics in the online setting. While I am aware that students may compare learning mathematics in different environments, I felt only one question concerning a comparison was necessary. The final question gets to the heart and goal of the
study, which would contribute to bettering online education. Therefore, participants were asked what recommendations should be made from a student perspective.

**Focus Groups**

After the interviews were conducted, focus group discussions were conducted via conference calls. There were two separate focus group discussions containing between two and four participants in each discussion. Each participant used a pseudonym ahead of time. Therefore, during the conference calls, none of the participants knew who the other students were or from which institution the person attended for the introductory online mathematics course. This made the discussion very open. I prompted the participants with questions. When a participant replied, the participant said his or her pseudonym first and then began to reply. Conversations arose from the prompted questions. I also did member checking with those who participated in this focus group discussion. This method of collecting data is appropriate for phenomenological studies because it allows the participants to interact with one another while the researcher observes (Sutton & Austin, 2015). Creswell (2013) states that focus groups encourage participants to share thoughts and ideas in a group setting. Questions asked in the focus group discussions included the following listed below.

1. What did you like most about learning introductory mathematics in the online college environment?
2. What did you like least about learning introductory mathematics in the online college environment?
3. What would you like to tell the other students in this group about your experience in the online classroom?
4. What would you like to know about the experiences of the other students in this class in the online learning environment?

5. Would you recommend taking introductory mathematics in the online environment to a fellow college student? Why or why not?

6. Why did you choose to take this course in the online environment?

7. Would you take another course in the online environment?

8. If you have taken other courses online, how would you compare taking mathematics online as compared to other content areas?

9. Tell us how communication worked in your online class with your instructor and with your fellow classmates.

10. Do you believe you understood the content of this course? Why or why not?

Data Analysis

Moustakas (1994) provides information pertaining to how a researcher may acquire new knowledge on a phenomenon by looking at it with a fresh eye, thus conducting a transcendental phenomenological study. To accomplish this in this study, I remembered to keep a fresh perspective as I reviewed answers to the questions provided in the questionnaires, interviews, and focus group. In addition, epoche was addressed as I examined my own biases through my experiences with introductory online mathematics courses (Moustakas, 1994). As I examined the results from the means of data collection, I searched for common meanings. These meanings formulated the results. The highlighting of significant statements, or horizontalization, also took place (Creswell, 2013). Then, descriptions came from the analysis of the data. The descriptions may serve to be a means of assistance for those who teach and create online introductory mathematics courses on the college level.
Transcription

I transcribed the data and used member checking by asking participants if what I wrote was what they intended to say. This is important to ensure the responses reflect what was intended to be said. This transcription is one of the primary steps in the data analysis process. As I transcribed the data, I did so in a fashion in which I reported what the participants intended to be said in their responses and comments. Therefore, I remained free of any prejudgments and fully became a researcher practicing phenomenological reduction (Moustakas, 1994).

Horizontalization

Each method of data collection (questionnaires, interviews, and focus groups) was weighted evenly (Creswell, 2013). Every expression relating to the experience was listed (Moustakas, 1994). I was receptive to all sources of the data collected. I gave equal value to all statements made whether they were made on a questionnaire, in a face-to-face interview, or within a focus group. By doing this, I remained open to capturing the true essence of participation in an online introductory college algebra course from the perspective of the students. Each of the responses in the study was of equal value. One response was not of more importance than another response. Keeping the values of the responses equal allowed the researcher the ability to practice the process of horizontalization as described by Moustakas (1994) as a component of phenomenological reduction.

Cluster for Meaning

After the transcription took place and horizontalization was applied, statements were clustered for meaning (Creswell, 2013). This meant that I looked at the statements and I clustered them into specific themes. While all statements were given equal value, those that overlapped were clustered into themes so that the true meanings could emerge (Moustakas,
The goal was to saturate the data until all emerging themes came to the surface. I went through the data until I could not find a new theme. Once this saturation occurred, I was able to generate descriptions of the data.

**Coding**

Coding involves placing the data obtained into categories (Creswell, 2013). This is where the themes emerge from the data. I used an Excel spreadsheet to record codes. I also used colors to organize the codes and to organize emerging themes. All coding was organized in detail on the Excel spreadsheet. This helped in providing the information for the results of the study.

**Descriptive Analysis**

I felt confident that the data was fully saturated. I recorded all emerging themes. These themes provided for a description of the student perception of learning introductory online mathematics in higher education. I summarized the essence of the beliefs and attitudes of the students, which fulfilled the purpose of the study. The descriptive analysis was written in such a way that instructors and administrators can use the information to improve upon designing and creating such courses. Using individual textural and structural descriptions aids in the process of the analysis (Moustakas, 1994). It is this process that led to the summary of the analysis. The focus of the descriptive analysis was to explain the essence of the study describing what the participants reported to have experienced through participation in college online introductory mathematics courses (Creswell, 2013). A final step was synthesizing the meanings and essences captured in the study (Moustakas, 1994). This was done through a textural-structural synthesis in which I described the findings of the study as I included the descriptions to provide the true essence of the experiences. This led to a summary of the study containing implications for any
possible research in the future relating to learning introductory mathematics in the online environment in higher education.

**Trustworthiness**

Trustworthiness is a term that has been used in qualitative research to refer to the validity of a study (Creswell, 2013). Researchers strive to have meaningful studies that are valid and can be verified through many different methods. This study provides credibility through member checking. The multiple methods of data collection provide dependability and confirmability. Transferability is also possible as this study could be conducted again in another setting. These areas of credibility, dependability, and trustworthiness are discussed in this section.

**Credibility**

Member checking is a technique used for validation in qualitative research (Birt, Scott, Cavers, Campbell, & Walter, 2016) and was used in this dissertation. It is important to ensure that all interview responses were transcribed as the participants intended. The conclusions were shared with the participants to ensure accuracy (Creswell, 2013). This method is similar to the validation of data used in the study Humphrey (1991) conducted pertaining to searching for life’s meaning (Moustakas, 1994). Humphrey (1991) asked his participants to review his descriptions and make necessary changes. This technique was utilized in this study.

In addition, triangulation of data occurred because I used three methods for data collection (questionnaires, interviews, and focus groups). Contact was made with Deans at each institution prior to the study to discuss data collection.

**Dependability and Confirmability**

The multiple methods of gathering data (questionnaires, interviews, and focus groups) provided for a triangulation of data and confirmed findings (Creswell, 2013). In addition,
dependability and confirmability took place to ensure accuracy (Creswell, 2013). I remained consistent in my descriptions and methods.

Transferability

A rich, thick description was used. The details of the participants and the setting details were provided (Creswell, 2013). I provided a deep and thorough account of the experience of my participants so that my study can be easily replicated. This is a study that could be done in another setting or within another content area.

Ethical Considerations

Prior to the study, IRB approval was obtained. In addition to the IRB approval, permissions from the community college and the branch campus of the university were also obtained. There was an informed consent that was signed by all of the participants. This included a description of the purpose of the study and stated that participation in the study was voluntary. The participants were not placed at risk. The identities of the participants were kept confidential. Finally, it is important to remember that throughout the methodology process, I avoided siding with the participants or reporting only the positive results (Creswell, 2013).

Summary

This chapter described the steps that were taken to provide an account of the lived experiences of students who have completed an introductory mathematics course in a college online environment. A transcendental phenomenological approach was used to capture the essence of the student perception of learning in this environment. Eleven participants completed questionnaires and participated in face-to-face interviews. There were focus group discussions conducted with the participants in which the issues of completing online introductory college mathematics courses were examined. Common themes were coded after data saturation was
achieved. This study aimed to uncover the student perception of learning introductory college mathematics in the online environment so that a contribution can be made to help improve in the creation and instruction of such courses in the future.
CHAPTER FOUR: FINDINGS

Overview

This study explored how students perceive learning introductory mathematics in the online environment in higher education. After an exploration of the literature on this phenomenon, it was determined that there was a lack of qualitative studies regarding how college students perceive learning introductory mathematics in the online environment. Studying the perceptions of students regarding their experiences in such courses showed that students have convicted thoughts and beliefs about the experience of learning mathematics online. A qualitative approach was used for this study. The results of the student perceptions are included in this chapter. These results reveal the lived experiences of the participants. In order to conduct the study, I kept my focus centered around the following research questions:

CRQ: What is the lived experience of students who have completed introductory college mathematics courses in the online learning environment?

SQ1: What is the student perception of being a successful learner in an introductory mathematics course in the online college environment?

SQ2: How do students believe that self-efficacy contributes to success for learning introductory mathematics courses in the online college environment?

SQ3: What academic or character traits do students perceive as helpful for succeeding in learning introductory mathematics in the online learning environment in higher education?

Chapter Four provides the results that were obtained from data collected through interviews, questionnaires, and focus group discussions. The sample size included 11 participants from either a community college or a branch campus of a larger university in the
Northeast. The techniques utilized provided an opportunity for each participant to voice a rich and thick description of the experience of learning introductory mathematics in the online environment in higher education. The transcriptions of the interviews and the results of the questionnaires were analyzed carefully so that themes could emerge (Moustakas, 1994). After reviewing all the data collected many times, I began phenomenological reduction by making notes of how each student described the experience of learning introductory mathematics in the online college environment. Next, the meanings were clustered together. This led to the discovery of themes which provided the results of the study.

Participants

The results of this qualitative phenomenological study were found through data collected from face-to-face interviews, questionnaires, and focus group discussions. The study included 11 participants who attended either a local community college or a local branch campus of a larger university in the Northeast. Purposive sampling was used as those included had to have completed an introductory mathematics course at one of the two institutions.

The sample included nine female students and two male students with ages ranging from 19 to 43. All the participants identified themselves as White. Two of the participants were college graduates attending school to enhance a prior degree earned. Nine of the participants had a high school diploma as the highest degree earned. The demographics are outlined in Table 1.

Table 1

| Participant Information |
Through this transcendental phenomenological study, I was afforded the opportunity to inquire about how each participant perceived what it was like to learn introductory mathematics in the online college environment. Students were able to speak freely and share their lived experiences of learning in this environment. The experiences are described through the responses. These descriptions are given so that the reader can also experience the essence of what the experience was like for each student. All names listed below are pseudonyms.

**Tami**

Tami is a 25-year-old female who worked in the cosmetology industry for some time after graduating high school. She decided to go back to school to earn her certification as an x-ray technician in radiation therapy. Tami said that she missed having the face-to-face interaction with an instructor, but she took the online mathematics course so that she could have a more personal flexible schedule. She said there was not much interaction between the students or with the instructor. That is something she likes when taking courses in a traditional setting. Tami believed she was successful in this course because she had a strong background in mathematics.

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<td>2</td>
</tr>
<tr>
<td>Highest Degree Earned</td>
<td></td>
</tr>
<tr>
<td>High School Diploma</td>
<td>9</td>
</tr>
<tr>
<td>College Graduate</td>
<td>2</td>
</tr>
</tbody>
</table>
She said that the course could be “a bit of a struggle” for those who do not have a strong mathematics background. She also said that in order to be a successful student in this learning environment, one must possess “willpower to focus.” Tami said the feeling of unconnectedness was experienced between her and her instructor as well as between her and the other students. Tami stated, “I didn’t have much communication [with the instructor], one-on-one, so I didn’t feel a connection to him. I never met or spoke with the other students taking the course, so there was no connection” (Tami, personal communication, March 18, 2019).

**Nikki**

Nikki is a 23-year-old junior majoring in accounting. She was a participant in an introductory online mathematics course last year. While she knows she will need more schooling, Nikki has an overall goal of obtaining a master’s degree. Nikki participated in the online mathematics course for convenience. She said she liked “being able to do work in her pajamas.” She believes she was successful in the course because she put forth a lot of effort into learning the material. She said she never spoke to her instructor at all. While she believes this setting is “useful for people who have to work,” she would not recommend it for students who learn better by watching an instructor. Nikki said that to be a successful learner in this environment, students must practice patience and be able to “dissect material without needing to watch examples.” Nikki attributes her success in the course due to her extra effort. Nikki stated, “Even though I struggled a bit, I did succeed and got an A in the course. I put in a lot of effort into trying to learn the material and it paid off” (Nikki, personal communication, March 26, 2019).
**Angela**

Angela is 19-year-old sophomore majoring in environmental resource management. While she worried the online mathematics course would be difficult, she said she actually had a “great experience.” She did say that she felt “unconnected” to the instructor and missed the face-to-face interaction. She realized that she prefers learning in a traditional classroom setting. She suggested that students who want to be successful learners in this environment “take notes” as they go through the material and to “practice what they do not understand.” Angela did not recommend taking online mathematics courses to other students because she believes most students require face-to-face interaction when it comes to mathematics. Although Angela’s experience was good for her, she did not recommend introductory online mathematics courses for other students. Angela stated, “I would not recommend taking them because while I am good in math, some people might need face-to-face interaction to learn math” (Angela, personal communication, March 26, 2019).

**Dave**

Dave is a 21-year-old sophomore majoring in radiology technology. Dave said that learning introductory mathematics in the online environment can be a positive experience for students who have good time management skills. He attributed his success in the course to his own time management skills. This course was a good fit for his schedule as he juggled school and working at a local sporting goods store. He said he did not feel a connection to the other students in the class as he would in a traditional setting. Dave had much to say with regards to time management. Dave stated, “To succeed you have to be able to manage your time wisely. I had a positive experience due to my time management skills” (Dave, personal communication, April 19, 2019).
Pam

Pam is a 28-year-old Certified Nursing Assistant furthering her education in hopes of becoming a Registered Nurse. She currently juggles school and working as a CNA, taking care of mentally disabled people. Pam did not suggest online mathematics courses for other students. She found her introductory online mathematics course “very difficult.” She believed student learners need “time and patience” to be successful in this learning environment. Pam did not have any communication with her instructor. She took the course because it “fit her lifestyle.” She believed she learns mathematics more easily in a face-to-face setting. Pam only recommended this learning environment for certain types of learners. Pam stated, “If you are a fast learner, I would recommend trying an online course. If you have difficulties, I would not recommend online” (Pam, personal communication, May 2, 2019).

Haley

Haley is a 19-year-old majoring in radiology technology. She began as a nursing major and then changed her major to radiology technology. She says she “loved” online courses, but mathematics can be difficult if the student is not strong in mathematics. She said that taking her introductory mathematics course in the online environment was “stressful” and suggested other students who struggled should obtain a tutor for assistance. She did not communicate with her instructor and believes she would have been more successful in learning the concepts had she been in a face-to-face setting. She said that those students who want to be successful in learning mathematics in this environment should be “determined, open-minded, and grounded.” She summarized her experience as a feeling of “being unconnected.” Haley believed the online learning environment for introductory mathematics courses works better for those students who
are good at mathematics. Haley stated, “My experience was unsuccessful because I am not a
math person. [I] recommend [the course] if the person loves math but do not recommend to
someone who hates math” (Haley, personal communication, May 2, 2019).

Richard

Richard is a 19-year-old freshman. He was transferring to a larger university in the fall to
play ice hockey. He had not officially declared a major. He liked learning in the online
environment but said that he had some difficulty learning mathematics in this setting. He said he
had to search for videos on YouTube to find assistance to learn some of the concepts. He had
very little communication with his instructor. Richard said they only interacted twice throughout
the semester. Richard suggested that students who want to be successful learners in this
environment possess “good organizational skills and the ability to problem-solve.” He believed
that he struggled in this course because he is a visual learner and would have learned more in a
face-to-face setting. Richard felt unconnected to the instructor and other students. In summary,
Richard enjoyed online education but would not recommend it for a mathematics course. He
said he felt alone in his online experience and had to search out help on the internet. Richard
stated, “I felt like I was completely by myself trying to learn the material. I used YouTube more
than the book because it was easier to understand” (Richard, personal communication, March 18,
2019).

Avery

Avery is a 21-year-old majoring in radiology. She attended another university for interior
design. Avery decided to withdraw from that program to pursue a degree in radiology. She
summarized the experience of learning introductory mathematics in the online college
environment as “difficult, yet flexible.” Avery did not like her experience. She would not
recommend it to other students because she said it was very easy to “fall behind.” Avery signed up for the course because she liked the idea of not having to go to a class at a specified time. However, she believed she would have learned better in a face-to-face setting. Avery said that students who want to be successful when learning mathematics in this environment should “be self-sufficient and have good time management skills.” Avery would have liked to have had more communication with her instructor. She said she did not feel connected to the instructor or to the other students in the class. Avery found that staying on pace was a challenge. She stated, “It is easy to lose track online. It’s easy to fall behind in math online” (Avery, personal communication, March 18, 2019).

Mary

Mary is a 28-year-old Licensed Practical Nurse. She has an educational background that allows her to teach other nurses and wants to pursue her degree to become a Registered Nurse. Mary had a very good experience in learning introductory mathematics in the online college environment. She attributed her success in the course to her former education. While she was a participant in an introductory level course for her degree requirements, she had already been exposed to higher-level mathematics when she was in high school. She took this course online because she knew she had a strong background in mathematics and because she would be able to manage her time as a busy mom by not having to attend a class at a specific time. She reported that she would have liked some face-to-face interaction when she had questions. Mary would advise potential online mathematics students to “manage time.” She said that it all comes down to the desire of the student taking the course. Mary stated, “If a student has the desire to learn, online learning is good. I feel online education is beneficial and can be helpful in obtaining your
goals if you have the motivation to work independently” (Mary, personal communication, March 15, 2019).

Leigh

Leigh is a 34-year-old Registered Nurse. She described the introductory online mathematics course as “challenging,” but said she enjoyed it. She added that “it’s difficult” and a student needs to have “willpower” in order to be a successful learner in such an environment. One of the reasons Leigh liked learning in an online setting is because it was convenient for her life. She would advise potential students to “not give up.” Leigh knew of other students in her course and said she felt connected to them because they “were in the same position” as she was. Leigh said she did not really need assistance from her instructor, but felt it was there for her if she needed it. Leigh recommended learning introductory mathematics in the online environment for certain types of learners and stated, “I would recommend someone to online math courses if they know they can do this and have the time to put forth in for extra help if needed” (Leigh, personal communication, May 2, 2019).

Lexi

Lexi is a 43-year-old working teacher. As the oldest participant in the study and a mother to two girls, she did not work for years and decided to go to school to earn her teaching certification in elementary education. She only recently finished her studies and was hired at a local elementary school. As part of her program she needed to take an introductory mathematics course, which she did online to fit her busy schedule. Overall, Lexi liked the experience but felt it was difficult for introductory mathematics. Lexi had taken other courses online. Lexi felt she would have done better with the mathematics course if she would have had face-to-face interaction with an instructor. She searched out videos on YouTube to help her better understand
the concepts in the course. Lexi said the course “was difficult for someone who needs a lot of help with math.” She had very little interaction with her instructor. Lexi believed that students who want to be successful learners of mathematics in the online environment should have “determination and self-motivation.” She felt that she was successful because she was motivated to do well. Lexi admitted that mathematics is not one of her strong subjects, but she “put in the time” to be successful in the course. She did not feel connected to the instructor or the other students. Lexi said that this online course was more work and took more time than the courses she had in a face-to-face setting. She did not recommend online learning for those who are weak in mathematics, noting

If math is a weak area, I would not recommend online. I spent a lot of time watching videos to learn how to solve problems and could have benefited from an instructor going step by step to help find my errors. (Lexi, personal communication, April 12, 2019)

Results

This section addresses how the themes were developed through the interviews, questionnaires, and focus group discussions. It describes the themes that were developed and are then presented in relation to the research questions. Data coding occurred through manual and repeated examination of the documents. This was how the themes were developed. This section begins by discussing the themes. Next, the research questions are answered through the insight provided by the participants in the study.

Theme Development

The process of clustering for meaning and coding led to the discovery of five emerging themes. My coding involved identifying concepts through similar responses provided by the
participants through interviews, questionnaires, and focus group discussions. As similar words and ideas were reported by the participants, I manually recorded this through notetaking. Next, I transferred all the data onto an Excel spreadsheet and marked the number of times certain ideas and concepts were reported by the participants. In the interview phase, I utilized notetaking and followed up with member checking to verify concepts. In the questionnaire phase, I simply looked at the written words provided by each participant. Data in this phase was also transferred to an Excel spreadsheet according to similar concepts and words used. In the focus group phase, I experienced confirmation as the participants discussed ideas with each other. I also took notes in this phase and transferred the results to the Excel spreadsheet.

I used “subjective openness” (Moustakas, 1994) as I conducted the research. Students spoke and wrote freely depending on the method of data collection, while I remained unbiased and nonjudgmental. The study focused on the central idea of gaining insight into the lived experiences of students who participated in learning introductory mathematics in the online college environment. Creswell (2013) stated that a phenomenological study focuses on a central idea. The purpose of the study remained focused on capturing the essence of the student perspectives. All of this was kept in mind as the search for emerging themes continued. All responses were read multiples times to be sure to gain understanding as to the initial category that would match the responses provided by the participants. The focus of the study was ontological in nature as the goal remained centered on capturing the essence of the lived experiences of the participants.

There were 11 ideas that the participants voiced through the various types of data collection. Each idea was given a color code along with the number of times the idea occurred through participant responses in the any of the forms of data collection. I kept all responses
evenly weighted throughout the study. I referred to these original ideas as categories as I then recorded the number of times each idea occurred through the research. The categories listed in the spreadsheet included: convenience, unconnectedness, difficulty, willpower, more effort than face-to-face instruction, preference for face-to-face instruction, time management skills, extra time needed in online setting, sought outside assistance, does not recommend to other students, and self-efficacy. After looking at the number of times each concept had been reported by the participants, there was a clear gap in the top five categories in comparison to the remaining six categories. There were five ideas that were shared 15 times or more. Other ideas were recorded 10 times or less. I believed that participants sharing similar perceptions of learning introductory mathematics in the online environment in higher education between 15 to 34 times was a substantial finding. This is how the identification of the five themes were determined. The top five were chosen as emerging themes while the bottom six were rejected because not only did the top five have the highest number count, the top five were also reported by the most participants in the study. The data showed the following five perceptions occurred between 15 to 34 times each in the data collection: unconnectedness, convenience, having difficulty learning mathematics online, a preference for face-to-face learning, and not recommending online learning for mathematics to other students. This was how I was able to allow the themes to emerge through the data provided.

**Data Organization**

I kept the data organized in three different ways. First, I kept a file on each participant containing the responses, which were written and transcribed. Second, I kept all voice recordings in files in an application named “Voice Recorder.” One-on-one interviews were stored under the pseudonym of each participant. Third, I kept an Excel spreadsheet that
contained the categories that emerged into themes as a result of the responses collected from the participants. There were 11 original categories discussed in this section that emerged through this process. I became fully immersed in the data as I kept a focus on the responses provided. I soon became aware of similarities in responses, which allowed me to organize the data through the process of coding.

**Coding**

My coding involved identifying concepts through notetaking. Through the data analysis, I identified those statements that were significant to the study. I went through these statements repeatedly until I was able to cluster the statements for meaning. Soon, after the notetaking, I transferred responses to an Excel spreadsheet. This spreadsheet contained colors to represent different concepts reported by the participants. This is how I was able to proceed and define the data. Responses that contained similar words or ideas were then placed in a category according to color. All responses were weighted evenly. I originally began with 11 categories for emerging themes: unconnectedness, convenience, difficulty, willpower, more effort, prefers face-to-face, time management, extra time, outside help, does not recommend, and self-efficacy. I recorded the response frequency in each category. This data is represented in Table 2. I updated the table as I continually went through the data collected. This process helped immensely in the identification of emerging themes.

Table 2

*Categories by Participant*
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<th>3</th>
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<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
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Key:
Tami (1) Nikki (2) Angela (3) Dave (4) Pam (5) Haley (6) Richard (7) Avery (8) Mary (9) Leigh (10) Lexi (11)
**Unconnectedness.** The first theme that emerged from the results of the study was that students enrolled in introductory online mathematics courses do not feel connected to their instructors. A connection between instructors and students can be easier to accomplish in a face-to-face setting than in an online setting because instructors can immediately reply to student questions. An important role of an online instructor is to establish a social presence to meet the needs of the students. In addition to not feeling connected to the instructor, students did not feel a connection to other students. Many mentioned that the use of Blackboard is a poor substitute for cooperative face-to-face learning.

One evident finding was that although the students want the convenience of the online schedule, they miss the connectedness of the traditional classroom. They desire to have some method to help the online setting feel more like a traditional setting. They want to be more connected to the instructor. They would also like to work together and help each other. Richard does not think that instructors know how to create this feeling of connectedness. He suggested that universities should offer “a class for teachers on how to teach the class and guide the students” (Richard, personal communication, March 18, 2019).

Twenty total statements from eight of the 11 participants were recorded with regards to not feeling connected to the instructor. Fourteen statements from all but one of the participants related to students not feeling connected to each other. Thus, a total of 34 statements of unconnectedness were recorded making this the top theme. Two of the participants mentioned the feeling of not being connected to the instructor four different times throughout the study. Many participants mentioned that a reason for not feeling connected to the instructor was not only related to the fact that they did not see the instructor in a face-to-face setting. Haley
mentioned that it was difficult to feel connected to a person who she never met and had no idea of what her instructor looked like. Nikki also mentioned that it was difficult to feel connected to a person one did not see. Richard referred to the amount of time it took for the instructor to answer questions he had. “I felt unconnected because he didn’t respond in a timely fashion. The assignments were already posted for the entire semester. There was little to no communication” (Richard, personal communication, March 18, 2019).

Convenience. The second theme found through the analysis of the results was the theme of convenience. Almost all the participants in the study said that they enrolled in the online introductory mathematics course because of the convenience it offered to fit their schedules. Online courses fit the busy schedules of individuals who want to attend school while keeping up with a career and family life.

Twenty total statements from 10 of the 11 participants were recorded with regards to convenience. Every student except for Dave mentioned that a reason courses are taken in the online environment is because it is a convenient way to fit education into a lifestyle or busy schedule. Many of the participants were juggling careers, families, and outside obligations in addition to school. The online setting gave students hope that they could take courses and still manage to meet the obligations of their daily lives. Haley mentioned that the convenience in her course allowed her to complete assignments ahead of time, saying, “I liked that I was able to complete assignments two weeks in advance” (Haley, personal communication, May 2, 2019).

Tami said that she took a class in the summer while working full time in order to fit her busy schedule: “I feel it is a great way for a lot of people with families and careers to further their education” (Tami, personal communication, March 18, 2019).
Difficulty. The third theme that emerged from the study was that the students perceived the introductory online mathematics courses as more difficult than those offered in a traditional face-to-face setting. While only a few students in the study viewed the online course as having a low difficulty level, most of the participants reported the online course was more difficult than a traditional course. Mary said she thought the class was easy, but she had successfully completed other online courses before and knew what to expect. Many of the students sought outside help in order to have extra practice. Others reported that they wished they had taken the introductory mathematics course in the traditional setting. Eighteen total statements from nine of the 11 participants were recorded referencing the difficulty of learning introductory mathematics in the online environment in higher education. Most of these statements included students saying that other online courses were easier to take in the online environment than the introductory mathematics courses. Avery said it was difficult to understand in the online setting. Richard said that learning introductory mathematics in the online learning environment was confusing. He said the material was difficult and the courses consumed too much of his time. When asked about thoughts on online education, Lexi said her thoughts varied:

It depends on the class. While I love the flexibility of online courses and working at my own pace, I struggle with math and reading comprehension. For math classes, I need to have face-to-face instruction. I need to be able to ask questions and get immediate feedback. (Lexi, personal communication, April 12, 2019)

Preference for face to face learning. The fourth theme that emerged from the study was that the participants would have preferred to have taken the introductory mathematics courses in a face-to-face setting instead of in an online environment. The students mentioned using YouTube or Aleks for assistance when learning specific concepts. In the review of the literature,
students said they liked talking to an instructor before class, after class, during class, or via email when needing assistance. Many online courses are set up to direct students to use technological programs (Graham & Lazari, 2018). In both the review of the literature and in this dissertation, it was found that students would prefer to just talk with an instructor. Students prefer questions answered by an actual person instead of trying to figure out a computer program.

Through the experience of learning introductory mathematics in the online environment, many of the students realized that they would prefer learning this topic in the traditional setting. This discovery can be good for students because if they need to take more mathematics courses in the future, they will probably look to enroll in one in the traditional setting. Sixteen total statements from nine of the 11 participants were recorded from students who said they would prefer to learn introductory mathematics in a face-to-face setting instead of in an online setting. Students did say that while they like the online learning environment for other courses, they would prefer to take introductory mathematics courses in a face-to-face setting. This idea connects to the previous emerging theme of difficulty. Many students said that they believe the course would not have been as difficult if they would have been in a face-to-face setting. Tami said she missed the face-to-face environment particularly when she needed help solving problems. Pam said she recently had an “amazing” face-to-face teacher for mathematics, so her recent experience of learning introductory mathematics online did not measure up to her prior experience. Haley said her experience was a negative one in the online environment and could have been a positive one if she had taken the course in a face-to-face setting. “I needed to be able to see the teacher work out the lessons visually. I needed to be able to learn from my peers as well” (Haley, personal communication, March 26, 2019).

Richard confirmed what many of the others said about taking courses online. He likes
online learning, but would have preferred to take introductory mathematics in a face-to-face setting:

I am a visual learner, so having to read about the material instead of seeing it was difficult. I think online education is a really good idea if it is set up properly. I enjoy my other online classes. Online math is not the best. (Richard, personal communication, March 18, 2019)

**Not recommended.** The final theme that emerged from the study was that the participants would not recommend taking an introductory mathematics course in an online college setting to other students. Some of the participants in the study did not recommend online learning for introductory mathematics to other students because they did not have a positive experience. Not only do students prefer a face-to-face setting for themselves, but they would recommend a face-to-face setting to other students who need to take introductory mathematics courses in higher education.

A wonderful discovery I made as a researcher is that many of the students truly want to help other students succeed. The environment does not feel competitive because the students make suggestions to one another. In this situation, many students said they recommended taking this course in the traditional setting to their friends. When asked this question in the interview setting, students said they would recommend the traditional setting if another student asked them for advice. Fifteen total statements were recorded from eight of the 11 participants in the study who said they would not recommend taking introductory mathematics in the online college environment to other students. While many students recommend online classes in general to other students, most say that they do not recommend introductory mathematics in the online environment especially if a person is weak in mathematics. Pam only recommended online
learning for “fast learners.” Haley only recommended learning math online for “someone who
loves math.” Mary said that online learning for introductory mathematics classes was for
students who have a strong “desire to learn.” Sara offered this advice to other students: “Don’t
take math online. If you do, be in contact with other students. Many times, I thought I
understood the material and still got it wrong” (Sara, personal communication, May 2, 2019).

**Connection to Research Questions**

This section will provide connections between the research questions and the results of
the study. I begin with connections to the central research question followed by connections to
each of the sub-questions.

**The central research question.** The central research question was, “What is the lived
experience of students who have completed introductory college mathematics courses in the
online learning environment?” A summary of responses to this research question could best be
described by stating that students missed the traditional setting for these courses, they desired
more personal communication from the instructors, and they believed the content would have
been easier to learn in a face-to-face setting. The finding that so many said they would not
recommend this setting for this subject to future students shows that changes to meet student
needs in this setting are necessary. Most students described the lived experience of learning
introductory college mathematics in the online learning environment as difficult. The students
felt alone and sought outside help through YouTube videos. Most students also said that they
experienced this difficulty because they lacked the feeling of being connected to the instructor.
Students wanted the instructors to be more visible and more responsive. While the students
reported that they enjoyed the convenience of taking online courses, they did not recommend
taking introductory mathematics in the online college environment to other students, especially
those who are weak in mathematics. This is because their lived experience was a struggle at
times, and they reported that the course would have been easier to learn in a face-to-face setting.
The students wanted a traditional feel of the course in an online setting. While this may seem
impossible, the themes developed provide insight to how instructors and administrators could at
least improve. The five themes which emerged are outlined above and connect directly to this
central research question. The struggle many of the students had can be summed up by Nikki,
who explained her lived experience of learning introductory mathematics in the online
environment in higher education.

I had a negative experience learning math online because it was time consuming,
frustrating, and difficult. Being taught via YouTube videos by other instructors
was hard too. It was like my professor wasn’t even the one teaching me. I do not
recommend taking introductory math classes in an online environment unless you
are very good at reading word problems and learning on your own. My professor
couldn’t always help. Aleks had very complicated problems that YouTube videos
did not cover. I also didn’t like that I had to spend my entire day on Aleks because
they take points away for every problem you got wrong. (Nikki, personal
communication, March 26, 2019)

The first sub-question. The first sub-question was, “What is the student perception of
being a successful learner in an introductory mathematics course in the online college
environment?” Students reported that while it was difficult to be a successful learner in an
introductory mathematics course in the online environment, it was possible if the students
worked for success in the course. Students reported that the online mathematics course took
extra time and effort when compared to other traditional or online courses. To be successful in
this environment, one must be motivated and dedicated. Students said they succeeded in passing the course because there was no other alternative. They took the extra time and sought outside assistance to help them understand concepts. In addition, many students had a fixed mindset and believed some people are just better at mathematics than others. The student perception was that if one is good at mathematics, it is easier to be a successful learner of introductory mathematics in the online college environment than if one is not a strong mathematics student. Instructors and administrators could focus on this perception and encourage a growth mindset in which all students can become better at learning topics with hard work and dedication. While Tami was one of the students who had a positive experience learning introductory mathematics in the online environment in higher education, her thoughts on being a successful learner directly relate to the students who did not have a positive experience.

I was successful with my course because I went to a high school that prepared me for such courses. I know some students were not as fortunate. I know online schooling isn’t for everyone. If you struggle with math, I wouldn’t encourage taking an online class. If you do well with math, I say go for it. There are many apps and websites that would help. (Tami, personal communication, March 18, 2019)

**The second sub-question.** The second sub-question was, “How do students believe that self-efficacy contributes to success for learning introductory mathematics courses in the online college environment?” This question focused on self-efficacy because it was a recurring theme in the review of the literature. Therefore, I believed there was a possibility it would surface in my research. Some students had some comments related to the idea of self-efficacy. As I read through comments numerous times and fully saturated the data, I discovered six comments from
a total of five students related to self-efficacy. Therefore, in this study, it was not one of the major emerging themes. While I had no bias as a researcher pertaining to this as a possible theme, I did remember the idea showing up numerous times in the review of literature. This is why I connected it to one of the original research questions. I do not have much to report on this idea because it simply did not appear as frequently as the other concepts. However, I do believe it shows I remained unbiased throughout the research, which was a reassurance to me. Leigh was one of the students who alluded to the idea of self-efficacy when discussing whether she would recommend learning introductory mathematics in the online environment in higher education to other students, “I would recommend someone to online math courses if they know they can do this. It is difficult. You need willpower (Leigh, personal communication, May 2, 2019).

I was surprised that more students did not talk about self-efficacy as the review of literature caused me to think that more students would attribute success in the course to belief in one’s self. There were only a few comments which could be classified under the idea of self-efficacy. Although it was a theme in the review of literature, it was not one of the major themes in this study.

**The third sub-question.** The third sub-question was, “What academic or character traits do students perceive as helpful for succeeding in learning introductory mathematics in the online learning environment in higher education?” Students believe that there are certain traits students have that help them to succeed in learning introductory mathematics in the online college environment. The traits identified in this study include the following: patience, honesty, time management skills, determination, organizational skills, problem-solving skills, the desire to do well, and self-motivation. Time management is the trait that was mentioned the most often.
Patience was needed because students had to spend extra time with this course in comparison to other courses. Students knew they needed to be honest or they would not fully learn the concepts. Students described managing time with outside obligations and other courses. Most said they had to dedicate more time to this course and planned accordingly. Students who were successful were determined to finish with a good grade. Students needed to remain organized to juggle all responsibilities and other courses. Problem-solving skills were needed because many said they did not have immediate access to a tutor or instructor. Participants were successful because they had the desire to do well. Students may have had different reasons for this desire, but all students wanted to pass the course and move on to the next level. Students said self-motivation was important because they did not have much interaction with professors or other students. Dave said that his time management skills were a major reason he was successful in learning introductory mathematics in the online college environment. He had a positive experience in the online classroom due to my time management skills. He said he was successful because he used his time wisely.

Summary

In Chapter 4, I presented the findings of the study. I included the lived experiences of the students who participated in an online introductory mathematics course in higher education. I provided the demographics of the 11 students who participated in the study. This was followed by in-depth descriptions which provided a starting point to help find emerging themes. After giving specific details from the findings with each participant, I listed the 11 categories for possible emerging themes. The categories were convenience, unconnectedness, difficulty, willpower, effort, preference for face-to-face learning, time management, extra time, outside assistance, not recommended for other students, and self-efficacy. After examination of the
categories, the emerging themes became evident and were identified as the following: unconnectedness, convenience, difficulty, preference for face-to-face learning, and not recommending introductory mathematics courses to other students. Each of these themes was discussed in detail with supporting evidence from the perspective of the students. Finally, the research questions were listed and connected to the responses provided by the study’s participants.
CHAPTER FIVE: CONCLUSIONS

Overview

The purpose of this transcendental phenomenological study was to understand the student perception of learning introductory mathematics in the online environment in higher education. A group of 11 students participated in the study, which included questionnaires, interviews, and focus group discussions over the course of four months. The interviews and focus group discussions were voice recorded with a phone application and then were transcribed. Phenomenological reduction (Moustakas, 1994) was utilized for the analysis of data. Through the process of analysis, there were five themes that emerged. These themes were reviewed and analyzed further. There is much to be learned when researching what it is like to be a student learning introductory mathematics in the online environment in higher education.

A summary of the findings is presented first in this chapter. In this section, the original research questions are examined with regards to the study. In addition to the examination of the research questions, the five emerging themes are presented along with evidence supporting how the themes emerged. After the summary, a discussion including the theoretical and empirical ideas is presented. In this section, a review provides evidence of how the current research and theories included in the study relate to the results. Next, the implications for theoretical, empirical, and practical purposes are presented. After the implications section, delimitations and limitations are presented. Finally, recommendations pertaining to learning introductory mathematics in the online environment in higher education and recommendations for future research are provided.
Summary of Findings

The central research question was, “What are the lived experiences of students who have completed introductory college mathematics courses in the online learning environment?” A summary of the findings is that the participants in this study perceived learning introductory mathematics courses in the online college environment as difficult. The students took the courses because of the convenience it provided for their lifestyles. The students perceived part of this difficulty due to not feeling connected to the instructor. The students enjoyed the convenience of not having to go to class at a specific time and day. However, an overwhelming majority of students in this study would have rather learned introductory mathematics in a face-to-face setting. This does not mean that the students in the study were not fans of online learning. They just perceived learning introductory mathematics in the online learning environment as more difficult when compared to other online courses. The comparison of learning introductory mathematics to other online courses was not a specific research question nor was it a question used in the interview, questionnaire, or focus group discussion. This finding came about after data saturation.

Students had various reactions to learning introductory mathematics in the online environment in higher education. However, many results provided answers to the research questions proposed in this study. Angela said that “online learning tends to be more difficult, depending on the subject,” as she reported having a struggle with introductory mathematics in the online setting, but not in other online courses. Richard did not like learning introductory mathematics in the online setting. However, he reported that he “enjoyed his other online classes.” Avery wished that the students would have participated in mandatory discussion boards as she did in her other online courses. Mary loved learning in an online setting. She said
that online learning can be “very beneficial in helping you obtain your goals.” Lexi enjoyed the flexibility of taking courses online. However, she believed she would have learned much more if she had her introductory mathematics course in a traditional face-to-face learning environment.

The first sub-question was, “What is the student perception of being a successful learner of introductory mathematics in the online college learning environment?” When it comes to introductory mathematics, Pam only suggested it was appropriate for students who are “fast learners with math.” Mary added that learning introductory mathematics in the online setting is not for students who are unable to learn independently. Lexi described mathematics as a “weak area” for her. She wished she would have taken her introductory mathematics course in the traditional environment. Yet, she felt she was successful in the online environment in other content areas.

The second sub-question was, “How do students believe that self-efficacy contributes to success for learning introductory mathematics courses in the online college environment?” The review of literature led me to believe that self-efficacy would be a recurring theme in my findings. However, there were very few comments provided regarding this concept. Lexi said a student needs “willpower” in order to be a successful learner in the online environment in higher education. A few others mentioned that students need to believe in themselves in order to be successful, but other themes were more prominent in this study.

The third sub-question was, “What academic or character traits do students perceive as helpful for succeeding in learning introductory mathematics in the online learning environment in higher education?” Students reported that in addition to willpower, effort was a trait necessary for success in this environment; nine comments were made regarding the idea that more effort is put into learning introductory mathematics in the online environment than in the traditional
setting. Ten students reported that time management skills were necessary to be a successful learner in introductory mathematics courses in the online environment in higher education. Along with time management skills, students said that extra time needs to be dedicated to learning introductory mathematics if a student takes such a course in the online learning environment.

Therefore, because most students described the lived experience of learning introductory college mathematics in the online learning environment as difficult, further examination shows that this is due to the fact that students report learning mathematics in the online setting as more difficult than learning other content areas in the online setting. Students also said that they experienced difficulty because they lacked the feeling of being connected to their instructor. They missed the opportunity to ask questions directly to an instructor while a problem was being presented. Richard reported that watching someone work out problems and being able to ask questions during that time was a better way for him to learn. He missed the “one-on-one help with a teacher.” Haley said she needed to “see the teacher work out problems visually.” Angela described her instructor as “unreachable.” Tami attributed her success in the course to her high school background despite having “no connection with the instructor” to whom she “never spoke” throughout the semester. The majority of students preferred to learn introductory mathematics in a face-to-face setting and did not recommend the online learning environment to other students for introductory mathematics courses, particularly for students who are weak in the area of mathematics.

Discussion

In this section the theoretical and empirical literature presented in the beginning of the study will be reviewed and examined with regards to the findings of the study. Theoretical
literature includes the theory presented that supports the study. Empirical literature includes information that was found in earlier research studies.

**Theoretical Literature**

Bandura’s (1977) social learning theory was the guiding theory for this study. The social learning theory says that people observe the way they should act in certain situations and act accordingly (McLeod, 2016). From the results of this study, it can be determined that many students learned how to behave in an online introductory mathematics course in higher education. While they were not in a physical classroom in which to observe behaviors with their own eyes, they quickly learned how to act in order to learn mathematical concepts in this setting. For example, many students reported researching YouTube videos to help them learn concepts. Others needed to learn to discipline themselves to spend more time learning the material.

Boree (2006) said the steps involved in Bandura’s social learning theory are attention, retention, reproduction, and motivation. In this dissertation, the participants gave their attention to the online course, retained information learned well enough to pass the course, were asked to reproduce knowledge through testing, and were motivated to pass the course. Boree (2006) also said that students will not be motivated unless there is some type of reinforcement. The reinforcement pertaining to this study would be a passing grade in the class, as some of the participants reported that they were motivated to learn and succeed because passing the course was the motivation to do well. Cho and Heron (2015) said that those with high self-efficacy would be more relaxed. This was also shown in the study as it was reported that those students who believed they had a firm mathematics background had the belief they would be successful in the course and were not as stressed as those students who did not have the belief they would succeed. In addition, if people have doubts about performing well in online courses, they will be
less likely to take those courses (Cho & Heron, 2015). This idea was confirmed as many students reported struggling in the course and not recommending learning introductory mathematics in the online environment to other students.

Bates (2009) states that adults are self-directed learners. This idea was shown in my study as many of the participants reported that they felt as if they were working all alone. They had to provide direction for themselves in order to succeed in the online course. In addition, my study also showed that adult learners did not need constant instruction in order to pass the course. Duverge (2016) said that constant instruction is not a necessity for adult learners. Adults are active learners who use past experiences to help them learn new concepts (Harrison & Holler, 2007). Some participants in this study said they remembered some concepts from other math courses and taught themselves to learn other concepts. Another connection to the theoretical literature relates to the internal beliefs of the students. Participants in the study reported that they needed to manage their time and motivation to succeed in the course. This was found in the literature by Lee and Martin (2017) and Marchand and Gutierrez (2011), who said students have internal beliefs about motivating themselves intrinsically and managing their time.

The participants in this study had the desire to behave as successful students who would pass the course. Mulhollem (2009) described this behavior as human agency. Individuals can regulate their actions and produce desired behaviors. The participants became self-directed learners in the online introductory mathematics courses. Hiemstra and Sisco (2011) said that self-directed learning is a natural development of people.

**Empirical Literature**

My study adds to the current research by providing student perception in the specific content area of introductory mathematics and the specific learning environment of online
education. The findings in my study are important because online learning is growing. Universities want to increase student success (Graham & Lazari, 2018) which is why this study can contribute to the field of education. Very little literature was found relating specifically to learning introductory mathematics in the online environment in higher education. It was initially thought that because self-efficacy was a theme which occurred often in the review of literature, it could also be a theme emerging in the study. While I considered self-efficacy as a possible theme because of the review of literature I conducted, I remained unbiased and was able to observe any themes which emerged through the research. Although self-efficacy was not an especially prominent theme, there were many other connections my research had to the review of the literature. There were many participants who reported that they took the online course to fit busy schedules and because of convenience. This connects to the findings that students enjoy the usefulness and ease offered through the online learning environment (Badri et al., 2014).

It was also found that retention in the online environment is lower than in the traditional environment (Khan et al., 2016). This is supported in the results of my study because many participants said they would have preferred learning introductory mathematics in a traditional setting instead of in the online learning environment. In addition, if the current students do not recommend online learning to other students, retention in that area would decline.

My participants reported that they enjoyed the flexibility of the online setting. O’Rourke et al. (2014) also found that students schedule online courses due to the flexibility they provide. However, the literature also showed that students wanted the online classroom to feel more like the traditional classroom (Slagter van Tryon & Bishop, 2012). This was a concern in my study as the participants reported having a feeling of disconnection with the instructor and the other students. If Blackboard was available, it was not mandatory to use it. This lack of feeling
connected made the students desire to learn introductory mathematics in a traditional setting as opposed to the online learning environment. Therefore, the challenge for administrators at the college level is to find methods to provide flexibility in scheduling yet meet the needs of students wanting connection with their instructors and other students.

Many participants reported that they would have rather experienced learning math concepts in a face-to-face setting. This could be because the quality of online learning does not match the quality of the face-to-face learning environment (Bowen, 2013) for mathematical topics. Huston and Minton (2016) had showed that completion rates were higher for face-to-face learning environments when compared to online learning environments. This could be due to lack of time management and motivation. Participants in my study reported that those qualities were necessary for success. O’Shea et al. (2015) said that a lack of time management and motivation are reasons many students are not successful in the online setting. Another reason the face-to-face setting was preferred could be due to the lack of interaction with the instructors. This idea was voiced by participants in my study. The literature showed that students are more satisfied when instructors are responsive (Franklin, 2014). Participants in my study said they had little to no interaction with some of their instructors. Marino (2012) found that immediacy behaviors such as quick responses emails and posting of grades were important to students. Very few of the participants in my study reported experiencing such behaviors. Students like it when instructors provide feedback (Welsh, 2014). They want to connect socially to other students and to their peers (Kuo et al., 2017). In my study these desired behaviors were not experienced by the participants. Participants said they wanted more interaction with the instructors. Students are more satisfied when there is more interaction (Song, 2010). In fact, they prefer face-to-face interaction when seeking help (Reeves & Sperling, 2015). This could be why so many students
said they would take the mathematics course in the traditional setting if given the chance again. This could be why so many of the participants would not recommend this learning environment for math to other students. Hopefully, this study can serve as a way to provide information to instructors and administrators who can meet the needs of students who desire more interaction and more of a traditional feel in the online environment. If online courses on this level are going to be continued to be offered, the hope is for the institutions to rise to the challenge of helping the students succeed.

**Implications**

This study contains findings which have theoretical, empirical, and practical implications for those involved in the teaching and learning of introductory mathematics in the online environment in higher education. Those stakeholders include the instructors who teach such courses, the administrators of the colleges and universities which offer such courses, and the students who chose to enroll in such courses.

**Theoretical**

Bandura’s (1977) social learning theory was the guiding theory for this study. An extension of this theory is referred to as the social cognitive theory (Mulhollem, 2009). In this theory, the idea of human agency is addressed. Human agency focuses on the methods humans use to regulate behaviors to produce desired results. Therefore, a theoretical implication relating to my study is that students have the desired result of passing the online introductory mathematics course and will regulate behaviors by practicing good time management skills, putting more effort into the course, and seeking outside assistance.

Another theoretical implication connected to social learning theory (Bandura, 1977) relates to the concept of self-efficacy. Self-efficacy was a concept which occurred many times.
throughout the review of literature. Although it was not a major theme which emerged through the responses of the participants in the study, it was recorded to have been mentioned a total of six times. Students said they did well because they believed that they would. They felt confident from the start of the course that they would pass. Therefore, students who believe they will succeed in an online introductory mathematics course in higher education may be more likely to do so.

**Recommendations.** A recommendation for the stakeholders would be to offer more courses in a hybrid learning environment for introductory mathematics. A course that meets, or has the option of meeting, one day per week in a face-to-face setting with the remainder of the week in an online setting could meet the needs of the students. Such a hybrid course could offer the flexibility needed for adult students to manage busy lives yet provide an opportunity to ask questions and receive immediate feedback from an instructor in a traditional setting. This would address the desire for immediacy behaviors and hopefully help the students feel more satisfied with their learning experience. In addition to working to provide students with a flexible schedule with some instructor interaction, the instructors who teach these courses need to have the qualities of patience and understanding. The students reported that these courses felt more difficult than some other courses. Mathematics does not come easy to everyone. Patient instructors can help students feel more at ease and increase the overall success rate.

**Empirical**

This study adds to the literature about online learning in higher education. It may be one of a few studies of a qualitative nature that focuses specifically on introductory mathematics courses.
The trend towards blended-learning environments. Albalawi (2015) found a trend in education towards a blended or hybrid learning environment. Because the results of my study show that students desire the ease offered in online learning, yet also desire the feel of a traditional learning environment, this connection to the literature can be understood. Slagter van Tryon & Bishop (2012) found that students desire more social interaction. This was a concern in my study. A blended environment could be a way by which to meet the needs of students who want the social interaction and still offer some flexibility in scheduling and study time.

Online mathematics is perceived as more difficult. Learning introductory mathematics in the online college environment can be difficult for many students. My participants reported needing to seek outside assistance. They also reported needing to spend more time and effort on the online course than on a traditional course. The participants said they would not recommend such a course to other students and wished they had participated in a traditional classroom setting for the introductory mathematics course. In the literature, it was found that on the community college level, students who participated in an online course were less likely to do so in the future (Huntington-Klein et al., 2017). In addition, remedial mathematics courses on the community college level were shown to be perceived as more difficult than the same courses in a traditional setting (Bahr, 2012). The completion rates for introductory mathematics courses have been found to be higher for those students who participate in a traditional setting as opposed to an online setting (Huston & Minton, 2016). This dissertation only included students who had successfully passed the online introductory mathematics course. It would be interesting to know how many students began the classes but later dropped them due to various difficulties encountered.
**The role of the instructor.** It is important to students that they perceive that their learning needs are being met by the instructor (Franklin, 2014). Students believe having learning needs met in the online environment is possible by having instructors who respond to emails in a timely fashion and offer feedback. Unfortunately, many students in my study reported feeling a disconnection with the instructor. The immediacy behaviors described by Marino (2012) were not prominently observed by my participants. A particular and favorable immediacy behavior of quick responding to emails (Marino, 2010) was reported to be lacking in the results of this dissertation. Students desire a social presence even if the course is not offered in a traditional setting.

**Practical**

Those instructors, administrators, and educators who design and teach online introductory mathematics courses should consider these findings to improve these courses so that the needs of the students are met. Students want to have the opportunity to participate in online courses because of the convenience it offers in their lives, yet students desire to feel connected to the instructor. Students do not want online classes to be more difficult than a traditional classroom. In fact, students would like for the online classroom to feel more like a traditional classroom. Finally, if these areas are addressed, it is possible the students would be more likely to suggest the online learning environment for introductory mathematics to other students because there would be more overall satisfaction.

**Recommendations for students.** Students who take introductory mathematics courses should consider two things. First, students should be honest with themselves when placed into a course. Colleges have placement tests for introductory courses. If a student scored low on a placement exam, perhaps he or she should consider taking a more basic mathematics course in
In order to master the skills needed and fully understand the content. Second, if the students are enrolling in the course in the online environment purely because of scheduling, they may want to re-examine that reasoning. As voiced by the participants in the study, many students would not recommend this learning environment to other students, especially those who are not strong in mathematics.

**For program directors.** Those who prepare programs and courses involving online introductory mathematics in higher education may want to consider the hybrid model for learning this concept. Upon reflection of my study, I have learned that the students desire convenience of scheduling and face-to-face interaction with an instructor. A method of learning that could meet this need would be to offer a hybrid course. The suggestion would be for the students to meet with the instructor one day per week at a scheduled time while completing the remainder of the coursework online. In this learning environment, students would have the opportunity to ask questions and receive immediate feedback. In addition, such a learning environment would not be as demanding for scheduling purposes. Meeting one time per week, would mean less commuting and less classroom time than a traditional face-to-face environment. In the end, students may not feel as if they put in more effort than they would in a face-to-face setting. This environment may be perceived as less difficult. The need for outside assistance should certainly decrease as the students would see the instructor more often than reported in the online environment situations of the study conducted.

**Ideas for the future.** If it is accepted that students will continue to participate in introductory mathematics courses in the online college environment for reasons including convenience, the issues voiced by the participants in this study should be addressed. Those individuals involved in the planning and instruction of such courses should look at methods in
which students are able to feel connected with the instructor. Some students said that they did not know what the instructor looked like. A simple photo and video at the beginning of the semester could be something instructors provide to promote connectivity to the students. The students also desired more of a traditional classroom feel. If students report that they prefer learning in the online classroom because of convenience but believe they would learn better in a face-to-face setting, perhaps methods in which to make the online environment have more of a traditional feel could promote greater student success while learning introductory mathematics in the online college setting. Many students said they sought help on their own by searching for YouTube videos from other instructors. Perhaps the instructors of the introductory mathematics courses could make their own videos and post them within the online course. This may also help address the issue of the course feeling difficult. Providing the ease of clicking on a video made by the course instructor in which the student can pause when necessary could help the student learn better and provide more of a traditional classroom feel.

**Delimitations and Limitations**

I limited the boundaries of the study by only permitting those students who were over the age of 18 and who had successfully completed an online introductory mathematics course in higher education to participate. The reason for the age requirement was because the focus of the study was restricted to higher education. Students under the age of 18 may have been enrolled in high school but taking one online course. It was the goal of the researcher to capture the essence of the experience of participating college students. Therefore, the age restriction was appropriate.

Another delimitation was that the participants had to have successfully passed the introductory mathematics course. Successful completion of the course was confirmed by each
institution concerning each participant. Because the study focused on the perception of learning introductory mathematics in the online environment in higher education, it was important that the participants in the study were students who put forth the effort to pass the course or did not drop the course at any point in the semester. It can be noted that those students who did not pass the course may have also put forth the effort; however, it is more likely that students who received a passing grade clearly put forth the effort and remained in the course for the entire semester.

This study was limited to an area in which the researcher could travel and interview participants in a face-to-face setting. The institutions were chosen because the researcher knew that the institutions offered online courses for introductory mathematics due to teaching at the institutions previously. A limitation would be that this study may have produced different results had it have been conducted with different institutions or in a different area of the country.

In addition to the limitation of the area used for the study, there is the limitation that other participants in this same location could have produced different results. Recruitment of participants occurred through flyers being posted in the hallways and word of mouth. There are other students who may have not known of the study or just did not want to participate in the study, which could have changed the results of the study.

A qualitative approach was appropriate to gain insight and delve into the perception of the students who successfully completed an introductory mathematics course in higher education. While the participants willingly took part in the study, some may have provided more detailed information than others. Some students may have kept the answers short just to obtain the gift card offered through participation in the study. The researcher used different methods to gain information from participants, but some may have still held back private thoughts on this subject.
Recommendations for Future Research

The goal of this study was to gain an understanding of the student perception of learning introductory mathematics in the online environment in higher education. When I began to research the literature pertaining to this area, I identified a lack of information about online college introductory mathematics courses. Furthermore, I noticed a lack of qualitative studies that truly focused on the student perception of learning. I hoped to help fill the gap in the literature of exploring the student perception of learning introductory mathematics in the online environment in higher education. This study was limited to students who completed the course, lived in a certain region, and were of a certain age. With these limitations in mind, I offer recommendations for future research.

The first idea to be considered that was not a part of my study is that of the dropout rate for students who enroll in online introductory mathematics courses in higher education. In my recruitment efforts, the participants had to have successfully completed the course. This means that each participant received a passing grade. I did not ask the participants what the grade received was, but I did confirm that each participant passed the course. It would be interesting to learn how many students drop a course of this nature partway into the semester, realizing they will not be able to complete it. It would be helpful to administrators and instructors to understand what those reasons may be. Such information could assist administrators and teachers as they prepare and instruct introductory mathematics students in the online environment in higher education. A quantitative study to determine the number of students who enroll in introductory online mathematics courses in higher education but drop out before the end of the semester could provide useful information to educators and administrators. In addition to the number of students who drop such classes, areas to be examined could include at what point
in the course did the students decide to drop the course, and what was the grade at the time the students decided to drop the course. Another recommendation for a study would be a transcendental phenomenological study that would examine the reasons why students drop introductory mathematics courses in the online environment in higher education. Just as my study gained the perspective of the students who finished and passed the course, instructors and administrators could gain insight as to why students drop the course. Such information could be used to prepare courses that better suit the needs of the students and eventually lead to more student retention.

Another idea to be considered would be that of exploring the results of a similar study conducted with younger participants. Because many elementary, middle, and high schools have increased their online education offerings, a younger population could produce different results. Examining what younger students have to say about learning mathematics in the online environment could provide useful information to educators as to how future college students like to learn mathematics. Such information could be gathered through phenomenology or through a case study if conducted in a specific school.

A final recommendation would be to conduct a similar study in a different area of the United States or with a group who is enrolled in such courses in a global online environment including all areas of the United States. If the study was to be repeated in a different area of the country, I would suggest the same approach of transcendental phenomenology. Therefore, perceptions of the students could be obtained and compared to the results found in the study already conducted. My study was limited to one area. Gathering information from a different area or many areas of the United States could add validity to this study or provide other useful
Summary

My study presents a look into the lived experiences of students who participated in introductory online mathematics courses in two institutions in the Northeast. The participants shared stories about what it was like to be a student learning introductory mathematics in the online environment in higher education. From the descriptions provided by the participants, I developed recommendations for those involved in the instruction and development of online introductory mathematics courses in higher education. Throughout the study, I remained unbiased and nonjudgmental. I also suggested that the results of the study would have implications for those involved in the instruction, development, and administration of introductory online mathematics courses. The students were provided a voice to share their lived experiences as I learned from them. From this experience, I gained much insight, which allowed me to thoroughly explore the phenomenon.

By gathering results that developed into themes, certain concepts emerged. The first concept is that students enjoy the flexibility online education provides to fit busy lifestyles. This idea is supported via the evidence provided in the study through the theme of convenience. Therefore, online education will continue to be used as a method for furthering educational goals, particularly for those with families and careers. The remaining four concepts which emerged from the data collection can be grouped together in a manner that truly describes the experience the students had when learning introductory mathematics in the online environment in higher education. The students felt unconnected to the instructors. The students perceived learning mathematics in the online environment as difficult and would have preferred to have
taken the mathematics course in a face-to-face setting. The students would not recommend the online learning environment to other students for introductory mathematics courses.

The feeling of not being connected relates to the review of literature in which other studies showed that students in the online environment felt a lack of social connectedness (Slagter van Tryon & Bishop, 2012). The perception of learning mathematics in this environment as difficult did relate to students wanting more of a traditional learning environment experience. Students quickly learned how to function as independent learners. This idea relates to the theoretical framework of the social learning theory (Bandura, 1977). Although the original thought of self-efficacy being a major point in the study did not materialize, the theory held true as the participants in the study showed how they were able to persevere and succeed in an environment in which they were not completely fond.

Now that this topic has been studied and researched, information has been revealed about how students perceive learning introductory mathematics in the online environment in higher education. Students want convenience. They want instructors who show they care. They want to understand the concepts and be successful. Administrators and instructors can use this information to meet these needs and prepare courses to help students succeed.
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APPENDIX A

The research included a questionnaire distributed to the participants which contained open-ended questions. The questionnaire is below.

1. What did you like most about taking an introductory college mathematics course in an online learning environment?
2. What did you like least about taking an introductory college mathematics course in an online learning environment?
3. Tell me why you believe you had a successful/unsuccessful experience completing your introductory college mathematics course in an online learning environment.
4. Tell me why you felt connected/unconnected to your online teacher of introductory mathematics.
5. Tell me why you felt connected/unconnected to the other students in your online introductory mathematics course.
6. In general, what are your thoughts on online education?
7. Why would you recommend/not recommend taking introductory mathematics courses in an online environment to other students?
8. Tell me why you had a positive/negative experience of learning mathematics in the online environment.
APPENDIX B

The research included an interview with each participant. Listed below are the interview questions asked by the researcher.

1. Tell me about yourself.
2. What is your educational background?
3. What are your thoughts on online education?
4. What are your thoughts about learning introductory mathematics in the online environment?
5. What practices do you think are helpful for students who learn mathematics in the online environment?
6. What are your personal beliefs about learning mathematics in the online environment?
7. How would you describe your experience of learning mathematics in the online environment?
8. How would you describe your relationship to your online instructor?
9. What traits do you believe students should possess in order to be a successful learner of mathematics in the online environment?
10. What traits do you believe instructors should possess in order to be successful teachers of mathematics in the online environment?
11. If you have participated in face-to-face traditional learning, how would you compare the online experience to the traditional experience?
12. How could the online experience of learning introductory mathematics on the college level be improved?
APPENDIX C

The research use focus groups to gain additional insight into the study. Listed below are questions asked.

1. What did you like most about learning introductory mathematics in the online college environment?

2. What did you like least about learning introductory mathematics in the online college environment?

3. What would you like to tell the other students in this group about your experience in the online classroom?

4. What would you like to know about the experiences of the other students in this class in the online learning environment?

5. Would you recommend taking introductory mathematics in the online environment to a fellow college student? Why or why not?

6. Why did you choose to take this course in the online environment?

7. Would you take another course in the online environment?

8. If you have taken other courses online, how would you compare taking mathematics online as compared to other content areas?

9. Tell us how communication worked in your online class with your instructor and with your fellow classmates.

10. Do you believe you understood the content of this course? Why or why not?
APPENDIX D

Below is the information that appeared on the flyers to recruit participants for the study.

Are you 18 years of age or older?

Have you completed an online mathematics course on the college level?

If you answered yes to either of these questions, you may be eligible to participate in a research study about how students perceive learning math in an online environment.

The purpose of this research study is to gain student perception of learning introductory mathematics in the online environment in higher education. Participants will be asked to complete a questionnaire (15-45 minutes), take part in an interview (15-60 minutes), and be a part of a focus group discussion (1-2 hours). The questionnaire and interview may be completed in one meeting. The focus group discussion date will be determined once all questionnaire and interviews are completed. Participants will also receive a $20 dollar gift card.

Jamie Brooks, a doctoral student in the School of Education at Liberty University, is conducting this study.
APPENDIX E

CONSENT FORM

Student Perception of Learning Introductory Mathematics in an Online Environment in Higher Education

Jamie Brooks

Liberty University

School of Education

You are invited to be in a research study of learning introductory mathematics in an online college environment. The student will focus on gaining student perception of learning mathematics in the online environment. You were selected as a possible participant because you have completed an introductory mathematics course on the college level and are 18 years of age or older. Please read this form and ask any questions you may have before agreeing to be in the study.

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

Background Information: The purpose of this study is to gain an understanding of how students perceive learning introductory mathematics in the online environment in higher education. The central research question is: “What are the lived experiences of students who have completed introductory college mathematics courses in the online learning environment?”

Procedures: If you agree to be in this study, I would ask you to do the following things:
1. Participants will be asked to complete a questionnaire containing open-ended questions about learning mathematics in the online college environment. This task should take between 15 – 60 minutes.
2. Participants will be interviewed in a face-to-face setting by the researcher. The researcher will audio-record the interview. The interview should last 30 -60 minutes.
3. Participants will take part in a focus group of 8 -12 participants in which thoughts on perceptions of learning mathematics in the online learning environment will be discussed. This should take between 1- 2 hours and will be audio recorded.

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

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

Benefits to society include the idea that information gained from learning about how students perceive learning introductory mathematics in the online environment in higher education could
provide insight to instructors and administrators who create/teach such courses. Such information could be used to attempt to improve the methods in which students learn through the design/delivery of the courses.

**Compensation:** Participants will be compensated for participating in this study. Participants will be given a $20 gift card at the focus group discussion for participating in the study.

**Confidentiality:** The records of this study will be kept private. Research records will be stored securely, and only the researcher will have access to the records.

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

**Voluntary Nature of the Study:** Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University, Penn State Fayette, or Westmoreland County Community 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 the researcher at the email address/phone number included in the next paragraph. Should you choose to withdraw, data collected from you, apart from focus group data, 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:** The researcher conducting this study is Jamie Brooks. You may ask any questions you have now. If you have questions later, you are encouraged to contact her at 724-366-4176 or jbrooks1@liberty.edu. You may also contact the researcher’s faculty chair, Dr. Carol Gillespie, at cagillespie2@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the Institutional Review Board, 1971 University Blvd., Green Hall Ste. 2845, Lynchburg, VA 24515 or email at irb@liberty.edu.

*Please notify the researcher if you would like a copy of this information for your records.*
Statement of Consent: I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

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

______________________________________________________________________________
Signature of Participant                  Date

______________________________________________________________________________
Signature of Investigator                  Date
December 7, 2018

Dear Jamie Brooks,

The IRB protocol (IRB# 200021) regarding your study entitled, “Student Perception of Learning Introductory Mathematics in the Online Environment in Higher Education,” has been approved by exempt review.

Your protocol is provided approval in accordance with the “Categories of Research That May Be Reviewed by the Institutional Review Board (IRB) through an Expedited Review Procedure” as published by the OHRP, 45 CFR 46.110 and FDA 21 CFR 56.110. This protocol is specifically granted approval per the categories listed by the Federal Office for Human Research Protections, which lists the following description for the category of your protocol, “Research involving the use of educational tests or surveys in a non-identifiable manner.”

All research must be conducted in accordance with this approved submission, meaning that you will follow the research plan you have outlined here, use approved materials, and follow data security policies. Any significant change to the protocol requires a modification approval prior to altering the project. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.

Please contact me if you have questions.

Lindsay Herrod
Dean/Planning, Assessment, and Institutional Effectiveness
Westmoreland College
Youngwood, PA  15697-1898
724-925-4059
APPENDIX G

February 14, 2019
Dear Jamie Brooks,

The IRB protocol (IRB# 200021) regarding your study entitled, "Student Perception of Learning Introductory Mathematics in the Online Environment in Higher Education," is approved by [Redacted].

Your protocol is provided approval in accordance with the "Categories of Research That May Be Reviewed by the Institutional Review Board (IRB) through an Expedited Review Procedure" as published by the OHRP, 45 CFR 46.110 and FDA 21 CFR 56.110. This protocol is specifically granted approval per the categories listed by the Federal Office for Human Research Protections, which lists the following description for the category of your protocol, "Research involving the use of educational tests or surveys in a non-identifiable manner."

All research must be conducted in accordance with this approved submission, meaning that you will follow the research plan you have outlined, use approved materials, and follow data security policies. Any significant change to the protocol requires a modification approval prior to altering the project. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity.

Please contact me if you have questions.

Sincerely,

[Redacted]

Chancellor and Chief Academic Officer
APPENDIX H

February 15, 2019

Jamie Brooks
IRB Approval 3565.021519: Student Perception of Learning Introductory Mathematics in an Online Environment in Higher Education

Dear Jamie Brooks,

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

Your study falls under the expedited review category (45 CFR 46.110), which is applicable to specific, minimal risk studies and minor changes to approved studies for the following reason(s):
6. Collection of data from voice, video, digital, or image recordings made for research purposes.

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies. (NOTE: Some research in this category may be exempt from the HHS regulations for the protection of human subjects. 45 CFR 46.101(b)(2) and (b)(3). This listing refers only to research that is not exempt.)

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
Research Ethics Office

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