COMMUNITY COLLEGE STUDENTS' PERSPECTIVES REGARDING THEIR REMEDIAL MATHEMATICS PLACEMENT

by

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ABSTRACT

Many students are entering college underprepared for college-level, credit bearing mathematics courses, and they are also having difficulty completing the remedial coursework that is required before they can move on to credit-bearing courses. The purpose of this exploratory qualitative research study is to gain an understanding of students' perceptions regarding their remedial mathematics placement. There is little research that takes into account student perspectives when trying to understand why so many students are entering college underprepared for credit bearing mathematics courses. Two-hundred sixty-seven students enrolled in remedial elementary algebra math courses were asked to voluntarily complete a survey online regarding their prior math experiences and their plans to overcome their remedial placement. One-hundred fifty-nine students completed the survey and sixty-seven students volunteered to participate in a follow-up interview. Twelve of these participants were then selected for follow-up interviews to gain a more in-depth understanding of their experiences. Results of the study indicated that participants attribute their remedial mathematics placement to a lack of mathematical knowledge/understanding, time between math courses, negative experiences with teachers, a lack of effort in high school, and lack of information and guidance regarding the college placement test. Participants planned to study and see a tutor to overcome their remedial mathematics placement.

DEDICATION

This dissertation is dedicated to my family and friends who supported me throughout the process. A special feeling of gratitude to my mom whose continual prayers and words of encouragement kept me motivated when I wanted to give up. To my sisters Liz, Mary, Adrianne, and Linda, who by far were my biggest cheerleaders and never doubted I could finish this project, words cannot express how much your support has meant to me.

LIST OF ABBREVIATIONS

CBMS	Conference Board of the Mathematical Sciences
CCSS	Common Core State Standards
CCSSO	Council of Chief State School Officers
FTE	Full time equivalent
NADE	National Association for Developmental Education
NBPTS	National Board of Professional Board Teaching Standards
NCES	National Center for Educational Statistics
NCLB	No Child Left Behind
NCTM	National Council of Teachers of Mathematics
NELS	National Education Longitudinal Study
NGA	National Governors Association

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CHAPTER 1 INTRODUCTION

A college education is often required before one can enter a desired field in the workforce. After graduating from high school, many students enter college to pursue a degree or to receive technical training to prepare them for today's workforce. It has been estimated that by 2018 there will be roughly 50 million new jobs, and the majority of those jobs will require some post-secondary training (Carnevale, Smith, & Strohl, 2010). This demand has caused an increase in the number of students entering college each year. According to the National Center for Education Statistics (NCES, 2012), first-time freshman enrollment at all degree-granting institutions increased by 37% from 2000 to 2010. It is expected to increase by a further 15% from 2010 to 2021 (NCES, 2013).

The job market has caused an increase in college enrollment for many reasons. One reason college enrollment is increasing is because graduates, on average, earn more lifetime wages than individuals with just a high school diploma (Zeidenberg, 2008). College enrollment is also increasing because jobs today require the use of technology, which has increased the demand for workers with greater math skills and post-secondary training (Golfin, Jordan, Hull, &Ruffin, 2005). This has increased the need for highly skilled workers with a college education and, in turn, increased the demands placed on post-secondary institutions (Phipps, 1998; Pretlow & Wathington, 2011).

Some of these students, however, are entering college underprepared for much of their coursework. Researchers estimate that anywhere from 30% to 60% of first-time College students require remediation (Bailey, 2009; Calcagno & Long, 2008; McCabe, 2000). After students are admitted to post-secondary education, they are most often required to take a placement test to determine if they meet a given level of academic proficiency in reading, writing and mathematics. Students entering college underprepared for post-secondary education coursework are being required to take remedial or developmental courses. Cohen and Brawer (2008) state, "Remedial, developmental, and less often, compensatory and basic skills, have been used more or less interchangeably for courses designed to teach literacy, the essentials of reading, writing, and arithmetic plus broader skills for living"(p. 292). As Merisotis and Phipps (2000) point out, because there are no agreed upon standards of what constitutes remedial, standards vary from institution to institution.

Community colleges provide the largest sources of remedial instruction (Golfin, Jordan, Hull, & Ruffin, 2005; McCabe, 2002; Pasad & Lewis 2003). This may be because some states have been focusing remediation at the community college-level for years. The increasing cost of remediation is forcing some states to send students to community colleges because it is cheaper to provide remediation at two-year institutions (Boylan & Saxon, 2001; Calcagno & Long, 2008; Zeidenberg, 2008).

Although the exact number of college students requiring remediation each year is unknown, many researchers (ACT, 2013; Attewell, Lavin, Domina, & Levey, 2006; Bailey, 2009; Calcagno & Long, 2008; Mcabe, 2000) have conducted studies estimating the percentage of students entering college underprepared. Among entering students, McCabe (2000) found that 41% of community college students and 29% of all college students are underprepared in

reading, writing, and/or math. Similarly, Calcagno and Long (2008) state 35% to 40% of first-time college students are placed into remedial courses each year. Using an Achieving the Dream database of 250,000 first-time community college students, Bailey (2009) found that 59% of students enrolled in at least one developmental education course. However, Bailey (2009) believed that this was a slight underestimation and it was more likely "that two-thirds or more of community college students enter college with academic skills weak enough in at least one major subject area to threaten their ability to succeed in college-level credit-bearing courses" (p. 3). With a sample of entering community college students in 2000, Attewell, Lavin, Domina, and Levey (2006) estimated that roughly 60% of the students were enrolled in at least one remedial course, approximately 40% were enrolled in anywhere from one to three remedial courses, and a little less than 15% were enrolled in more than three remedial courses. Lastly, ACT, formerly known as American College Testing (2013), stated that of all the students who took the ACT only 26% met college readiness benchmarks in the four areas (math, English, reading, and science).

Many post-secondary institutions offer remedial courses in reading, writing, and mathematics. More students require math remediation than in any other area (Adelman, 2004; Attewell, Lavin, Domina, & Levey, 2006; Bonham & Boylan, 2012; Boylan & Saxon, 1999a; Martorell & McFarlin, 2011; Merisotis & Phipps, 2000; Parsad & Lewis, 2003). Courses in mathematics have traditionally been a gateway, or gatekeeper, to degree completion in higher education (Bonham & Boylan, 2012; Fike & Fike, 1997; George, 2010; Morrison & Schmit, 2010; Schoenfeld, 2002; Seymour & Hewitt, 1997; Stinson, 2004). According to the National Center for Education Statistics, over 70% of post-secondary institutions offer at least one developmental mathematics course (Merisotis & Phipps, 2000; Parsad & Lewis, 2003). When

looking specifically at mathematics remediation rates, Bahr (2008) found that 80% of first-time freshman enrolled in a remedial math course and, given this high rate of enrollment, remediation is essential. Without a remedial math course, “substandard math skills can hinder a student’s ability to succeed in other university courses and meet graduation requirements” (Johnson & Kuennen, 2004, p. 25).

Developmental mathematics education usually includes remedial coursework, tutoring centers and varying forms of individualized instruction (Boylan & Saxon, 1999a). Requiring remedial coursework is the most frequently used method for helping students who are under-prepared for college-level coursework (Bettinger & Long, 2009; Brothen, & Wambach, 2004; Calcagno & Long, 2008). Generally, students do not receive college credit for completing remedial and developmental courses, but the courses must be completed before the student can enroll in a college-level, credit bearing mathematics course (Howard & Whitaker, 2011). The topics covered in these courses usually range from basic math skills up to introductory algebra. These topics should have been mastered in high school, middle school, and even as far back as elementary school. One concept taught in remedial mathematics, for example, is adding and subtracting fractions. This concept is supposed to be taught in elementary school in the fifth grade (CCSS.Math.Content.5.NF.A.1). Another concept taught in remedial mathematics is writing and evaluating algebraic expressions. This concept is supposed to be taught in middle school in the sixth grade (CCSS.Math.Content.6.EE.A.2). Lastly, solving equations is taught in remedial mathematics and this concept is supposed to be taught in high school algebra (CCSS.Math.Content.HSA-REI.B.3).

Critics of remedial programs argue that remediation costs taxpayers twice because colleges are teaching academic skills that students should have already learned in high school or

earlier (Bahr, 2008; Boylan & Saxon, 2001; Merisotis & Phipps, 2000 Zeidenberg, 2008). Post-secondary institutions and states use a significant amount of resources on remediation. Some estimate that public colleges spend around one billion dollars annually on remedial education (Boylan & Saxon 2001; Breneman & Harlow, 1998 cited from Calcagno & Long, 2008). Out of frustration with these expenses, some states have even begun to mandate that remedial courses not be offered at public institutions (Cohen & Brawer, 2008). In West Virginia, for example, non-credit or non-degree courses are, by law, not included in the tuition costs for students at public four-year institutions of higher education who receive state funding (Cohen & Brawer, 2008). The additional cost of remediation cannot be paid for directly from financial aid, but can be paid for with financial aid refunds after books, tuition, and other fees have been paid.

Proponents argue that remediation pays for itself. Institutions benefit from successful remediation because they are able to retain more students and generate more revenue from tuition, and society benefits by having an educated and productive workforce (Gallard, Albritton, & Morgan, 2010). Students who successfully remediate become regular attendees who pay tuition (Phipps, 1998). When colleges offer remedial education they are implying they understand the importance of creating opportunities for everyone (Gerlaugh, Thompson, Boylan, & Davis, 2007). In a highly developed society, all citizens must be able to demonstrate basic skills to participate fully (Bahr, 2008). Students who obtain a college education are contributing to society as a whole; they generate more tax dollars, have a statistically lower crime rate, and a higher quality of life (Phipps, 1998).

Even with the resources that colleges and universities provide, remediation may not always help students. The National Education Longitudinal Study (NELS), which includes students who entered two-year and four-year, private and public, selective and nonselective

colleges, found that only 30% of these students who pursued vocational training, as well as two-year and four-year degrees, pass all their remedial math courses on the first try (Attewell, Domina, & Levey, 2006). It was also noted that fewer than 25% of students who take remedial courses finish a degree or certificate within eight years (Attewell, Domina, & Levey, 2006). After a conducting a literature review on the usefulness of developmental programs at two-year colleges, Bailey (2009) argued that developmental education does not seem to help students with their academic deficiencies. It has also been shown that non-developmental students graduate at higher rates than developmental students (Easterling, Patten, & Krile, 1998). Students who successfully remediate should have academic outcomes equivalent to non-developmental students. Calcagno and Long (2008) indicated that remedial education does not increase the chances that students will earn college credits or complete a degree. The National Center for Educational Statistics (NCES, n.d.) supports the claim, "…that despite assistance offered through remediation, students enrolled in remediation are less likely to earn a degree or certificate" (para. 2). Not many students successfully remediate, and the ones who do are usually the ones who had the fewest academic deficiencies to begin with (Bahr, 2008). Remediation adds time and courses to a student's college career and "by increasing the number of requirements and extending the time to degree, remediation may negatively impact student outcomes such as persistence, major choice, and eventual labor market returns" (Bettinger & Long, 2009, p. 737).

To complicate matters students who have multiple skill deficiencies are less likely to remediate successfully. Bahr (2007) conducted a longitudinal study aimed at determining the effects of multiple basic deficiencies on the likelihood of successful remediation. Specifically, Bahr wanted to determine the effects that varying levels of math deficiency and English proficiency would have on mathematics remediation. Results indicated that the poorer the

student's English skills, the increased negative impact of math deficiency on the likelihood of remediating successfully in mathematics. It was noted that the likelihood of successful math remediation is very low.

These findings indicate that remediation is likely more ineffective than effective. However, it is a necessary and essential part of the public education system for non-fault students or career changers to remediate successfully. Many students who have not mastered the concepts before entering post-secondary education struggle to complete their remedial mathematics coursework and progress on to college-level mathematics courses. The difficulty some students face in trying to pass the remedial mathematics coursework can be frustrating to them and may lead them to drop out before completing a degree or to an increase in the time needed to complete a degree (Zeidenberg, 2008).

Statement of the Problem

Many students are entering post-secondary education underprepared for credit-bearing mathematics courses and remediation does not always appear to be successful. Research is needed to address students' perspectives with respect to remediation in post-secondary institutions. Most prior research has found that students are placed in remedial mathematics courses due to issues in the K-12 system and to student characteristics such as self-efficacy and motivation. Students' perspectives have not been given much attention in the research related to remedial mathematics (Howard, 2008; Koch, Slate, & Moore, 2012; Schornick, 2010; Weinstein, 2004). The voice of students who have placed in remedial mathematics courses may provide information needed to better understand why they are not learning. Students' thoughts can influence their behavior (Bandura, 1986). To successfully remediate students or prevent the need for remediation altogether, research needs to address all the potential issues, including student's

perceptions about the problem. Therefore, the problem for this study is that many students who are entering college underprepared for college-level credit bearing mathematics courses are also having difficulty completing the remedial coursework that is required before they can move on to credit-bearing courses.

Purpose and Research Questions

The purpose of this qualitative research study is to gain an understanding of students' perceptions regarding their remedial mathematics placement. The research questions for this study are:

(1) What are the factors remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial mathematics?

(2) What do remedial mathematics students perceive as a resolution to their difficulty in mathematics and current placement in remedial mathematics?

Rationale and Significance of the Study

There is little research that takes into account student perspectives when trying to understand why so many students are entering post-secondary education underprepared for credit bearing mathematics courses. This study will contribute to the existing remediation literature by exploring perspectives of students entering post-secondary education in remedial mathematics courses. Because a large number of students are not only placing in remedial mathematics courses, but also having difficulty passing the remedial mathematics courses, it is important for us to gain a better understanding of why these students are placing in these courses and also struggling to successfully remediate. We must begin to understand the difficulty these students face in trying to succeed. Public policy must focus on the following two goals: implementing strategies that reduce the remediation rates and improving remedial programs in post-secondary

institutions (Phipps, 1998). A better understanding of students' perceptions about why they failed to learn the necessary mathematics concepts can help all educators change the way mathematics is being taught in their classrooms, as well as help educators address any student misconceptions. The results of this study can help inform educational practice and policy in higher education and in the K-12 system.

Theoretical Framework

The theoretical framework for this study is social exploratory research. According to Babbie (2009) the purpose of social research is exploratory, explanatory, or descriptive, but most studies have elements of all three. The goal of social research is to find patterns of regularity in everyday life. Exploratory research is usually done "to satisfy the researcher's curiosity and desire for better understanding, to test the feasibility of undertaking a more extensive study, and to develop the methods to be used in a subsequent study" (p. 92). This type of research is done "when a researcher is examining a new interest or when the subject of study is relatively new and unstudied" (p. 92). Exploratory studies are necessary when a researcher is exploring something new, and these studies usually produce fresh insight into a topic for future research. Moreover, exploratory social research can dispel misconceptions that will help focus future research.

According to Stebbins (2001), exploration can also be thought of as a perspective, or a way of approaching and carrying out a social study and reporting on what has been learned. He defines social exploratory research as:

> "a broad-ranging, purposive, systematic, prearranged undertaking designed to maximize the discovery of generalizations leading to description and understanding of an area of social science or psychological life. Such exploration is, depending on the standpoint taken, a distinctive way of conducting science-scientific process-a special methodological approach, and a pervasive personal orientation of the explorer. The emergent generalizations are many and varied;

> they include the descriptive facts, folk concepts, cultural artifacts, structural arrangements, social processes, and beliefs, and belief systems normally found there" (p. 3).

It is the "preferred methodological approach when a group, process, activity, or situation has received little or no systematic empirical scrutiny" (p. 9). Unfortunately, exploration is typically seen as messy, directionless, time consuming and fraught with possible disappointments, among many other unwarranted qualities. But it should be seen as a process that does not unfold within individual studies, but across several studies. The early flaws in of the study tend to get corrected over the course of several studies. The results of these procedures and the purpose of exploration is the creation of inductively derived generalizations that the researcher can weave into grounded theory. Because the process usually happens over the course of several studies, exploration comes to a halt only when the researchers believe that there are no significant new ideas that can come from further open-ended investigation, at which point pressing confirmatory issues begin to dominate.

Exploratory studies have some disadvantages. They are often inconclusive and not generalizable. Exploratory research will result in a range of possible solutions to a specific problem, whereas, conclusive research will identify the one solution (Babbie, 2009). Exploratory studies seldom provide answers to research questions; however they provide possible solutions as well as guidance for later studies. The main reason exploratory studies are inconclusive is because the sample studied may not be representative of the population (Babbie, 2009). But, as mentioned earlier, if a researcher uses the results of the initial exploratory studies to continually study the topic of interest, the researcher may be able to eventually provide generalizable and conclusive findings.

This framework was chosen because there is limited prior research regarding the perspective of remedial mathematics students and exploratory research allows for the exploration of topics in which there is limited research. The researcher hopes to use the results of this study to guide later research involving remedial mathematics students.

Overview of Methodology

The researcher used qualitative research methods for this study. Qualitative research provides methods that best investigate the research questions of this study. The questions for this study focus on understanding students' perceptions regarding their remedial mathematics placement, and as Creswell (2009) states "qualitative research is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (p. 4). The research was conducted using a phenomenological focus, in which, the researcher seeks to understand the meanings that experiences hold for each individual (Creswell, 1998) and perceptions are the primary source of knowledge (Moustakas, 1994). For this research study, the phenomenon is students' perceptions of the prior mathematics experiences in relationship to their current remedial mathematics course placement, as well as their perceptions on successful completion.

This study was conducted in two phases. In the first phase, students were asked to voluntarily complete a qualitative survey containing demographic and background questions along with open-ended questions regarding their remedial mathematics placement. Based on the themes identified from the survey, the researcher selected students who could provide more details about each of the themes to participate in the second phase of the study. In the second phase of the study, participants were interviewed to gain more insight. Both traditional and nontraditional students were included in this study.

To improve the credibility of the study, the researcher employed peer reviews through external audit, member checking, and triangulation. An instructor at the research site, familiar with qualitative research, who was not involved with the project, was asked to review the study. An additional data-coder was also used in data analysis to verify themes. To further verify the credibility of the study, the researcher asked participants who completed interviews to review the research findings for accuracy. Finally, the perspectives of multiple individuals were included in this study, which aided in the triangulation of the findings.

The final report includes a narrative description of the study. Creswell (2009) states that "the basic procedure in reporting the results of a qualitative study are to develop descriptions and themes from the data, to present these descriptions and themes that convey multiple perspectives from participants, and include a detailed description of the settings and individuals" (p. 193).

Limitations of the Study

In qualitative research, limitations are "often related to inadequate measures of variables, small sample size, errors in measurement, and other factors typically related to the data collection and analysis" (Creswell, 2005, p. 593). The first limitation of this study is that only participants who volunteered completed the survey. Of the 267 students enrolled in the remedial math course Math 098, only 159, or 60%, completed the survey. The perspectives of the students not completing the survey may not be represented in the findings. The second limitation of this study is that only participants who volunteered were selected for follow-up interviews. The researcher could only select participants who indicated they were willing to participate in a follow-up interview, and who included their name and contact information. Therefore there may have been other students who could have possibly provided more details regarding their experiences, but the researcher was limited to the 67 students who volunteered for follow-up

interviews. The third limitation of this study is that the data collected included only self-reports by students. Student could have been dishonest about their experiences or failed to accurately assess the factors related to the remedial placement due to a wide range of influences.

Delimitations of the Study

There are several delimitations of this study. First, data were collected from only one institution and therefore the findings cannot be generalized beyond the community college in this study. Second, only students enrolled in the remedial mathematics course Math 098 were invited to participate in this study. Therefore the perspectives of remedial math students enrolled in a lower level remedial mathematics course are not included in this study. Third, findings from the interview data cannot be generalized past the individuals interviewed. The sample was not representative of the population or the populations of similar studies. Fourth, researcher effects may have influenced coding process. The researcher and additional coder are both math faculty at the community college, and prior to conducting the study discussed possible findings. Therefore themes may have been misinterpreted or not identified. Fifth, the researcher's bias may have impacted the interview sampling. Purposeful sampling was used to select interviews participants. These selections were based on the researcher's beliefs and criteria stated in chapter four. Lastly, the researcher primarily selected interview participants based on the five themes identified for research question one, because the responses for research question two were not very detailed. Consequently, it is possible that students were eliminated from the interview pool that could have provided information regarding the themes for research question two.

Assumptions

The following are assumptions of this study: (1) the participants responded honestly to all survey and interview questions; and (2) a K-12 education should have prepared students for college-level coursework.

Definition of Terms

(1) *Credit-bearing courses*: courses that count towards a degree.

(2) *Non-credit bearing courses*: courses that do not count towards a degree.

(3) *Non-traditional Students*: Students who have been out of school for a prolonged period of time and have decided to enroll in college.

(4) *Post-secondary education*: all collegiate levels after high school

(5) *Remedial courses*: The term remedial is synonymous with developmental; courses in reading, writing, and mathematics for students that are underprepared for college-level coursework (Merisotis and Phipps, 2000)

(6) *Remedial students:* Students enrolled in the remedial courses.

(7) *Traditional students*: Students who have continued their education soon after high school without a lengthy break.

Study Overview

This chapter provided an introduction to the research study. The following chapter provides a review of the related literature. A detailed description of the methods is provided in chapter 3. The data collection is presented in Chapter 4 and discussed in Chapter 5. Chapter 5 includes implications for practice and recommendations for future research.

CHAPTER 2 REVIEW OF THE LITERATURE

Chapter Introduction

College remediation dates back to the beginning of higher education in the United States. Although its use has been widespread, there is not a clear definition of what it entails or who actually benefits from it. It is seen both as a necessary and unnecessary expense, and the effectiveness of remediation is an area of concern. Researchers have tried to figure out exactly why students are leaving high school underprepared, in hopes of eliminating or reducing the need for remediation, as well as reducing attrition in post-secondary education. However, very few researchers have included the perspective of the remedial students in their search for a solution to this growing problem.

This literature review will provide a brief history of remediation. This review will address the costs to provide remediation and other issues surrounding remediation. The effectiveness of remediation will be discussed. The possible reasons why the need for remediation exists will be presented, as well as a few research studies similar to the proposed study.

The History of Remediation

College remediation is not a new concept. Remedial coursework has been a consistent part of the curriculum at post-secondary institutions since the colonial era (Breneman & Haarlow, 1998, cited from Merisotis & Phipps, 2000). Initially a college education was only for the wealthy and consisted of mainly Latin-language-based education. According to Merisotis and

Phipps (2000), Harvard had to provide tutors in Greek and Latin for its underprepared students. The tradition of Latin-language-based education continued until the late 1700s (Dotzler, 2003).

In the 1800s a number of private colleges were founded for men who could afford to pay their own tuition, just as the country was beginning to fund public schools (Dotzler, 1994). Admission policies varied in the early colleges because they were established before public education became widespread (Cohen & Brawer, 2008). Colleges had to provide tutors for underprepared students, and in the mid-1800s the University of Wisconsin became the first college to develop a remedial education department (Boylan & White, 1994).

In 1862 the Morrill Federal Land Grant Act aided in the formation of agricultural and mechanical colleges (land grant colleges) in each state, to serve the war effort and to help with the increasing educational demands of students wanting professional, technical and business training (Boylan & White, 1994 cited from Dotzler, 2003). The philosophy guiding the formation of these colleges was that higher education needed to focus on more practical subjects (Markus & Zeitlin, 1998). This welcoming of the middle class into public post-secondary education led to a tremendous need for remedial education. In order to meet the needs of the underprepared, most higher education institutions established remedial education programs (Boylan& White, 1994 cited from Dotzler, 2003).

The late 1800s and early 1900s saw the establishment of colleges to serve the needs of women and newly freed slaves, and the primary function of these schools was to provide the substantial compensatory education needed to bring college-level education to students who had been largely denied a secondary education (Boylan & White, 1994 cited from Dotzler, 2003). By 1915, issues related to educating underprepared students caused over 350 colleges and

universities to form departments specifically for remediation (Markus & Zeitlin, 1998). Because of the competition for students, underprepared students continued to be accepted at post-secondary institutions. More than half the students enrolled in the nation's tops schools did not meet admissions standards and were placed in remedial courses (Merisotis & Phipps 2000).

During the 1940s, the demand for community colleges began to emerge. In 1944 the G. I. Bill offered federal subsidies to almost twenty million veterans who had served honorably in the armed forces (Markus & Zeitlin, 1998). Veterans were provided access to education at little or no cost, and by 1947 veterans made up almost half of all college students (G. I. Bill, nd, cited from Dotzler, 2003). This led to the demand for hometown post-secondary institutions and technical institutions. The first junior colleges of the early 1900s became the community colleges of modern America (Boylan & White, 1994 cited from Dotzler, 2003).

According to Cohen and Brawer (2008), President Truman's Advisory Commission on Higher Education in 1947 further increased the need for community colleges. The commission recommended that post-secondary education be made available to all those who could possibly benefit from the experience, and the key to accomplishing this goal was the establishment of a network of publicly supported two-year colleges. The community colleges bore the impact of the underprepared students and responded to the challenge by opening their doors to all students.

"As the number, caliber and range of students enrolled in institutions of higher education increased, so to, did the problems facing the universities concerning student preparedness" (Markus & Zeitlin, 1998, p. 169). The Civil Rights Act of 1964 and the Higher Education Act of 1965 allowed thousands of students to be admitted to post-secondary institutions (Boylan 1990, cited from Payne and Lyman, 1998). Academic deficiencies did not prevent students from enrolling in college, and federal and state aid minimized the financial barriers normally

associated with attending college (Markus & Zeitlin, 1998). Markus and Zeitlin (1998) found that post-secondary education faculty members believed that the basic skills deficiencies shown by entering freshman belonged in the domain of the high schools, but colleges and universities continued to offer remedial classes. They did so to increase their enrollment and funding, as well as to meet the needs of the general public. The welcoming of these new students led to an increase in the number of developmental programs and services, and labels "such as preparatory studies, academic support programs, compensatory education, learning assistance and basic skills, multiplied as well" (Payne & Lyman, 1998, p. 18).

According to Payne and Lyman (1998), "in the late 1960s and early 1970s, during the baby boom wave of underprepared students, significant amounts of money were allocated for delivery of basic skills programs" (p. 20). Unfortunately, funds for research and evaluation of these programs were not given much priority. These programs varied widely which made them difficult to research and evaluate.

In the late 1900s remedial education, became a permanent fixture at almost all of America's post-secondary institutions, from the local community college to Ivy League colleges (Boylan & White, 1994 cited from Dotzler, 2003). Currently, although developmental education is recognized at most institutions of higher learning, there is not a nationwide curriculum or set of standards that guide these programs. The number of institutions offering remedial courses remained stable until policy changes in the 1990s that removed remedial courses from many four-year state universities (Merisotis & Phipps, 2000).

According to Cohen and Brawer (2008), many efforts have been made to unify college admissions policies. In the late 1800s the National Education Association formed a committee to

develop a curriculum for secondary education, and in the early 1900s the College Entrance Examination Board started offering common exams for college admissions. However with the wide variety of colleges and universities in the United States, there has never been a uniform set of admission standards. Even now, the Educational Testing Service and ACT Program offer uniform examinations, but each institution of higher education decides its own admission standards.

The demand for remedial education has grown over the last 30 years due to an increase in college admissions and the need for highly skilled workers (Handle & Williams, 2011). As Merisostis and Phipps (2000) state, "The days when all students who enrolled in college were adequately prepared, all courses offered at higher institutions were "college-level," and students made smooth transitions from high school to college simply never existed and they do not exist today" (p. 69). Colleges and universities have been accepting underprepared students for over 200 years and at the same time struggled to figure out how to meet their needs (Casazza, 1999). Post-secondary remediation provides students a second opportunity to develop the minimum skills necessary to be a productive citizen, as well as giving them an opportunity to acquire the skills necessary for college-level coursework (Bahr, 2008). Unfortunately, very little progress has been made in reducing remediation rates. However without some level of post-secondary education, these students may not be able to provide comfortably for themselves or their families (Killian, 2009), and will be marked for unemployment or a life in poverty.

Defining Remedial/Developmental Education

There are many terms used to identify underprepared college students, including disadvantaged, nontraditional, high risk, developmental, and remedial (Markus & Zeitlin, 1998). The process of preparing these students for college-level coursework is commonly known as

remedial education, although, many educators prefer less stigmatizing terms such as developmental or college preparatory (Attewell, Lavin, Domina, & Levey, 2006). According to Payne and Lyman (1998), developmental education seems to have an identity crisis because it cannot decide on a name and stick with it. In 1976, the field finally decided on the name of developmental education instead of developmental and remedial education.

Traditionally phrases like remedial, underprepared, extra assistance, preparatory departments, and developmental have often been grouped together and used interchangeably (Casazza, 1999). The literature usually distinguishes remedial coursework from developmental coursework based on whether the coursework is being retaken (remedial) or if it is new (developmental) (Bettinger & Long, 2009). However, some educators also feel that developmental education is more complex than just providing coursework in a particular subject area. This can be seen in the National Association for Developmental Education's (NADE) formal definition of developmental education. NADE defined developmental education as:

> A comprehensive process which focuses on the intellectual, social, and emotional growth and development of all learners. Developmental education includes, but is not limited to, tutoring, personal and career counseling, and academic advisement and coursework. It promotes the cognitive and affective growth of all learners at all levels of the learning continuum. It is sensitive and responsive to the individual differences and special needs among learners" **(**NADE Executive Board, 1998 cited from Casazza, 1999).

In short**,** developmental education refers to programs and services designed to meet the needs of students who are not prepared for college-level coursework (Payne & Lyman, 1998). Both developmental and remedial programs are centered on coursework below credit-bearing college-level coursework, and as Boylan and Saxon (2001) state, the primary research on this topic refers to the services and the students that benefit from them as remedial. Remedial is the

most frequently used term to describe an underprepared student (Casazza, 1999). Therefore, this research study will primarily use the term remedial, but developmental and remedial may at times be used interchangeably.

Finding a suitable name is not the only issue facing developmental education. According to Merisotis and Phipps (2000) the discussion of remedial education makes one think of courses in reading, writing, and mathematics whose content is below credit-bearing college-level coursework, while the term college-level suggests consensus in the educational community that a course will satisfy a degree or certificate degree program. Unfortunately, what qualifies as remedial is determined by each individual post-secondary institution. There are sometimes different standards within one institution. “There is no objective or generally agreed upon cut-off below which college students require remediation” (Attewell, Lavin, Domina, & Levey, 2006, p. 887). Some students who place in remedial courses do not enroll and are still successful while other students who do not place in remedial courses are unsuccessful (Bailey, 2009).

Currently remediation provides both a second opportunity for students and a way for post-secondary institutions to ensure they are providing students with a quality education (Attewell, Lavin, Domina, & Levey, 2006). There are no set standards on how to effectively remediate students (Bailey 2009). When reviewing remediation practices across six states and over a dozen colleges, Perin (2006) observed that there were just as many approaches to remediation as there were colleges (cited from Bailey 2009). Most colleges offer remedial classes which range from traditional lecture formats to more student-centered models to fully online or computer delivered instruction. Colleges also use formats that require students to utilize tutor lab centers.

Cost of Remediation

According to Merisotis and Phipps (2000), and Saxon and Boylan (2001), data on the cost nationwide for remediation are hard to find because there are numerous roadblocks to obtaining reliable information. Some of the roadblocks include: there are no agreed upon standards of what constitutes remedial education; costs are distributed among several activities within an institution; the distinction between appropriated cost and expenditures is not always indicated; institutions do not report cost regularly; and costs are often underestimated.

However, as stated earlier, Breneman and Haarlow (1998 cited from Merisostis & Phipps, 2000) estimated, from a survey of all fifty states, that the cost of remedial education nationally is about one billion dollars annually out of a public higher education budget of $115 billion. This is approximately 1% of expenditures. Their estimate was later updated to about $1.13 billion (Pretlow & Wathington, 2011). Other researchers have estimated the annual cost of remediation at $1.9 to $2.3 billion dollars in community colleges and another half of billion dollars at 4-year institutions (Strong American Schools, 2008 cited from Bailey, 2009). Community colleges commit considerably more resources towards remedial education, due to their open door admission policies (Mersotis & Phipps, 2000) and regional focus in smaller communities.

According to Merisotis and Phipps (2000), the Breneman and Haarlow (1998) estimate does not consider the following: the cost of remediation at private institutions, the burden placed on students from missed wages, or the cost to society by not developing a productive workforce. Because of all of these factors, Merisotis and Phillips (2000) estimate the cost of remediation at two billion dollars annually, which is still only 2% of higher education expenditures. Using data collected from a review of the literature on studies related to the cost of remedial education,

Saxon and Boylan (2001) estimate that remediation usually costs less than 10% of the entire education budget and is actually only around 1% to 2% of the budget.

A study comparing the cost to educate students in remedial programs with the cost to educate students in core academic programs indicated that remedial programs cost much less than the core academic programs (Phipps, 1998). Remedial courses rarely cost more than what they produce in tuition (Saxon & Boylan, 2001), and remedial education is a more cost-effective investment when compared to alternatives such as unemployment, low-paying jobs, welfare, and prisons, which cost society much more (Gallard, Albritton, & Morgon, 2010; Phipps, 1998).

However, critics of remediation still argue that if students had learned these skills before entering college, taxpayers would not have to pay twice for the same educational opportunities, and the money could be used in other areas of post-secondary education (e.g., Bahr, 2008; Boylan & Saxon, 2001; Merisotis & Phipps, 2000 Zeidenberg, 2008). Some critics also argue that remediation may not always seem to be effective due to the low rates of successful completion (e.g., Bailey, 2009; Calcagno & Long, 2008; NCES, n.d.).

The Effectiveness of Remediation

While the use of remediation is widespread, many researchers believe little is truly known about its effectiveness (Bahr, 2008; Bettinger & Long, 2004; Bettinger & Long, 2005; Bettinger & Long, 2009; Martorell & McFarlin, 2011). This may be because the research regarding the effectiveness of remedial education programs has usually been random or inadequately funded, and has usually yielded inconclusive findings (Merisotis & Phipps, 2000; Payne & Lyman, 1998). Some of the research studies regarding the effectiveness of remediation have yielded mixed results. Researchers' focus has been on varying aspects of remediation

including persistence, retention, and degree completion, passing a remedial mathematic course, and passing a college-level mathematics course. These many foci have made it hard to determine remediation's true levels of effectiveness.

Positive outcomes of remediation. Some studies have indicated developmental education benefits remedial students. Jepson (2006) compared the outcomes of remedial and non-remedial students enrolled at community colleges in California. Only students who were referred by staff members to take remedial courses and who had similar backgrounds were included in this study. Results indicated that remediation had positive effects on both students' persistence and degree completion.

Retention was the focus of another study that indicated positive finding regarding the effectiveness of remediation. Lesik (2007) conducted a three-year study involving over 1200 students enrolled in a 4-year university beginning during the fall of 2000. The purpose of the study was to obtain a causal impact on retention of students participating in a developmental mathematics program. The students participating in the study were students who placed near the cutoff for college-level mathematics. The students who placed below the cutoff were placed in developmental mathematics (intermediate algebra) while students who scored above the cutoff were placed in the college-level mathematics course. By using students who scored just above and just below the cutoff, the researcher felt that she could provide an unbiased estimate of the effect of developmental mathematics on retention. Findings of the study indicated that students who participate in developmental mathematics programs had a significantly lower risk of leaving college when compared with equivalent students who do not participate in such programs. Also noted in this study was the researcher's belief that there is a difference between developmental education and remedial education. The researcher considered the students participating in the

study as developmental, while students at a lower level would be considered remedial. She stated that “remedial mathematics programs, which are considered to be at a lower level than developmental programs, have a very strong presence in the community college curriculum” (Lesik, 2007, p. 605).

To investigate the effectiveness of developmental courses in preparing students for college-level coursework, Waycaster (2001) conducted a study at community colleges in Virginia, which have common system-wide guidelines for developmental courses. Fifteen developmental mathematics classes at five community colleges were involved in this study. Participants included students enrolled in developmental math beginning in the fall of 2000. The students were tracked for three years. The primary variables in this study included: course credit hours, class size, attendance, student gender, teacher gender, class participation rates, methods of instruction, success rates in the courses, retention rates, and graduation rates. The researcher wanted to isolate factors which could positively impact the success of developmental mathematics programs at two-year colleges. Results of the study indicated that attendance was poor by the end of the course, which the author noted was a characteristic of many developmental mathematics courses. Success rates were around 50% across all five colleges. Success rates did not appear to be related to a particular type of instruction. When looking at success in the credit-bearing math course, developmental students did as well as or better than the students who placed directly into the college-level course. Developmental students had higher retention rates than non-developmental students. The researcher believed this was due to the smaller class sizes and special attention developmental students were given through advisement. Lastly, over 40% of the graduates from the five community colleges had taken some developmental courses.

A study conducted to measure the effectiveness of remedial education writing courses on academic performance also indicated positive findings. To determine the effectiveness of remediation, Crews and Aragon (2004) compared students in remedial English with students who placed in remedial English but decided not to take the course. The sample included over 600 students. Students who failed or dropped the course were not included in the sample data. Results indicated that students who participated in the developmental English program had higher GPAs and also had higher grades in the college-level English course. Furthermore, 90% of the students who completed developmental English succeeded in English 101.

Similarly, Southard and Clay (2004) measured the effectiveness of remedial English. Results of the study indicated that the remedial students had better pass and retention rates than non-remedial students in college-level English. The remedial students also required fewer attempts to pass the college-level English course.

Negative outcomes of remediation. Although the previous studies had positive findings, some researchers have obtained negative outcomes regarding remedial education. As mentioned earlier, Bailey (2009), using an Achieving the Dream database containing longitudinal data of 250,000 first-time community college students enrolled in 83 community colleges in 15 states, stated that remedial education is not very effective in overcoming academic deficiencies. This is mainly because most students referred to remedial programs do not complete their remedial coursework. Only about 44% of those who are referred to remedial reading complete all the coursework, and only 31% of those referred to remedial math complete all the coursework.

Negative outcomes were also indicated in a study to investigate the relationship between remedial education and student persistence rates at community colleges. Hoyt (1999) tracked

three freshman cohorts (fall 1993, 1994, and 1995) to determine how many students either graduated, transferred, were currently enrolled, or dropped out of the institution by fall 1998. Results indicated that as the number of remedial areas increased for students, so did their drop-out rates. Also, students who required remediation in reading usually needed remediation in all three areas. Students who needed remediation in two or three areas had higher dropout rates than non-remedial students. Lastly, remedial students had lower first term GPAs than non-remedial students.

Mixed outcomes of remediation. Others studies have had both positive and negative findings in a single study. Seybert and Soltz (1992) conducted a study to determine the effectiveness of remedial reading, English and mathematics courses. Data collection included course grades and pass rates, grades in related college-level courses, overall academic success, and scores on standardized assessments taken prior to and after remedial courses. The students were tracked for four years. Results of the study indicated that students in remedial reading and English courses showed significant improvement on standardized assessment test; remedial course completion rates ranged from less than 40% in some remedial math courses to more than 90% in remedial reading; developmental students' GPAs dropped drastically in the semester after their remedial coursework, but then gradually increased back to their initial GPA; remedial students earned passing grades in college-level courses related to their remedial courses, but had grades and completion rates lower than the college-wide averages for those courses; remedial reading students graduated at a rate slightly higher than 50% of the rate of the entire study body; remedial English students graduated at roughly the same rate as the entire student body; and remedial math students graduated at a rate almost double that of students overall.

To compare the academic outcomes of remedial students versus non-remedial students, Bahr (2008) conducted a large study involving over 85,000 freshman enrolled at 107 community colleges in California during the fall 2005 semester. The study revealed both positive and negative outcomes. The study compared long-term academic outcomes (degree completion and transfer rates) of students who progressed to college-level math coursework by completing remedial coursework with students who progressed to college-level coursework without remedial assistance. The students were tracked for 6 years, and their academic outcomes were tracked for 8 years. The results of the study indicated that the two groups experience comparable outcomes, which indicates that math remediation is effective at resolving academic deficiencies. Unfortunately, only 25% of students remediated successfully. It was noted that a little over 80% of first-time freshman enrolled in remedial math, and 59% of them did not complete a credential or transfer. It was also noted that the probability of successful remediation in math decreases rapidly as the degree of deficiency increases, and that further research is needed to identify the roadblocks that prevent successful remediation.

In a somewhat different study, Boatman and Long (2010) examined the impact of remediation on students at varying levels. The researchers looked at the effects of remediation on students needing one course in remediation compared to student needing several courses. The study included students enrolled at public colleges and universities in the state of Tennessee. They estimated the causal effect of being assigned to a particular level of remediation with the number of credits accumulated over time, persistence, degree completion, and grades in their first college-level course. The researchers looked at both math, which had three levels of remediation, and writing, which had only two levels of remediation. Results indicated that remediation had negative effects on students near the cutoff of needing any remediation, but

students on the opposite end showed some positive results. Students assigned to one remedial course were less likely to complete a college degree in six years and earned fewer credits within three years. However, students at the lowest level of remediation persisted through college and obtained a degree at higher rates than their counterparts in the next highest level course. Results indicated that the effectiveness of remediation depends on a student's level of deficiency.

From these mixed results, it is hard to determine if remediation is truly effective. Also since researchers are focusing on varying aspects of remediation, it is hard to determine if remediation is truly beneficial to students. Many of the studies also suffer from methodological and data limitations (Barh, 2008; Handell & Williams, 2011; Martorell & McFarlin, 2011). These studies draw on generalizations based on single-institution data (Bahr, 2008; Handell & Williams, 2011); lack information about indicators of effectiveness (Handell & Williams, 2011); lack extensive information on students background (Bettinger & Long, 2004); lack longitudinal data (Bettinger & Long, 2004; Calcagno & Long, 2008); lack information regarding institutional remediation policies (Bettinger& Long, 2004); or only provide comparisons between remediated and non-remediated students and do not account for differences between the students (Attewell, Lavin, Domina, & Levey, 2006; Calcagno & Long, 2008; Crews & Aragon, 2004; Bettinger & Long, 2005; Handell & Williams, 2011). Also, some of these studies fail to address the true goal of remediation. As Bahr (2008) states, "Students who remediate successfully should exhibit academic outcomes that are comparable to those students who do not require remediation, all else being equal" (p. 424). In other words, passing a single remedial course does not mean that a student is ready for college-level course nor does simply retaining remedial students indicate that the students are ready for college-level courses.

Rigorous studies. A few researchers have attempted to rectify these methodological issues and dataset limitations and, because of the rigorous nature of their studies, their research has been heavily cited and recommended by other researchers (Bahr, 2008; Bailey, 2009; Calcagno & Long, 2008; Martorell & McFarlin 2011). The first was a study conducted by Attewell, Lavin, Domina, & Levey (2006). The researchers used data from the National Educational Longitudinal Study (NELS), which provides college transcript data from a national cohort of student, to measure the effectiveness of remediation. The data indicated that 40% of the students took at least one remedial course in college. Mathematics remediation was required most frequently, with 28% of the students taking courses in remedial mathematics. Nine percent of the students took remedial reading, almost 20% took remedial English coursework, and 9% took remedial coursework in other areas. The study occurred prior to the removal of some remedial programs from four-year institutions. The researchers controlled for academic preparation, high schools skills and family background, and compared students with equivalent academic backgrounds at different institutions. Findings indicated that students at two-year institutions had a greater probability than students at four-year institutions of taking remedial courses. The same was true for students at public institutions versus private institutions. It was also noted that African American students were more likely than white students to take remedial courses. Findings further indicated that remedial coursework did not negatively impact degree completion at two-year institutions. It did lower the likelihood of completing a degree for students at four-year institutions, though by less than 10%. Results also indicated that taking multiple remedial courses did not negatively impact students at two-year institutions, but it did negatively impact remedial students who took multiple remedial courses at four-year institutions. At four-year institutions, taking multiple remedial reading courses had a negative impact on

graduation but taking multiple remedial mathematics courses or English courses did not. At two-year colleges, taking remedial English and reading improved chances that a student would graduate. However taking remedial mathematics caused a slightly lower graduation rate. Sixty-eight percent of students passed remedial writing and 71% passed remedial reading courses, with most students passing all the remedial courses they were enrolled in. However remedial math courses had a pass rate of only 30%. Students at two-year institutions who successful passed remedial reading had a stronger likelihood of graduating than students at four-year institutions.

The second recommended study was conducted by Martorell and McFarlin (2011). The researchers used a longitudinal dataset of Texas students who entered college in the 1990s. The students were tracked for six years. The sample included over 250,000 two year college students and almost 200,000 four-year college students. The researchers looked at students who placed right above and right below the cut scores for remedial and college-level courses. They attempted to measure student success in college based on academic credit hours earned, performance in the first college math course, years of college completed, and degree attainment. They also examined the outcomes of remediation on wages by using unemployment data to determine whether remediation had an impact on wages earned. Data used in the study were collected from state agencies that handled public K-12 and post-secondary records, as well as state agencies that handled unemployment information. Data collection also included basic demographic information. Results of the study indicated that remediation slightly increased grades in the first college-level mathematics course, but it did not increase the likelihood of actually passing the course, transferring, degree completion, or higher labor market performance.

The third study was conducted by Calcagno and Long (2008), who compared academic outcomes for community college students who placed just above the cutoff for remedial

coursework with students who placed just below the cutoff and enrolled in remedial coursework. The researchers used a dataset of over 100,000 first-time community college students, enrolled in one of Florida's 28 community colleges between the fall of 1997 and the fall of 2000, who were seeking at least an associate degree. The results indicated that math and reading remediation had mixed benefits. The researchers found that the students who scored just below the cutoff for math remediation were more likely to continue to their second year, and accumulated more total credits, but found no impact for reading. Remedial English students were slightly less likely to pass college-level English, but there was no difference in pass rates between remedial and non-remedial math students in college-level mathematics. Both remedial math and remedial reading had a positive impact on total credit hours earned, but no impact on the number of college-level credits earned or on degree completion.

The last set of studies was conducted by Bettinger and Long (2004, 2005, & 2009). Bettinger and Long (2004) conducted a study to examine the effect of math remediation on roughly 9,000 students at nonselective four-year colleges from fall 1998 to spring 2002. Data were provided by the Ohio Board of Regents, which collects a variety of information from students including information from admissions applications; standardized tests scores and surveys; and college transcripts. While simply looking at the effect of being placed in remediation and comparing remedial and non-remedial students, Bettinger and Long (2004) observed the students in remedial courses had a greater probability of dropping out or transferring to a lower-level institution. Remediation did not impact transfer rates to more selective institutions or degree completion. The researchers suggested that the negative effects may be due to remediation serving as a way of re-sorting students. Initially students may enroll at institutions that are too difficult for them, but being placed in remedial courses might force

students to re-think their decision to attend a particular institution. Results indicated that the effects of remediation depend on career choices, and that students who complete remediation are more persistent. Unfortunately, these students required more time for degree completion and had a greater probability of transferring to a lower-level institution

The next Bettinger and Long (2005) study analyzed first-time degree seeking community college students who were age 18-20 and had taken the ACT. Students were enrolled in one of 19 public two-year colleges in Ohio in fall 1998. The students were tracked until the spring of 2003. The researchers used a dataset of over 13,000 students. They relied on the variability between the placement test cutoff scores to compare remedial and non-remedial students at different institutions. When the researchers simply compared remedial students with non-remedial students, the results were negative. Among full-time students, those in remediation completed fewer credits, and were less likely to complete a degree or transfer. However, when they compared students with similar backgrounds and levels of academic achievement at institutions with different remedial placement cut scores, they found positive outcomes for remediation. Remedial students had a greater probability of transferring to a four-year institution and they earned more credits than non-remedial students. Researchers also noted that their results were not relevant for students with serious academic deficiencies because the study only involved students who had placement scores right above and right below the cut off scores for remedial coursework.

The last Bettinger and Long (2009) study also used data from the Ohio Board of Regents to track almost 30,000 full-time students. They tracked traditional age freshman (18-20) at public two-year and four-year colleges for over six years (beginning fall 1998) in order to investigate the effects of remediation on college success and persistence. Only students who took the ACT

and either attended a four- year college, or signified their intent to complete a four-year degree on their community college application, were included in the study. Data included longitudinal information from college transcripts, applications, standardized test reports, and student surveys. The researchers compared similar remedial students at different post-secondary institutions. They focused on marginal students, which are students who have placement scores right around the cut off for remedial coursework. The results of the study indicated that students who placed in remediation are more likely to persist in college when compared to students with similar test scores and backgrounds who were not required to take the courses. Results also indicated that remedial students were more likely to complete a four-year degree. Math and English remediation decreased the probability that students would drop out and increased the probability that students would complete a degree within four to six years. Estimates were more favorable for groups of students near the cut-off of needing remediation. Remediation had no effect on students' choices of major. While it did seem to discourage students from choosing English as a major, it did increase the likelihood of students selecting math as a major. This study also excluded students who were extremely underprepared for college-level coursework.

These studies avoid some of the methodological issues that other studies have faced. Most of these studies include large datasets from multiple institutions. They also include longitudinal data and compare students with similar backgrounds. Also, since the goal of remediation is to prepare students for college-level coursework and to be able to complete a college program, most of these researchers have tried to determine if remediation actually does what it is intended to do, instead of just looking at student success in one remedial course or retention and persistence in college. Although these studies represent some of the more rigorous research on the effectiveness of remediation, the results were also mixed.

Summary of major findings. The ultimate goal of remediation is to prepare students to be successful in college-level courses, and although it is unclear if remediation is effective, some researchers have had encouraging results when studying remedial students. Waycaster's (2001) longitudinal study of community college mathematics students indicated that developmental students did as well or better than the students who placed directly into the college-level mathematics course. Also Crews and Aragon (2004) reported that developmental writing students had higher GPAs, as well as higher grades in the college-level English course than non-developmental students. Unfortunately, results like Bailey (2009) and Bahr (2008) are very discouraging. Both reported that fewer than 50% of students remediate successfully. Attewell, Lavin, Domina, and Levey (2006) had similar findings in mathematics but more positive findings in reading and writing. They reported pass rates around 70% in writing and reading, but only 30% in mathematics. With the use of two very large datasets, Martorell and McFarlin (2011) found little evidence that remediation works. When comparing students who scored just above and below the cutoff for remediation, Calcagno and Long (2008) noted that remediation in reading, writing, and mathematics did not improve a student's chances of completing a college-level course. Bettinger and Long (2004) also compared developmental students with observationally-alike students who were not in developmental courses. The researchers noted that the developmental students were more likely to drop out. However, Bettinger and Long (2005) found more positive results for remedial students at two year colleges. When simply comparing remedial students with non-remedial students, remedial students completed fewer credit hours and were less likely to complete a degree or transfer. However when the researchers compared remedial students with similar students, results indicated that remedial students were more likely to transfer to a four-year institution, and that they earned more credit hours than non-

remedial students. Lastly, Bettinger and Long (2009) looked at remedial students at both two-year and four-year institutions. Results indicated that remedial students were more persistent and more likely to complete a four-year degree. Even with all the existing research regarding remediation, its effectiveness remains unclear and more research is needed.

Summary of math findings. When looking only at the findings related to mathematics, the results are also mixed. Some of the researchers had positive findings related to mathematics remediation (Bettinger & Long, 2009; Calcagno & Long, 2008; Lesik, 2007; Waycaster, 2001). When looking at persistence, Lesik (2007) indicated that remedial math students who actually enrolled in remedial math courses were more persistent than those remedial students who did not. When looking at performance in college-level math courses, Waycaster (2001) and Bahr (2008) found that remedial math students had grades similar to students who placed directly into the college-level math course. Calcagno and Long (2008) indicated that students who score just below the cut-off for remediation were more persistent to a second year and earned more credits than students who scored just above the cutoff for remediation. Bettinger and Long (2009) indicated math remediation reduced the probability of students dropping out, and also increased the probability of students graduating.

However, some researchers (Attewell, Lavin, Domina & Levey, 2006; Baily, 2009; Barh, 2008) had negative findings related to mathematics remediation Baily (2009), Barh (2008), and Attewell, Lavin, Domina and Levey, (2006) indicated that only 25 to 30% of remedial math students complete all of their remedial math coursework. Attewell, Lavin, Domina and Levey (2006) also found that students at community colleges who were required to take remedial math courses have lower graduation rates. From these results it is hard to determine if math remediation is effective.

College Preparation

Many believe the reason students are placing in remedial mathematics courses in college is because they were not adequately prepared while in the K-12 system **(**e.g., Berry, 2003; Hoyt, 1999; Hoyt & Sorenson, 2001; Venezia, Kirst, and Antonio, 2003, Zelkowski, 2011**)**. Researchers have reviewed a variety of issues with the K-12 system that might help explain why students are entering college underprepared (e.g., Berry, 2003; Hoyt, 1999; Hoyt & Sorenson, 2001; Venezia, Kirst, and Antonio, 2003; Zelkowski, 2010**)**. Although issues with the K-12 system might explain why some students are leaving high school underprepared for college-level coursework, students' personal issues may also play a part in their lack of preparation.

K-12 issues. Researchers feel that the lack of alignment between K-12 and post-secondary institutions plays a role in why so many students are entering college underprepared (e.g., ACT, 2006; Conley, 2001; Venezia, Kirst, & Antonio, 2003**)**. ACT (2006) compared the standards in 39 states to their College Readiness Standards (which are based on their course placement research with post-secondary institutions) and found several differences between state standards and college readiness standards. Conley (2001) reviewed a National Commission on the High School Senior Year Report and found that K–12 and post-secondary systems are not aligned. Venezia, Kirst, and Antonio (2003), using data from the six-year national Stanford Bridge Project, found that high school testing focused on different kinds of knowledge and skills when compared with placement testing at post-secondary institutions. Admission policies and placement testing at most post-secondary institutions, for example, are based on lower-level thinking skills by utilizing multiple choice tests, whereas some high school systems are using more subjective measures in their K-12 assessments.

Research has also shown that K-12 teachers and post-secondary teachers have different views about which math concepts are important for students to learn. In a national curriculum survey that identifies the gap between post-secondary expectations and what secondary teachers are teaching, ACT (2007a, 2007b, & 2010) noted that post-secondary instructors and high school teachers have different views on what students should be learning or what they should already know when they enter college. ACT (2007a, 2007b, & 2010) also noted that high school mathematics teachers stressed more advanced topics but math instructors at post-secondary institutions believed a solid foundation in basic math concepts was more important for students to know.

Some students are not taking the necessary college preparatory courses in high school. According to the U.S. Department of Education, only four states required students to have four credits in mathematics in 2001, while seventeen required only two credits, and the rest required three (NCES 2002, table 152). Today, twelve states require students to have four Carnegie Units in mathematics, nine require only two units, and the rest require three (NCES, 2012, table 199). A study done by officials at North Arkansas College found that "a higher rate of students who completed courses higher than Algebra 2, when compared to those who did not, successfully completed their first math course, whether it was remedial or college-level" (Berry, 2003, p. 393). It was also noted that only 25% of the students had completed a course more advanced than Algebra 2 (Berry, 2003). Hoyt (1999) found that recent high school students who completed college-preparatory math courses in high school had a higher ACT math sub-score, higher math placement test scores, and a lower probability of being required to take a remedial mathematics courses. Similarly, Adelman (2006) stated that "the highest level of mathematics reached in high school continues to be the key marker in pre-collegiate momentum, with the tipping point of

momentum toward a bachelor's degree now firmly above Algebra 2" (p. xix). A study done by the Nevada Department of Education (2007) examined the relationship between mathematics course taken in the 12th grade and remedial mathematics courses taken at Nevada's post-secondary institutions. Results indicated that students who completed college preparatory math courses in 12th grade had lower rates of remediation than those who completed lower-level courses. In a study to explore variables that can help students be mathematically college-ready, continuous enrollment in mathematics throughout all four years of high school ranked higher than other variables (Zelkowski, 2011). After a discussion with college and high school teachers, Berry (2003) noted that because some states only require three years of mathematics, students do not see a need to take a course higher than Algebra 2 their senior year.

Researchers have found that high school math courses may not be as rigorous as college math courses. Berry (2003) noted that high school teachers felt pressure from their administrators to pass students. In a study to determine the relationship between high school preparation and college remediation rates, Hoyt & Sorensen, (2001), found that a substantial number of students who successfully completed the equivalent to college algebra, pre-calculus, and trigonometry at the high school level had ACT scores that would not allow them to take College Algebra in college. Hoyt (1999) found a substantial remedial placement rate for students completing Intermediate Algebra and Honors Intermediate Algebra in high school. After a discussion with high school and college teachers, Berry (2003) noted a couple of differences: in college, test grades make up the majority of the College Algebra grade, whereas homework made up the majority of the grades in high school; in high school students can pass a course with a D, but must have a C to meet higher mathematics course pre-requisites in college. According to ACT (2005), teachers may feel the need to grade their students more leniently to enhance the students'

chances of getting into college. ACT conducted a study to determine if high school grade inflation exists. Grade inflation can be seen as a boost in a student's grade without any real academic improvement (ACT, 2005). Participants included students who took the ACT in the eleventh and twelfth grade and graduated from a public high school from 1991 to 2003. The students GPA was calculated based on students' self-report of grades in a little over 20 courses in the four core academic subjects. Results indicated that GPA increased about 6.25% without an increase in overall ACT score. It was noted that 6.25% was an underestimate, and that grade inflation was probably around 12.5% because very few Ds and Fs (less than 5%) are given in high school, which cuts the possible grade range and therefore eliminated them from consideration.

Students might be coming to college under-prepared because of inadequate reform efforts, forced mandates, and standardized assessments (Killian, 2009). The No Child Left behind (NCLB) laws forced states to employ only teachers who were considered to be highly qualified and demanded greater accountability from each school. In order to meet the requirements of NCLB, some teachers felt they had to cut parts of the curriculum to have time for increasing the students' scores on assessment, which in turn reduced the quality of education in the schools (Popham, 2004). In traditionally low performing areas such as mathematics, teachers have often times taught to the tests, and standardized tests typically measure low level skills for short-term learning goals, which may not prepare students for college-level courses requiring deeper understanding of the mathematics from high school. Even before the NCLB Act, Toch (1991) stated that educators felt that testing affected the level of instruction, and was to blame for students' poor academic performances. Implementing mandates can leave little time

to give students the attention they need. This is particularly true for students that make very little effort, need motivation, or for those who do not learn as quickly as others (Killian 2009).

An overarching theme in the K-12 system that may be adding to the problem is the belief the college is for everyone. As Rosenbaum and Rosenbaum (2003) writes:

> In the past two decades, changes in the U.S. economy have altered the requirements for both college and work, with important implications for school counselors whose job it is to provide information and guidance to students with regard to personal, academic, and career options. The unfortunate tendency has been for educators to assume that the changing economy simply requires more education, resulting in the misguided belief that all students should attend college. At the same time, the dramatic increase in open admissions policies, especially among two-year colleges, has made a college education much more accessible. The result has been a well-meaning but misguided college-for-all attitude among educators and students (Rosenbaum & Rosenbaum, 2003, p.252).

For U.S schools, college-for-all has caused high school to be viewed by students as more of a social experience instead of an educational experience. Students do not see the need to work hard in high school, because almost everyone will have an opportunity to go to college. Students believe they can wait until college before they take their education seriously. However, this is not the case in other countries. According to Takehiko (2011), in most European schools students must qualify to attend college-preparatory schools by passing a rigorous test in the eighth grade or earlier. In some countries students must pass this test just to attend the standard high school. Students who do poorly on these tests then go to vocational/technical schools, and from there they have little to no chance of going on to college. The college-for-all mentality in the U.S may be inadvertently affecting remediation rates in post-secondary institutions.

K-12 teacher quality. Another K-12 issue that may have a direct impact on the preparedness of students is teacher quality. Teachers play one of the most important roles in educating students. Research has indicated that differences in the quality of the teacher explain more of the variation in student achievement than any other *school-based* factor (Goldhaber & Brewer, 1997). NCLB, National Board of Professional Teaching Standards (NBPTS), The National Council of Teachers of Mathematics (NCTM), and the Conference Board of the Mathematical Sciences (CBMS) have all identified descriptions and/or standards of highly qualified mathematics teachers (see Table 1 below). The NCLB legislation mandates that states require highly qualified teachers to hold a minimum of a bachelor's degree; hold full certification or pass a teacher certification test; hold a teaching certificate that is not classified as emergency, temporary, or provisional; and demonstrate competencies in subject knowledge and teaching skills. Because of the key role that teachers play in preparing students for college, many researchers have looked at student outcomes based on varying aspects of teacher quality.

Table 1

Standards for Highly Qualified Teachers

Conference Board of Mathematical Sciences (CBMS)
Prospective teachers need mathematics courses that develop a solid understanding of the mathematics they will teach.
Prospective teachers need coursework that allows time to engage in reasoning, explaining, and making sense of the mathematics they will teach.
Teachers need opportunities for continued growth in their mathematical knowledge throughout their careers.
All courses and professional development experiences for mathematics teachers should develop the habits of mind of a mathematical thinker and problem solver.
At institutions that prepare teachers or offer professional development, teacher education must be recognized as an important part of a mathematics department’s mission and should be undertaken

in collaboration with mathematics education faculty.
Mathematicians should recognize the need for improving mathematics teachings at all levels.
National Board of Professional Teaching Standards (NBPTS)
Teachers are committed to students and their learning.
Teachers know the subjects they teach and how to teach those subjects to students.
Teachers are responsible for managing and monitoring student learning.
Teachers think systematically about their practice and learn from experience.
Teachers are members of learning communities.
National Council of Teachers of Mathematics (NCTM)
A teacher who knows mathematics well and who can guide students' understanding and learning.
A teacher who understands how students learn mathematics.
A teacher who expects all students to learn mathematics.
A teacher who employs a wide range of teaching strategies.
A teacher who is committed to lifelong professional learning.
No Child Left Behind (NCLB)
Teachers must have a bachelor's degree.
Teachers must have full state certification or licensure.
Teachers must prove that they know each subject they teach.

Note. Adapted from "The Mathematics Education of Teacher II," by Conference Board of Mathematical Sciences, 2012, Retrieved 10/28/2014 from http://cbmsweb.org/MET2/. Copyright 2012 by the American Mathematical Society and Mathematical Association of America; "The Five Core Principles," by The National Board of Professional Standards, 2014, Retrieved 10/28/2014 from http://www.nbpts.org/five-core-propositions. Copyright 2014 by The National Board of Professional Standards; "Highly Qualified Teachers," by The National Council of Teachers of Mathematics, 2005, Retrieved 10/28/2014 from http://www.nctm.org/about/content.aspx?id=6364. Copy right 2005 by The National Council of Teachers of Mathematics and; "New No Child Left Behind Flexibility: Highly Qualified Teachers," by U.S. Department of Education, 2005, Retrieved 10/28/2014 from http://www2.ed.gov/nclb/methods/teachers/hqtflexibility.html. Copyright 2005 by the U.S. Department of Education.

To determine the effect of observable and unobservable school characteristics on student achievement, Goldhaber and Brewer (1997) conducted a study using data from the National Educational Longitudinal Study of 1988 (NELS). NELS is a comprehensive, nationally representative data set that contains information on the backgrounds of eighth grade students in 1988, and who were subsequently surveyed in 1990 and 1992, and were then followed through the year 2000. NELS also connects students to a specific class and teacher, and contains information on specific teacher behaviors, such as time in class spent on small group exercises and individualized instruction. The sample used in this study included over 5000 tenth grade students from 638 schools and over 2,000 math teachers. Variables for the study included four groups: individual and background variables, school variables, teacher characteristics variables, and classroom variables. The overall results of the study indicated that some educational resources and teacher characteristics seem to have a significant impact on tenth-grade mathematics test scores. Results indicated that teachers who are certified in mathematics, as well as teachers with degrees in the subject have students with higher test scores. Results also indicated that observable school, teacher, or class variables account for a tiny percentage of the variability in student test scores, while related unobservable variables seem to be much more important. The research did not specify which unobservable factors were important.

Using a review of the literature, Wayne and Youngs (2003) conducted a study to examine the relationship between students' standardized test scores and the following four characteristics of teachers: college ratings, test scores, degrees and coursework, and certification status. Results indicated that studies that tried to determine whether students learn more from teachers who graduate from higher-rated undergraduate institutions had difficulty in discerning links, but that those relationships which were found tended to be positive. Among the studies that looked at

teachers' test scores and student achievement, the findings were mainly positive. When looking at degrees and coursework, results varied depending on the subject area. In mathematics, all findings were positive. It was also noted that the positive findings in mathematics were from high school students, and that more evidence was needed to assess elementary school students. Lastly, the impact of teacher certification appears only when teachers have certification in their subject area, and positive findings have again been in mathematics. Teachers who have a standard certification in mathematics have students who perform better. Although most of the results indicated positive relationships, the researchers cautioned that the effect sizes were relatively small, and that results may have been different if these characteristics were compared to graduation rates or future earnings.

In a similar study, a review of the literature on teacher quality was used to discuss teacher quality. Bolyard and Moyer-Packenham (2008) focused on the following six characteristics of teacher quality: general ability, experience, pedagogical knowledge, subject knowledge, certification status, and teacher behaviors, practices and beliefs. Results indicated that studies that used student mathematics performance as a variable found that there is a positive relationship between teachers' ability and student success in mathematics. Studies that examine the impact of teachers' years of experience on their effectiveness yielded inconclusive results. Mathematics and science teachers' pedagogical knowledge studies reported that teacher preparation programs had a positive impact on teachers’ knowledge and practices. Studies that treat education coursework as a variable to determine teachers’ pedagogical knowledge found a positive relationship with the coursework and student success. This finding was mainly at the secondary level. Studies that measured the impact of degrees in education and educational

coursework on student success indicated that degrees in education had a more positive effect with elementary students.

At the secondary level, Bolyard and Moyer-Packenham (2008) report that degrees in education have a slight or negative effect on student success and studies indicate that coursework taken in content-field pedagogy is positively related to secondary student success, predominantly in mathematics. Studies that examine content-knowledge in mathematics indicate a positive link between content-knowledge and student success. Studies show a positive relationship between secondary teachers' content-knowledge and student success, mainly again in mathematics. When reviewing studies comparing mathematics achievement to teacher certification, studies reported that teacher certification status positively effects student achievement. Findings also indicated that what mathematics and science teachers' believe about teaching and learning, and what they do in the classroom, effects student achievement. Pajaras (1992) argues that teachers' beliefs impact their perspectives and judgments, which in turn influence their behavior in the classroom. Therefore more research needs to be conducted to understand these beliefs to help improve teachers' preparation and teaching practices.

Unlike the previous studies that looked at teacher quality in relation to student achievement, Torff and Session (2009) looked at teacher quality based on principals' perceptions to determine if teacher ineffectiveness was due to a lack of pedagogical knowledge or content knowledge. Principals' perceptions were used in this study because the researchers felt that using students' test scores may not accurately reflect students' level of understanding. Torff and Sessions argue that although the principals' evaluations may not be perfect, their assessment provides school-level managers' perspectives. Participants included 251 secondary school principals in New York and Michigan. School principals were surveyed and asked to state the

frequency with which teacher ineffectiveness, in their experience, has been caused by content or pedagogical knowledge. The five components of teacher quality were: content knowledge; lesson-planning skills; lesson-implementation skills; ability to establish rapport with students; and classroom management skills. Results indicated that threats to teacher quality came mostly from deficiencies in student-interactive pedagogical skills. Lesson planning skills were next, and the deficiencies in content knowledge were the least likely to cause teacher ineffectiveness. It was also noted that teacher effectiveness in all subjects was more often produced by deficiencies in pedagogical knowledge than deficiencies in content knowledge. However, principals may not be able to effectively assess teachers' content knowledge if they are not experts in the content area. A principal with a background in English, for example, may have a difficult time evaluating the content knowledge of a math teacher.

Teacher quality in relationship to college remediation needs was the focus of Howell (2011). In this study the researcher wanted to examine the relationship between high school teachers' characteristics and students' need for remedial coursework in college. Three teacher qualities were measured: years of experience, educational attainment, and credential status. The study was conducted with first-time freshman students enrolled in the California State University System. Data were collected from the California State University mathematics and English proficiency reports, and from the California Department of Education Basic Education Data System, which contains information for all public schools in California, including information on the teachers. Results indicated that teachers who possessed a master's degree had students with lower rates of math remediation. The results for English were not significant. Oddly, teachers with master's degrees and additional coursework had slightly higher rates of remediation. Also, teachers with emergency certifications or teaching waivers had greater remediation rates. Results

also indicated teachers with more experience had a slightly negative impact on math remediation rates but no impact on English remediation rates.

Common Core State Standards. In an effort to address some of the issues with K-12 systems, an overwhelming majority U.S. states and all U.S. territories have adopted the Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The standards should guarantee students graduate from high school prepared for post-secondary education or the workforce, so long as, students meet the minimum levels of proficiency upon graduation from high school. The standards clearly define what each student should know by the end of each school year in order to be on track for college or the workforce (McDonnell & Weatherford, 2013). The Common Core State Standards focus on conceptual understanding, procedures with real-life applications, and promote higher-order thinking (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010.

According to National Governors Association Center for Best Practices & Council of Chief State School Officers (2010), states voluntarily adopt the standards which "promote equity by ensuring all students, no matter where they live, are well prepared with the skills and knowledge necessary to collaborate and compete with their peers the United States and abroad" (Overview, para.5). Unlike in the past, when each state had its own set of state standards, the Common Core State Standards ensures that all states are on the same page and the standards encourage states to work together (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The standards were developed based on what students need to know to be successful. They were developed using research and surveys on what skills students need to enter the workforce and college, and the standards of high-

performing states and nations (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). State officials led the movement, but teachers, parents, school administrators, professional in the fields, and state leaders participated in the development of the standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The standards guide the educational objectives for students, but allow teachers autonomy in their classrooms and the ability to individualize instruction to meet the needs of their students (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Teachers do need this autonomy in their classroom, but they may also need some guidance implementing this new curriculum.

Teachers' mathematical knowledge for implementing standards. Teachers play an important role in educating students, but are often faced with this daunting task with little to no experience. According to Ball, Lubienski, and Mewborn (2001), mathematics education has remained the same since the early 1900s. Teachers teach the way they were taught. They explain how to do procedures, and give tests on definitions and procedures. This fact helps explain why so many students are underprepared for college-level mathematics. For various reasons reform efforts have failed to change the way mathematics is taught. "The most frequent explanations are the misrepresentation of mathematics; culturally embedded views of knowledge, learning, and teaching; social organization of schools and teaching; curriculum materials and assessments; and teacher education and professional development. "However, the understanding of mathematical knowledge that is needed to teach mathematics well is the underlying problem for all of these explanations" (Ball, Lubienski, & Mewborn, 2001, p. 435). Implementing reform ideas depends on teachers' knowledge of mathematics, but most teachers do not have any experience doing these things. "Although many researchers, teachers, policymakers, and teacher educators have

recognized the importance of teachers' mathematical knowledge, understanding the nature and role of mathematical knowledge for teaching-plus developing it effectively-remains an unsolved problem for the improvement of mathematics teaching and learning" (Ball, Lubienski, & Mewborn, 2001, p. 440). Teachers' exposure to mathematical content alone is supposed to somehow equip them with the resources needed for effective teaching, but often times it does not.

"If mathematical proficiency is indeed to become a widely held competence, better mathematics teaching is needed and quality instruction depends on teachers, therefore their preparation and continuing professional development is crucial" (Adler, Ball, Krainer, Lin, & Novotna, 2005, p. 360). Teachers will need some guidance. According to Adler, Ball, Krainer, Lin, and Novotna (2005) "Many practicing teachers have not learned some of the content they are now required to teach, or they have not learned it in ways that enable them to teach it as required" (p.361). This might lead teachers to avoid teaching certain topics in the curriculum. The curriculum may be "quite different from the one for which they were educated, and from which they experienced" (Adler, Ball, Krainer, Lin, & Novotna, 2005, p. 361). Teachers will not be able to do this alone. They will need more support if all students are to truly learn mathematics (Adler, Ball, Krainer, Lin, & Novotna, 2005).

Issues with underprepared students. Students also play a role in their remedial mathematics placement. Some students are entering college underprepared in mathematics because of personal reasons, or because of reasons not directly related to the K-12 system. Lack of information is probably a key reason some students are underprepared for college. Most students graduating from high school know very little about the requirements for college (Greene & Forster, 2003), which could be a sign of weaknesses in K-12 counseling. This claim is

supported by a recent survey of remedial students which indicated that most of them believed they were ready for college (Strong American Schools, 2008 cited from Bailey, 2009).

Some students may have tried to prepare for college by taking the college preparatory courses in high school, but they may not have mastered the content, or they forgot some of the content (Kinney, 2001) because of long periods between math classes or math practice (Godbey, 1997). Some students may also be underprepared because not all students learn as quickly as others, or in the same way as their classmates (O'Banion, 1997), and they simple could not keep the pace. Also, some students have poor study skills and/or learning disabilities that may have hampered their ability to master the necessary mathematics concepts to be successful in college. Other influences that may contribute to students' lack of math knowledge and understanding might include: a fear of math; excessive absences in high school; belief that math ability is hereditary; or a negative experience with a teacher (Godbey, 1997). Some students do not understand why math is important for them to learn, which can lead to a negative attitude about mathematics or school in general.

According to Middleton and Spanias (1999), "students must feel comfortable with mathematics, must be challenged to achieve, and must expect to succeed before they are intrinsically motivated to do math" (p. 67). Students generally learn to dislike math, and this becomes part of their math self-concept. By middle school, students begin to perceive math as a special area in which only smart students can succeed, and that effort will not change their ability to do math. However, if students are exposed to a curriculum designed to emphasize usefulness and interest, student motivation can be increased, which in turn can increase their mathematics achievement (Middleton, Leavy, & Leader, 2012). Students' motivation to learn mathematics must be addressed by the time they enter college, because by then, they will have already formed

stable attributions regarding their success in math. Students, who attribute their failures in math to internal factors (ability), and their success to external factors, are likely to avoid math courses (Middleton & Spanias, 1999).

Self-efficacy. Students' mathematics self-efficacy may also play a role in why some students have failed to master the necessary mathematical concepts to enroll in college-level mathematics. Self-efficacy is a person's belief in his or her ability to be successful in a given situation or at a particular task (Bandura, 1994). Therefore, mathematics self-efficacy can be thought of as the belief in one's own ability to perform math related task. Bandura (1977 cited from Hackett & Betz, 1982) argued that self-efficacy expectations were a good predictor of behavior. Self-efficacy includes "perceptions of performance capability in relationship to math problems, math task, and mathematics related course-work" (Hackett & Betz, 1982, p. 6).

A study was conducted to examine the predictive ability of mathematics self-efficacy, with regards to mathematics problem solving. Pajares and Miller (1994) wanted to "determine whether the confidence with which the students approached solving math problems had a stronger direct effect on their problem solving performance than other factors (e.g., mathematics self-concept, math anxiety, perceived usefulness of mathematics, prior experience with mathematics, and gender)" (p. 193). They subscribed to Bandura's (1986 cited from Pajares & Miller, 1994) argument that how people behave can be best predicted by their self-efficacy beliefs. Findings indicated that mathematics self-efficacy was a better predictor of problem solving ability than math self-concept, perceived usefulness of mathematics, prior experiences with mathematics, or gender.

In a somewhat unusual study, Hall and Ponton (2005) compared the self-efficacy of developmental math students and calculus students. Results indicated that calculus students possessed not only more math skills but also more self confidence in their ability to succeed. In general, the researchers believed that the implications of the study suggested that educators should focus on increasing the mathematics self-efficacy of remedial math students because prior research had shown the relationship between high mathematics self-efficacy and other factors related to success in mathematics.

Mathematics beliefs were the focus on this next study. Stage and Kloosterman (1995) focused on the beliefs of remedial college students. Although mathematic self-efficacy was not directly mentioned, beliefs about mathematics are the components of mathematics self-efficacy. The researchers wanted to determine whether students' prior experience, highest level of mathematics completed, and mathematics skill level after completing high school were related to their mathematics beliefs. The study included 236 students (95 females and 126 males) enrolled in college remedial mathematics classes at a public research university. Students' scores from the Mathematics Belief Scales (an instrument to measure beliefs regarding difficulty of problems, steps to complete problems, word problems, understanding and effort)- along with an arithmetic pretest, math skills assessment test scores, and final grades -were used to determine the relationship between mathematics self-efficacy and mathematics ability. Results of the study indicated that mathematics skills were related to students' beliefs about the difficulty of the problems and final grades were related to students' beliefs about both the difficulty of the problems and the steps to solve the problem. Also, surprisingly, high school mathematics experience was not linked to beliefs or achievements for males or females. Mathematics achievement indicated a negative relationship to the scores on the understanding belief scale,

and, a positive relationship to the steps belief scores (Stage and Kloosterman, 1995). Findings also indicated that belief scores were comparable for males and females. Overall, the researchers felt that the findings of the study implied that students' mathematics beliefs should not be overlooked in attempts to explain mathematics ability and success.

Remedial Students' Perspectives

Issues within the K-12 system and students' personal issues probably both play a role in why students are not mastering the concepts necessary to enter college-level mathematics. But to fully understand why so many students are entering college underprepared, the perspective of the remedial student must be included in the discussion. However, very little research has been done that actually involves the perspectives of remedial students. Schornick (2010) writes, "few studies have approached the situation by talking directly with the students" when discussing college remediation (p.19). Also, as mentioned earlier, Weinstein (2004) stated that "the perspective of mathematics students, particularly remedial students, is often overlooked or ignored" (p. 231).

After an extensive search of the literature, five studies were found that included the perspective of remedial students. The first study conducted by Elise (2007) explored the perceptions of remedial reading students at a community college in Louisiana. Data collection included a reading course survey, an interest/attitude survey, and interviews with students. Participants included 56 students, but only eight students were interviewed. Results of the study indicated that students believed classroom activities that focused on comprehension and vocabulary were helpful to them. Also, students' perceptions of reading improved because they could better understand what they were reading.

The second study involving the perspectives of remedial mathematics students was conducted by Weinstein (2004) to investigate the impact of tutoring sessions on students' perceptions. The study was conducted at a large Midwestern university. The university had higher admission standards than other campuses, and therefore offered only a few remedial courses. The researcher observed, surveyed, and interviewed students enrolled in basic algebra. He looked at students' negotiation of mathematical meaning in their study groups and tutor sessions to determine how the students' experiences with tutors affected their perceptions of their own success. The focus of the researcher's analysis was the process of negotiation during these tutoring sessions and networking interactions including negotiation over conflicting meaning for mathematical language and symbols; negotiation through emotions; negotiation by novices and experts over task-orientation and environmental distracters; and other areas of negotiation. These processes can be summarized as the negotiation of mathematical meaning in an active, collaborative, conversational tutoring session. Initial results indicated that students spent 8 to 12 hours per week working on homework, and that they worked regularly with a peer, the instructor, or a tutor. Findings also indicated that, "tutor-student negotiation can occur over the use of terminology when discussing problems, in compromises made to accommodate different learning styles, between different tactical approaches to doing specific kinds of math problems, and concerning the resolution of, and coping mechanisms for, emotions such as anger, frustration, and nervousness" (Weinstein, 2004, p. 232). The researcher used the result of this study to change his own teaching practices. The researcher decreased the amount of class time spent lecturing, and instead spent most of the class time allowing students to work in groups so they could work together to find mathematical meaning and understand processes while the instructor/ researcher acted as coach and cheerleader.

The perspectives of remedial students were also included in a study conducted to examine the effectiveness of remediation. Koch, Slate, and Moore (2012) conducted a study of students' perceptions about their experiences in a sequence of remedial courses offered at community colleges. The subjects of the developmental courses were not identified by the researcher. To participate in the study, students had to have graduated from high school and be currently enrolled in a sequence of developmental courses at a community college in the state of Texas. The study included three students. Data collection included interviews. The themes that emerged during data analysis were: academic perception, behaviors, resources, and perceived benefits. Overall, students felt that the class was beneficial to them. Most of the students felt that they were not adequately prepared in high school. Students identified behavior by both the teacher and themselves that contributed to their success, such as completing the homework and receiving helpful feedback from the teacher.

The self-efficacy of remedial students was the focus of a study conducted to examine how students felt about being placed in a remedial mathematics course. Killian (2009) wanted to know if self-efficacy had an impact on the effectiveness of remediation. The study took place at a Midwestern university and involved students who had just graduated from high school. The study involved only a single class of remedial students. Data collection included a demographic questionnaire, classroom observations, and a mathematics self-efficacy survey (MSES-R). Findings indicated that students with high levels of self-efficacy worked harder and were successful in the course, while students with low levels of self-efficacy either dropped the course or failed. The level of self-efficacy determined the perceived difficulty of the problems and the efforts that the students put into working the problems. Students with higher self-efficacy viewed the problems as less difficult and therefore made stronger efforts to solve each problem.

In a similar study, Howard and Whitaker (2011) conducted qualitative research "to describe what experiences, attitudes, and learning strategies developmental mathematics students believed contributed to their failure to gain basic math skill proficiency in the past and what experiences, attitudes, and learning strategies these students now believed were most likely to enhance their successful learning of basic math skills" (p. 3). Based on teacher recommendations, 14 successful students enrolled in remedial mathematics at a western university were asked to participate in the study. Half of the participating students were nontraditional. Developmental instructors were asked to recommend their top two students. Students were enrolled in courses from pre-algebra to intermediate algebra. Data collection included interviews, classroom observations, formative assessments (informal classroom questions, quizzes, and chapter exams) and summative assessments (midterm and final exam). Level of motivation was the key factor between unsuccessful and successful academic outcomes. A key factor for motivation and attitude was mindset. When students believed they were going to be unsuccessful, they were unsuccessful and when they believed they were going to be successful, they were successful. In Howard and Whitaker's (2011) study, all students remembered when they started to dislike math or have a negative attitude towards mathematics. This moment was linked to problems with understanding a difficult mathematics concept. Students were also unmotivated to learn mathematics due to lack of support at home, and some did not see the value in learning mathematics at all. Their learning environment, including class size, teacher, and classroom atmosphere, was also mentioned as factors contributing to their failures. All students reported they had avoided doing math in the past. Students believed they were more motivated now because of career goals. They all enjoyed mathematics when they

were successful. Students suggested the following changes for the K-12 system: (1) provide resources such as a math lab and (2) provide close monitoring of progress.

In another study similar to the current study, Schornick (2010) examined remedial mathematics students' perspectives regarding their K-12 experiences. The researcher focused almost solely on issues within the K-12 system. The researcher interviewed six remedial students currently enrolled in remedial mathematics courses at four different institutions .Schornick (2010) stated that the interviews were "to gain thick, rich descriptions of the students' mathematical educational experiences and provide themes related to the underprepared college mathematics students K-12 mathematics education" (p. 20). The interview guide used in the study contained the following sections: demographic/personal, K-12 curriculum/rigor, K-12 school environment/relationships with teachers, and family. Results indicated two areas that students felt affected their mathematics experiences during their K-12 career: academic environment (courses and course sequence, rigor, technology, and relevance) and social environment (teachers, students, and parents). As far as academic environment, students felt the courses and sequence of courses taken in high school inadequately prepared them for college. Most students did not take a math course their senior year, or take any college preparatory math courses. Students also felt the courses were not rigorous enough to prepare them for college-level mathematics. The lack of technology used in the classroom and the relevance of the mathematics they were learning in high school were also indicated as factors affecting the K-12 mathematics preparation. When looking at social environment, the students felt like the teachers did not seem to care about them learning the material, or did not appear to enjoy teaching. A few students mentioned they did not feel a sense of belonging when they were in school, while others felt a sense of belonging solely through various extracurricular activities. Most students felt they had

an influential family member that kept them encouraged, and that their parents had positive attitudes towards math and education in general.

All five of these studies included the perspective of remedial students. The current study also includes the perspective of remedial students. Two of the studies are similar to this study, but unlike the Schornick's (2010) study, this study examined issues within the K-12 system as well as other possible issues, such as students' personal issues, as possible explanations for the high rates of remediation. Also, all remedial mathematics students were asked to participate in the study, unlike in the Howard and Whitaker's study, which only included students who were experiencing success in the remedial mathematic course. The Howell and Whittaker (2011) study included the perspectives of 14 students, and the Schornick (2010) study included the perspective of six students. This study includes the perspective of more students. In this study, 159 students voluntarily completed an online survey, and 12 of those students participated in follow-up interviews.

Chapter Summary

Although remedial education has been around for several centuries, the effectiveness of remediation has shown mixed results. From the beginning, remedial/developmental education programs were developed to meet the needs of the large numbers of students entering college underprepared for the coursework and consisted mostly of non-traditionally aged students returning to college. However today, with the growing numbers of students entering college immediately after high school who need remediation, critics are concerned about the extensive costs associated with non-credit bearing remedial coursework. Proponents of remediation see it as beneficial to society as a whole, and believe it is far more cost-effective than alternatives such as-unemployment, welfare, and/or incarceration. The effectiveness of remediation has been the

focus of many research studies. Some of the research has yielded positive results which indicate that remediation is beneficial to students, while other researchers have had negative results or mixed results which indicate that remediation might not always be effective. Unfortunately, there have been no conclusive findings when it comes to the effectiveness of remediation.

There are numerous factors that might play a role in why students are entering college underprepared. Some researchers have focused mainly on issues with the K-12 system (e.g., Berry, 2003; Hoyt, 1999; Hoyt & Sorenson, 2001; Venezia, Kirst, and Antonio, 2003, Zelkowski, 2011), such as teacher quality and the lack of alignment between the K-12 curriculum and the post-secondary education curriculum. Other researchers (e.g. Hall & Ponton, 2005; Killian, 2009, Pajares, 1994, Stage & Kloosterman, 1995) have focused on various personal student issues such as self-efficacy or motivation. Only a few researchers have included the perspective of the students (Howard & Whitaker, 2011; Killian, 2009; Koch, Slate, Moore, 2012; Schornick, 2010; Weinstein, 2004). While much research that has been done regarding remediation, there is still more research that needs to be done with respect to student perspectives about such remediation.

CHAPTER 3 METHODS

Chapter Introduction

As presented in Chapter 2, many researchers have tried to uncover why students are entering post-secondary education underprepared for credit bearing (or degree counting) mathematics courses. However, there is very little research that includes the perspective of the students. This chapter describes the methods for the study that were used to investigate the research questions: (1**)** What factors do remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial math?; and (2) What do remedial students perceive as a resolution to their difficulty in mathematics and current placement in remedial math? The chapter includes a discussion of the following: (1) the qualitative research design; (2) the researcher's prior experiences; (3) the study site; (4) the participants; (5) phase I data collection and data analysis; (6) phase II data collection and data analysis; and (7) methods for validation.

Research Design

This study was conducted using a qualitative research design. A qualitative research design was chosen because qualitative research methods will help the researcher to understand the students' perspectives regarding their remedial mathematics placement. Qualitative research is a method of inquiry which seeks to build a holistic, mainly narrative, description of a social or cultural phenomenon, and is used when the researcher is looking for a detailed understanding of

a central phenomenon (Creswell, 2005). Creswell(2005) defines qualitative research "as a type of research that relies on the views of the participants, asks broad, general questions, collects data consisting largely of words (or text) from participants, describes and analyzes these words for themes, and conducts the inquiry in a subjective, biased manner" (p. 39). In qualitative research, the researcher brings his or her own experiences to the study, and the researcher often times chooses to study a problem because it is something they want to understand (Patton, 2002).

According to Patton (2002), "Qualitative methods permit inquiry into selected issues in great depth with careful attention to detail, context, and nuances; that data collection need not be constrained by predetermined analytical categories contributes to the potential breadth of qualitative inquiry" (p. 227). Qualitative methods also generally produce a wealth of information about a small number of participants, which increases the depth of understanding of the participants being studied, but unfortunately reduces generalizability.

Even after a researcher has decided that a qualitative research design will best help to seek answers to research questions, there are still issues the researcher will face. The researcher must decide how to focus the study. As Patton (2002) states, the researcher must decide how much time and effort they are able to invest in trying in trying to increase understanding of a phenomenon. However, there is no rule of thumb to tell a researcher how to focus a study. The extent to which a research study is broad or narrow depends on the purpose of the study, the resources available, the time available, and interest of those involved (Patton, 2002).

In this qualitative study, the data were collected in two phases over the course of one semester. In the first phase, the qualitative data were collected using a survey. The goal of the first phase was to identify the most common experiences that students attribute to their

placement in a remedial mathematics course, and what they believe can be done to overcome these experiences. In the second phase, data were collected from individual interviews. The goal of the second phase was to gain a more in-depth understanding of the students' experiences and perceptions based on results from the first phase. Further details regarding phase I and II are discussed in the data collection sections.

Phenomenological focus. The study was conducted with a phenomenological focus to gain a better understanding of students' experiences. Phenomenological researchers seek to understand human experiences through the meaning the experiences hold for each individual (Creswell, 1998). In this study, the researcher wanted to better understand the prior math experiences of remedial students. Groenewald (2004) defined phenomenological research as "a design to describe, and the aim of the researcher is to describe the phenomenon as accurately as possible" (p. 5). According to Welman and Kruger (1999), "Phenomenologists are concerned with understanding social and psychological phenomena from the perspectives of the people involved" (cited from Groenewald, 2004, p. 5). Phenomenology is focused on how things appear through experience or in consciousness, whereas the researcher aims to provide a vivid textured description of actual experiences (Finlay, 2005). Moustakas (1994) states, "Phenomenology is also concerned with wholeness, with examining entities from many sides, angles, perspectives until a unified vision of the essence of a phenomenon or experience is achieved" (p. 58).

Researcher's Prior Experiences

In qualitative research, the researchers should identify their biases, values, and personal background experiences that may shape their interpretations formed during the course of the study (Creswell, 2009)**.** This will help set the tone of the research project because the researcher is usually personally invested in whatever he or she seeks to understand. Also, the researcher's

excitement and curiosity inspire the research, and the researcher's personal history will help focus the problem of the study (Moustakas, 1994).

The researcher for this study has taught mathematics at the high school level and is currently teaching at the community college-level. While teaching at the high school level, the researcher noticed her students had difficulty learning new mathematics concepts because they lacked an understanding of basic math skills from elementary and middle school that should have been mastered before they entered high school. The researcher also found it very difficult to motivate her students to want to learn mathematics and to see the benefits of learning mathematics. However, since the researcher was a novice teacher when she taught high school it is very likely that the difficulty the researcher faced when trying to motivate her students was related to her inexperience as a beginning teacher. As a new teacher, the researcher had not had time to fully develop pedagogical skills that would have helped her motivate her students in coming years.

While teaching at the community college-level the researcher observed that the majority of entering students placed in remedial mathematics courses because they lacked an understanding of basic math skills as well as concepts that they should have learned while in high school. The students in the remedial math courses would often times give a variety of reasons as to why they had placed in the remedial mathematics course. The reasons ranged from "I just hate math" to "I didn't take the placement test seriously." Another concerning phenomenon that the researcher noticed was that, the majority of incoming freshman were not only placing in remedial mathematics courses, but they were also having difficulty passing the remedial mathematics courses. At the community college where the researcher teaches, more than 50% of students fail their initial remedial mathematics courses on their first attempt. Some

of the students were likely having difficulty overcoming barriers that probably impacted their remedial placement. The researcher wondered why so many students were entering college underprepared, and after becoming familiar with the research regarding remedial mathematics students, the researcher believed the only way to fully understand the problem was to talk to the students involved.

Before conducting this study, the researcher did not realize how much her inexperience would impact the study. The researcher had difficulty selecting interview participants and phrasing interview questions in a manner that encouraged students to provide details instead of yes or no responses. The researcher thought quantifying the survey data would safeguard against researcher effects in identifying the themes. However, the researcher believes the themes were impacted by her biases. This was a valuable learning experience for the researcher. When conducting exploratory, qualitative research, or any other type of research, each step must be carefully considered.

Research Site

The participants in the study were students enrolled at a community college campus in Alabama. The community college is a multi-campus institution with four campuses and one instructional site. Students enrolled at all four campuses and the instructional site were asked to participate in the study. The college offers academic transfer courses and career technical educational opportunities to over a quarter of a million people in a seven-county service area. The college has 35 to 50 feeder high schools. The college has an open-door admissions policy, and therefore all students with a high school diploma or GED are admitted.

Of the students enrolled at the college, 81% are Caucasian, 15% are African American, almost 1% are Hispanic or American Indian/Alaskan Native, Asian/Pacific make up almost 1% combined, 2% do not specify their ethnicity. Of students enrolled, 65% are female and 35% are male. Roughly 50% of the students are between the age of 18-24 and 8% are over the age of 50.

The college uses the COMPASS Placement Test developed by ACT to test students' academic proficiency in English, reading and math. COMPASS, along with ACCUPLACER, which was developed by College Board, are the placement tests most commonly used by community colleges (Hughes & Scott-Clayton, 2011). The college system administrators set the guidelines (cut scores) for remedial placement that must be adhered to by all colleges in the system. Based on COMPASS scores, almost 80% of incoming students place in remedial courses, with 78% of those placing in remedial mathematics. Of the students who place in remedial math, 60% of those students place in the remedial math course Elementary Algebra (Math 098).

Participants

Participants in this study included only students who were enrolled in the remedial elementary algebra course (Math 098). Again, most entering students place into Math 098. During spring semesters, there are usually 350 students enrolled in Math 098. However, during spring 2014, enrollment was down, and there were only 267 students enrolled (see Table 2). The survey was made available two to three weeks after the semester started, because typically in this course 5% to 10% of the students who enroll stop attending after the first few weeks of the class. These students are believed to enroll only to receive a Pell Grant and/or financial aid refund check (Blaime & Mullin, 2012; Field 2012). This is a problem faced by many community colleges. Recently, attention has been drawn to the misuse of federal financial aid, with concerns

related to students' abuse of the system (Blaime & Mullin, 2012; Field 2012). These students enroll in the course only to receive financial aid refunds, and once they receive the check they stop attending class. Therefore, this may further reduce the sample size of the potential participants.

The perspectives of traditional and nontraditional students were included in this study, although nontraditional students may have a different type of remediation need than traditional students (Bailey, 2009). Older returning students may have experiences in secondary education from earlier decades (Seybert & Soltz, 1992) and therefore their experiences may not reflect the current state of affairs in secondary education.

Table 2

Sample for the Spring 2014 Semester

Campus	Sections of Math 098	Students Enrolled in Math 098
Campus 1	2	52
Campus 2	2	37
Campus 3	4	68
Campus 4	4	90
Instructional Site	2	20
Totals	14	267

For the first phase of the study, convenience sampling was used. In a convenience sample "the researcher selects participants because they are willing and available to participate"

(Creswell, 2005, p. 149). Students were contacted via their remedial mathematics instructor to participate in the study. Before any contact was made with the students, the researcher obtained approval from the research site (appendix G) and the Institutional Review Board (appendix H) to conduct the study. All students enrolled in Math 098 were asked to participate in the study. Students were given a flyer (appendix D) with details about where they could complete the study online, and where they could get more information about the study (appendix E). Students were informed that their privacy would be maintained and that they were volunteers and could withdraw from the study at any time without penalty.

The participants selected for the second phase of the study depended on the results from the surveys. The researcher selected participants based primarily on participants responses to the survey questions. Demographic information such as age, gender, race, whether a student was repeating the remedial course, whether a student was traditional or a nontraditional student, and students' prior relationship with researcher, were also considered when the researcher selected the participants. The researcher's main objective was to select participants who could provide more details regarding the themes identified in phase I. Therefore, for the second phase of the study, a purposeful sample was used. In purposeful sampling, researchers intentionally select participants who might provide valuable information to understand the central phenomenon (Creswell, 2005). At the end of the survey, students were asked if they were willing to participate in a follow-up interview. If they were willing to participate, they were then asked to give their contact information. However, names were not used in the study. Participants were given pseudonyms. Participants were selected for interviews based on their responses to the survey (see Selection of Participants from Phase I data collection for more detail). After themes were

identified in Phase I, the researcher selected participants who could provide more detail about each of the themes. Figure 1 is a flow chart of phase I and phase II data collection.

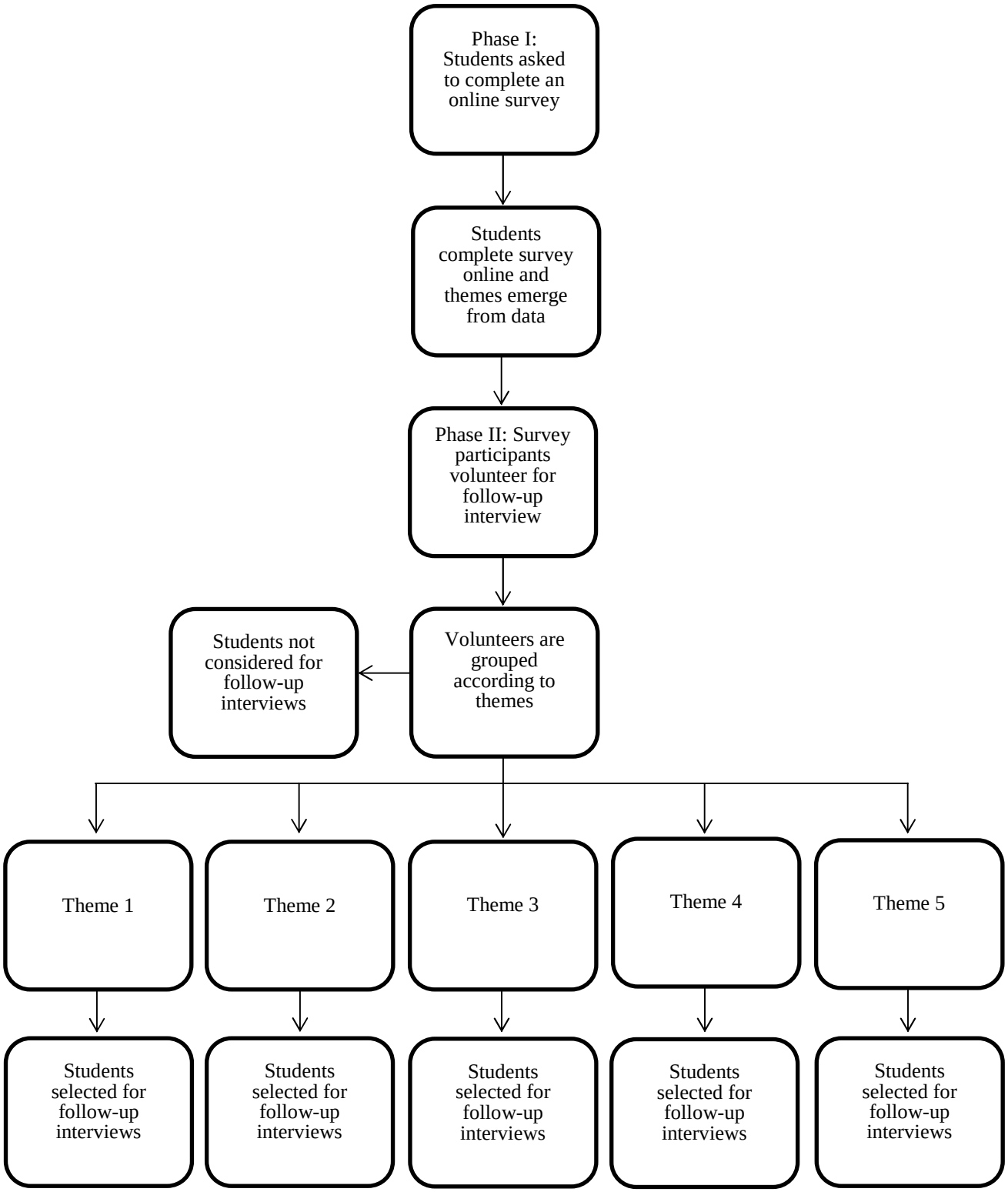

Figure 1. Phase I and Phase II Data Collection

Phase I Data Collection

Data collection for the first phase of the study included data collected from a qualitative survey. Qualitative surveys collect information on the meanings that people attach to their experiences (Fink, 2003). The survey was designed by the researcher, and seeks to uncover students' perceptions regarding their remedial mathematics placement. Fink (2003) notes that those who employ qualitative surveys do not necessarily aim for representative or generalizable results. Their purpose in using qualitative surveys is to provide depth and individual meaning to the questions of interest. The questions were developed based on the researchers' prior experiences with remedial students, and a review of the literature related to why students are entering college underprepared. The researcher also sought the input of other remedial mathematics instructors when developing the survey (appendix A). The first section of the survey contained demographic and background information questions. Participants were asked to indicate (to the best of their ability) their age, gender, ethnicity, college major, if they are repeating the course, and the mathematics courses completed in high school. The second section of the survey was composed of open-ended questions. The first question uncovered students' perceptions about why they placed in a remedial mathematics course. Students were asked what prior experiences they perceive contributed to their remedial mathematics placement. The second question found out what students perceive could have been done differently to better prepare them for college-level mathematics. The third question asked students what they perceive can be done now to help them overcome these experiences. Creswell (2005) writes that in qualitative research, "researchers ask open-ended questions so that participants can best voice their experiences unconstrained by any perspectives' of the researcher or past research findings" (p. 214). The open-ended questions allow participants the opportunity to express in their own words

their perceptions regarding their remedial mathematics placement. Open-ended responses allow the researcher to understand the world as seen by the participants (Patton, 2002).

The survey instrument was pilot tested on roughly 125 students enrolled in Math 098 during the fall 2013 semester. One section of Math 098 from each of the four campuses and the instructional site was selected for the pilot test. Fink (2003) states that for a pilot test, 10 or more participants are needed. In a pilot test, participants are asked to "mark any problems on the survey, such as poorly worded questions, responses that do not make sense, or if it takes an excessive amount of time to complete the instrument" (Creswell, 2005, p .367). The purpose of the pilot study was to make sure the survey questions were clear and concise.

The five pilot sections were randomly selected. The instructor of each section was contacted via email regarding the pilot survey. They were then mailed copies of the pilot survey to distribute to their students. In the pilot survey, students were asked to answer each of the open-ended survey items. After answering each survey question, students were then asked if the questions were clearly worded and if they had any difficulty answering any of the questions. The results of the pilot study were used to revise the survey instrument.

Most students stated the survey was clear and easy to follow. Because students could not remember the courses taken in high school, the researcher added checkboxes listing all math courses offered in high schools in Alabama. The researcher also noticed that the students' responses to the survey questions were very short, and decided that the survey was too leading and that students needed to be encouraged to provide more details regarding their experiences. The researcher removed phrases that she believed were leading the students. The researcher also

added the following phrases to the open-ended questions: “Please provide a specific example or provide details.”

Phase I Data Analysis

Data analysis for the responses to the demographic and background questions involved descriptive statistics. Creswell (2005, 2009) gives the following as suggestions when analyzing survey data: (1) report response rate and response bias; (2) analyze data to develop a demographic profile of the sample and; (3) present the results in tables and figures.

The response rate is the percentage of surveys that are completed (Creswell, 2005). A high response rate is more valuable when the study’s purpose is to make generalizations to a larger population, but not as valuable if the purpose is to gain insight (Creswell, 2005). The purpose of this study was to gain insight from the students’ perspectives of their remedial mathematics placement. Fink (2003) states that no single response rate is considered standard and rates vary depending on how the survey was administered. For an online survey, response rate is usually low (Millar, and Dilliman, 2011), around 30% (Sheehan, 2001). Creswell (2005) writes that a way to encourage a high response rate is to investigate a problem of interest to the potential participants under study, because they will be more likely to participate. The researcher believes that students were interested in sharing their views on what they believe contributed to the remedial mathematics placement. The instructors were also asked to encourage the students to complete the survey honestly, and to remind students that their individual results would only be seen by the researcher.

According to Creswell (2005), response bias occurs in survey research when the participants’ responses do not accurately reflect the views of the sample and the population. To

determine if results indicate survey bias, researchers can monitor the returns using a procedure called wave analysis. In wave analysis, the returned surveys are grouped in intervals (each week), and reviewed to see if the responses to a few select questions change from the first week to the final week in the study. Responses in the final weeks should be similar to the responses in the first weeks. If they differ significantly, the researcher should report that the results may be biased and may not be representative of the sample and the population.

The next steps in the descriptive data analysis are to analyze data in order to develop a demographic profile of the sample and to present results in tables and figures. Participants were asked to provide their gender, age, race/ethnicity, intended college major, and provide a list of the math courses completed or at least the last course in high school. Descriptive statistics were calculated for each of the previous items to provide a profile of the sample. Some of these results are displayed using charts and tables in chapter 4.

The open-ended qualitative questions on the survey were analyzed for themes. Qualitative survey analysis is for the exploration of meaning and experiences. According to Fink (2003), content analysis a method for analyzing and interpreting qualitative survey results. The researcher employed inductive content analysis instead of deductive content analysis. In inductive analysis, the researcher reviews the data for dominant themes, but in deductive content analysis the researcher preselects themes that he or she thinks will likely occur (Fink, 2003). In deductive analysis, the researcher is allowed to add themes to the list of preselected themes as they emerge. Prior to administering the survey the researcher created a starting list of codes and themes (appendix C) to aid in the coding process as suggested by Miles and Huberman (1994). The following steps were taken by the researcher to analyze the open-ended survey data: (1) read

through all of the surveys several times; (2) code the data by hand; and (3) use the coding process to create a list of themes.

The first step in the analysis of the open-ended questions on the survey data was to read through the data several times. The researcher read through the responses several times to become familiar with the data. Reading through the data several times allowed the researcher to gain an overview of the responses before the coding process.

The next step in the analysis of the open-ended questions on the survey data was to code the data. The researcher did this by hand. To code the data, the researcher read through the survey responses again, and then began assigning codes to key words and phrases in the data. The researcher used the starting list of codes to aid in the process, and more codes were added. Once the researcher was confident that all the data had been coded, a response chart, was created using Excel to group the words or phrases that have the same code together. The researcher then counted how many times each of the codes appeared.

The third step in the analysis was to use the coding process to identify themes. To identify the themes for the data, the researcher reviewed the response chart for the codes that occurred most frequently and that seemed to summarize the overall perceptions of the students. The researcher also reviewed the code list to see if any of the codes could be grouped together because they had similar meanings or pointed to a larger idea. The grouped codes were then assigned a new code based on these similarities. These dominant codes were used as the themes for the survey data. A colleague of the researcher, who is familiar with qualitative research, was asked to also code the data to verify the researcher's findings. According to Patton (2002),

“Important insights can emerge from the different ways in which two people look at the same set of data, a form of analytical triangulation” (p. 464).

Once the themes or experiences were identified, the researcher selected participants for follow-up interviews to help describe the themes in more detail. Overall, the first phase was to collect a large sample of survey data that provided insight and that guided the design of phase II interviews.

Phase II Data Collection

Data collection for the second phase of the study included data collected from individual interviews. Interviews are beneficial when asking sensitive questions. They also allow interviewees to ask questions or provide details that might go beyond the initial questions (Creswell, 2005). The purpose of interviewing is to allow the researcher into the participants’ perspective, which allows the researcher to capture how those being interviewed view their world, learn the participants’ terminology and judgments, as well as to capture the complexities of the participants’ individual perceptions and experiences (Patton, 2002). The interviews added to the qualitative data collected from the surveys. The interviews allowed the researcher to include direct quotes from both what participants had written down and from what they said. Patton,(2002) suggests, “Direct quotations are a basic source of raw data in qualitative inquiry, revealing respondents’ depth of emotion, the ways they have organized their world, their thoughts about what is happening, their experiences, and their basic perceptions” (p. 21).

There are no rules for sample size in qualitative research (Patton, 2002), because sample size is determined by the purpose and content of the study (Nolinske, 1998). Therefore the number of interviews depended on the themes identified in phase I and on students' willingness

to participate. The researcher in this study interviewed 12 participants. Boyd (2001; cited from Groenewald, 2004; Creswell, 1998) states that two to 10 participants can be sufficient to reach saturation, or to thoroughly examine the topic when conducting interviews, and Onwuegbuzie and Leach (2007) recommend that phenomenological studies should include three to 10 subjects (cited from Koch, Slate, and Moore 2012). Elise (2007), for example, conducted a study that included 56 students initially, although only eight students were ultimately interviewed.

Selection of participants from phase I. The goal of the second phase of data collection was to elaborate, or expand, in detail the findings from the survey. After the themes were identified in phase I of the study, the researcher reviewed the survey data again and selected at least two participants for each theme to interview. The researcher used purposeful sampling to select participants primarily based on their survey responses. Participants who appeared to be able to provide more details about each of the themes were selected for interviews. Again, these were the themes that emerged in phase I of data collection and analysis. The researcher conducted a second inductive content analysis on the sample of surveys completed by the volunteers to select students for the follow-up interviews. The following information was used to select participants for follow-up interviews: age, gender, race, whether a student was a traditional or non-traditional student, if a student was repeating the course, if the researcher had a prior experience with the student, keywords or phrases within the survey responses, and if a student failed to provide a response to a survey question. The students were contacted by the researcher via phone or email to set up the follow-up interview. The researcher created a phone/email script (appendix F) prior to the contacting the students.

Interview protocol. To help structure the interviews, an interview protocol (Appendix B) was used. Creswell (2009) suggests using an interview protocol to assist in asking questions and

recording answers during an interview. The protocol contains a list of interview questions, with space for participants' responses and reminder notes for the researcher. The interviews were recorded and transcribed verbatim. Participants had the opportunity to review the transcriptions for accuracy.

The protocol was developed based on the themes identified from phase I of the data collection and analysis. Before the start of each interview, the participants were asked to review the consent agreement that provided all the pertinent information about the study (appendix E). The researcher discussed the purpose of the study with each participant and made sure that each participant was comfortable with being recorded. Participants were first asked to discuss their previous response to the open-ended survey questions. The researcher then asked clarifying and probing questions that encouraged the students to share examples, feelings, and reactions to the experience when it happened. Prior to the interviews, the researcher developed a series of potential follow-up questions based on student responses to the initial survey questions. The interview was structured to allow for unscripted questions that may emerge over the course of the conversation. The researcher also asked questions to make sure that she understood exactly what the participants meant by their statements. The questions focused on getting students to fully describe their experiences and views. If a student stated that he or she always disliked math, for example, the researcher asked an explanatory follow-up question. Or if the student felt like he or she has always had terrible math teachers, the researchers tried to find out why the participants felt their teachers were terrible, what the teachers did that made them terrible, and what could have been done differently by everyone involved.

Phase II Data Analysis

The interview data was analyzed for themes. The steps in this phase of qualitative data analysis included: (1) transcribing the interviews; (2) reading through all of the transcribed interviews several times; (3) coding the data by hand to combine them with the themes previously identified in phase I; (4) writing a detailed narrative of each of the themes; (5) providing an interpretation of the data (adapted from Creswell, 2009). All of this was done while keeping in mind that, “phenomenology is committed to descriptions of experience that retain as close as possible the original texture of things" (Moustakas, 1994, p. 58).

The first two steps in the analysis of the interview data required the researcher to transcribe each of the interviews and read through the transcribed interviews. After each participant was interviewed, the researcher transcribed the interview verbatim. The transcriptions also include the instructor notes. The instructor notes included information regarding the theme that was addressed in each interview. After transcribing the interviews, the researcher read through each interview multiple times.

The next step in the analysis process was to code the data by hand. Because each participant was purposefully selected based on the themes that emerged from the survey data, the researcher already knew the theme that each interview may add. However, the researcher reviewed each interview to verify and to check for new, emerging themes, or themes that may have been missed in the initial coding process. To code the interview data, the researcher assigned each of the previously identified themes a highlighter color and a separate color was used to identify new themes. As the researcher read through the interview data, she highlighted text, in the appropriate color, that further supported or added more detail to each of the themes. The researcher also reviewed the interview data for new themes that either went unnoticed or

that were not mentioned in the survey data. The interview data allowed the researcher to describe each theme in more detail. An additional coder was used to verify the researcher's findings. The researcher asked her colleague to review the interview transcriptions to make sure the researcher had not missed any themes or misinterpreted any information. Once the researcher was confident that all themes had been identified, the researcher proceeded to the next step in the process and combined both the survey and interview data to write a narrative description of each of the themes.

After each theme was thoroughly described the researcher interpreted the findings in relation to the research questions and the overall purpose of the study. The researcher discussed how the findings impact current policy and practice, as well as made suggestions for further research.

Validation of Findings

Qualitative research findings require validation. That is, that the findings must be found to be "trustworthy and believable in that they reflect the participants', researchers', and readers' experiences with a phenomenon" (Corbin and Strauss, 2008, p. 302). Using various strategies, the researcher tried to verify the accuracy and credibility of the findings. Triangulation, member checking, and auditing (peer review) are three primary forms used by qualitative researchers to validate their findings (Creswell, 2005).

According to Creswell (2005), "triangulation is the process of corroborating evidence from different individuals, types of data, or methods of data collection in descriptions of themes of qualitative research. The inquirer examines each information source and finds evidence to support a theme. This ensures that the study will be accurate because the information draws on

multiple sources of information, individuals, or processes" (p. 252). In this study, themes were triangulated from multiple individuals from survey and interview data.

Member checking involves taking the findings back to the participants and asking them to verify the accuracy of the report (Creswell, 2005). The researcher began the process of member checking during the interviews. Each person selected for an interview was asked to discuss their responses to the open-ended questions on the survey items. This insured that the researcher had accurately interpreted the meaning of the participants' statements and accurately identified the themes. After the researcher transcribed the interviews, the participants were asked to review the transcription to make sure it was accurate. Also, each participant selected for interviews was asked to review the findings of the study and asked to provide feedback regarding the accuracy. They were asked to review the presentation of the data and results sections of the study. They were also asked to respond to the following three questions: (1) Are the descriptions accurate? If not, why? (2) Are the themes accurate? If not, why? (3) Are the interpretations fair and do you think they accurately represent your experiences and perceptions? If not, why?

Next the researcher conducted an external audit, which involved getting an outside person to conduct a review of the project (Creswell, 2005). A faculty member not involved with the study was asked to review the study and provide feedback regarding the strengths and weaknesses of the project. The researcher asked an instructor, who had experience with qualitative research, to review the entire study. The reviewer had a doctoral degree and experience in conducting qualitative research. The reviewer was asked to give an overall opinion of the study, and to respond to the following questions: (1) Based on the data, are the themes accurate? If not, why? (2) Do you think the findings are supported by the data? If not, why? (3)

Does the research seem biased? If so, why? (4) What do you think should have been done differently in this study?

Chapter Summary

This chapter provided an overview of the methods that were used in this study. This study was conducted using qualitative research methods. Data was collected in two phases: through surveys and in follow-up interviews. Once the data were collected, it was analyzed for themes that helped to answer the research questions of the study.

CHAPTER 4 THE DATA

Chapter Introduction

Chapter four presents the data and analyses used to describe and investigate the research questions of this study. The research questions are the following:

(1) What are the factors remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial mathematics?

(2) What do remedial mathematics students perceive as a resolution to their difficulty in mathematics and current placement in remedial mathematics?

The chapter includes a discussion of the following: (1) a summary of the methodology used in the study, (2) response rate, response bias, and respondent demographics, (3) survey themes, (4) description of interview participants, (5) themes based on interview data, and (6) chapter summary.

Methodology Summary

This study collected survey data during the spring semester 2014, with a convenience sample of 159 students who volunteered to be a part of the study by completing an online survey. The students were enrolled in Math 098 Elementary Algebra, a remedial math course at the community college-level. The community college has four campuses and one instructional site. In the first phase of the study, students completed an online qualitative survey regarding their

perspectives of their current remedial mathematics placement. The survey also contained demographic and background questions. On the survey, the students were also asked three open-ended questions regarding their remedial mathematics placement:

Based on the student responses to these open-ended questions in phase I, the researcher identified seven themes that seemed to capture the majority of the students' perspectives regarding their remedial mathematics placement. These themes guided phase II of the study. In the second phase of the study, twelve students were interviewed. The researcher reviewed the students' survey responses and selected at least two students to be interviewed for each theme. The interviews were conducted to gain a more detailed account of the students' perspectives regarding each of the themes.

Response Rate, Response Bias, and Respondent Demographics

There were 267 students enrolled in the Math 098 Elementary Algebra course during the spring semester. All of these students were asked to complete the survey. Of the 267 students enrolled in Elementary Algebra, 159 students completed the survey. This represents a response rate of 60%. To check survey results for response bias, the completed surveys were divided into two groups based on whether they were completed during week one or week two. This was done for two of the three open-ended survey questions. To check for response bias, the researcher randomly selected two of the three open-ended questions. Eighty-seven students completed the survey during week one, and 72 students completed the survey during week two. The researcher then reviewed the participants' responses to the open-ended questions on the surveys to see if there was a difference in the responses given each week. There did not appear to be any major difference between the responses during week one and week two of the survey. For question one, the same five themes occurred in both week one and week two of the survey. Also most of the

themes occurred around the same number of times each week. For question one, 20 students indicated time as a factor in their remedial mathematics placement during week one, and 16 students indicated time during week two. For question three, the same two themes occurred in both week one and week two. For question three, 32 students from week one of the survey indicated that they would study, and 30 students from week two of the survey indicated they would study. Most of the counts for week one and week two were close. Therefore the researcher did not feel there was any significant response bias for the survey**.**

Of the students completing the survey, 71% were female and 29% were male. This is somewhat consistent with the demographic of the entire population of students enrolled in Math 098 during the spring semester, where 69% of the students are female and 31% are male. Seventy-four percent of the participants identified themselves as Caucasian, 25% African American, and 1% identified as Hispanic. These numbers are also consistent with the demographics of the population, which are 76%, 20%, and 1% respectively. The other 3% of the population of the Math 098 students included less than 1% Native American Indian/Alaskan Native and roughly 2% who did not identify their ethnicity. About 82% of the participants were age 18-24. This number is somewhat inconsistent with the population, which indicated that 72% of the students are aged 18-24. Almost 30% of the participants were repeating the course. Again, this is consistent with the entire population in of Math 098 students, in which 28% of the students are typically repeating the course in spring semesters. The course typically has a 50% pass rate and during this spring semester the pass rate was 46%.

Most of the participants took algebra and geometry in high school. Fewer students had completed Algebra II courses, or courses above Algebra II such as Pre-calculus Algebra. The sample data could not be compared with the population data because the college does not collect

this information. Figure 2 below shows the courses participants remembered taking in high school.

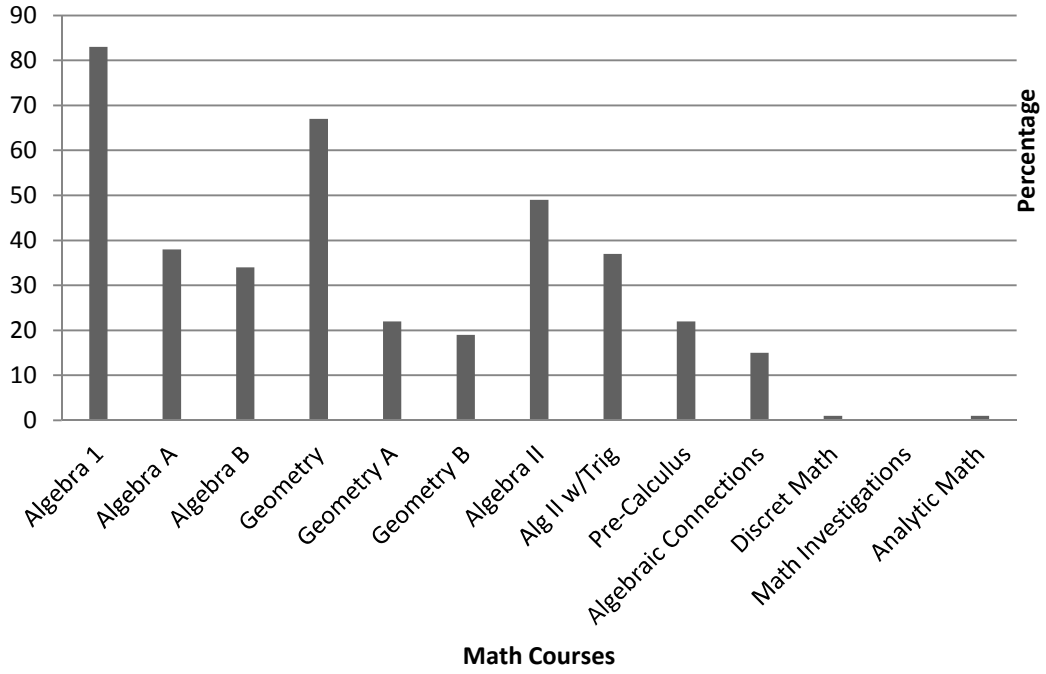

Figure 2. Math Courses Taken in High School by Participants

A majority (53%) of the students completing the survey are majoring in a health-sciences related field. Most of the students are nursing majors. Nursing majors represent 82% of the health science majors. The Associate Degree in Nursing requires students to complete College Algebra so students in Math 098 will have to complete one additional math course. Once students complete the Associate Degree in Nursing, some may transfer to a four-year institution to complete a bachelor's degree. Students completing the bachelor's degree will be required to complete two more math courses. Therefore it appears that the student's ability to successfully complete their remedial math course will play a significant role in his or her college careers, as

well as success in College Algebra, should they seek a four-year degree. (See Figure 3 below for a full breakdown of the percentage of students in each major.)

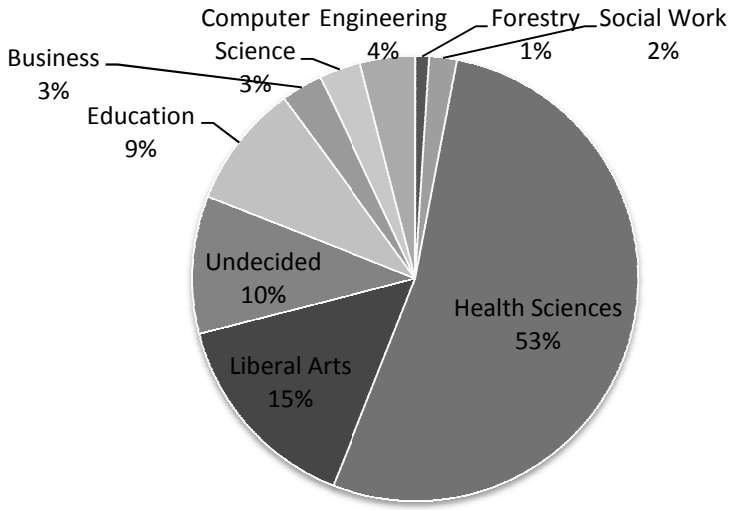

Figure 3. Participants' Majors

The sample data are fairly consistent with the population. Health science majors made up 46% of the population data and nursing majors accounted for 82% of the health science majors. Eleven percent of the population were liberal arts majors, 25% were undecided, 8% were education majors, 4% were business majors, 3% were computer science majors, 2% were engineering majors, and 1% were forestry majors. The sample data contained slightly more health science majors, and fewer students who were undecided.

Phase I Survey Themes

The survey contained the following three open-ended questions:

1. What prior experiences do you think contributed to your placement in a remedial mathematics course?

2. What, if anything, do you think could have been done to prevent your placement in a remedial mathematics course?
3. What do you think can be done now to help you overcome these experiences or barriers?

Participants were asked to respond to all three questions. The researcher reviewed the responses to the open-ended questions on the survey to identify the emerging themes. The first open-ended survey question was used to identify the themes for research question one and the third open–ended survey question was used to identify the themes for research question two (see Table 3 below). The second open-ended was not used in developing the themes for research questions one or two. The second open-ended survey question was intended to be a follow-up to survey question one, and, to provide more details as to why students think they placed in a remedial mathematics course. However, it can be interpreted as a question leading into survey question three, which is related to what students think will help them overcome their remedial placement. The students' responses varied. Some students responded to the question like it was a follow-up to question one, while others responded to it like it was a question leading into question three. Therefore this question as not used in determining the themes for research question one or two. It was however used to provide clarity to students' responses to survey question one and two.

Table 3

Development of Survey Themes

Open-ended Survey Questions	Research Questions
1. You are enrolled in Math 098, which is a course that provides no credit towards a degree. <u>What prior experiences</u> do you think contributed to your placement in a remedial mathematics course? That is, why do you think you placed in a remedial mathematics course? (*Please provide a specific example or provide details*)	**1. What are the factors remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial mathematics?**
2. What, if anything, do you think could have been done to prevent your placement in a remedial mathematics course? (*Please provide a specific example or provide details*)	• Data from this question were not used to determine themes for research question one or two • Data used to clarify responses to open-ended survey questions one and three
3. What do you think can be done now to help you overcome these experiences or barriers? (Please provide a specific example or provide details)	**2. What do remedial mathematics students perceive as a resolution to their difficulty in mathematics and current placement in remedial mathematics?**

To identify the themes, the researcher copied the survey responses into an Excel file and coded the data. Each survey response was coded and then grouped together according to the codes. The researcher reviewed the codes to see if any could be either broken down into smaller groups or combined into a larger group. The researcher wanted to make sure that the codes accurately reflected the perceptions of the participants. The codes were then reviewed for the responses that occurred most frequently and seemed to summarize the overall perceptions of the students. These dominant codes that emerged became the themes for the survey data. To verify the accuracy of these codes, the researcher then asked a colleague to code the data. The additional coder was given the raw data and asked to code the data independently. The additional coder was also given the starting list of codes. Finally, the researcher and additional coder

compared and discussed their results. The researcher and additional coder had similar results for most of the themes. Initially, the inter-coder reliability was 78%, but after some discussion it increased to 88%. The researcher and coder had to come to an agreement on the official wording for each theme because most of the codes were not on the starting list of codes. The researcher initially labeled the lack of math knowledge and understanding code as BAD (Bad at math), for example, and the additional coder labeled it as DIFF (Difficulties with math). Also the researcher and coder debated about the placement test theme because, from the students' responses, it was difficult to determine if they were stating they just needed a placement test review or if they did make an effort on the placement test. The researcher and coder agreed on the placement test theme and that the interviews would be used to determine exactly what students meant by their comments regarding the placement test. (See Table 4 for a breakdown of the percentage of participants indicating each theme based on the research questions.)

Table 4

Percentage of Participants Indicating Each Theme

	Survey Themes	Percentage of Participants
Research Question 1		
	Theme 1: Lack of math knowledge and understanding	35%
	Theme 2: Time between math courses	25%
	Theme 3: Lack of Effort in high school	15%
	Theme 4: Negative experiences with teachers	10%
	Theme 5: Placement test	10%
Research Question 2		
	Theme 6: Study	40%
	Theme 7: See a tutor	15%

The following are the seven themes that emerged from the open-ended questions on the survey: *Lack of math knowledge and understanding; Lack of effort in high school; Negative experiences with teachers; Time between math courses; Placement test; See a tutor;* and *Study*. Below are some of the participants' survey responses that lead to the development of the themes.

Theme 1: Lack of math knowledge and understanding. Of the students completing the survey, 35% of the students indicated that they were bad at math or they did not have a good understanding of math. Math was their worst subject. They expressed they had a difficult time

learning math concepts, and that it takes them more time to learn math than other subjects. Participants mentioned that they had struggled with math for some time and that math confused them or just did not make sense to them. Below is a list of participants' responses to the survey questions leading to the lack of math knowledge and understanding.

- Being bad at Math.
- not a complete understanding of math
- I lack some math skills
- I have always been a slow learner when it comes to math.
- Math is not my strong subject.
- i dont not understand math and have never been very good at it
- I know for sure im lacking in math knowledge. / I have always struggled in math.
- I have always had an extensive amount of problems with math. The only way I know to explain it is it's like reading a foreign language I've never heard of seen written.
- I was placed in remedial math because math is harder for me to take in than other subjects. Therefore It takes me a bit longer to understand some things before it clicks in my head.
- I hate math. It confuses me.
- I belive I got placed in a remidial math course because I'm very bad at math.
- I'm terrible at math. I have never been good at it. Its just very difficult for me to understand.
- I am not good at math and need refreshing
- because, there is something about math that I do not understand.
- Maybe if I had a better understanding in general
- I have never ever been good at math nor have I been one of the lucky ones to enjoy it
- Math is a weak subject for me. I have struggled with math since high school years.
- I was placed in remedial math because math has never been a very good subject for me. And also I struggle in mathI have always had a weakness in math.
- I have always had a weakness in math.

Theme 2: Time between math courses. Of the students completing the survey, 25% of the students indicated they placed in a remedial math course because they had not taken a math course in several months or years. Due to the time lapse between their last math courses, most felt they had forgotten how to do some of the math. Some participants mentioned they had not had to use the math that they had previously learned, so they had forgotten how to do it. Several of the students stated that they should not have waited so long to enroll in college and take a

math course. Below is a list of participants' responses from the survey that lead to the time between math courses theme.

- I'm poor at test taking and I had not had a math class the semester I took my test.
- I wasn't prepared for the exam and forgot a lot of the content during the summer break.
- One reason I think I was placed in a remedial mathematics course is because it has been around 10 years since I have had any math classes and if it isn't something we use on a daily basis we tend to either push it to the back of your mind or forget it all together.
- Did not take a math course at the ending semester in high school.
- It has also been four years since I have taken any college classes and do not use the same math at work that was on the compass test.
- because i have been out of high school for 7 years and dont retain as much information as i should
- I feel I placed in MTH 098, because I did not stay brushed up in my Math skill. I feel that let them slide after gratuating.
- I think I placed in this course because I havent used math or been in a math class in a long time and if you dont use it you lose it.
- I haven't done math in quiet a while, so it's better that I take the course since it's been two years since my senior year in high school.
- Because I forgot everything over the summer before I took the placement test, therefore, I had not prepared myself well enough to place in a higher math class.
- I think I was placed in Math 098 because I need to freshen up on my basic math skills. I had AP Calculus my Senior year of High School meaning that I haven't had basic math since junior high.
- I believe I placed in math 098 because of the fact that I can not remember math a long time after I learn it. I tend to forget how to solve problems after a span of time.
- I think I placed into a remedial math course because I did not attend a math college course straight out of high school.
- I could have taken a small math class over the summer so I didn't lose everything I had learnt in high school

Theme 3: Lack of effort in high school. Of the students completing the survey, 15% of participants indicated they did not really make an effort in high school mathematics. They did not apply themselves or study. Some participants expressed that they did not pay attention or take math seriously. Other participants admitted to goofing off in high school. Several participants stated that they could have tried harder, been more focused, or made more of an

effort in high school. A few students also stated that they would make more of an effort and focus to overcome their difficulties with math. Below is a sample of participants' responses from the survey that lead to lack of effort in high school theme.

- I never tried in school so I never learned what I needed.
- Poor study skills, lack of applying myself.
- Not trying in high school
- I did not take math seriously in high school.
- I didn't pay attention in math in high school.
- i know me not trying, paying attention, and goofing off not taking it serious in class is the reason why i am in remedial math. This gives the people that struggled or not tryed a second chance to learn it.
- Nothing. I failed Algebra in high school because I did not care about math at that specific time in my life.
- I could've studied more and tried harder in my high school math courses.
- I could of practice and took it more seriously. I'm glad I'm starting with the basics though.
- I could have worked harder in high school.
- I could have tried harder in high school and applied myself
- if i would of buckled down in in high school and tryed instead of trying to be funny and goofed off in class. I would of probably did a lot better, and been in a higher math cause we have great teachers that tought at my school and gave us the tools to be successful and its my fault for not using it and not respecting there teaching.

Theme 4: Negative experiences with teachers. Of the students completing the survey, 10% of participants expressed frustration with their prior teachers. Many stated their high school teachers either did not teach, or did not do a good job teaching. Participants also expressed that their prior teachers did not care about whether they learned the material. Some participants stated their teachers did not seem to want to teach, or that they did not enjoy teaching. Below is a list of participants' responses from the survey that lead to the negative experiences with teachers theme.

- Our high school teacher didn't teach the math very good. I think I need more of a review.
- I believe I was placed in a remedial mathematics course because I never had a good math teacher in high school and I was never able to learn a lot in any of the mathematics classes I took.

- I think I was placed in a remedial math course, because in high school I didn't have any teachers that year or the teachers just didn't care. I didn't take the compass test seriously either, but then again I really didn't know the stuff because I was never taught it.
- The teacher did not have good teaching skill
- I think I am in this math class because of my teachers and experience in high school. My teachers never took anything serious and hated teaching us.
- When I was in High School I had a teacher whose name I will not disclose that was lazy and did not want to actively teach the class. This teacher literally sat behind her desk everyday and acted like it was a chore to help people who had questions. Keep in mind she rarely taught so this was why so many people were asking questions.
- I got Placed in remedial math because I didn't have that great of math teachers in high school. I feel like I didn't learn anything from them but then again I cant blame them for everything im just not that great at math
- My high school math teachers did not really care about our education.
- I feel as if while in high school I wasn't taught enough to advance me to the level necessary.
- I think I placed in a remedial mathematics course because I was not well prepared for college classes in high school. In my high school math classes we were allowd to use study guides and notes with our test and I do not believe that it was beneficial to my mathematical education.
- When I was in high school I had a teacher for two years that literally didn't teach anything. He graded us by having a notebook and as long as we wrote down what he had written on the board you passed.

Theme 5: Placement test. Before enrolling in a math course at the community college, students are required to take a placement test, or can use their ACT math sub-test score. Most of the students at the college took the placement test because their ACT math score generally indicated they are not ready for college-level mathematics. Of the students completing the survey, 10% of participants indicated that the placement test (COMPASS) was a factor in their remedial placement. Some expressed they were not focused when they took the test, or did not take their time when taking the placement test. Many participants stated that they did not prepare or review before taking the placement test and that a review before for the placement test was

needed. Below is a list of participants' responses from the survey that lead to the placement test theme.

- I think that i was placed in a remedial mathematics course maybe because i did not try my best on the campus test.
- When I took the compass test I was not really paying attention and not focusing on my test when I should of been.
- The reason I was placed in a Math 098 course is because when I took the compass test back in April of 2013, I didn't pay very close attention to the problems. I was rushing my brains, when all I had to do was stay focus, so that is the reason I think I was placed in math 098.
- Because honestly i didn't take my time on the Compass test in the math section.
- Yes, pay more attention when taking the compass test. /
- I could have studied more before the placement test.
- Reading and going over the content before going in to take the test.
- hire a math tutor to review before I took the placement test
- refreshed my memory before taking the placement test
- Studied before I took the placement test.
- I could have tried studying some math that way I would have done better on the placement test.
- If we would have specifically went over thins before taking a placement test. /
- I could have brushed up on my math skills before taking the ACT/Compass.
- I DID NOT TRY MY BEST ON THE COMPASS
- When I took the compass test I was not really paying attention and not focusing on my test when I should of been.

Theme 6: Study. To overcome their difficulties with mathematics, 40% of students stated they would begin to study to overcome the remedial mathematics placement. Students also indicated they would practice, work hard, and stay focused. Below is a list of participants' responses from the survey that lead to the study theme.

- Study better and practice better at home
- I think if i would have studied more than what i did, and stay focused i would have been better and i wouldn't have had to take it.
- Study more, take better notes, pay more attention, work on the material etc.....
- study more, do more practice problems, ask more questions, etc.

- I could have studied math more and tried harder to understand it.
- I should have had more discipline when it came to studying math.
- Practicing math every day
- To study and practice more on my math
- make time to refresh what I have lost and study and do good on my test
- To study and look over all the assignments really good.
- practice practice practice math problems as much as possible.
- study harder then I did in high school
- study a little harder its really not a hard class all you got to do it study and pay attention.
- study more, do more practice questions, seek help, etc.
- Study all the time. Do not miss class
- I think to overcome these barriers, I can study more and try harder in this math class which will help me succeed in the future.
- For me to study more and pay attention to the teacher.
- I can spend time studying my problem areas. So that I have all the pieces to the the math problem, not just a few. I feel this is the best thing for me to do..
- Study and ask questions to be sure that I clearly understand more of the content and not be dependable on the calculator.
- Pay attention in class, do homework, and study.
- Study and ask questions about anything I do not understand.

Theme 7: See a tutor. Fifteen percent of students indicated that they would see a tutor in the future to overcome their difficulties with mathematics. Students also mentioned attending SI or Supplemental Instruction, which is a special peer tutoring program being offered at the college. Below is a list of participants' responses from the survey that lead to the see a tutor theme.

- I could of took advantages of the tutoring sessions.
- got a tutor
- maybe private tutor sessions throughout high school.
- Work Hard, never miss a class and use the tutors and SI that are on campus to help us.
- Work Hard and go to tutoring for what I do not know.
- I believe if I apply myself and work on extra problems out of the book or even get a tutor then I will excel at this.
- For me to go to tutoring and pay very close attention in class.
- get a tutor so that i can understand better
- The SI help is great. I learn better one on one, and the tutor was very helpful.
- Stay focus and going to tutoring

- Focus and go to tutoring
- Getting a tutor to help me understand!
- participate in the si
- I use a tutor and have to study a lot of more than most other students to grasp it.
- Focus and go to tutoring
- study get help from tutors
- Using a SI tutor to help me pass this course.
- Study harder and get help from tutors
- Do not be bashful about letting the/my instructor know if I do not understand. Get one on one tutoring.
- I believe that if I attend SI sessions and tutoring then it will help me.

The themes for research question two, studying and seeing a tutor only represented 55% of the participants. Of the students completing the survey, 40% indicated they planned to study to overcome their remedial placement and 15% of the participants indicated they would see a tutor. The remaining responses were wide-ranging. Five students did not respond survey question three, and less than 10% of the students completing the survey indicated the sample responses given in Table 5 for below.

Table 5

Wide-ranging Student Responses to Survey Question Three

Students Responses	# of Students
“come to class”	6
“pay attention"	6
“have review courses before the start of the placement test. Not mandatory of course some don’t need it”	6
“take the class and learn the math”	6
“trying harder”	5
I need to stay focused”	5
“put more effort in my class”	4
“not just look over the problem always check the answer”	4
“be determined and take my time on all assignments”	2
“learn from my mistakes”	1
“Nothing”	1
“I have no idea to how to overcome what feels like a learning disability”	1
“buy a mathlab”	1
“Get better at math”	1
“Do good in my class”	1
“I don’t know”	1
“Nothing really, I like starting over	1
“I have overcome most of them”	1
“Just do my best”	1
“Just accept where I currently am at and focus now on the future and what I can control”	1
“give an option weather paper or computer”	1
“I believe high school students should not be allowed to use study guides on the test”	1
“make math fun”	1

“Nothing now”	1
“I am not sure. It is what it is”	1
“change the system in which high school administrators assign classes the first year. Let students pick them”	1
“I believe have a formal experience with someone actually guiding me through everyting”	1
“refreshing my memory”	1
“test out of the class”	1
“time management”	1

Phase II Selection Process

At the end of the survey, students were asked if they would volunteer for follow-up interviews. Sixty-seven students volunteered to participate in a follow-up interview. Twelve of these students were selected for follow-up interviews based on their responses to the survey questions. For each of the seven themes, at least two students were selected for an interview. Some students were selected for multiple themes, and during the course of the interview some students provided information related to themes they may not have been initially selected.

Inductive content analysis and purposeful sampling was used to select participants. Inductive content analysis allowed the researcher to examine the data for dominant or leading themes (Fink, 2003). Purposeful sampling allowed the researcher to deliberately select participants who seemingly could provide the most detail (Creswell, 2005) regarding the themes that emerged from the opened ended questions on the survey. According to Miles and Huberman (1994), the qualitative researcher “is looking for good explanatory exemplars, not for all instances” (p. 65).

Initially the researcher planned to interview 14 students, two for each of the seven themes, but the researcher realized that almost all of the students had survey responses that fell into two themes. A student might indicate that they had a lack of mathematical knowledge and understanding, for example, and that they planned to study or see a tutor. Either students indicated the study theme or the tutor theme, or else students' response to survey question three did not correspond with either of the two themes. The main reason the researcher decided to divide the surveys into five groups instead of seven is because the responses related to studying and tutoring were not very detailed, and all seemed very similar (refer to the list of responses for Theme 6: Study and Theme 7: Seeing a tutor). Students did not provide any real distinguishing details to their responses to survey question three. Because of this, the researcher decided to select the interview participants based on the five other themes (lack of math knowledge and understanding, lack of effort, time between math courses, negative experiences with teacher, and placement test). The researcher felt confident that the sample would include students who could provide details about their plans to study or see a tutor, and if the sample did not include students who could provide details regarding the tutor and study theme, the researcher would revisit the survey data. The researcher used students' responses to survey question one to initially divide the students into five groups. Their responses to question two and three were used when selecting the best participant was not clear and more data was needed.

Using purposeful sampling, students were eliminated who did not have responses that coincided with the five themes already identified from the survey data. The researcher used the students' responses to survey question one to determine if students should be eliminated. Of the students who completed the survey and volunteered for a follow-up interview, nineteen students were omitted from phase II because their responses to survey questions one did not coincide with

the fives themes identified from question one on the survey data. Table 6 below shows the students' responses. The responses cannot be categorized with the previously identified themes (lack of math knowledge and understanding, lack of effort, time between math courses, negative experiences with teacher, and placement test).

Table 6

Students Not Considered For Follow-up Interviews

Gender	Age	Race	Repeat	Response 1
Female	21	White	no	“i dont know!”
Male	20	White	yes	“so I can be better well prepared for moth 100 and up”
Female	19	White	no	“I don't like computers and the test was by a computer I know all of what the teacher is going over.”
Male	20	White	yes	“math 98 is a good class to have”
Female	18	Black	yes	
Male	18	White	no	“You have to take this before math 100 if you didn't place high enough on the placement test.”
Male	24	White	no	“The reason I was placed in Math 098 is because I didn't advance further before I quit school.”
Male	20	White	no	“No”
Female	23	White	yes	“To make me do better in math 100”
Male	38	White	no	“I have a learning disability.”
Male	48	White	yes	“I was going to be a professional baseball player in 1980, so I took "General Math" in high school. Did not make it in baseball.”
Female	18	Black	no	“Its helps to get ready for the next math.”
Female	18	Black	yes	“Because repeating something is basically so you can learn exactly what you missed”
Female	20	White	no	“I have forgotten a lot of the math concepts.”
Male	27	White	yes	“I attended Georgia Northwestern Technical College in Rome, GA in 2011”
Female	30	White	yes	“What little I do manage to grasp I lose quickly and the stress of it causes me to panic and I forget everything. “
Female	30	White	yes	“I need more with math 098.”
Female	23	White	no	“I have just forgotten a lot since high school”
Male	22	White	no	

Note: A blank cell indicates the student did respond to the survey question one.

Looking at students responses to survey question one, the remaining surveys were then divided into five groups based on the theme each survey response corresponded to. The students in each group were then ranked partially based on the clarity and thoughtfulness of their responses. The researcher looked for students who provided detailed responses, and who seemed interested in sharing their experiences. The researcher wanted to select students who were good representatives of their group/theme, meaning their responses seemed to depict what other students with similar responses to that theme were trying to say. Also, when possible, if students had similar responses, the researcher ranked students in the minority groups (males and African American students) higher to try to make sure they were included in the study. Besides students' responses to survey question one, the following other data were used as criteria when deciding which students to contact for interviews: gender, race, age (traditional or nontraditional), whether a student was repeating the course, students' responses to questions two and three, and if the researcher had a prior relationship with the student. The researcher did not want a prior relationship with the student to influence the research. Students who had a prior relationship (former student or advisee) were ranked the lowest. The researcher, for some of the themes, used specific characteristics in the selection of participants. These varied based on the theme. Therefore, they will be discussed with each theme. The researcher ranked participants in each category to determine which students to select for interview. The researcher decided to rank at most, the top three students in each category. If the top ranking students declined an interview, the researcher would review the surveys again and continue ranking the students. The rankings for each theme varied. They are therefore discussed individually below.

Theme 1: Lack of mathematics knowledge and understanding. On the survey, eighteen students volunteered for a follow-up interview that indicated a lack of mathematics

knowledge and understanding on survey question one. The researcher wanted to interview a repeater from this group of students. The researcher felt like a repeater could provide valuable information about their experience since they were repeating the course. The researcher believed that a student repeating the course could potentially provide more insight on this theme since they had enrolled in the course previously, and still attributed their placement in a remedial mathematics course to the lack of mathematics knowledge and understanding. The student repeating the course was ranked number one because the researcher selected her first for an interview due to the fact that she was the only repeater who volunteered to participate in a follow-up interview in this category. The researcher had a very difficult time selecting students for this category. The researcher decided to select students that indicated a lack of "understanding" and not just those who indicated they were bad at math. The researcher thought a student who stated they did not "understand math," versus one who indicated they "didn't like math" or "hated math," might indicate that the student had thought more deeply about their issues with math and remedial placement and realized that their lack of "understanding" was the issue. It is possible the researcher put too much weight on this phrase when selecting participants. In hindsight, the researcher should have only selected one of the participants who indicated "understanding" rather than two participants. This is a delimitation of the study, and it was discussed along with other delimitations in Chapter 1. Only participant two indicated a lack of "understanding" in his response to research question one. The researcher decided to interview another student in this category because 35% of the students had indicated a lack of math knowledge and understanding as a contributing factor in their remedial mathematics placement. The researcher then decided to look at the students' responses to the second survey question. Two more students had indicated a lack of "understanding." The researcher decided that

participant three's response provided more detail than participant four. All three participants agreed to a follow-up interview. (See Table 7 below for a complete list of participants who volunteered for a follow-up interview for the lack of mathematics knowledge and understanding themes.)

Table 7

Lack of Mathematics Knowledge and Understanding

Rank	Gender	Age	Race	Repeat	Response 1	Response 2
1	Female	18	White	Yes	“because i was not properly prepared mentally to take a college level math course.”	“maybe if I had a better understanding in general”
2	Male	23	White	no	“not a complete understanding of math”	“studying “
3	Female	20	White	no	I was not very good in math and It is giving me the oppertunity to get better in math.	“I just don't understand math. I know for sure im lacking in math knowledge. / I have always struggled in math.”
4	Female	18	White	no	“Because I struggled with math throughout high school.”	“For some reason I just don't understand math.”
	Male	18	Black	no	i have the worst habit of procrastinating. And I have always been a slow learner when it comes to math.	“math is just difficult”
	Male	18	Black	no	“I just can't do math”	“I really dont think so. Im glad i was put in this class.”
	Female	18	White	no	“i did not learn alot of math in highschool”	“tried better in highschool”
	Female	20	White	no	“Because I was not very good at math in High school and I forgot most of what I learned before I started college.”	“I don't believe anything could have been done.”
	Female	19	White	no	“I think I placed in a remedial mathematics course because I was not well prepared for college classes in high school. In my high school math classes we were allowd to use study guides and notes with our test and I don't believe that it was beneficial to my mathematical education. “	I” believe preparation for college mathematical courses, tutoring, and/or not being allowed to use study materials on tests could have prevented me from being placed in a remedial mathematics course.”
	Female	19	White	no	“i didn't know the material to be moved to a higher class.”	“to study harder and try harder on the compess test.”

	Female	18	White	no	“I needed a better basis in math to be more confident in what I am going to do.”	“Worked harder to make the grades I wanted.”
	Female	19	White	no	“I think I placed in a remedial mathematics course because I was home-schooled throughout my high school career and didn't have any formal instructors and/or teachers. Everything I know, I taught to myself.”	“I think having an actual instructor or someone to guide me through all the mathematics courses to ensure that I was learning, I wouldn't have placed in a remedial mathematics course.”
	Female	38	White	no	“I only remember taking Basic and General Math in High School. I was never very good at math. Still not very good at math evidentially because I am struggling with Math 098.”	“I could have worked harder in high school.”
	Female	19	White	no	“I have never ever been good at math nor have I been one of the lucky ones to enjoy it. It didn't help I was only able to attend my math class two days a week during my eleventh grade year because of health reasons. Also, I had enough credits to not have to take a math class my senior year and my freshman years at Bevill I avoided it like the plague. So, it's been about two years since I have even thought about math.”	“Honestly, I do not know of anything except that if I may have applied myself more.”
	Female	23	Black	no	“i wasn't ready for math 100 course and needed to practice”	“if i remembered all my math courses and equations”
	Female	48	Black	no	“I have always had a weakness in math. I have come to realize, it how some instructors teach. I have learned more and have a somewhat better at math, since I have been in college, even though on a lower level of math.”	“Maybe if I had a better instructor or got some tutoring before I took the placement/Compass test.”
	Female	32	White	no	It is not a strong subject for me, so I had to work extra	“I believe maybe a short refresher class to go over

				hard	general rules that you tend to forget over the years, hence I've been out of high school for some time now. This would help you remember some things you may not use in your daily life and have forgotten."
Female	19	Black	no	"I really didn't get it so, i want to start from basic. I feel like i need to start from sratch."	

Note. The Repeat column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response 1 column indicates the students' responses to the first survey question and the Response 2 column indicates the students' responses to survey question 2. A blank cell indicates the student did respond to the survey question.

It should be noted that the student who was repeating the course was interviewed but failed to provide information regarding lack of math knowledge and understanding. She indicated on the survey a lack of understanding, but she did think her prior experiences caused her placement in a remedial mathematics course. She focused on her current experiences in the remedial mathematics course. The student had been homeschooled. She believed she learned better in the homeschool setting, in which she was able to move at her own pace and teach herself the concepts. She felt she was repeating the remedial mathematics course because the course was too fast paced. During the interview, all of her responses focused on her experiences in her current remedial mathematics course, because prior to her placement in remedial math she did not have difficulties with mathematics. Because this student was homeschooled, she did not have a traditional or typical high school experience. However, she did provide information regarding her study habits and experience seeing a tutor. Out of the fifteen students who were repeating the course, none of the other participants indicated a lack of mathematical knowledge

and understanding. The researcher thought this was odd because one would think students who are repeating the course would indicate a lack of math knowledge and understanding.

Participant two also failed to provide information regarding the lack of mathematics knowledge and understanding theme. During the interview, he stated he felt his remedial placement was due to time between mathematics courses instead of a lack of mathematics knowledge and understanding. The researcher then decided to interview participant four since two out of the three originally selected participants failed to provide any information regarding a lack of mathematics knowledge/understanding. Participant four agreed to participant in a follow-up interview.

Theme 2: Time between math courses. Of the students volunteering for follow-up interviews, seventeen indicated time between math courses as a factor in their placement. The researcher thought the time between mathematics courses was an obvious factor for nontraditional remedial mathematic students since nontraditional students had taken a break from school for years. The researcher was curious about time as a factor for recent high school graduates. Therefore the researcher decided to select one nontraditional student and one traditional student. Nine of the students were classified as nontraditional, and eight of the students were classified as traditional. The researcher separated the students into groups and selected one non-traditional student and one traditional student.

The nontraditional students had very similar responses to survey question one. Most of them indicated the number of years they had been out of school. The researcher then decided to look at the participants' second and third survey questions to help in the selection process. Two of the students failed to respond to the second and third survey question. Because the researcher

was using purposeful sampling, the researcher decided that since the participants failed to provide a response to two of the three open-ended survey questions, those two students might not be able to provide enough information to aid in answering the research questions, and the two students were not considered for a follow-up interview. The students are not included in Table 7 below. The researcher reviewed each of the remaining seven participants' surveys and noticed that the participant ranked first had been out of school for fourteen years, and only felt like she needed to have her memory refreshed. The participant stated that she just needed a refresher, and that she was good at math and that she planned to participate in the college's tutoring program. The researcher was intrigued by the participants' confidence with mathematics because nontraditional students usually do not often express they are good at math. Participant one was also the only participant to indicate responses that covered two themes. The researcher decided to contact this participant before ranking the remaining participants. The other participants would only be ranked if participant one declined. The participant agreed to a follow-up interview. Therefore, the remaining participants are included below in Table 8 in no particular order.

Table 8

Time Between Math Courses - Nontraditional Studies

Rank	Gender	Age	Race	Repeat	Response 1	Response 2	Response 3
1	Female	32	White	No	“because 14 years passed between high school and college”	“I really believe I just need to have my memory refreshed. I was good at math.”	“participate in the si”
	Male	25	White	No	“because i have been out of high school for 7 years and dont retain as much information as i should”	“college right after high school instead of waiting”	“continue to well in math 098”
	Female	36	White	Yes	“I am 36 years old and am pursuing a degree so in my experience it is because it has been so many years since I have been in school.”	“Nothing in my situation. It has just been to long since I have done any of the math.”	“Unless there are study sessions, nothing. When you wait so long to go back to school it just helps to have these refresher courses.”
	Female	38	White	No	“It has been over 20 years since I have been in high school and I did not do well in math then.”	“I could have possible studied prior to taking the placement test before I entered college, however, a lot of the concepts I do not understand and feel I will benefit to taking the whole semester.”	“Being 20 years older, and not having so many "teenage" distractions, I am more focused and willing to learn the concepts. /”
	Female	39	White	No	“I think I placed in this course because I havent used math or been in a math class in a long time and if you dont use it you lose it.”	“Continuing in school and not waiting so long to come back and using math more.”	“Keep using and taking math classes so I dont lose what i have learned / “
	Female	49	White	Yes	“Because I've been out of school 31 years and had forgotten how to do it.”	“Knowing how to do the problems”	“Take the class and practice”
	Female	27	White	No	“High school math, I have been out of school for several years”	“nothing”	“to work hard and try to relate the math to life and thing that i find instering”

Note. The Repeat column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response 1 column indicates the students' responses to the first survey question. Response 2 and 3 are students' responses to the second and third survey questions.

There were eight traditional students who perceived time between mathematics courses had impacted their remedial mathematics placement. The researcher wanted to interview a recent high school graduate to see how time had indicated their placement, since they had just graduated and not much time has passed. The researcher decided to interview the most recent high school graduate. Age was used to determine the most recent graduates. Two participants were age 19. The researcher could not decide based on survey question one. Survey questions two and three were therefore considered for only those two participants. Participant one had responses that seem more beneficial to the study. Participant one indicated that she believed tutoring would help her overcome her remedial placement. Participant two responded "nothing" to question two, and "come to class daily" for question three. Participant one was selected because her responses to survey questions two and three could potentially provide more insight to the time between math courses and the tutoring theme. Table 8 below contains the demographic for all the traditional students who indicated time between math courses as a factor in their placement. Participant one and two are ranked, but the remaining nontraditional students were not ranked because age was used to determine the participant selected for an interview, and participant one agreed to participate in an interview. All traditional students indicating time between mathematic courses are listed below in Table 9

Table 9

Time Between Math Courses - Traditional Students

Rank	Gender	Age	Race	Repeat	Response 1	Response 2	Response 3
1	Female	19	White	No	"I think I placed into a remedial math course because I did not attend a math college course straight out of high school."	"I think I should have attended more math tutoring."	"I believe that if I attend SI sessions and tutoring then it will help me."
2	Female	19	White	No	"because it had been a while"	"nothing"	come to class daily
	Male	23	White	No	"Did not take a math course at the ending semester in high school		
	Female	23	White	No	"I joined the military out of high school, and it has been 5 years since I have used algebra."		
	Female	23	White	No	"I have been out of school for over five years. This course is intended to be a refresher course so that I am not struggling in higher math."		
	Male	23	Hispanic	no	"I been placed in this course because its been long time that I graduated"		
	Male	24	White	No	"i have been out of school since 2007. There were a lot of things I needed to refresh my memory on .		
	Male	24	White	No	i havnt had math in 6 years."		

Note. The Repeat column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response1 column indicates the students' responses to the first survey question. Response 2 and 3 are students' responses to the second and third survey questions.

Theme 3: Lack of effort in high school. Only two out of the sixty-seven students who volunteered had survey responses to question one that indicated a lack of effort in high school. Because there were only two students, both were selected for follow-up interviews. Both agreed to participate in a follow-up interview. Table 10 below show some demographic information for the participants, and their response to survey question one.

Table 10

Lack of Effort in High School Interview Participants

Gender	Age	Race	Repeater	Response
Male	20	White	No	"i know me not trying, paying attention, and goofing off not taking it serious in class is the reason why i am in remedial math. This gives the people that struggled or not tryed a second chance to learn it."
Female	19	White	No	"I did not take math seriously in high school."

Note. The Repeater column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response column indicates the students' responses to the first open-ended question on survey

Theme 4: Negative experiences with a teacher. There were five students with responses that were related to negative experiences with a teacher. The top ranking student in this category had good and bad teacher experiences, and the researcher decided that student would be most valuable because she might be able to provide a description of both good and bad teachers. The researcher had trouble deciding between the remaining students. The researcher decided to interview student number two because she was African American. African Americans make up 20% of the population of students, and 25% of the sample of students who completed the survey. However, the African American student declined participation in the study, and the third student participated in the study. The third student was selected because it seemed that she

could provide some specific details regarding her negative experiences with teachers. The fourth seemed to be unsure if her remedial placement was due to her negative experiences with teachers or her lack of mathematical knowledge and understanding. It was probably a combination. The researcher had a prior relationship with the fifth student. The fifth student was one of the researcher's advisees. Therefore the researcher ranked her lowest. (See Table 11 below for a complete listing of the participants in this category.)

Table 11

Negative Experiences with Teachers

Rank	Gender	Age	Race	Repeater	Response
1	Female	18	White	No	“in 9th grade I had a great high school teacher and in11th and 12th grade I have a teacher who really does not teach me anything. where I did learn things in the 9&10th grade I have became reliant on using study guides on test instead of my brain”
2	Female	18	Black	No	“because of the teacher I had in high school didn't teach really”
3	Female	24	White	No	“When I was in high school I had a teacher for two years that literally didn't teach anything. He graded us by having a notebook and as long as we wrote down what he had written on the board you passed.”
4	Female	18	White	No	“I got Placed in remedial math because I didn't have that great of math teachers in high school. I feel like I didn't learn anything from them but then again I cant blame them for everything im just not that great at math”
5	Female	19	White	No	“I believe I was placed in a remedial mathematics course because I never had a good math teacher in high school and I was never able to learn a lot in any of the mathematics classes I took.”

Note. The Repeater column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response column indicates the students’ responses to the first open-ended question on survey

Theme 5: Placement test. There were six students who volunteered with responses related to the placement test. Three students were placed at the bottom of the list in no particular order because they were repeating the course, and perceived that the placement test was the issue. This did not seem consistent to the researcher, because the students had been given multiple attempts to move to the next course. In addition to taking the placement test the first

time, students were given a departmentally developed placement test the first day of class each semester they enrolled in the course (2 attempts). Less than 1% of the students at the college demonstrate proficiency on this exam, which leads the department to think that the placement test is accurately placing the students. The student also had an opportunity to demonstrate proficiency and mastery of the material the first time they enrolled in the course. With the remaining three participants, the researcher noticed that the participant ranked second, did not provide specific details regarding her placement testing. The remaining two participants provided a few more details. Since there were only two participants remaining and they both agreed to participate in a follow-up interview there was no need to rank them. They are listed in the Table 12 below in no particular order. See Table12 below for a complete listing of the participants in this category.

Table 12

Placement Test

Rank	Gender	Age	Race	Repeater	Response
1	Female	19	White	No	"When I took the compass test I was not really paying attention and not focusing on my test when I should of been. "
1	Female	18	Black	No	"I could have been placed in a higher math if I took the compass test over again but I decided to just let my memory get refreshed and stay in the remedial course."
2	Female	35	White	No	"I think I was placed in this due to my placement test scores."
	Male	19	White	Yes	"Did not study well for the COMPASS test"
	Female	20	White	Yes	"Because I didnt score high enough on my compass test"
	Female	19	White	Yes	"Im poor at test taking and I had not had a math class the semester I took my test."

Note. The Repeater column indicates whether a student is repeating the remedial math course during the Spring 2014 semester. The Response column indicates the students' responses to the first open-ended question on survey.

The researcher did not begin calling participants until all eleven had been selected. After initially selecting the eleven participants, the researcher made sure that among the eleven students selected, at least two students had been included for the study theme and the see a tutor theme. It actually turned out that five students had indicated they would study, and two indicated that they would see a tutor. The initial eleven students selected for an interview included nine females, two males, nine white students and two African American students. Also included in this group was one student who was repeating the remedial math course. As mentioned above,

one student declined to participate and therefore had to be replaced. Two others students from the same theme failed to provide information for the theme selected. However the researcher only selected one additional student to interview, since the researcher had initially selected three instead of two participants for the theme. Once the twelve interviews were completed, the researcher reviewed the interview transcriptions to see if more students needed to be interviewed. The researcher felt that the students were beginning to sound redundant, and that the themes could be described with the data that had already been collected. Table 13 below contains demographic information for each of the interview participants and the themes discussed during the interviews.

Table 13

Interview Participants

Student	Gender	Age	Race	Repeat	Themes	Grade
Student A	Male	23	white	no	time/study	C
Student B	Female	32	white	no	time/tutor/study	B
Student C	Female	19	white	no	time/tutor	C
Student D	Female	24	white	no	teacher/tutor/study	F
Student E	Female	18	white	no	teacher/study	B
Student F	Female	18	black	no	test /teacher/study/tutor	C
Student G	Female	19	white	no	test	B
Student H	Female	19	white	no	effort/study/tutor	W
Student I	Male	20	white	no	effort/study	D
Student J	Female	20	white	no	knowledge/study	W
Student K	Female	19	white	no	knowledge/effort/tutor	B
Student L	Female	18	white	yes	tutor/study	W

Note. The Grade column indicates the students' final grades in the remedial math course during the spring semester. The Repeat column indicates whether a student is repeating the remedial math course during the Spring 2014 semester.

Interview Participants

Student A. Student A is a 23 year old white male. He hasn't decided on a major. He remembers taking Algebra I and Algebra II in high school. When he was asked what factors contributed to his placement in a remedial math course he responded, "Not a complete understanding of math." The student stated that he had to retake Algebra 1 in high school, and made between low C's and F's in his high school math courses, but had made B's in math prior to high school. The student was initially selected for an interview because of his statement

regarding his lack of math knowledge and understanding. However, during the course of the interview, he stated that he felt his placement in a remedial math course was due to the time it had been since his last math course. Student A was also interviewed regarding his plans to overcome his remedial placement. He stated that he plans to study to overcome his remedial placement. He was also asked if there was anything else that would help him be successful in his remedial math course, to which he replied, "I think paying attention, paying attention is the best thing and um not missing any days which I never do."

Student B. Student B is a 32 year old white female. Her major is nursing. She remembers taking Algebra I, Algebra II with Trigonometry, and Pre-Calculus Algebra in high school. When she was asked what factors contributed to her placement in a remedial math course she responded, "Because 14 years passed between high school and college." The student did not have to repeat any courses in high school and made A's and B's in her high school math courses. The student was selected for an interview to discuss the impact time had had on her remedial mathematics placement, and also how she thought a tutor might help her overcome her remedial placement. During the interview she also mentioned that she plans to not only see a tutor but also study to overcome her remedial placement. When Student B was asked if she would like to add anything else about her prior math experiences, she talked about her favorite teacher. She stated,

> "Mrs. Y was awesome. She was an awesome algebra teacher and I took all the way up to pre-cal with her and she was… and she stayed on me cause she knew I was wanting to quit. I tried to drop out of high school because I had to pay bills. My mom and dad were divorced and I had to help out with bills and go to school and tried to drop out and she's the reason why I didn't drop out. Her and my science they talked me into staying in school and finishing."

Student C. Student C is a 19 year old white female. She is majoring in nursing. She remembers taking Algebra 1, Geometry, Algebra II with Trigonometry, and Pre-Calculus

Algebra in high school. When she was asked what factors contributed to her placement in a remedial math course she stated, “I think I placed in a remedial math course because I did not attend a math college course straight out of high school.” Student C made mainly B’s in her high school math courses, and did not have to repeat any of the math courses. This student was selected for an interview to discuss how time had impacted her remedial mathematics placement, and also how she thought a tutor might help her overcome her remedial placement. At the end of the interview, Student C was asked if she could think of anything else that might help her overcome her remedial placement. She stated,

> “I like to review a lot in class. It seems like some of our reviews are a little brief and I guess I like going over it at a little bit of a slower pace that way I can make sure I understand so if it were to review a little bit more, a little bit slower, that would probably help.”

Student D. Student D is a 24 year old white female. She is majoring in one of the health science fields. Student D remembered taking Algebra 1 and Geometry in high school. When asked what factors contributed to her placement in remedial math, she stated, “When I was in high school I had a teacher for two years that literally didn’t teach anything. He graded us by having a notebook and as long as we wrote down what he had written on the board you passed.” Student D stated that she made B’s and C’s in high school, and did not have to repeat any math courses. Student D was selected for an interview to discuss how her prior experiences with her math teacher impacted her remedial mathematics placement, and also how she thought a tutor might be able to her overcome her remedial math placement. During the course of the interview she stated that she also planned to study. At the end of the interview she was asked if there was anything else she would like to add about her remedial mathematics placement. She stated, “It

has definitely taught me if you are not good at something practice makes perfect and you have to start doing it every, every, every, every day."

Student E. Student E is an 18 year old white female. She is majoring in nursing. Student E remembers taking Algebra A and B and Geometry A and B in high school. When asked why she thought she placed in a remedial math course she responded, "I have a teacher who does not teach anything. I have become reliant on using study guides on test instead of my brain." Student E is currently still in high school. She is a senior in high school, and also taking a remedial math course at the college. She took the college placement test last spring at the end of her junior year of high school and decided to get an early start on her remedial coursework. Prior to taking the placement test, she had already completed both Algebra A and B. Student E made good grades in her prior math courses, usually A's and B's, before placing in a college remedial math course. She has not had to repeat any math courses in high school. Student E was selected for an interview to discuss how she thought her prior current and prior experiences with her math teacher has impacted her remedial mathematics placement, and also how she plans to study to overcome her remedial placement. Student E stated that, "I think I am doing what I can," when asked if there was anything else that could be done to help her overcome her remedial mathematics placement.

Student F. Student F is an 18 year old black female. She is majoring in nursing. She remembers taking Algebra 1, Geometry, Algebra II with Trigonometry, Pre-Calculus Algebra, and Algebraic Connections in high school. Student F thinks that lack of effort she made on the test was a contributing factor as to why she placed in a remedial math course. She stated,

> "I could have placed in a higher math course if I took the compass test over again but I decided to just let my memory get refreshed and stay in the remedial math course. I

> could have focused more on the compass test and then came back to retake the compass test at a later date."

Student F made A's in her high school math courses, and did not have to repeat any courses in high school. She was selected for interview to discuss how the placement test impacted her remedial mathematics placement. However, during the course of the interview, she mentioned prior experiences with math teachers that also contributed to her remedial mathematics placement. She also discussed how she would study and see a tutor to overcome her remedial mathematics placement.

Student G. Student G is a 19 year old white female. She is majoring in psychology. Student G remembers taking Algebra 1, Geometry, Algebra II with Trigonometry, and Pre-Calculus Algebra in high school. Student G thinks that the lack of effort she made on the placement test is the reason why she placed in a remedial math course. She stated, "When I took the compass test I was not really paying attention and not focusing on my test when I should have been." Student G made A's and B's in her high school math courses, and did not repeat any math courses in high school. She did not think that she would need anything special to help her successful complete her remedial math course.

Student H. Student H is a 19 year old white female. She is majoring in nursing. She remembers taking Algebra A and B, Geometry, and Algebraic Connections in high school. When Student H was asked what factors contributed to her remedial math placement she stated, "I did not take math seriously in high school." Student H had to retake both Algebra A and Geometry in high school. She made mainly C's and D's in her high school math classes. Student H was selected for an interview to discuss why she did not take math seriously in high school, and to discuss how she planned to study to overcome her remedial placement. During the course

of the interview, she stated she would also see a tutor to help overcome her difficulties with mathematics. Student H also thought her home life played a role in her remedial placement. She stated, “I definitely think my home life. My mom if she would have pushed me to do better that would have made a difference. I didn’t have a good home life and my mom really didn’t make me go to school.”

Student I. Student I is a 20 year old white male. He is majoring in criminal justice. He remembers taking Algebra A, Algebra B, Geometry A, and Geometry B. When asked what prior experiences contributed to his remedial mathematics placement, he stated, “I know me not trying, paying attention, and goofing off not taking it serious in class is the reason why I am in in remedial math. This gives the people that struggled or not tryed a second chance to learn it.” Student I stated he made mostly D’s in high school, and did not have to repeat any math courses in high school. He was, however, required to complete remediation in high school to bring up his grade in a Geometry course. Student I was selected for an interview to discuss his lack of effort in high school and how he plans to study to overcome his remedial math placement. Student I also stated that he plans to pay attention and not miss any class meetings in his remedial class to help him overcome his remedial placement.

Student J. Student J is a 20 year old white female. She is majoring in nursing. She could only remember taking Algebra A and B in high school. Student J believes that she has difficulty understanding math, and that is why she placed in a remedial math course. She stated, “I was not very good in math and It is giving me the oppertunity to get better.” Although Student J was not very good at math she made mainly A’s and B’s in her high school math courses, and did not have to repeat any math courses in high school. This student was selected for an

interview to discuss her lack of math knowledge and understanding, and to discuss how she plans to study to help overcome her remedial mathematics placement.

Student K. Student K is a 19 year old white female. She is majoring in nursing. She remembers taking Algebra 1, Geometry, Algebra II, and Pre-Calculus Algebra in high school. When asked why she placed in a remedial math course, she stated, "Because I struggled with math throughout high school." Student K made mainly D's in her high school math courses. This student was selected for an interview to discuss her difficulties with mathematics. During the course of the interview, Student K also mentioned her lack of effort while in high school and how a tutor might help her overcome her remedial placement. She stated, "I could have tried harder in high school and applied myself."

Student L. Student L is an 18 year old white female. She has not decided on a major. She remembers taking Algebra 1, Geometry, Algebra II with Trigonometry, and Pre-Calculus Algebra in high school. When asked why she placed in a remedial math course, she stated "Because I was not mentally prepared to take a college-level math course." She received B's and C's in her previous math courses. This student was selected to discuss her difficulties with mathematics, and to discuss how she thought studying would help her overcome her remedial mathematics placement. At the start of the interview, Student L mentioned that she was homeschooled, and during the interview she focused heavily on her current remedial class. She did not seem to think her prior experiences impacted her remedial placement. She felt she was doing poorly in the remedial course because of the teaching methods used in her remedial class. The methods were very different from how she had taught herself while being homeschooled. She stated, "Like at home, I, the book basically taught me and I did fairly well having the book teach me like Algebra and now in my Math 098 class they…they move at a faster pace." In her

homeschool courses, she was able to go at her own pace. Prior to placing in remedial math she thought she was OK at math, and she was comfortable with basic math. Still she figured she would place low. Student L was asked if there was anything else that could be done to help her overcome her remedial placement, and she stated, "Um definitely having the teacher break down what she's doing…explain it more so than just running over the concepts and expecting you to grasp it."

Themes Based on Interview Data

To gain a more in depth understanding of the themes identified from the survey data, each of the eleven participants were asked questions related to one or more of the following seven themes: *Lack of math knowledge and understanding; Time between math courses, Lack of effort in high school, Negative experiences with teachers, Placement test, Study,* and *See a tutor*.

Theme 1: Lack of math knowledge and understanding. Student J and K both indicated that they did not understand math and that their lack of understanding contributed to their remedial mathematics placement.

Student J stated,

> "Because when they give me a problem with letters in it that throws me completely off. I am not sure if I just do not study that hard problem enough or if I just do not take the time to figure it out or that's why I get frustrated with it. I do not, I do not, I do not really study on it."

Student K stated,

> "I struggled with math throughout high school. I have always had a hard time learning math. I just do not understand it. It just doesn't make sense to me. I guess I just didn't think I could get it. I thought I was just one of those people who couldn't get math. My parents are bad at math."

Both students were asked when their difficulty with math began and how they got through their math courses. Student J stated that her troubles with math did not begin until high school, when variables were introduced. To get through her math courses, she always asked a lot of questions, and asked her teachers and friends for help. Although Student J had difficulty with math in high school, she remembers making mainly A's and B's in her high school math courses. Student K remembered having difficulty in elementary school with fractions and decimals, and also in middle school when she took Pre-Algebra. The introduction of variables in middle school also confused her, and she still has difficulty with the concept. Student K stated she did the bare minimum, and relied on bonus points and extra credit to pass her math classes with D's mainly.

Theme 2: Time between math courses. Students A, B, and C all indicated that the time was a factor in why the placed in a remedial math course.

Student A stated,

> "I think I'm good at math when it's at that time of like what subject were on but the longer I do not do it the more I forget. I think I was used to uh kind my own way of doings things I think. I thought well I know it. Usually I did, but after so long. At the beginning of it I didn't realize how much you know I did remember and how much I had forgotten. I think after the farther you go along in um algebra and stuff and math it just keeps piling on top of each other and you need more and more you know. You have to remember certain things."

Student B stated,

> "Because 14 years passed between high school and college, um did not use it so I lost it and the math you got to do it every day to remember it."

Student C stated,

> "I think I placed in a remedial math course because I did not attend a math college course straight out of high school. I was I was not very current with it so of course I didn't really remember anything because I didn't have to use it. Right now we're um we're covering like multiplication principles and such. I remember a decent amount of that and most

everything before it it's just you do not think about it because I was doing Pre-Cal my senior year of high school. So I went from doing Pre-Cal back to like the simpler stuff."

For the most part, all three students felt they just needed a review of the concepts. They remembered seeing the concepts in high school, but felt they just needed a refresher course.

Student A stated,

"I've lost a lot of it you know. I think I remember some of it and the more I go along I mean a lot of it I am remembering. I need a good refresher."

Student B stated,

"Yes, this is the same stuff I took in high school exact to the Tee. Just if I would have refreshed before I took the COMPASS I probably could have placed. Just review. I believe though with a review I already know the concepts. They're stored in there. They just I have to be reminded."

Student C stated,

"I'd have to say most of it's a refresher there are a few things that I might have to actually be retaught cause I do not remember that well but most of it going to be just touching up. I kind of flipped through the textbook and there's a couple of things that look familiar that I feel like I really wouldn't have to struggle that much to kind of work my way through it and then there are some things I have no idea... I think some it is some of the science classes I've had to take. We have had to use certain parts of it and some of it is my teachers did teach it in such a way it kind of stood out."

Theme 3: Lack of effort in high school. Students H, I, and K all indicated a lack of effort in high school as a factor in their remedial mathematics placement. They were asked why they didn't make an effort in high school. All three indicated that they did not think it would be important.

Student H stated,

"Because I didn't think it would be important in college. I didn't think I would really need it. I didn't think you would actually use it in the real world or for nursing. I didn't think you had to have like, a math class for that major…. I didn't pay attention in class. I

didn't really study for test or if I did homework I would just write down answers to get the points. I didn't take, I mean I didn't try. I went to class not as much as I should of in math because you have to go every day to get a good foundation because you learn new stuff every day. I didn't think math was really important and you had to have a good foundation like each grade and I do not have a good foundation right now and I'm struggling with it. I wish I would have took that more seriously."

Student I stated,

"I do not know it was more like because of my friends and stuff like that and I uh I was trying to be I guess impress them and be cool and stuff and not care and I just, I felt like the teachers weren't like, like I know they were teaching and stuff but they didn't really get into like the teachers at college do. Like the teachers here they'll like they'll cut up with you but they still teach at the same time. And the way they in high school they act like dictators you know just teaching they do not talk to you… I was like that in all of my classes. I mean there was like maybe one or two that I actually like, like tried in but that was because the teachers like were interesting. I was just thinking about the present and then uh now it kind of hit me."

Student K stated,

"I just didn't think it mattered. It really didn't hit me until the end of my senior year when my friends were apply for scholarships and taking about the schools they might go to. I just wish I would have made more of an effort in high school. I just didn't know it would be important. And then I got here and I place in the lowest math and I have to take these remedial math classes."

Although these students stated they did not make much of an effort in high school, they all passed their math classes. When asked how they think they got through their math classes, all three indicated bonus points.

Student H stated,

"Homework and participation points they all average out. Like my teacher told me the first day that you could fail every single test but if like, you do all your homework you'll pass with like a C. Man he shouldn't have told us that. Like in my senior class I was taking an Algebra Connections class and if you opened up like a savings account or checking account or like credit card. It was like a financial planning class but you'd get like, I think like, 50 points for each thing like each semester, like each 9 weeks. Like 50 points for opening up a checking account. Also like, bring can goods for the food drive."

Student I stated,

> "Uh, if you want me to be honest--cheating… Uh the teachers sometimes was like, if we clean the lunchroom tables or something like that. I did that. Just anyway of getting at least a D."

Student K stated,

> "I always just did the bare minimum. I would always ask the teacher if there was anything I could do to just pass, anything extra, I would do whatever for bonus points bring in supplies whatever."

The students were asked what could have been done to encourage them to make more of an effort in high school. Both students H and K indicated they were not aware of the remedial coursework.

Student H stated,

> "People could have or the teachers could have told me that about the remediation math classes in college and that you do not get credit for them and you still have to pay for them."

Student K stated,

> "Maybe if my teachers would have just told me about how I was going to need this in college and might have to take remedial math in college if I didn't learn it now."

Student I wasn't sure exactly what would have encouraged him but he did mentioned the teachers again. "Uh the teachers getting into it that was one of the things I think uh and just uh I really do not know."

Theme 4: Negative experiences with teacher. Students D, E, and F all indicated that they had negative experiences with their high school math teachers, and that it played a role in their remedial mathematics placement.

Student D stated,

"For the ninth and tenth I had a teacher that pretty much I didn't learn anything at all. Talk about nothing. Everything that he even said was foreign I mean. He pretty much made us just keep a notebook and then like just take down everything off the board that he had wrote, and as long as you had everything in the notebook you know then you passed… Like the whole class would be doing the test and he'd just write the you know answers and stuff on the board… I made good grades cause he liked me yeah. He was just a cut up teacher I mean there's no way I could have passed because I didn't know it you know. I do not know it now so (*student laughing*)."

Student E stated,

"Ok like whenever I was you know like really younger I had really good math teachers. Yeah they were really good and then my ninth grade teacher he was I mean he was amazing and then my tenth grade teacher she was she was awesome. Both of them teacher I mean I remember when I was in ninth grade I dreaded going to that class because he was hard we had homework all the time but he would actually, you know, you would realize, you know, I now realize afterwards that I actually learned stuff in his class but I have a teacher now who I've had, I had last year, and I have this year, you know, I am a senior in high school and he gives us a study guide you know we do the study guide together and then on our test he lets us use the study guide. Um my 11th grade year and this year he like gives you your study guide, you do the study guide together and then on the test he lets you use your study guide. And the questions might be like, you know, I am in Geometry but it's not, you know, where a problem might be 2+2 on the test it be like 4+4. He just changes the numbers up but the format the exact same and he really doesn't teach us anything. He just sits there and he puts it on the board and he just answers it all and you copy it down he really doesn't go through much."

Student F stated,

"Like she my sophomore year she'll just right stuff down on the board and wouldn't explain it to us. She just tell us to go home and study it look over it."

Based on their experiences students were then asked to describe a good teacher and a bad teacher. Participants indicated that a good teacher takes their time with students and explains.

Student D stated,

"Ok, alright a good teacher would be um someone who takes their time um makes sure you know at the end of the day that you're at least understanding a little bit, following,

um, just basically took time. A bad teacher would be someone who doesn't take time with the students, um, who's basically, is there to get their job done."

Student E stated,

"Well a good teacher, you know, actually takes time and actually goes over things and then the bad teachers he doesn't. He just gives you all the answers. I mean that's what a lot of kids want are just the answers but that's not going to help you in college I mean it's going to help you pass the class but it's not going to help you, you know, further in life. And then the good teacher he actually will give you homework. I know kids do not like homework but I mean it helps you. It really does because you have to think on your own and then like the bad teacher he doesn't ever give us homework and then like my good teacher he would take time, and if you like needed help he would tell you, you know "come in my planning period. You can. I'll help you with this or come when you have a free period" and my other teacher he acts like he doesn't care and he doesn't want us to come you know and he acts like we aggravate him when we come to him."

Student F stated,

"A good teacher, um go through steps and tell us, explain each step to us. A bad teacher would just throw a problem out there and expect us to know how to do it I'll self."

Theme 5: Placement test. Student F and G both mentioned the placement test as a contributing factor in their remedial mathematics placement. They were asked what could have been done to encourage them to take the placement test more seriously. Both felt that the importance of the test was not made clear to them, and that they needed more guidance and information regarding the placement test prior to taking the test. As mentioned earlier, the interviews would be used to determine the meaning of student comments on the survey regarding the placement test. From this point forward, the theme will be renamed "Lack of placement test guidance."

Student F stated,

"Um maybe if they maybe if I had of talked to and advisor and they told to me why I was taking the test I would've."

Student G stated,

> "I feel like my school like prepared me as in like they taught me the stuff but I do not feel like they actually like prepared me for like the test like how it was going to be taken and like that, in that sense. Um maybe just giving us like a little, like I do not know a review or something of the test, and like maybe I do not know making it sound more like its important. Cause their just like "here come take the compass test so you'll like get placed in this class." Ok I do not really think they put a whole lot of importance on it. I mean like we knew we'd get placed in a class, but I do not know. I just, I do not know, I guess we're teenagers and just didn't really; they didn't give us some big lecture so it didn't seem important."

During the interviews, Student F also mentioned that she had forgotten some of the material, but had seen the same types of problems in high school. She felt that high school had prepared her for the material that was on the test, but was not aware she could be placed in a remedial math course. She felt that she did need to be refreshed on some of the material, but remembers a lot of the concepts from high school.

Student G stated that she too had forgotten how to do some of the material, but had seen the same types of problems in high school. She stated, "When I was in this math in high school I had a tutor, so I'm like, so like, I do not remember everything like 100% but for the most part when she goes over it like on the board I'm like ahh I remember this."

Theme 6: Study. Many of the students mentioned that they planned to study to overcome their remedial placement. They were asked how they planned to study.

Student A stated,

> "I study in a week; I might only study about two hours…Um, I would just look over notes or read through the chapters. When I study I just, I mean I can look over something and I can kind of remember it. Then you know when it comes to, I really do not do much studying when it comes to math. It's just you just kind of have to learn it and I can do it over and over again but um for me it's easier, just, I can look over it. I might work a few problems, but usually I just review. I'm visual."

Student B stated,

"I listen to the lectures at least twice. I heard somewhere in the beginning of the semester that you‘re supposed to put in two hours study per semester hour and I'm taking 13 semester hours so that 23 hours of study time a week. I'm not quite getting that much. Um, right now I'm I usually go anywhere from 15 to 30 minute spurts throughout the day and that's about 3-5 days a week. So I'm maybe, I try to get in at least 2 hours a day and I'm getting anywhere from 6-8 hours a week."

Student D stated,

"Um... like the only thing I really do I take my math book home and I like go through the chapters that were on and I try to understand you know like what she said I try to remember what she went over during the day and sometimes I just get so frustrated with it I mean I just shut it down. I know one thing I do do different. I've been writing notes in math class and you wouldn't think that writing notes in math class would help, but I mean it makes a difference."

Student E stated,

"Well like now I have sheets from like review. Like every section we do here he gives us these little worksheets. It's not really worksheets it's kind an outline of the chapter and it helps and you know I study that and then it has like the work that we do in class I take them problems and I work them out myself and then he gives us review for our test that I just work over and over again."

Student F stated that she studies by reviewing her notes and working practice problems. She studies about thirty to forty minutes four times a week.

Student H stated,

"Um I do the odd problems in the book after each lesson that she teaches and then I go back over them and I go to Supplemental Instruction once or twice a week to like review for tests. I study like every day, like a little every day, and for the test it. I do not have to cram. I do a lot better when I do that…I study two to three nights a week for about an hour."

Student I studies with a friend that is in the remedial math class with him. To study they practice working problems about two or three nights a week.

Student J stated,

> "Um basically what I do is, I just like, we have math books and I go through there and maybe sometimes I'll just write out a problem out of my head and I'll try to do it and if I can't I'll just find you know what kind of problem it is and then I'll try to do it."

Student L stated,

> "I work really well with bright colors and flash cards so I've taken to where I'll write right down all the little tips or all the little steps they give you with rules and I'll highlight them and I'll study them over and over and if I forget I can go back and look and I set aside a time at night time and I'll sit there and study for an hour or two hours it just depends on how the night is."

The students were then asked if they had studied in the past, and if they felt their teachers encouraged them to study in the past. They were also asked about homework given in high school. Most stated that they did not study in the past. Student A stated that he did not study in the past because he did not need to do so. He did not think his teachers encouraged them to study. He stated,

> "In high school we were given homework maybe once every now and then. We didn't get it every week. A lot of ours was done in class. And if we did get homework you know we had time so I would usually do it before class ended."

Student B stated,

> "No, I did not study at all. I was in band. We had band practice after school and then I worked and then I came home went to bed and got up and went to school the next day. And I never had time to study. What I did, well, we had one usually around lunch time. We had an hour to do homework at school. I guess it was called study hall. Yeah study hall. I just studied in study hall for the hour, hour and a half…Yes, a lot of homework, but I always did my homework in study hall… Um, it was 4 nights a week four night a week every now and then it was only three but it was usually, if we were going to have a test that week we knew because we only 3 weeks-3 days of homework. But if we didn't have a test we got 4…They did but they knew my situation at home, that I didn't have time to study with my extracurriculars and I was working a part time job to so."

Student D stated that she did not study in the past, but she now spends about three hours a week studying. When I asked her why she didn't study in the past, she stated," it didn't seem important at the time now I have 2 kids and it's very important." She does not remember her

teachers encouraging her to study in the past, though she was given homework two or three nights a week. She remembered not doing the homework, or copying off of other people if she did do it.

Student E stated that she has always studied, and currently studies about 15 hours a week. She does not feel like her current high school math teacher encourages her to study. He only sets around four problems for homework, and doesn't check it for accuracy. The homework is usually completed in class.

Student F did not study in the past because she did not need to do so. She did not think that her teachers in the past encouraged her to study. She was only given homework once every two weeks.

Student H did not study in the past. She did not think her teachers encouraged her to study in the past. They gave homework, but it was completed in class and she didn't really do it. She also copied others. Student H expressed regret about not studying in the past.

Student I admitted that he did not study in the past because it just seemed "time consuming and pointless, and something I didn't think I would ever need." He believes his teachers encouraged him to study in the past, and remembers being given homework two or three nights a week, but cheated on those assignments and the actual classwork assignments that were usually completed in class.

Student J stated she plans to study for between sixty to ninety minutes twice a week. She did not study in the past mainly, because she was too busy with her friends. However, she believed her math teacher encouraged her to study because they were given homework every night.

Theme 7: See a tutor. Seven of the students mentioned that they would see a tutor to help them overcome their remedial mathematics placement. They were asked how they thought a tutor would be able to help them. They indicated that the tutor could go step-by-step with them, and maybe explain concepts better, or show them other ways to work problems. They also indicated they felt more comfortable asking questions with a tutor.

Student B stated,

> "Um, maybe they would have already been through the class and they've been taught by the teacher before and they know how the teacher teaches so maybe they could explain it. Like they figured it out a little different. They could explain it a little easier."

Student C stated,

> "Well if there is anything that I do not really understand they can point me in the right direction you know if I have problems kind of working something out they can show me how to go through the process. Because some times in class they go over stuff a little bit quicker than a tutor---a tutor is more of kind of one-on-one… Well that, you know, sometimes in a room full of people you do not want to ask certain questions and then when you are one-on-one you are not so worried about it."

Student D stated,

> "Um one-on-one with me, that way they can sat down step by step and um show me you know exactly what I'm doing wrong, what I'm doing right, that way I know where I'm at. In a classroom setting it's just like you do not really want to feel stupid you know and say a wrong answer even if, you know, if it's right, you do not know and you say a wrong answer you kind of feel stupid you know."

Student F also mentioned that she might see a tutor even though she had not seen one in the past. She stated a tutor would probably be able to "help me to remember and learn."

Student H stated,

> "It's smaller their not as many students. I can ask more questions and like if I do not understand something she can redo it step by step its one-on-one so it helps me a lot too and she has more time to explain it than the regular teacher does during lecture time."

Student K stated,

"Sometimes I just need to see it over and over again step-by-step. I need to see it slower and sometimes they can show me another way to do it that's easier for me. And sometime when I ask questions in class the other students will say "she just said that" or" she just showed us that." It makes me not want to ask questions in class."

Student L stated,

"They broke it down step-b-step. They showed you exactly how to do it many different ways. That way you can choose the way the was best for you. And when you choose the way then they focused on that way and helped you to choose to understand how to break down the rest of it…They can cater to my needs and see where I am lacking at."

These students were also asked what they thought the difference was between a tutor and a teacher.

Student B stated,

"Um a teacher is certified and then a tutor would be someone that's just been recently through the course. Um a tutor would be more like a peer they probably wouldn't expect to say it one time and expect for you to know it right then. Where a teacher would be like ok I explained it the best I can you either got it or you do not."

Student C stated,

"A teacher is going to introduce you to it and I suppose teach you different ways to do it but a tutor is going to kind of teach you in a way to apply it to yourself because not everybody learns the same way so a tutor might teach you to break it down in such a way that you can understand it whereas a teacher is kind of more general."

Student D stated,

"Ok um a tutor is someone to be there I guess to kind of coach to get you used to like tests and reviews and everything as to where a teacher is there to set the guidelines and tell you what to do but not as so much you know go into detail."

Student F stated, "Um a teacher, a teacher is they just teach it to us and the tutorer help us to better understand it." Student F was asked how a tutor would help her better learn and she stated that" they go over it, over and over again."

Student H stated,

> "Well my tutor she really wants to help and she does more hours to than she's required to really help us and I mean my teacher she cares but I just think my tutor my tutor like really, really wants us to succeed and she make sure we really understand it before we like leave. I just think the tutor really cares if you pass. My teacher she goes really fast and I do not like how she teaches."

Student K stated,

> "Um, um I guess a teacher is certified and I trust the teachers help more because they really know how to do the math and a tutor is just someone who has taken the course and has learned how to do the math and can help you learn it. I guess they uh a tutor works with you one-on-one and goes slower with you but a teacher has to teach the whole class and cannot teach just to you."

Student L stated,

> "The teacher has to focus on the group and the tutor has to focus on you."

Chapter Summary

This chapter presented the results of the study. An overview of the methodology was presented along with information about the survey and interview data. Information about the survey included the response rate, response bias and respondent demographics. The data analysis of the open-ended survey questions provided insight into the participants' perspectives of their experiences, and the following seven themes were identified: *Lack of math knowledge and understanding; Lack of effort in high school; Negative experiences with teachers; Time between math courses; Lack of placement test guidance; See a tutor; and Study*. Twelve students were selected for an interview and the chapter included a description of the themes with direct quotes from the participants taken directly from the survey and interview data. Chapter 5 will summarize the study, address the research questions, and also speak to insights constructed from the literature review, as well as implications of the study and possible future research needs based on the findings of study or information not found within the current study.

CHAPTER 5 FINDINGS

Chapter Introduction

In the previous chapter data collected from surveys and interviews was presented and analyzed. This chapter discusses the findings of the study. Included in this chapter are a brief summary of the study and a discussion of the findings related to the research questions. The rationale for the findings are interpreted, explained, and discussed in terms of the research literature. Implications for practice and recommendations for future research are also presented in this chapter.

Study Summary

Many students are entering college underprepared for college-level, credit-bearing mathematics courses. The purpose of this research study was to gain an understanding of students' perceptions regarding their remedial mathematics placement. The research questions that guided the study are:

(1) What are factors remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial mathematics?

(2) What do remedial mathematics students perceive as a resolution to their difficulty in mathematics and current placement in remedial mathematics?

To answer these questions, students enrolled in a remedial math course were asked to voluntarily complete an online survey (159 of 267 or 60% the students completed the online survey), and twelve students were selected for follow-up interviews. From the data collected, the following seven themes were identified: *lack of math knowledge and understanding, lack of placement test guidance, lack of effort in high school, the time between math courses, negative experiences with teachers, see a tutor, and study.*

Findings Related to Research Literature

Research question 1: What are the factors remedial mathematics students perceive as leading to their difficulty in mathematics and current placement in remedial mathematics? Based on the results of the survey and interview data, students attribute their placement in a remedial math course to one or more of the following: *lack of math knowledge and understanding, the lack of placement test guidance, lack of effort in high school, the time between math courses, and/or negative experiences with teachers.*

Lack of math knowledge and understanding. Thirty-five percent of the students surveyed, and two of the students interviewed, indicated a lack of math knowledge and understanding as a factor in their remedial mathematics placement. Many of these students stated that they did not understand mathematics or hated mathematics that it was confusing, and that they had a difficult time trying to understand it. Others simply stated they were bad at math. During the interviews, both students recalled having difficulty with variables. In Koch, Slate, and Moore (2012) students indicated that they always struggled with math and reported specific academic deficiencies that resulted in their remedial placement. Howard and Whitaker (2011) also had participants who expressed difficulty with math, along with concepts they had difficulty understanding.

Time between math courses. Roughly 25% of the students surveyed, and three of the students interviewed expressed that the time since their last math course had an impact on the remedial mathematics placement. Some participants expressed that they did not take a math course their senior year of high school, and others indicated they had not taken a math course recently. Many of the survey participants had not been in a math class in over 10 years. Both groups felt they had forgotten some math concepts and skills during the time between their last math course and current remedial placement. Also, participants who expressed time as a factor in their remedial placement felt they just needed to have their memories refreshed. Boylan (2011) argues, "The amount of elapsed time since a student has taken their last math course has significant consequences on placement into college-level math course" (p.20). In a study to understand the students' perspectives of why so many entering students are underprepared for college, Schornick (2010) indicated that whether or not the high school student participated in a mathematics courses during their senior year contributed to the preparedness of the student, and that many of the students in the study did not take a math course during their senior year.

Lack of effort in high school. Fifteen percent of the students surveyed, and three of the students who were interviewed, expressed a lack of effort in high school as a contributing factor in their remedial mathematics placement. Many students indicated that they did not think learning math was important or relevant, or that they were distracted by other things. They indicated they did not think they were going to ever need the math they were being taught. They said they would have made more of an effort if they had been told what they were being taught was going to be important. Schornick's (2010) findings indicated that students felt that their placement in remedial math class was due to the fact their teachers did not make the lessons interesting. Howard and Whitaker (2011) had similar findings. Students indicated a lack of effort

in high school or motivation contributed to their unsuccessful experiences with mathematics. They were not motivated to learn math because they felt like math was a waste of time. The absence of the application or utility of mathematics continues to be a major issue in the teaching and learning of mathematics in high school, as found in this study.

Negative experiences with teachers. Based on the analysis of the survey and interview data findings, approximately 10% of participants' surveyed, and two students that were interviewed, indicated that their negative experiences with teachers contributed to their remedial mathematics placement. Some of the participants stated that their teachers did not teach, or did not have good teaching skills. Others stated that their teachers did not seem to like to teach, and they did not care about them. Schornick (2010) indicated that students perceived their learning was not valued by their teachers, their teachers did not enjoy teaching, or their teachers were generally uncaring. Some students in the Schornick (2010) study reported that their teachers did not teach. Howard and Whitaker (2011) indicated that the students' learning environment, including the teacher, contributed to their difficulties with math and current remedial placement.

Many teacher quality studies (e.g. Bolyard and Moyer-Packenham, 2008; Goldhaber & Brewer, 1997; Howell, 2011; Torff and Session, 2009; Wayne and Youngs, 2003) have been conducted to determine the relationship between various characteristics of teachers and their effectiveness. The teacher quality study conducted by Torff and Session (2009) has findings that have implications in this study. Their study was conducted to determine the source of teacher ineffectiveness. Results indicated that teacher ineffectiveness was more often produced by deficiencies in teachers' pedagogical knowledge. Teachers often know the content they are teaching, but lack the training and skills to effectively teach the content and manage the classroom. However, this is contradicted by studies (e.g. Campbell, Nishio, Smith, Clark, Rust,

DePiper, Frank, Griffin, & Choi, 2014; Hill, Rowan & Ball, 2005 cited from Campbell, Nishio, Smith, Clark, Rust, DePiper, Frank, Griffin, & Choi, 2014) that indicate content knowledge and depth of understanding also contributed to ineffective teaching and student achievement.

Lack of placement test guidance. Ten percent of the students surveyed, and two interviewed, indicated that the lack of guidance and information prior to taking the placement test was a contributing factor in their remedial mathematics placement. Students felt they did not fully understand why they were taking the placement test, and that no one explained it to them prior to the test. They felt they had seen the concepts on the placement test, but had forgotten how to do some of the problems, and needed a review, before taking the COMPASS test. During the interviews, the students expressed that they would have taken the test more seriously if they had fully understood its purpose, including the possibility of being required to take no-credit remedial coursework. Schornick (2010) had findings that support this study. Results of the study indicated that few students remembered their teachers doing things that prepared them for the college entrance exams. In Venezia, Bracco, and Nodine (2010), students indicated that they were uninformed about the placement tests. Some stated that they did not even know about placement tests. Others were unaware of the risks involved, and/or not prepared for the topics covered on the test, or for the format of the test. Before taking the assessment, most students did not realize that their performance would affect whether they would be able to get college credit for their classes. Similarly, Safran and Visher (2010) indicated that students often take placement tests without understanding their real purpose, and students often take tests without having reviewed the skills to be tested.

Research Question2: What do remedial mathematics students perceive as a resolution to their difficulty in mathematics and current placement in remedial

mathematics? Based on the analysis of the survey and interview data, students perceive that seeing a tutor and studying will help them overcome their remedial mathematics placement.

Study. Forty percent of students surveyed, and nine of the students who were interviewed, indicated that they planned to study to help overcome their remedial mathematics placement and difficulties with mathematics. Students planned to study by reviewing their notes and practicing problems. Although most students indicated that they planned to study to overcome their remedial placement, most of the participants indicated that they did not study in the past, and half of the students interviewed about their study habits indicated that their teachers did not encourage them to study in the past. Only one of the students interviewed recalled being given homework every night, and the four students who remembered being given homework periodically stated that their homework was done in class. Also, three of the students admitted that they cheated on homework assignments by copying their classmates. Howard and Whitaker (2011) indicate that successful remedial mathematics students were "proactive in their study habits by diligently and consistently doing their homework and by doing more than assigned when the need for comprehension arose" (p. 10). Students in the Howard and Whitaker (2011) study also admitted that they did not study or do homework in the past. Similarly, Koch, Slate, and Moore (2012) identified students' completing homework as a contributing factor to their success in their remedial mathematics course. Students also reported cheating and not doing homework outside of class in high school.

See a tutor. Roughly 15% of the students surveyed, and six interviewed, indicated that they would see a tutor to help overcome their difficulties with mathematics. Many students indicated that they would see a tutor to help them better understand mathematics. Some stated that the one-on-one help, that a tutor could provide would help. Many students felt that if a tutor

could spend more time helping them and also show them multiple ways to solve problems or explain it in a manner that was easier to grasp, they would improve their mathematics achievement. During the interview, several of the students mentioned that they would feel more comfortable asking questions when working with a tutor. Koch, Slate and More (2012) identified the use of additional support resources including tutoring as contributing to student success in their remedial mathematics course. Howard and Whitaker (2011) identified tutors as a resource for helping students learn mathematics. Students also mentioned the need for one-on-one help. Lastly, Weinstein (2004) indicated that tutors were able to successfully help remedial math students learn mathematics even when the tutors had to accommodate the students' varying learning styles and tactical approaches to doing math problems.

Discussion

Based on the survey and interview data results, several factors have contributed to the remedial placement of the students in this study. Some students attribute their placement in a remedial mathematics course to a lack of mathematic knowledge and understanding. This was not surprising, because similar studies have indicated as much (Howard & Whitaker, 2011; Koch, Slate, and Moore, 2012). The study's findings indicate that students' lack of mathematics knowledge stems from years of difficulty with mathematics, which was never fully addressed. Students made comments such as, "Math is a weak subject for me. I have struggled with math since high school years" and "i did not learn alot of math in highschool." During the interviews, students were asked when their difficulty with math began. Student K stated, "Um…I guess middle school…Pre-Algebra...when we started working with x's and y's…letters." The researcher asked if she had any problems with math prior to middle school, and Student K stated,

“Yeah…I still have trouble with fractions and decimals. I just can’t seem to remember all of the rules.”

Study results indicate that students are being given passing grades, and passed on to the next course, in spite of the fact that they haven’t mastered the content. Student J stated that she passed her math course with A’s and B’s and did not have to repeat any courses in high school. When asked how they passed their previous math courses, Student K stated, “I always just did the bear minimum…I would always ask the teacher if there was anything I could do to just pass…anything extra… I would do whatever for bonus points...bring in supplies…whatever.”

It also seems that when these students encountered difficulty with mathematics, they lost confidence in their ability to do math. It affected their mathematics self-efficacy. On the survey, students made comments such as, “I am not that good in math” and “I have never been good at math.” During the interviews, Student K stated,

> “I struggled with math throughout high school. I have always had a hard time learning math. I just do not understand it. It just doesn’t make sense to me. I guess I just didn’t think I could get it. I thought I was just one of those people who couldn’t get math. My parents are bad at math.”

When students learn to dislike math it becomes a part of their math self-concept (Middleton & Spanias, 1999). As early as middle school, students begin to perceive math as a special area in which only smart students can succeed, and that effort will not change their ability to do math. It has been shown that students’ belief about their ability to do math affects their performance. Pajares and Miller (1994) examined the predictive ability of mathematics self-efficacy in regards to mathematics problem solving, and findings indicated that mathematics self-efficacy was predictive of problem solving ability. Students’ difficulties with mathematics must be addressed before they start to believe they cannot do mathematics. Of the two students interviewed

regarding their lack of math knowledge and understanding, only one of them was able to remediate successfully. It should also be noted here that, in hindsight, the lack of math knowledge and understanding theme could have been more accurately called lack of mathematics self-efficacy theme, or a combination of the two.

Some students completing the survey indicated time between math courses as a factor in their remedial mathematics placement. This finding was confirmed by a similar study Schornick (2010). On the survey, students made comments such as, “Did not take a math course at the ending semester in high school,” and “because i have been out of high school for 7 years and dont retain as much information as i should.” Time between math courses was an obvious and expected factor for nontraditional students who have been out of high school for years, and have either forgotten a lot of the mathematics they learned, or were never exposed to some of the concepts, But for recent high school graduates, time between math courses indicates students need to be enrolled in college preparatory math course all four years of high school.

Currently, in Alabama, students are required to earn four Carnegie units in mathematics to graduate from high school. Most of the students in this study would have entered high school in 2009 or earlier. In 2009 students were required to complete Algebra 1, Geometry, and two additional math electives, which for weaker math students would have been Algebra 1A and 1B with Geometry A and B as four credits. Zelkowski (2010) finds that students can easily fulfill the final mathematics credits with electives that may fail to increase college-readiness, due to watering down advanced courses until they no longer advance students’ college-readiness. Student H made the following comment regarding her senior year math course: “Well I made a B my senior year for Algebraic Connections. It wasn’t really math.” In addition to this, students who are on the block schedule are able to complete these requirements in their first two or three

years of high school (Zelkowski, 2010). Therefore, a lot of these students may not take a math course their senior year of high school, since they have already met the graduation requirements. In a study to explore variables that can help students be mathematically college-ready, continuous enrollment in mathematics throughout all four years of high school was the dominant variable at predicting bachelor degree completion (Zelkowski, 2011).

Just taking a math course all four years of high school is not the solution. Students not only need to be continuously enrolled in math courses, the math courses must be geared towards college preparation for students who will be pursuing college degrees. Zelkowski (2010) indicated that the highest mathematics course completed in high school was a strong predictor of bachelor degree attainment, and continuous enrollment in secondary mathematics may be more likely to produce a college-ready student over a college-eligible student. Also, as mentioned earlier, Adelman (2006) stated that "the highest level of mathematics reached in high school continues to be the key marker in pre-collegiate momentum, with the tipping point of momentum toward a bachelor's degree now firmly above Algebra 2" (p. xix). Similarly, Berry (2003) indicated that four years of college preparatory math courses, which include courses higher than Algebra II, greatly increased the probability that a student would place into college-level math and successfully complete the course. Recently in Alabama, the mathematics credit requirement was increased for high school graduates of 2013 and beyond. They will have to complete four units of mathematics, including at minimum, Algebra 1A, 1B, Geometry, and Algebra 2. This might help reduce the high rates of remediation, but students still need to be encouraged to take four years of college preparatory mathematics, including courses higher than Algebra II.

Interestingly, the traditional student selected for an interview to discuss how the time between math courses contributed to her remedial mathematics placement completed a math

course all four years of high school, took a course higher than Algebra II, but still placed in a remedial mathematics course. The time she was referring to was her first semester of college. She did not take a math course during the fall semester. It actually turns out that 44% of the students enrolled in this remedial mathematics course completed a course higher than Algebra II. This might have implications for the rigor of the math courses, and maybe the students who complete courses higher than Algebra II are the ones who remediate successfully, or they are the students who just need a review. Forty-four percent of the population completed a course higher than Algebra II, and 46% of population remediated successfully.

Many students indicating time as a factor also expressed that they just needed to have their memories refreshed. On the survey, students made comments such as, "I have been out of school for over five years. This course is intended to be a refresher course so that I am not struggling in higher math." One issue faced in this class is that students have seen the concepts before and they are familiar with them, but they do not realize that they did not learn them. During the interview, students were asked if they had seen the concepts that were on the COMPASS, or the concepts that were being covered in their remedial mathematics course. Student B stated, "Yes, this is the same stuff I took in high school exact to the Tee." Students were then asked if they thought they needed a review or to be taught the concepts covered in their remedial mathematics. Student B stated, "Just review. I believe though… with a review…I already know the concepts. They're stored in there. They just…I have to be reminded." Yet fewer than 50% of the students pass the course each semester. Students are familiar with the concepts, but they do not realize that they do not truly understand them.

Howard and Whitaker (2011) argue that, both traditional and nontraditional students may have forgotten some of their basic math skills and need a refresher course due to the *time off*

from mathematics study, but it is also possible that they may have never learned the skills. Again, the pass rate is usually around 50%. During the spring semester, 72% of the students enrolled in the course could be classified as traditional students, and it turns out that 70% of the students' failing the course were traditional age. Therefore only 30% of the students failing the course were non-traditional, and non-traditional students make up only 28% of the population of students in Math 098. So it seems that traditional students face the same difficulty passing the remedial mathematic course as nontraditional students.

Some students perceived that their lack of effort in high school contributed to their remedial mathematics placement. These findings were also confirmed by previous studies (Howard & Whitaker, 2011; Schornick, 2010). On the survey, students made comments such as, "I did not take math seriously in high school." and "I never tried in school so I never learned what I needed." During the interviews, students were asked why they did not take math seriously in high school, Student H stated,

> "Because I didn't think it would be important in college. I didn't think I would really need it. I didn't think you would actually use it in the real world or for nursing I didn't think you had to have like a math class for that major"

Next, the students were asked what could have been done to encourage them to take math more seriously in high school, Student H stated, "People could have or the teachers could have told me that about the remediation math classes in college and that you don't get credit for them and you still have to pay for them." Student K stated,

> "It really didn't hit me until the end of my senior year when my friends were apply for scholarships and taking about the schools they might go to…I just wish I would have made more of an effort in high school… I just didn't know it would be important…And then I got here and I place in the lowest math and I have to take these remedial math classes. Maybe if my teachers would have just told me about how I was going to need this in college and might have to take remedial math in college if I didn't learn it now."

Students indicated a lack of effort in their high school math courses because they failed to see the relevance of mathematics. This perception that students are missing the *utility of mathematics* has long been a push of the NCTM principles and standards (NCTM, 2000). Students did not have opportunities in their high school math courses to see the purpose and relevance of their studies of mathematics (i.e. the utility of mathematics), which made them question why they needed to learn mathematics, which in turn made the students not want to study or learn. Teachers may to fail to recognize when students become disengaged it is an important signal that may jeopardize a student's future success in mathematics (Howard and Whitaker, 2011). Of the two students interviewed who indicated a lack of effort in high school, neither of them remediated successfully. They were not able to overcome the effects of their lack of effort in high.

Students participating in this study indicated negative experiences with teachers as a contributing factor in their remedial placement. These findings were confirmed by similar studies (Howard & Whitaker, 2011; Schornick, 2010). On the survey, students made comments similar to, "the teacher I had in high school didn't teach really" and "My teachers never took anything serious and hated teaching us." During the interviews, Student D stated,

> "For the ninth and tenth I had a teacher that pretty much…I didn't learn anything at all. Talk about nothing. He pretty much made us just keep a notebook and then like just take down everything off the board that he had wrote and as long as you had everything in the notebook you know then you passed whether or not you know…."

Student E stated,

> But uhm my 11th grade year and this year he like gives you your study guide, you do the study guide together and then on the test he lets you use your study guide. And the questions might be like you know I am in Geometry but it's not…you know where a problem might be 2+2 on the test it be like 4+4. He just changes the numbers up but the format the exact same and he really doesn't teach us anything

When the students were asked about grades and passing the class, Student D stated, “I made good grades cause he liked me yeah…I mean pretty much all…he was just a cut up teacher…I mean ….there’s no way I could have passed because I didn’t know it…you know. I don’t know it now so.” Student H stated,

> “Homework…and participation points…they all average out. Like my teacher told me the first day that you could fail every single test but if like you do all your homework you’ll pass with like a C. Man he shouldn’t have told us that.”

These comments by the students regarding their negative experiences with their teachers seem to indicate a lack of rigor in their mathematics courses. Berry (2003) indicated that “teachers sometimes feel pressure to pass students and high schools and colleges often use different grading criteria” (p.404). Test grades make up the majority of the grade in college, whereas homework made up the majority of the grades in high school (Berry, 2003). According to Boylan (2011), “High school math grading systems often use effort and extra credit as indicators of success” (p. 21). Although only 10% of the students indicated negative experiences with teacher as a contributing factor in their remedial placement, throughout the study many students indicated getting grades for tasks that had nothing to do with mastering the math concepts. For example, Student I stated, “Uh…the teachers sometimes was like of….if we clean the lunchroom tables or something like that… I did that...just anyway of getting at least a D.” Rigor of high school was not a theme of this study, but a similar study (Schornick, 2010) indicated the lack of rigor of high school courses as a factor in remedial students’ placement.

Students indicated the lack of guidance and information regarding the placement test prior to taking the test as a contributing factor in their remedial mathematics placement. These findings were support by a similar study (Schornick, 2010). During the interview Student G stated, “I feel like my school like prepared me as in like they taught me the stuff but I don’t feel

like they actually like prepared me for like the test like how it was going to be taken and like that in that sense" and Student G also stated,

> "Um…..maybe just giving us like a little….like I don't know…a review or something of the test and like maybe….I don't know making it sound more like its important cause their just like here come take the compass test so you'll like get placed in this class….Ok I don't really think they put a whole lot of importance on it."

Students felt they needed more guidance on college admissions procedures and requirements. However, this may prove difficult if teachers and counselors do not have a clear understanding of the requirements themselves. Venezia, Kirst, and Antonio (2003) found that many high schools students do not know "what is expected of them in college and most K-12 educators do not know how to help students gain an understanding of those standards" (p. 22). Teachers and counselors must be aware of their students' plans after high school. In a study to understand students' plans after college, teachers reported only 50% of their students planned to attend a post-secondary institution, but when students were asked, 79% reported they planned to go to college (Barth, 2003). Once students take the placement test and place in a remedial course, they are most often required to complete the remedial course(s), even if they feel like they already know the material being covered in the remedial course. College policies often allow students minimal recourse once they have tested (Safran & Visher, 2010). Students need to be prepared for the test before they are required to take it.

Students indicated that they would study and see a tutor to overcome their remedial mathematics placement. Although many students indicated that they had not studied or seen a tutor in the past, many stated that they would study or see a tutor to overcome their remedial placement. Almost half of the students in this study reported they would study to overcome their remedial placement. On the survey, students were asked how they would overcome their

remedial placement and students made comments such as, “study and look over all the assignments really good.” However, several of the students reported not studying or having homework in high school on a regular basis. Student A stated,

> “In high school we were given homework maybe once every now and then. We didn’t get it every week. A lot of ours was done in class. And if we did get homework you know we had time so I would usually do it before class ended.”

This could explain why so many of the students are placing in remedial mathematics courses. Zelkowski (2011) found mathematics homework completed outside of school during the 12th grade was extremely important in producing a college-ready high school graduate. In order to learn mathematics, students must practice the concepts they are learning. Students need repeated exposure to difficult math concepts to learn the material, and repetition may be a normal aspect of learning required to master the material (Hoyt & Sorenson, 2001).

As students transition to college, adjusting their study habits may prove challenging. In high school, teachers bear the majority of the responsibility for students’ study habits, but in college the majority of the responsibility is on the students. College courses require that students spend a lot of time outside of class studying (Conley 2008b). In high school students may study a total of 2 hours for each 6 hour school day. However in college students are expected to study around 2 hours for each hour of class time. Also, in college, study skills require more than just reading the textbook and answering the homework questions (Conley 2008b). Students are expected to think critically and demonstrate their level of understanding. The participants in this study are aware that they need to study, but they may find it difficult because they have not had to do it in the past, and they may be unaware of the effort and time it will require. Their college instructors will expect them to already know how to study. Students in this study may be ill-prepared to study for their college courses.

Students indicated that they would see a tutor to overcome their remedial mathematics placement. On the survey students made comment such as, “Getting a tutor to help me understand!” or “study get help from tutors.” Several students in this study indicated they would see a tutor to get additional help because they did not feel comfortable asking questions in a class setting. Student H stated,

> “It’s smaller their not as many students. I can ask more questions and like if I do not understand something she can redo it step by step its one-on-one so it helps me a lot too and she has more time to explain it than the regular teacher does during lecture time.”

Schornick (2010) indicated that students also expressed not feeling comfortable asking the teacher questions when they were confused. Students thought that a tutor could show them multiple ways to solve a problem, provide them one-on-one assistance, or even explain concepts better than teachers. The instruction in a tutor setting is also probably at a slower pace than the traditional classroom instruction. It is true that some students may need additional support from tutors to learn mathematics, but tutors should not be used as replacement for teachers. When students see tutors as a replacement for the teacher, they are in a sense giving up on the teacher. If students give up on their teachers, they may stop attending lectures, taking notes, or participating in class, and may come to depend solely on the tutors, who may not be able to provide them all of the support they need to learn the concepts covered in the course. One student stated,

> “Well my tutor really wants to help and she does more hours than she’s required to…to really help us… and I mean my teacher… she cares but I think my tutor like really, really wants us to succeed and she make sure we really understand it before we leave. I just think the tutor really cares if you pass. My teacher she goes really fast and I do not like how she teaches.”

The negative experiences students have had with teachers have caused some students to distrust teachers. Students feel like their teachers do not care if they learn, or that teachers are not

willing to put in the extra time to help them learn. Sometimes students feel more comfortable asking questions in a one-on-one setting or small group setting. They are afraid that, in the regular classroom, they will say something that makes them look stupid. Sometimes the teacher has done something to make students feel uncomfortable asking questions.

As Howard and Whitaker (2011) indicated, during students' unsuccessful times, they did not ask the teacher questions or ask for help but during the students successful times they did ask the teacher questions or asked for help. They realized it was essential for them to understand if they wanted to be successful in the course they must feel comfortable seeking help. Students' questions are an important part of the teaching and learning process. Student questions alert the teacher to concepts students may be having difficulty understanding, and also allow the teacher to clear up misconceptions. As mentioned earlier, students may give up on teachers and become reliant on the tutor for understanding, but tutors may not always be available or able to explain concepts in a manner that is beneficial to the students. Research indicates that tutors need training to be effective (Boylan & Saxon, 1999b; & Nolting, 1994). Students must realize they need to ask question as the teacher is presenting the concepts. This is not to say that students cannot learn when working with tutors. As Weinstein (2004) states, with the support of tutors "students could bring their mathematical learning to a level beyond their independent means" (p. 232).

The purpose of this study was to understand the perspectives of students enrolled in remedial mathematics. Unfortunately, there is little research that takes into account the remedial students perspectives when trying to better understand why so many students require remediation when they enter college. This study will add to the limited existing literature in the area. It is important to address remedial students' perspectives as we try to reduce the rates of remediation.

Weinstein (2004) notes, “There is much to learn, both for the sake of pure learning and the sake of pragmatics applications, from listening to their voices and hearing their stories” (p. 231).

Thirty-five percent of the student in this study indicated a lack of math knowledge and understanding, and 25% indicated the time between courses as a factor in their remedial mathematics placement. These two themes alone represent 60% of the students participating in this study, and may be key influences in the remedial placement of these students. Forty percent of the students planned to study to overcome their remedial placement, and 15% planned to see a tutor. These two themes represent 55% of the students participating in this study and indicate what students plan to do to overcome their remedial mathematics placement. The plans that students have to overcome their remedial placement have implications for practice.

It seems possible that some of the themes that emerged in this study may be interrelated, and multiple factors may have influenced students’ placement in a remedial mathematics course. Students who indicated a lack of math knowledge, for example, may have been unmotivated or failed to see the purpose in learning mathematics because of negative experiences with their teachers, their lack of effort, and/ or their poor study habits. Student F indicated a lack of information with placement testing and negative experiences with teachers. She also mentioned she would study and see a tutor to overcome her remedial placement. There is not a simple solution to making sure all students prepared for college math. However, steps can be taken to reduce the high rates of remediation, and to help students successfully remediate.

Implications for Practice

The findings of the study have implications for the community college in which the study took place. The sample of participants completing the survey online were fairly representative of

the population of students enrolled in the remedial math course during the spring 2014 semester. Therefore, students enrolled in the remedial Math 098 course attribute their placement to lack of mathematics knowledge and understanding, time between math courses, a lack of effort in high school, negative experiences with teachers, and a lack of information regarding the placement test. Students planned to overcome their remedial placement by studying and by seeing a tutor. Because the interview participants were purposefully sampled, the data collected from the interview participants are not generalizable to the population. Although this study is not generalizable beyond the community college these students attend, it might provide valuable insight to community colleges of similar size and demographics. Table 14 below shows the demographics of the population, survey sample, and interview sample for this study.

Table 14

Demographic Information for Population and Samples

	Population	Survey Sample	Interview Sample
Females	69%	71%	84%
Males	31%	29%	16%
Caucasian	76%	74%	92%
Minorities	24%	26%	8%
Traditional	72%	82%	92%
Non-traditional	28%	30%	8%

Schornick (2010) and Howard and Whitaker (2011) were similar to the proposed study, and had similar findings. However the results of this study are not generalizable to the similar studies. Howard and Whitaker (2011) took place at a four year university with a student population of approximately 4,000 students. The sample in the study was representative of the population at the university, which is 85% Caucasian, 4% Hispanic, with other minorities accounting for less than 2% each of the population. Females accounted for 60% of the population and 60% are classified as traditional students. Schornick (2010) did not provide demographic or background information for the population or sample, other than the fact that the participants were recent high school graduates, involved in the study. Although the findings in the study are not generalizable to the similar studies, the findings in the similar studies might have implications for practice for students in this study.

As mentioned earlier, the rigor of mathematics course taken in high school was a theme found in the Schornick (2010) study. However, it did not emerge as a theme in the survey data,

and it was not explicitly mentioned during the interviews during this study. Though, it was certainly implied when students discussed their grades in their high school mathematics course. Prior to conducting the study, the researcher of this study expected it to be a theme of the study. But remedial students may not fully understand what it means to take a "rigorous" course, and therefore they did not explicitly state that their courses were not challenging in high school when questioned about their prior experiences with mathematics. Also, it seems possible that the rigor of mathematics courses emerged as a theme in the Schornick (2010) study only because the researcher specifically asked about the rigor of the participants' high school mathematics courses. It was noted as a category on the researcher's interview protocol.

Learning strategies was a theme indicated in a similar study. Howard and Whitaker (2011), which only included successful remedial math students, indicated that during students successful experiences with mathematics they had strategies that they thought positively impacted their success. The current study included both successful and unsuccessful students and took place fairly early in the semester when students' success was yet to be determined. Howard and Whitaker (2011) indicated,

> "students consistently attended and positioned themselves in the classroom where they would be least distracted; they paid attention or focused in the classroom and were quick to ask questions when they did not understand; "they were proactive in their study habits by diligently and consistently doing their homework and by doing more than assigned when the need for comprehension arose; understanding mathematical concepts was the students top priority; and they were proactive in finding and using available resources to aid them in learning mathematics" (p. 12).

Some of the learning strategies emerged as themes in this study. Others were mentioned by only a few students, and did not emerge as themes in this study. Maybe the students in the current study who were successful engaged in many of the learning strategies listed above. In hindsight, maybe the researcher should have also interviewed students at the end of the course to

determine the actions of those students who successfully remediated, and those who failed to remediate successfully.

The majority of students in the current study indicated that they would study by practicing problems, and would see a tutor for help. The researcher and other remedial mathematics instructors have noticed that the college currently offers multiple options for tutoring. They provide math tutoring through the Student Support Services Department and the math department, as well as offering Supplemental Instruction designed specifically for students enrolled in the course that that was the subject of this study and the subsequent course. The problem, however, is not the availability of tutoring services, but that students fail to take advantage of the services. Students that utilize the services report that it is beneficial, but few students use the service, and the students who really need to see a tutor often fail to seek help. Similar findings were indicated in a study to determine the effectiveness of an online tutoring program for remedial algebra students at a community college (Offenholley, 2014). In a study of 15 community colleges to determine the use of learning assistance centers, Perin (2010) noted that six of the community college reported students did not use the centers. However it could have been due to the duplication of services at the colleges.

Another concern that the researcher has with students' plans to overcome their remedial placement is that they may not understand what it means to study. During the interviews, students were asked, "How do you plan to study?" In hindsight, the researcher should have asked something more on the lines of "What does studying for math mean to you?" Nevertheless, students' responses indicated that they really did not understand what it means to study for math. Studying math is different from studying other subjects (Nolting, 1994). From the students comments during the interviews most stated that their teachers did not encourage them to study.

Students cannot really be blamed for not knowing how to study math, because it is possible that some teachers do not teach students how to study math. Maybe teachers do not teach them because it is hard to describe, or difficult to put into words. It does involve practicing problems, reviewing notes, and reading the textbook, but there is more to it. The goal is to understand the underlying concepts and principles not just to know the facts or follow the procedures. Some teachers may focus on the facts and the skills rather than the thought process. Students do not know that to understand mathematics, they must continuously ask questions until things make sense. To them it means regurgitating what they have been shown (Schoenfeld, 1983b). Teachers ask students to justify their solutions by showing work so that they can assess whether the students understand as well give them tips such as, “make sure you practice” or “try to do the problem without looking at your notes” and “make sure you understand what you are doing and why you are doing it."

When searching the literature specifically for “how to study math”, there were not a lot of scholarly, peer reviewed sources. Plenty of school websites suggested study tips for mathematics. However, not even NCTM specifies any instruction for teaching students how to study mathematics. One name that appeared multiple times in my search was Dr. Paul Nolting, a learning specialist, who has an award book entitled *Winning at Math: Your Guide to Learning Mathematics Through Successful Study Skills* (Boylan, 2011). In the book, he provides students with specific instruction on how to study mathematics. Nolting (1994) states, “teaching study skills specifically designed for math is necessary in order to decrease test anxiety, improve learning, and increase grades.” (p. 1). He also states, “general study skills text offer little information on mathematics study and do not teach students how to listen for key words, take

notes, do homework, develop memory techniques, take tests, analyze test results, or reduce test anxiety" (Nolting, 1994, p. 2).

In addition to teachers not teaching how to study of math, students may not have the metacognitive skills to know how to study effectively, determine what factors are causing their difficulty with mathematics, or what to do to overcome their remedial placement. Bandura (1986) states that

> "self-reflective consciousness enables people to analyze their experiences and think about their own thought processes. By reflecting on their varied experiences and on what they know, they can derive generic knowledge about themselves and the world around them; however, these metacognitive processes can produce faulty thought patterns" (p. 21).

Metacognition has been the focus of many studies and prior to Bandura (1986), Flavall (1976) wrote metacognition

> refers to one's knowledge concerning one's own cognitive processes and products or anything related to them, e.g., the learning- relative properties of information or data…Metacognition refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects on which they bear, usually in the service of some concrete goal or objective (cited from Garofalo & Lester, 1985, p.163).

(Narode, 1985) believed the most important parts of this definition are the acts of monitoring and self-regulating. If students lack these skills they may have difficulty overcoming their remedial mathematics placement. These skills take time to develop and "students have limited beliefs about mathematics, faulty notions about mathematics performance and they are also deficient in the regulatory skills of monitoring and assessing" (Garofalo & Lester, 1985, p.168).

Metacognitive skills are important in learning mathematics, especially in problem solving (Garofalo & Lester, 1985; and Schoenfeld, 1981). This could help explain why students struggle with mathematics. They lack metacognitive skills. Teaching students to understand mathematics

requires attention to students' background knowledge, their metacognitive activities used to select strategies and resources to solve a problem, and it also requires addressing students' misconceptions about mathematics (Schoenfeld, 1983a). To help students understand the metacognitive processes required solving math problems, teachers need to explain their thought processes when problem solving, and use student ideas when problem solving (Schoenfeld, 1983a). This will help students develop their metacognitive skills. NCTM (2000) includes problem solving in each of the standards for prekindergarten -12th grade. NCTM (2000) states students should,

- "build new mathematical knowledge through problem solving;
- solve problems that arise in mathematics and in other contexts;
- apply and adapt a variety of appropriate strategies to solve problem;
- monitor and reflect on the process of mathematical problem solving" (NCTM, 2000, p.52).

Once students have developed metacognitive skills, they can then regulate the other skills needed for problem solving (Mayer, 1998; Schoenfeld, 1981) and studying mathematics.

Studies involving metacognitive instruction and mathematics problem solving have indicated some useful practices. In a study conducted on the effects of metacognitive training with seventh grade math students, Lester, Garofalo, and Kroll (1989) stated that instruction was most likely to be effective when it occurred over an extended period of time and when it was included with math instruction rather than as a separate part of the curriculum. Problem solving must be built into each lesson.

In a similar study involving remedial math students, Narode (1985) indicated paired problem solving would help remedial students develop metacognitive skills. In paired problem solving, one student verbally states how to solve the problem while the other student asks

clarifying questions, and the teacher is a bystander in the process. Students are also asked to write down their thought process, in which they can draw diagrams or pictures if necessary. Narode (1985) concluded that "the effectiveness of a remedial math program rests on the ability of students to formulate a better understanding of the type of thinking that math entails" (p.14). Schoenfeld (1992) defines this *thinking mathematically* as the interaction of "metacognition, belief, and mathematical practices" (p.363).

As mentioned earlier, self-regulation is an important part of metacognition (Narode, 1985) and the learning process. Zimmerman (1989) states that self-regulated students,

> "personally initiate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents, or other agents of instruction. To qualify specifically as *self-regulated* in my account, students' learning must involve the use of specified strategies to achieve academic goals on the basis of self-efficacy perceptions. This definition assumes the importance of three elements: students' self-regulated learning strategies, self-efficacy perceptions of performance skill, and commitment to academic learning. Self-regulated learning strategies are actions and processes directed at acquiring information or skill that involve agency purpose, and instrumentality perceptions by learners." (p. 329).

Zimmerman and Martinez-Pons (1986, cited from Zimmerman, 1989) found that high school students do the following self-regulated learning strategies, which influenced student success: "self-reflect, organize, set goals and plan, seek information, keep records and monitor, structure their environment, self-reward and self-punish, rehearse and memorize, seek help, and review notes" (p. 337). This definitely has implications for remedial math students. Students who self-regulate will adequately identify areas where their skills must improve and seek help to improve them (Wambach, Brothern, & Dikel, 2000).

Much of the work on problem and metacognition were influenced by Polya's (1945) work *How to Solve It*, although Polya does not explicitly mention metacognition (Garofalo &

Lester, 1985; Narode, 1987; Lester, Garofalo, & Kroll, 1989). Remedial students probably need help developing metacognitive strategies and problem solving is one way to help them develop these skills. According to Lester, Garofalo, and Kroll (1989), “Problem solving is difficult to teach and many teachers have received little systematic training in problem solving when they were students, or when they were training to become teachers” (p.14). However, students need effective metacognitive strategies to help them accurately access their strengths and weaknesses so that they can seek help when needed or adjust their study habits. Wambach, Brothern, and Dikel, (2000) propose that self-regulation training should also be a part of remedial education, because students who fail to accurately access their abilities and make necessary changes may fail to remediate successfully.

In addition to incorporating problem solving and metacognitive strategies into instruction, Boylan (2012) noted the following promising practices in developmental math education: “greater use of technology as a supplement to classroom instruction, integration of classroom and lab instruction, offering students a variety of delivery formats, project-based instruction, proper student assessment and placement, integration of counseling for students, and professional development for faculty” (p. 15). Two fairly recent initiatives in remedial mathematics education incorporate some of these strategies, and are yielding some success. They are the course redesign models Pathways and the Emporium.

The Community College Pathways Program (CCP) program was developed by the Carnegie Foundation for the Advancement of Teaching (CFAT) in conjunction with almost thirty community colleges and three universities across eight states (Clyburn, 2013). Including programs and organizations such as Achieving the Dream, California community-colleges system’s Basic Skills Initiative, the American Association of Community Colleges, and the

American Mathematical Association of Two-Year Colleges were involved in the development (Clyburn, 2013). The Pathways program involves two different tracks for STEM and non-STEM majors. Statway is the track for non-STEM majors that allow students to complete their remedial mathematics and college-level statistics course in just one year (CFAT, 2014). The Quantway track is for STEM majors, and prepares students for college-level math in a year (CFAT, 2014). Pathways courses are being offered at over 40 colleges and universities in almost a dozen states, with even more colleges preparing for implementation (Clyburn, 2013). The tracks are different from traditional courses because they "enable students to think and reason quantitatively unencumbered by memories or past failures" (Clyburn, 2013, p. 1). The remedial mathematics concepts are embedded within the statistics and quantitative reasoning concepts (Clyburn, 2013). Both tracks have had some promising results. With the Statway programs, 52% of students completed college-level math, while with the Quantway program, 54% complete the remedial coursework in one -semester and were ready for college-level mathematics (CFAT, 2014). Of those students completing the first Quantway course, 68% earn college-level math credit (CFAT, 2014). The Pathways program is not yet an option for community colleges in the state of Alabama.

The other initiative that has experienced some success with remedial math students is the Emporium Model. The community college in this study is currently using the Emporium Model, which is one of the six course redesign models supported by The National Center for Academic Transformation (NCAT) in a lower-level remedial basic mathematics course (NCAT, 2013). The other five models (supplemental, replacement, fully online, buffet, and linked workshops) emerged from the development of the Emporium Model, and have a combination of elements from the traditional format, the Emporium Model, and the online format (NCAT 2014). Courses

generally selected for redesigned are those with low pass rates, remedial courses, courses in which students have trouble in the subsequent course, and those courses with few qualified part-time instructors (Boylan, 2012, p16). Virginia Tech designed the model with the support of NCAT, and the basic principle behind the Emporium Model is that "students learn math by doing math, not by listening to someone talk about doing math" (NCAT, 2013, p. 1). "The model involves interactive computer software, combined with personalized, on-demand assistance, and mandatory student participation" (NCAT, 2013, p. 1). NCAT has identified the following 10 components as vital to the Emporium Model:

1. "Redesign the whole course sequence and establish greater course consistency.
2. Require active learning and ensure that students are "doing" math.
3. Hold class in a computer lab or computer classroom using commercial instructional software.
4. Modularize course materials and course structure.
5. Require mastery learning.
6. Build on ongoing assessment, and prompt(automated) responses
7. Provide students with one-on-one, on demand assistance from highly trained personnel.
8. Ensure sufficient time on task.
9. Monitor student progress and intervene when necessary.
10. Measure learning, completion, and cost" (NCAT, 2013, p. 3)

NCATE (2014) has worked with 159 post-secondary institutions on course-redesign. Overall the redesigns have reduced costs almost 35%, increased student learning by roughly 70%. Twenty-eight percent have indicated student learning remained the same. When looking specifically at basic math redesigns, student success has increased by between 1% and 18%. The community college in this study implemented the Emporium Model in the fall of 2013 and has

had a 5% increase in the pass rate of students enrolled in the lowest level remedial course, as well as a 5% increase in the pass rate in the next course when only looking at students who started at the lowest level. According to Bonham and Boylan (2012), “The advantages of the emporium model include the use of multiple approaches to teaching and students are actually doing math, but the disadvantage is the overreliance on technology” (p. 16). Since the college is experiencing some success with this model, there is some discussion about redesigning the Math 098 course, which was the subject of the study.

This course is helping both traditional students and nontraditional remedial students who lack foundational and/or algebraic knowledge to be successful in a college-level course. The overreliance on technology is sometimes problematic for nontraditional students. As Boylan (2011) states, “ it is difficult enough for nontraditional students to learn mathematics let alone change their learning styles to access technology based math information and materials” (p. 26). Therefore, instructors have to provide more instructions on basic computer and internet use. However, nontraditional students generally have a stronger understanding of basic mathematics when compared with traditional students and tend to need help mainly with algebra. These students are also more motivated to learn and generally seek help when they are having difficulties. Boylan (2011) noted, “these students exert more control over learning math than they did in high school by attending lectures, reading the text, taking notes, completing text-based homework, meeting with a tutor, or meeting in groups to discuss their homework” (p. 26). As noted earlier, nontraditional students had higher pass rates than the traditional students in this study. Also in the Howard and Whitaker (2011) study, nontraditional students who made up half of the sample, experienced success in remedial mathematics because of the strategies they utilized. Nontraditional students are older and have had a chance to reflect on their past mistakes.

They may also have more metacognitive skills and are able to better assess their abilities, adjust their study habits or seek help. Traditional students are frustrated that they have to do "elementary work," but many will admit that they did not understand it. But after watching the videos and being forced to practice until they master it, they come away with a better understanding. Traditional students also like using the technology, and are happy to work on their own rather than have a teacher lecture at them.

The findings of this study have some implications for practice. Perhaps the college can also try offering one of the other five redesign models to better suit the needs of the students and give them some options. Another finding from the study that has implications for the practice is student's lack of guidance regarding the placement test. The college could begin to offer review sessions for the placement test that include basic information, and information about what placement test results mean for students. The college currently allows students to retake the COMPASS test once. Also, students enrolled in remedial math courses are given a pre-test on the first day of class, and if they score high enough on the test, they can move to a higher-level mathematics course. Only ten percent of the students indicated a lack of guidance regarding the placement test, but it is very possible that more students needed some guidance.

There are so many factors impacting student success in remedial math courses. At the community college in this study, fewer than half of the students pass the Math 098 course on the first attempt. Students who make a C in the course are likely to fail the subsequent course (Boylan, 2011). Only looking at students who made an A or B in the class, the pass rate would be about 25%. This seems about right, because only half of the students who pass Math 098 successful complete the next course, College Algebra. Instructors need to accommodate students varied learning styles and needs as they teach. They need to help student develop effective

metacognitive skills to adjust their approach to learning mathematics. Students at the college also need help managing personal issues such as finances, daycare, and emotional issues. Boylan, (2011) writes, “A college wide math summit is needed to establish a team to address all the variables affecting math success, because the math department alone cannot solve all the problems” (p. 21). There are so many areas that need to be addressed to help students successfully remediate and reduce the high rates of remediation. More research is still needed.

Recommendations for Future Research

In the state of Alabama, where the community college in this study is located, the state school board recently adopted a new set of educational standards. Beginning the 2013-2014 school-year, schools will begin implementing the College and Career Readiness Standards in math and English. The standards are a combination of the Common Core State Standards and the Alabama Course of Study (Alabama Department of Education, 2014). They address what students should learn from kindergarten through twelfth grade, along with college and career readiness standards that address what students need to know in order to be prepared for college or the workforce (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010).

According to the Alabama Department of Education (2014) elementary students will no longer be required to take the Alabama Reading and Mathematics Test (ARMT), but will instead take the ACT *Aspire*. Students in the eighth grade will take the ACT *Explore*. In high school, students will no longer be required to take the Alabama High School Graduation Exam. Beginning in the 10th grade, students will take the ACT *Plan*. Juniors will be required to take the ACT plus writing, and all high school students will be required to complete ACT’s end of course exams. Using assessment tools from ACT, which took part in the development of the Common

Core State Standards, will better align K-12 and post-secondary institutions' expectations, as well as let teachers, parents, and students know if students are prepared for college or to enter the workforce after graduation (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The new assessment will provide transparency between the K-12 system and parents. As opposed to the previous assessments for K-12 which provided no information regarding college readiness or where students stand on a national level.

Hopefully the math standards will help reduce the high rates of remediation at community colleges. "The sequence of topics in the math standards are clear, based on research, and lead to college and career readiness" (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010, Process, para. 2). The math standards lay a solid foundation for students in elementary school and require students in middle school and high school to "practice applying mathematical ways of thinking to real world issues and challenges" (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010, Myth vs. Fact, para. 8). Students should be more motivated to learn with a solid foundation of the basics and a focus on the utility of mathematics. Once these standards have been fully implemented, research needs to be done to determine their effectiveness.

It will take years before the effectiveness and impact of these standards is determined. In the meantime, more research needs to be done to gain a better understanding from the students' perspectives, of why so many students are entering college underprepared for college-level mathematics. Expanding and duplicating this research study with a larger sample would contribute to the research base, as well as extending it to other populations of students, including students at four-year institutions. Conducting multiple interviews with participants throughout semester could help provide a richer description of student experiences and help determine if and

how students' views of their previous experiences change as they progress through the remedial course. As Babbie (2009) states, exploratory research generally provides direction for future research.

Only 46% of the students in this study successfully completed the remedial mathematics course. More research needs to be conducted to determine why some students successfully remediate and others do not. Specifically, what works and what does not work in remedial education programs? We need to better understand why students fail their remedial math courses. What are the factors that play a role in their unsuccessful remediation (Golfin, Jordan, Hull, & Ruffin, 2005)? Are the students who remediate successfully or the high performing remedial students, the ones who scored near the cutoff for remediation and only needed a refresher or review course? Do students who remediate successfully have certain strategies that enable them to be successful? These factors are crucial in creating successful remediation programs. Additional research in the K-12 system is needed to determine specific instructional practices that are "most effective in identifying, improving, and eradicating obstacles that prevent students from making a seamless transition from high school into posts-secondary education" (Koch, Slate, Moore, 2012, p, 78). Is there a way high schools could teach a senior mathematics class that was more about *college algebra readiness* than just a higher mathematics class? Researchers need to track the progress of students to identify the practices that benefit students the most.

Concluding Thoughts

Conducting this research study allowed me to gain a better understanding of students' perspectives regarding their remedial mathematics placement. I had informally discussed most of the themes that emerged with students and colleagues prior to conducting this study, but the

study allowed me to dig a little deeper and to better understand the students' perspectives. One finding that I did not expect was the range of issues related to the placement testing. I had no idea that students did not know ahead of time the importance of the placement test before taking the test. Student G stated, "a review or something of the test and like maybe…I don't know making it sound like it's important… cause their just like here come take the COMPASS test so you'll get placed in this class." Also a couple of students mentioned they did not know about the possibility of placing in remedial courses. One student stated, "Teachers could have told me about the remediation math classes in college and that you don't get full credit for them and you still have to pay for them." As an advisor for remedial students, I help the students schedule their classes after they have already taken the placement test. I have been taking for granted that the students fully understand their remedial placement. I do not go into great detail about the remedial courses. I assume students understand what it means unless they ask questions. Although I think students need to fully understand why they are taking the placement test before taking the test, I plan to do a better job of explaining what their remedial placement means.

Students need to understand the importance of why they are learning mathematics and what it may mean if they don't learn it. Several students mentioned their lack of effort in high school was related to the fact that they did not know it would be important later. One student stated, "I just didn't think it was important…I just got by… I didn't realize it was important until now." Of course I know as a math teacher that students need to understand why learning mathematics is important and how it is used in everyday life. But I think hearing the students say it over and over again reinforced the importance to me. I am guilty of not always taking the time to show students how the math concepts we are covering are used in everyday life, or why it is important for them to learn the concepts. When I am behind or strapped for time, the first thing I

cut is the practical applications, Instead these need to be how I begin the lesson. This study has reminded me that students need to see the relevance when learning mathematics.

This exploratory qualitative research study was conducted to gain a better understanding, from the students' perspective, of why they are coming to college underprepared for college-level mathematics, and what these students plan to do overcome the barriers of their remedial mathematics placement. Although these findings are not conclusive, they provided insight into factors that may contribute to remedial placement, as well as insight into what can be done to prevent the need for remediation. Students should be able to graduate from high school and be prepared for college-level, credit bearing mathematics courses. More research needs to be done in this area to help lower the rates of remediation and improve the quality of remedial programs.

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APPENDIX A: MODIFIED SURVEY QUESTIONS

Please respond to each of the following items listed below:

Gender:_____Male _____Female

Age:_____

Race/ethnicity: _____

Intended College Major: _____

Are you repeating Math 098? _____Yes _____No

What math courses do you remember taking in high school? Mark all that apply.

- ☐ Algebra I
- ☐ Algebra A
- ☐ Algebra B
- ☐ Geometry
- ☐ Geometry A
- ☐ Geometry B
- ☐ Algebra II
- ☐ Algebra II with Trigonometry
- ☐ PreCalculus
- ☐ Algebraic Connections
- ☐ Discrete Mathematics
- ☐ Mathematics Investigations
- ☐ Analytical Mathematics

1. You are enrolled in Math 098, which is a course that provides no credit towards a degree. <u>What prior experiences</u> do you think contributed to your placement in a remedial mathematics course? That is, why do you think you placed in a remedial mathematics course? (*Please provide a specific example or provide details*)

2. What, if anything, do you think could have been done to prevent your placement in a remedial mathematics course? (*Please provide a specific example or provide details*)

3. What do you think can be done now to help you overcome these experiences or barriers? (Please provide a specific example or provide details)

APPENDIX B: INTERVIEW PROTOCOL/PROMPTS

Before the interview begins, the researcher will do the following:

- *Provide students with a copy of information about the study and review it thoroughly with each participant. (This is the information students reviewed online before consenting to be in the study)*
- *Students will be reminded that they can withdraw from the study at any time without penalty.*
- *Students will be told that they only have to answer questions they feel comfortable answering and they can withdraw for from the study at any time.*
- *Students will be told that their names will not be used in the study report nor will any of their traceable information be used in the study report.*

- Is it okay for me to email you a copy of the study results to get your opinion on the accuracy?
- Is it okay for me to email you if I have any follow-up questions? (verify student email address) _____
- Can I audio-record the interview?

Date:

Time:

Interviewee

Your name will not be used in this study!

Take your time answering the questions. You can think about your responses before you say them!

Lack of math knowledge and understanding

1. On your survey you indicated that you were not good at math. Why do you think you are not good at math?
2. Can you give me some examples of this or describe in detail a specific experience?
3. When did this feeling of not being good at math start?
4. Do you remember specific concepts that gave you trouble? If so, what concepts?
5. Are their concepts that you learned easily? What are some of those concepts?
6. Why do you think you learned those concepts without any difficulty?
7. Do you still have trouble with this concept?
8. Have you ever tried to seek help for your math difficulty? If so, what have you tried?
9. How did you think you got through your previous math courses?
10. What strategies did you use to get through your previous math courses?
11. Did you have to retake any math courses in high school? Which courses? Why?
12. What kind of grades did you make in your previous math courses?

LACK OF EFFORT HS

1. On your survey you indicated that you did not try in high school. Why do you think you did not try in high school?
2. Can you give me some examples of things you did in high school that indicate a lack of effort?
3. Did you think school in general was unimportant? Did you think math as unimportant? Why or Why not
4. What do you think would have motivated you to make more of an effort in your previous math courses?
5. Did you have to retake any math courses in high school? Which courses? Why?
6. How did you think you got through your previous math courses?
7. What strategies did you use to get through your previous math courses?
8. What kind of grades did you make in your previous math courses?

TIME

1. On your survey you indicated that you placed in remedial math because you had been out of school for some time or had not taken a math class recently.
2. How long has it been since you were last in a math class?
3. How do you think this has affected your math knowledge?
4. Do you think you have completely forgotten everything you learned in the past?
5. What are some of the concepts you can remember? What are some concepts you have forgotten?

6. Why do you think you remember some concepts but not others?
7. Do you think you just need a good review or do you need to be retaught the concepts?
8. What makes you think you need a refresher or to be retaught?

TEACHER

1. On your survey you indicated that you had terrible teachers in high school. What did your teachers do that made them terrible teachers? Give me some examples.
2. What could they have done differently?
3. Describe what you consider to be a good teacher?
4. Describe what you consider to a bad teacher?

PLACEMENT TEST

1. On your survey you indicated that you did not try on the compass test. Why do you think you did not try in on compass test?
2. What do you think could have motivated you to make more of an effort on the compass test?
3. When did you take the compass test? (while still in hs; summer before starting college; etc.)
4. Do you feel like you were prepared to take the compass? Why or Why not?
5. The math problems that were on the compass test, had you seen those types of problems before?
6. Had you forgotten how to work some of the problems? If yes, why?
7. Did you understand why you were taking the compass test? If yes, explain?
8. Do you now understand why you were asked to take the compass test? If yes, why?

STUDY

1. On your survey you indicated that you felt you could overcome your remedial placement by studying. How do you plan to study?
2. How often?
3. Have you tried these study methods before? Do you think they were beneficial
4. Did you study in the past?
5. How did you study in the past? Why didn't you study in the past?
6. Were you required to study or encouraged to study in your HS math classes? Were you given homework? Did you do it regularly?
7. Is there anything else that you think can be done to help you successful complete your remedial math courses?

TUTOR

1. On your survey you indicated that you felt you could overcome your remedial placement by seeing a tutor. How do you think a tutor will be able to help you?
2. Why do you think a tutor will be able to help you?
3. How often do you think you will need to work with a tutor? How do you choose your tutor?
4. Do you think you learn better with one on one assistance? Why?
5. Have you seen a tutor in the past? Why or Why not?
6. Did seeing a tutor in the past help? How?
7. What do you think the difference is between a tutor and your teacher?
8. Is there anything else that you think can be done to help you successful complete your remedial math courses?

Is there anything else you would like to add about your prior math experiences?

Students will be paid $20 for participating in the follow-up interview.

Thank you so much for taking the time to talk with me. The information you provided has been valuable to my research. Have a nice day! Good Bye.

I was compensated $20 for participating in a follow-up interview.

Signature:

Date:

APPENDIX C: STARTING LIST OF CODES AND WORKING DEFINITIONS

CODE	THEME	REFERENCE
FEAR	Fear of math	Godbey, 1997 Howard and Whitaker 2011
LS	Learning Style	O'Banion, 1997
MOT	Motivation	Middleton and Spanias,1999 Howard and Whitaker 2011
SELF-E	Self-efficacy	Pajares and Miller, 1994 Stage and Kloosterman1995 Killian, 2009 Godbey, 1997 Howard & Whitaker, 2011
DEV	Developmental course helpful	Koch, Slate, and Moore (2012)
ADD-SUPP	Additional support helpful	Koch, Slate, and Moore (2012) Howard and Whitaker 2011
TEA-P	Teacher behaviors-Positive	Koch, Slate, and Moore (2012) Schornick, 2009 Howard and Whitaker 2011 Elise 2007
TEA-N	Teacher behaviors-Negative	Elise 2007 Schornick, 2010 Ball, Lubienski, &Mewborn,2001 Adler, Ball, Krainer, Lin, & Novotna, 2005 Godbey, 1997 Howard & Whitaker, 2011
STU-P	Student behaviors-Positive	Koch, Slate, and Moore , 2012 Howard and Whitaker 2011
STU-N	Student behaviors-Negative	Howard and Whitaker 2011 Kinney, 2001
PAR	Parental influence	Howard and Whitaker 2011 Schornick, 2010
PR-COU	Prior courses	Schornick, 2010 Godbey, 1997 Koch, Slate, and Moore , 2012 Howard and Whitaker, 2011 Berry, 2003 Hoyt,1999 Adelman, 2006 Zelkowski, 2011 Hoyt & Sorenson, 2001

Working Definitions of Codes

FEAR: Students may attribute their placement in a remedial mathematics course to their fear of mathematics. Students may have developed a fear of mathematics because of their past inability or experiences.

LS: Students may attribute their placement in a remedial mathematics course to their learning style. Students may feel like they did not learn in the same way as their classmates. Students may feel that the teacher did not teach in a manner that they could understand.

MOT: Students may attribute their placement in a remedial mathematics course to their lack of motivation. Students may feel they did not have a reason to learn mathematics in the past. Students may express they did not see the importance of learning mathematics. Students may not have believed in their ability to learn mathematics and therefore they were not motivated to learn how to do mathematics. Students may think they need to be motivated to learn mathematics.

SELF-E: Students may attribute their placement in a remedial mathematics course to their lack of self-efficacy. Students may have felt they did not have the capability to do math and therefore believed they could not do mathematics.

DEV: Students may perceive that the remedial course itself may resolve their difficulties in mathematics and remedial placement in mathematics. Students may think the developmental course will help them overcome their deficiencies and prepare them to be successful in college.

ADD-SUPP: Students may perceive that they will need additional support to resolve their difficulties in mathematics and remedial mathematics placement. This might include access to instructors via office hours or email. This could also include access to learning centers or tutors.

TEA-P: Students may perceive that teachers need to do certain things to resolve their difficulties in mathematics and their remedial mathematics placement. This might include: being nice and caring if their students learn; using a particular instructional strategies; responding to questions, maintaining an open door policy; making sure students understand; make students feel comfortable and excited; being patient; explaining really well; get students involved;

TEA-N: Students may perceive that teachers did certain things that can be attributed to their placement in a remedial mathematics course. This might include: the use of a particular instructional strategy; the teacher did not care or seem to like the students; teacher did not enjoy teaching; a negative experience with teacher; only lectured; did not answer questions; used ineffective teaching strategies; only explained how to do procedures; and tested only on procedures and definitions.

STU-P: Students may believe there are certain things they can do to overcome their placement in a remedial mathematic course: complete homework; be persistent; attend class; pay attention and focus; sit at the front of the class; ask questions until they understand; take notes; do extra

practice problems; work hard to understand concepts; seek immediate help when they are confused; use additional resources provided-math lab, tutors, teachers, online resources;

STU-N: Students may think that they did certain things that contributed to their placement in a remedial mathematics course such as: avoided participating in class; sat in back of classroom hoping not to be noticed; did not ask questions; did not study; did not ask for help; did not take enough math classes; did not master the content; did not understand the content; and took long periods between math classes or math practice.

PAR: Some students may attribute their placement in a remedial mathematics course to parental influence. Some parents have had negative experiences with mathematics and tell their child that it is okay not to be good at math. Because of this the students then feels like they cannot ask their parents for help when they are struggling with math. Parents' negative attitude towards math also can influence the student to believe that math is not important because it is not important to their parents.

PR-COU-Some students may attribute their placement in a remedial mathematics course to their prior coursework. They may think they did not take the proper sequences of courses in high school. Students may also think the rigor of the courses was not sufficient enough to prepare them for college. Some students only took the necessary courses and did not take any college prep math courses. Students may feel like they did not learn or do anything in previous courses, but still passed the course. Some students cheated in their high school math courses to pass. In their previous math classes, a lot of he classwork was done in groups or only graded for effort. Little to no homework was given in prior math courses.

APPENDIX D: RECRUITMENT FLYER

MATH 098 RESEARCH STUDY

You are invited to participate in a study that is being conducted to understand the perspectives of college students in remedial mathematics courses. This study is being conducted by Laura Crosby, a doctoral student at the University of Alabama, Department of Curriculum and Instruction. The study involves completing a 10-15 minutes survey online and some participants may be asked to voluntarily participate in a follow-up interview.

If you are currently enrolled in Math 098, and would like to participate in this study, please go to web link below to get more information about the study and to complete the survey online if you wish.

If you have questions or concerns please contact Laura Crosby at [redacted] or lcrosby@bscc.edu

Survey Link: http://tinyurl.com/ob54z9t

APPENDIX E: INFORMATION ABOUT THE STUDY/CONSENT FORM

Information about the Math 098 Study

You are being asked to take part in a research study. The study is called "Community College Students' Perceptions Regarding Their Remedial Mathematics Placement." The study is being done by Laura J. Crosby, a graduate student in the College of Education at the University of Alabama. She is also an instructor at Bevill State Community College. Ms. Crosby is being supervised by Dr. Jeremy Zelkowski who is a professor in the College of Education at the University of Alabama.

Institution if other than or collaborating with UA: Bevill State Community College

What is this study about?
Many students are entering college underprepared for college-level mathematics. The purpose of the study is to understand students' perceptions regarding their placement in a remedial mathematics course. Specifically, the investigator would like to know what experiences students believe led to their placement in a remedial college math course and what students believe can be done to overcome these experiences. You will also be asked some background and demographic questions. You will be asked to provide your age, gender, ethnicity, the math courses you completed in high school, and if you are repeating the remedial mathematics course.

Why is this study important or useful?
This knowledge is important because understanding students' perception regarding their remedial mathematics placement can assist mathematics instructors in remediating their students. The results of this study will help educators understand better ways to teach mathematics and may prevent the need for remediation altogether.

Why have I been asked to be in this study?
You have been asked to be in this study because you are currently enrolled in Elementary Algebra (Math 098), a remedial mathematics course.

How many people will be in this study?
The investigator hopes to survey 60-90 people

What will I be asked to do in this study?
You will be asked to complete a survey online and some participants may be asked to take part in a follow-up interview.

How much time will I spend being this study?

The survey should take no more than 10-15 minutes to complete. Follow-up interviews should take 30-45 minutes.

Will being in this study cost me anything?
The only cost to you from this study is your time.

Will I be compensated for being in this study?
Some students will be asked to participate in follow-up interviews. If you are selected to participate in a follow-up interview and you agree to participate in the follow-up interview, you will be compensated for your time.

What are the risks (dangers or harms) to me if I am in this study?
Little or no risk is foreseen because no sensitive questions will be asked during the survey

What are the benefits (good things) that may happen if I am in this study?
There are no direct benefits to you, however, you may feel good knowing that the information you provided may help influence the process of mathematics remediation.

How will my privacy be protected?
You do not have to answer any questions that you do not want to answer. You may refuse to participate in the interview.

How will my confidentiality be protected?
Your name will not appear anywhere in this study. The survey does not ask you any information that can be traced back to you.

What are the alternatives to being in this study? Do I have other choices?
The alternative to being in this study is not to participate.

What are my rights as a participant in this study?
Taking part in this study is voluntary. It is your free choice. You can refuse to be in it at all. If you start the study, you can stop at any time. There will be no effect on your relations with the University of Alabama or Bevill State Community College.

The University of Alabama Institutional Review Board ("the IRB") is the committee that protects the rights of people in research studies. The IRB may review study records from time to time to be sure that people in research studies are being treated fairly and that the study is being carried out as planned.

Who do I call if I have questions or problems?
If you have questions, concerns, or complaints about the study, please
Call the investigator Laura Crosby at [redacted] or Dr. Jeremy Zelkowski at [redacted]

If you have questions about your rights as a person in a research study, call Ms. Tanta Myles, the Research Compliance Officer of the University, at 205-348-8461 or toll-free at 1-877-820-3066.

You may also ask questions, make suggestions, or file complaints and concerns through the IRB Outreach website at http://osp.ua.edu/site/PRCO_Welcome.html or email the Research Compliance office at participantoutreach@bama.ua.edu.

After you participate, you are encouraged to complete the survey for research participants that is online at the outreach website or you may ask the investigator for a copy of it and mail it to the University Office for Research Compliance, Box 870127, 358 Rose Administration Building, Tuscaloosa, AL 35487-0127.

If you do not wish to participate in this study please exit the study by closing your web browser

CONSENT TO PARTICIPATE

By clicking the continue arrows>> below you agree to the following statement:

I have read this form, and I voluntarily agree to participate in this study. I agree to allow the use of my study-related records as described above.

I have not given up any of my legal rights as a research participant. I will print a copy of this consent information for my records.

If you are selected for a follow-up interview, can the researcher audio-record the interview session?

- ☐ Yes
- ☐ No

APPENDIX F: PHONE/EMAIL SCRIPT FOR CONTACTING PARTICIPANTS FOR INTERVIEWS

- Students will be contacted via phone first. If the researcher is unable to reach student by phone, the researcher will send the student an email.

Phone script

P = Potential Participant; I = Interviewer

I - May I please speak to [name of potential participant]?

P - Hello, [name of potential participant] speaking. How may I help you?

I- This is Laura Crosby a doctoral student at the University of Alabama in the department of Curriculum and Instruction. You recently participated in a research study that I am conducting at Bevill State Community College. You completed a survey online regarding the perspectives of remedial mathematics students. You were asked questions regarding your perceptions of your remedial mathematics placement. You provided your contact information and indicated you would be interested in participating in a follow-up interview. I would like to interview you and get some more details about your experiences. Are you interested in participating in a follow-up interview? It should take 30-45 minutes.

P- No

I- I understand and that it is completely acceptable. I would like to thank you for the time you took completing the survey. Have a nice day! Good Bye.

OR

P- Yes

I- Is there a particular day this week or next week that you are available?

What time?

Can we meet at the college in Building XXX Room XXX? We should have privacy at this location.

Or is there another location that would be more convenient for you?

You should have printed a copy of the consent information for the study. I will review all of this information with you before the interview, but I can send you a copy if you would like me to. If you have any questions or concerns please feel free to contact me at 205-387-0511 ext 5732 or you can contact my advisor Dr. Zelkowski at 205-348-9499.

Thank you for agreeing to participate in the follow-up interview. I will see you (the researcher will repeat time, location and date). Good bye.

Email Script

Insert Student's Name

This is Laura Crosby a doctoral student at the University of Alabama in the department of Curriculum and Instruction. You recently participated in a research study that I am conducting at Bevill State Community College. You completed a survey online regarding the perspectives of remedial mathematics students. You were asked questions regarding your perceptions of your remedial mathematics placement. You provided your contact information and indicated you would be interested in participating in a follow-up interview. I would like to interview you and get some more details about your experiences. Are you interested in participating in a follow-up interview? It should take 30-45 minutes.

If so, please contact me at [redacted] or reply yes to this email so that we can set up a date, location, and time to conduct the interview. (After we arrange the interview, I will inform them that I will review all of the consent information before the interview, but I will also ask them if they would like me to send them another copy of the consent information to review before the interview. I will give them my contact information and the contact information of my advisor.)

If you are not interested, I completely understand and that is perfectly acceptable. Thank you for the time you took completing the survey.

Thanks,
Laura Crosby
Doctoral Student
Curriculum & Instruction
University of Alabama
lcrosby@bscc.edu

[redacted]

APPENDIX G: COOPERATING INSTITUTION APPROVAL

BEVILL STATE COMMUNITY COLLEGE

Kristi Barnett Ext. 5703
Office of Grants, Planning, Research, and Institutional Effectiveness

October 23, 2013

Ms. Laura Crosby
5728 Finch Road
Pinson, AL 35126

Dear Ms. Crosby:

Bevill State's Institutional Review Committee met on October 17, 2013 to discuss your request to conduct research at BSCC. The Committee unanimously agreed to grant your request to survey and interview students for use in your dissertation research. We do wish to clarify that no student identifiers will be recorded with the final data.

Sincerely,

[redacted]

Kristi Barnett
Director of Grants, Planning, Research, and Institutional Effectiveness
Bevill State Community College
kbarnett@bscc.edu
205-387-0511 ext. 5703

APPENDIX H: IRB APPROVAL

Office for Research

Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
RESEARCH

December 10, 2013

Laura Crosby
Department of Curriculum & Instruction
College of Education
Box 870232

Re: IRB#: 13-OR-381 "Community College Students' Perceptions Regarding their Remedial Mathematics Placement"

Dear Ms. Crosby:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waivers. Approval has been given under expedited review category 7 as outlined below:

(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

Your application will expire on December 9, 2014. If your research will continue beyond this date, complete the relevant portions of the IRB Renewal Application. If you wish to modify the application, complete the Modification of an Approved Protocol Form. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, complete the appropriate portions of the IRB Request for Study Closure Form.

Please use reproductions of the IRB approved stamped information sheets to obtain consent from your participants.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

[redacted]

Carpantato T. Myles, MSM, CIM,CIP
Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama

358 Rose Administration Building
Box 870127
Tuscaloosa, Alabama 35487-0127
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FAX (205) 348-7189
TOLL FREE (877) 820-3066