Attitudes, Beliefs, and Perceptions of College Level Students In an Introductory College Algebra Course

by

Lindsay C. Weise

A thesis submitted to the Department of Education and Human Development

of the State University of New York College at Brockport

in partial fulfillment of the requirements for the degree of

Master of Science in Education

December 1, 2012

Table Of Contents

Chapter One: Introduction

Many people are starting their higher education career at the community college level. Esch (2009) estimates that 6.5 million under-graduate students, nearly half of all college bound students, begin at the community college level. While there are countless factors that lead an individual to begin their higher level education at a two-year community college, one major characteristic of community college students is their inadequate academic level of achievement. An increasing number of high school graduates are academically underprepared for college level coursework (Bettinger & Long, 2009). Instead of extending the knowledge of students, community colleges have had to back track and reteach skills that should have been mastered upon obtaining a high school diploma. Students who are underprepared for college level course work have now become the norm rather than the exception (Esch, 2009). Not only are students enrolling that are right out of high school, but so are non-traditional older students. Many of these adult learners are returning to college in hopes of furthering their career. Many students have been out of high school for five or more years, and therefore are out of practice when it comes to mathematics.

As a result, many students entering the community college field have to take remedial mathematics classes before being able to enroll in an actual credit fulfilling mathematics course. Approximately 80 percent of four year universities and 98 percent of community colleges offer remedial courses (Bettinger & Long, 2009). It has been estimated that at least 43 percent of two year community colleges and 30 percent of students enrolled in four year universities have to take at least one remedial course (Schachter, 2008). These remedial courses often do not teach new material, but rather focus on basic skills that are expected of high school graduates. Remediation has been designed to elevate students to the level needed in order to start college

level curriculum, to help older students become proficient at basic skills that are out of practice, and to bridge the gap between what students are supposed to know when they graduate high school, and what they actually know (Esch, 2009). Bettinger & Long (2009) propose that the purposes of remedial classes are to "address academic deficiencies and prepare students for subsequent college success. By teaching students the material they have not yet mastered, the courses may help underprepared students gain skills necessary to excel in college" (p.739). Remediation in basic mathematical skills is essential for future academic success.

As a result of being in remediation, students may have negative attitudes and beliefs about mathematics education. Cifarelli, Goodson-Espy, and Chae (2010) found that prior difficulties in mathematics influence student views, attitudes, and beliefs about mathematics. The purpose of this research is to examine the attitudes, beliefs, and perceptions of college level students enrolled in an algebra course at the community college level. Royster, Harris, and Schoeps (1999) emphasized the need for teachers to assess students' mathematical attitudes because of the crucial role beliefs play in the learning and instruction that takes place. By identifying the preconceived notions and beliefs that students have about mathematics and their academic ability, a teacher can use this knowledge to better meet the needs of students. It is important to consider the significant role that mathematical beliefs play so that teachers can promote optimistic beliefs and instill positive attitudes in students

Chapter Two: Literature Review

In order to best meet the needs of students, a teacher must take substantial time to not only get to know the students, but to learn about student beliefs and attitudes towards mathematics. Vanayan, White, Yeun & Teper (1997) define the term attitude "a mental concept that depicts favorable or unfavorable feelings toward an object" (Papanastasiou, 2000, p.28). Favorable feelings will result in positive attitudes and unfavorable feelings will result in negative attitudes. An individual's attitudes towards mathematics have many facets (i.e. enjoyment, engagement, interest, relevance, etc.) Neale (1969), defines attitudes in mathematics to be "an aggregated measure of liking or disliking of mathematics, a tendency to engage in or avoid mathematics activities, a belief that one is good or bad at mathematics and a belief that mathematics is useful or useless" (Akin & Kurbanoglu, 2011, p.265).

Once attitudes are established, an individual organizes these attitudes to create a belief system. Fishbein & Ajzen (1975) describe the term belief as a "representation of what a person knows or perceives about an object or concept" (Papanastasiou, 2000, p.28). Cifarelli, Goodson-Espy and Chae (2010) explain student mathematical beliefs as the conceptions one holds about mathematics and how one will act when confronted with a mathematical problem. Often, individuals hold on to negative experiences more than positive ones, which result in misconstrued perceptions. One negative experience in mathematics could be detrimental to an individuals' belief system. Harboring negative beliefs can result in low self-esteem and a lack of self-efficacy.

Akin & Kurbanoglu (2011), describe self-efficacy as expectations about a person's beliefs in being able to successfully complete a task. A low level of self-efficacy will negatively affect the mathematical success of a student. Jinks and Morgan (1999) found that low-self efficacy leads

to less effort, which results in lower success (as cited in Ahin & Erdogan, 2009). This notion is supported by Akin & Kurbanoglu (2001) because self-efficacy also indicates the amount of effort and persistence that a person will use to overcome a difficult task. Without the will and desire to persevere to complete a challenging problem, a student may simply give up and stop attempting the problematic task. Cifarell, Goodson-Epsy & Chae (2010) found a direct relationship between the strength of one's self-efficacy and a student's persistence to remain focused when confronted with difficulty in mathematics. As the level of self-efficacy decreases, a student will have little to no motivation to persevere. Bandura (1993) also found that a heightened level of self-efficacy sustains an individual's ability to cope with failure (as cited in Ahin & Erdogan, 2009). It is inevitable that a student will face some form of academic failure. However, the most important lesson a student can learn in light of this difficult situation is how to overcome this setback and move forward.

Numerous theoretical models have been proposed to explain the influence on one's mathematical beliefs and attitudes on performance. Siegel, Galassi, and Ware (1985) constructed a social learning theory that relates mathematics performance aptitude, and anxiety. According to this social learning model, the most critical factors in mathematics performance are skills, incentives, efficacy, and expectations. According to Eccles (1987), a child's beliefs and attitudes are directly related to the expectation of success. These expectations can be both internal and external. The key internal factors are the child's self-concept of his or her own mathematical ability and the affective memories obtained from the experience with both success and failure. Externally, the perceptions that are held by teachers and parents significantly influence a child's belief system. Fennema and Peterson (1985) proposed a learning behavior model that also includes internal and external factors. The internal influences include beliefs

about oneself and mathematics, affect, and attitudes. The external influences include teacher expectations and societal stereotypes. These influences directly determine what learning experiences students will have in schools.

One factor that contributes to a student's belief system comes from the influence of others; specifically one's parents. Attitudes, beliefs, and values about mathematics are conveyed by parents to their children (Jacobs & Bleeker, 2004). Unfortunately, negative perceptions that parents have about their own mathematical experience could be conveyed to their children. Ferry, Fouad, and Smith (2000) found that parents have a direct influence on their child's self-efficacy and learning experiences. A study conducted by Papanastasiou (2000) found that the educational background of the family is a major factor that influences both student attitudes towards mathematics and the beliefs regarding success in mathematics. The highest level of education obtained by one's parents cannot only dictate the path that a child decides to pursue, but how they view themselves. Generally, students whose parents did not attend college view themselves as less adequate than others for a higher education path in college (Bryd & MacDonald, 2005). For this reason, there are many scholarships for "first generation" college students.

Besides a child's parents, one of the most important role models in a young person's life is teachers. Robertson (1991) noted that one's mathematical teacher is the most influential person in shaping beliefs and attitudes about mathematics (as cited in Walker & Plata, 2000). A study conducted by Royster, Harris, and Schoeps (1999) found that the attitudes of a teacher have a great effect on the attitudes of the students. Many students idolize teachers and try to mimic their behaviors; attitudes are no exceptions. Thus, teachers play an important role in shaping student belief process and attitudes towards mathematics. One role of a teacher is to inspire and

encourage students. It is imperative that a teacher continually encourages and reminds a student of his/her mathematical accomplishments and the ability to overcome obstacles (Perry, 2004). A teacher must set high expectations and hold students to elevated standards, but personalize criteria to each individual. Papanastasiou (2000) cautions that if expectations are not reasonable for each student, students will struggle to fulfill these potentials.

Gender also plays an important role in student beliefs and attitudes towards mathematics. Overall, males respond more positively to mathematics than females (Royster, Harris, and Schoeps, 1999). There are negative stereotypes that compare men and women in the field of mathematics. The most commonly heard stereotype is that women preform at a lower level in mathematics when compared to men (Hollis-Sawyer, 2011). Most horrifying is the fact that 76% of females indicated that at least one time in their education experience, a teacher indicated that males were better at mathematics (Hollis-Sawyer, 2011). This ideology of inferiority in women can be detrimental to a woman's belief system. One possible outcome due to this feeling of inferiority is that women do not pursue a career in a mathematics related field. Eccles (1987) indicated that a woman's attitude towards mathematics predicts her willingness to pursue an advanced degree in mathematics that will lead to a career in the field (as cited in Steele & Ambady, 2006). The National Science Foundation (2006) found that women accounted for only 24% of doctoral degrees in mathematics, represented only 17% of doctoral degrees in engineering, and made up less than 10% of mathematics faculty (as cited in Good, Rattan & Dweck, 2012).

It is also important to look at specific belief differences among males and females. When comparing gender, Good, Rattan & Dweck (2012) found a major discrepancy in student's sense of belonging to mathematics. Women felt a significantly lower level of belonging in

mathematics than men. Good, Rattan & Dweck (2012) defined sense of belonging as "one's personal beliefs that one is an accepted member of an academic community whose presence and contributions are valued" (p.701). A direct correlation was found between sense of belonging and the willingness to pursue mathematics. Specifically, as the feeling of belonging in mathematics increased, the student reported a greater intention to pursue mathematics in the future. In addition, this increased sense of belonging contributed to less anxiety in mathematics, higher confidence, and an increased importance of the value of mathematics.

The age of an individual also affects beliefs and attitudes towards mathematics. Previous research indicates that there are different learning motivations between young learners and older adult learners. Hollis-Sawyer (2011) found that older learners are more motivated by internal factors then younger learners. Hence, the beliefs and attitudes that older learners have play a significant impact on their willingness to learn mathematics. In general, these nontraditional older students exhibit significantly higher test-specific anxiety, and lower levels of self-efficacy beliefs about performance and math abilities (Hollis-Sawyer, 2011). However, older learners did not rate negatively in all areas. Byrd and MacDonald (2005) found that older students have more confidence in approaching instructors and seeking out help when they are struggling. Although adult learners may have lower beliefs about being successful, they are more willing to put forth effort to try to overcome their difficulties.

Another interesting trend looks at gender differences as age increases. There is specific interest in the effects of attitudes and beliefs among college students. The results of a study conducted by Wilkins & Ma (2003) found that a substantial negative change in student attitudes and beliefs occurs as students move from elementary school to secondary school and beyond. Jackson and Leffingwell (1999) suggest that a major reason for this decline is that when students

have a negative experience with mathematics in elementary and secondary schools, they have an intensive hostile attitude toward the subject and future encounters with mathematics (as cited in Ahin & Erdogan, 2009). Hyde, et al. (1990) found that the gender differences in mathematics attitudes and self-confidence are greater among high school and college ages students than among younger elementary students. At this level specifically, decreases levels of beliefs and attitudes result in high levels of math anxiety.

Math anxiety has been defined in multiple ways. Richardson and Woolfolk (1980) described mathematics anxiety as a condition where students have negative experiences with mathematics; including concepts, procedures, evaluation, and computation (as cited in Cates & Rhymer, 2003). Other symptoms of mathematics anxiety include discomfort with performing mathematics tasks, avoidance, poor test performance, and insignificant response to remedial instruction in mathematics (Brady & Bowd, 2005). More recently, Bai et. al. (2009) found that "research on mathematics anxiety has shown that it is a multidimensional psychological construct that involves complex factors, such as feelings of pressure, performance inadequacy, and test anxiety." Math anxiety is a complex condition that includes many different facets, where each component needs to be examined adequately.

Researchers have studied math anxiety among specific groups of people. Research has been done to analyze gender differences and the role it plays in math anxiety. Students with learning difficulties and even gifted students have been found to suffer from math anxiety. There are many differences between males and females, particularly as it relates to mathematics achievement and math anxiety. A study conducted by Hyde, et. al. (1990) indicated that there are significantly more females than males with extremely high levels of math anxiety. Tsui and Mazzocco (2007) found a significant difference in gender when comparing timed tests to

untimed tests. Based on math performance, males were found to be equally accurate on timed versus untimed testing. On the other hand, girls were less accurate on timed tests, as compared to their own untimed testing. Frenzel et al. (2007) studied the differing emotions towards mathematics with respect to gender. Boys reported more enjoyment and pride in mathematics, and less anxiety and hopelessness than girls. Girls were considerably less confident about their abilities. Females also had a greater extent of mathematics anxiety when tested with the MARS (Brady & Bowd, 2005). Frenzel et al. (2007) also found that both girls and boys rated the importance of doing well in mathematics as high. Girls experienced significantly less enjoyment and pride, but more hopelessness and shame in mathematics. Girls also had considerably lower competence and found mathematics to be intrinsically less valuable. However, girls and boys reported similar levels of the value of achievement.

There are diagnosed conditions that can help explain math anxiety in children. Students with arithmetic learning difficulties (ALD) have delayed development of arithmetic skills, commit significant numbers of computational errors, take much longer to solve problems, and can be prone to math anxiety (Micallef & Prior, 2004). These researchers found that children with ALD performed more poorly than peers of the same age, but were comparable to younger students with similar arithmetic levels. This study also showed that ALD children are developmentally delayed in addition, subtraction, and multiplication and are more anxious when asked to solve math problems.

Although some students have been classified, numerous other children suffer from undiagnosed or unlabeled disabilities. Gilbertson et. al. (2008) looked at students who were at risk academically and behaviorally, and who exhibited low levels of math performance. They concluded that difficulty of mathematics problems contribute to students' anxiousness. Students

should be matched with academic tasks that are consistent to their ability. It was also discovered that students' time on task is directly related to their level of anxiousness. Their research helped establish a relationship between the effects of task difficulty and task behavior.

Gifted students can also suffer from math anxiety. Rayneri et al. (2006) examined learning styles of gifted students and their perceptions, and how these two items had an impact on academic averages. The results of this study found that learning styles play an important role in classroom performance. However, many of the students did not perceive their classroom environment as highly compatible to their learning style. Nevertheless, the environment was not as important to academic achievement as students' personal will to achieve and find success. Tsui and Mazzocco (2007) studied gifted students and the effect of math anxiety and perfectionism. These researchers found that math performance is negatively correlated to math anxiety and perfectionism. They also stated that time pressure may lead to anxiety, which will ultimately lower academic performances. When students were asked to complete a timed test, they were significantly less accurate.

Although much research has been conducted in the area of math anxiety, researchers have given many suggestions of concepts and ideas that still need to be explored. Cates and Rhymer (2003) suggest that research should be conducted to see if math anxiety is actually related to problem length rather than complexity. They also state, "By systematically varying levels of instruction at various stages of learning and measuring pre and post levels of anxiety, research may lead to a more precise understanding of the functional relationship between mathematics anxiety and mathematics performance." Zakaria and Nordin's (2008) results indicated a significant difference in achievement as it relates to math anxiety as well as a significant difference in motivation as it relates to math anxiety. There are negative correlations between

math anxiety and achievement as well as math anxiety and motivation. However, these authors expressed concern that there could be other variables that influence student achievement that were not identified or explored.

Other such variables that should be examined more closely for possible relationships are how math anxiety and perfectionism influence math performance (Tsui & Mazzocco, 2007). Rayneri et al. (2006) believe that future research needs to examine students' learning style preferences, perceptions of classroom environments, and the relationship to achievement. Another contributing factor to be researched is the type of environment that is needed to stimulate students' interests and learning needs (Rayneri et al., 2006). Frenzel et al. (2007) stressed an importance of studying gender differences in groups such as high ability students, students with special needs, and students in other cultures in order to generalize findings.

According to the Cates and Rhymer (2003) additional research should be conducted to investigate the extent to which mathematics anxiety increases with grade level. Another growing problem is underperformance of gifted students. "Until teachers understand the needs and learning styles of gifted children and make efforts to appropriately differentiate the curriculum, underachievement and unfilled potential will continue to be a problem in classrooms across America" (Rayneri et al., 2006). Gifted students, especially, need to be both mentally and physically stimulated to maximize learning. By learning more about math anxiety and how it affects students, teachers will be better capable of helping children succeed.

Chapter Three: Methodology

This research study was conducted at a community college in western New York State. This college is a large institution that has two separate locations. Approximately 18,000 students are enrolled each year with approximately two-thirds of these students enrolled as full time, and one-third enrolled as part time. This community college's student population is extremely diverse. The subjects in this study represent different genders, race, ethnicity, religion, and age. The age of students range from eighteen to fifty-five and include both part-time and full time students. Some students are attending college right after graduating high school, while others are returning after many years in the work force.

As common is most community colleges, all matriculated students are required to take placement tests to assess skill levels in English and Mathematics. Bettinger & Long (2009) suggest that the remediation placement exam that is given to incoming students has become "the key academic gate-keeper to postsecondary study." Placement in a remedial math course has a negative correlation between obtaining a two-year degree. Recent studies report that between 60 and 70 percent of students who were placed into remedial math courses never reached graduation (Bryk & Treisman, 2010). Non-matriculated students are not required to take the placement test, but are strongly encouraged to do so to facilitate advisement. Exceptions also apply to students who have transfer credits in college-level English and Math, have a score of 500 or more on the SAT verbal and SAT math test, or have a minimum score of 21 on the ACT. As a result, not all students in this study have a placement score. Future research should look at the relationship between placement scores and student beliefs about mathematics.

The placement test used at this community college is called the ACCUPLACER and was developed, validated, and tested for reliability by the College Board (which also administers the

SAT and GRE). ACCUPLACER is used by more than 1000 colleges nationwide as on-line format and contains both arithmetic and algebra content. This community college began using the ACCUPLAER in November, 1993. The ACCUPLACER is extensively computer based, with a multiple-choice format, where time is unlimited. The ACCUPLACER test is designed with adaptive techniques that automatically determine which questions are presented based on responses to prior questions. The results of this test are used to determine the appropriate level of course to be taken. Students are placed on a scale of one to ten.

All students in this study are currently enrolled in Intermediate Algebra. Intermediate algebra is a crucial course for students seeking to obtain a degree. This course is the lowest mathematic course in the sequence that can be applied towards the graduation requirement. It is also the pre-requisite for many other courses (i.e. college algebra, trigonometry, math for elementary teachers, and statistics). In order to be eligible to enroll in this course, students must place at a level six on the ACCUPLACER placement test. As mentioned previously, non-matriculated students do not have to take the ACCUPLACER test. Therefore, not all subjects have a placement score. There are multiple students who did not score at least a level six, and therefore were placed in a lower level math course and had to work their way up to Intermediate Algebra (MTH 104). These students had to enroll and pay for multiple courses that did not count for credit, but were needed in order to be placed in MTH 104. Students who scored at a level 1 were placed in a non-credit basic math course (TRS 092). Students who scored at a level 2 or 3 were placed in a non-credit pre-algebra course (TRS 094). Students who scored at a level 4 were placed in a non-credit elementary algebra math course (MTH 098). Students who scored at a level 5 were placed in intermediate algebra (MTH 104) in addition to an elementary algebra non-

credit math lab (MTH 099). Thus, some of the subjects had to complete as many as three non-credit math courses before even being eligible to be enrolled in this course.

Participants

Twenty-four students participated in this survey. There were 11 male and 13 female students. Eighteen students were enrolled full time and six were enrolled part time. Twenty-one students attended a public school. One student each attended the following: private parochial, private non-parochial and home school. The age of participants ranged from those who were recent graduates from high school, to those who graduated high school more than ten years ago. Six students took this course for at least the second time. Eighteen students took this course for the first time. More than half of the students (58%) enrolled in this course already took a pre-algebra remedial course prior to taking this course.

Instruments of Study

The survey used for this study was adapted from the FICSMath (Factors Influencing College Success in Mathematics) survey. The FICSMath project was funded by the National Science Foundation and was designed specifically for students enrolled in college calculus. Researchers at the Harvard-Smithsonian Center for Astrophysics and the Harvard Graduate School of Education were interested in student experiences in learning mathematics. The ultimate goal of this survey is to find ways to improve mathematics education for future students.

The FICSMath survey was pilot tested with 47 students at two institutions. A focus group with experts in science and mathematics education was held to discuss the questionnaire. This indicated that the FICSMath survey could be considered valid. To gauge reliability, a separate study was conducted in which 175 students from three different colleges took the survey

twice, two weeks apart. The analysis found that, for groups of 100, less than a 0.04 percent change of reversal existed.

The format of the survey items varied. Scales were developed, through pilot testing, to reflect the appropriate variability in student experiences. Many questions where dichotomous, which divided participants into two different classifications. Some items were Likert-type scales; participants had to specify their level of agreement based on a scale from 1 (No, not at all) to 6 (Yes, very much). One question required participants to mark all answers that apply. Others were multiple choice, where participants choose the answer that best applied.

The particular survey that was used in this research was redesigned to specifically relate to students enrolled in college algebra at a local community college. The survey was shortened to include only demographic questions, and those that specifically related to student beliefs and attitudes in mathematics.

Chapter Four: Results and Analysis

Demographic information was obtained from all participants in order to make comparisons among different groups. Analysis on data examined the differences among gender (male vs. female) and type of enrollment (full time vs. part time). Analysis was also done to determine if there was a significance difference between students who took a college pre-algebra course before enrolling in the algebra course. Another comparison was made between students who were taking the course for the first time, and those that were repeating the course. Differences were also compared based on the number of years since a student completed high school. The statistical tests used for analysis were independent t-tests, ANOVA (analysis of variance), and Fisher's LSD (least significant difference).

The variables of particular interest for this study concerned a student's personal thoughts and feelings towards mathematics. These survey items were designed for participants to rank their feelings on a scale from one to six. Specifically, participants were asked about their enjoyment, interest, nervousness, relevance, discouragement, performance on exams, and understanding of mathematics. Participants were also asked to rate their feelings about wishing they did not have to take math classes and looking forward to taking more math courses.

In addition to variables regarding thoughts and feelings towards mathematics, questions were included about the support of home life, the encouragement received from others, and the view that various people (oneself, parents, relatives, friends, and mathematics teachers) have of the individual as a mathematics person. Lastly, the highest level of education for the male and female parent/guardian were analyzed to see if this variable was had a significant importance in the research. The mean and standard deviation of the questions specifically relating to attitudes and beliefs are shown in the table below.

Table 1

Descriptive Statistics of Mathematical Attitudes and Beliefs

	Mean	Standard Deviation
I enjoy learning mathematics	3.63	1.58
Math is intereresting	3.57	1.70
Math makes me nervous	3.71	1.85
Math is relevant to real life	4.50	1.32
Setbacks discourage me	3.92	1.32
I can do well on math exams	3.44	1.61
I look forward to taking math	3.21	1.74
I wish I did not have to take math	3.63	1.93
I understand the math I have studied	3.92	1.41
Do you see yourself as a mathematics person?	3.02	1.59
Do your parents/relatives/friends see you as amathematics person?	3.19	1.59
Does you mathematics teacher you as a mathematics person?	3.17	1.47
Was your home enviroment supportive of math?	3.96	1.27

More than half of the students (58%) enrolled in this course already took a pre-algebra remedial course prior to taking this course. The male parent/guardian of those students who took pre-algebra had a significantly different amount of education than those who did not take pre-algebra. On average, those who took pre-algebra had a male parent/guardian whose highest level of education was high school. On average, those who did not take a pre-algebra had a male parent/guardian whose highest level of education was some college. This seems to indicate that the education level of the male parent had a significant effect on the amount of mathematical content knowledge these students transferred from high school to college. It is possible that these students had a positive male role model in their life that encouraged them to pursue mathematics. Future qualitative studies should include interviews with participants about the impact that a male role model played in their life. There was no significant difference when comparing the female parent/guardian. There was also a significance difference between those students who took pre-algebra and those who did not in regards to their feelings about having to

take math. Students who took pre-algebra had, on average, a much higher feeling about wishing they did not have to take mathematics.

Table 2

The Effect of Pre-Algebra in College

(Standard Deviations appear in parentheses below means)

	Pre-algebra in college			
	Yes	No	t	df
Highest level of education for male parent/guardian	2.15	3.22	-2.863**	20
	(.90)	(.83)		
I wish I did not have to take math	4.29	2.70	2.133*	22
	(1.86)	(1.70)		

Note. $*= p \leq .05,\ **= p \leq .01.$

Twenty-five percent of the students took this course for at least the second time. Seventy-five percent of the students took this course for the first time. There was a significance difference between students' feelings on the support for learning mathematics and their home environment. Those students who were repeating this course ranked the support of their home environment to be much higher than those who are not repeating this course. This is a surprising fact because one would think the opposite to be true. One possible explanation is that repeating students had parents/guardians that enabled them. These parental figures most likely were very active in their child's education process. However, they could have made excuses for their children and blame their lack of success on others.

Table 3

The effects of Repeating College Algebra

	Repeating Course			
	Yes	No	t	df
Was your home environment supportive of mathematics?	5.00	3.61	2.60*	22
	(.89)	(1.20)		

Note. $*= p \leq .05.$ Standard Deviations appear in parentheses below means.

Seventy-five percent of students who participated in this study were enrolled full-time at the college. Twenty-five percent of students were enrolled part –time. Full time students and part time students significantly differed on their own thought of being a "mathematics person". Full time students viewed themselves as more of a mathematics person than part-time students. This might indicate that full time students feel a stronger sense of belonging to the college community.

Table 4

The Effects of Enrollment Status

	Enrollment Status			
	Full-time	Part-time	t	df
View yourself as a mathematics person	3.33	2.08	2.20*	22
	(1.65)	(1.02)		

Note. $*= p \leq .05$. Standard Deviations appear in parentheses below means.

Forty-six percent of students who participated in this study were males. The other fifty-four percent of students were females. Surprisingly, there were not many significant differences between males and females. The only significant difference between males and females were their views on setbacks. Females felt that setbacks were much more discouraging to them than did males.

Table 5

Differences in Gender

	Gender			
	Male	Female	t	df
Setbacks discourage me	3.27	4.46	-2.428*	22
	(1.42)	(.97)		

Note. $*= p \leq .05$. Standard Deviations appear in parentheses below means

The other statistical tests used were ANOVA (analysis of variance) and Fisher's LSD (least significant difference). This analysis was used when comparing the time that a student has been out of high school. Four students had been out of high school for less than twelve months, six students had been out of high school for one to two years, seven students had been out of high school for two to four years, two students had been out of high school for five to nine years, and five students had been out of high school for at least ten years. The highest level of male parent/guardian education of students who have been out of high school for less than 12 months was significantly different from students who have been out of school for 2-4 years, 5-9 years, and 10+ years. Students most recently out of high school had a male parent/guardian who completed, on average, the most amount of education compared to the other groups (approximately 4 years of college). The highest level of education for the female parent/guardian of students who have been out of high school for the most amount of time (10+ years), was significantly different from those students who have been out of school for less than 12 months, 1-2 years, and 5-9 years. Students who have been out of high school for 10+ years had a female parent/guardian who, on average, earned a high school diploma. Students who have most recently attended high school (have been out for less than 12 months), had statistically significant views on the discouragement from setbacks. Their views were significantly different from those who have been out of high school for 1-2 years, 2-4 years, and 10+ years. Recently high school graduates believe that setbacks are less discouraging. It is possible that students who have been out of high school for a significant amount of time are giving college one last attempt. It is possible that they feel a stronger necessity to complete the program quickly, and cannot afford to spend time repeating courses.

Chapter Five: Conclusions and Recommendations

One of the most important things that an effective teacher must do is learn about each individual student. While commonalities can be found among students of the same gender, age, and enrollment status, it is important to look beyond these groups and focus the attention on individual students. A teacher must examine the attitudes, beliefs, and preconceived notions that every student has about mathematics. A teacher will then use this understanding to develop strategies and techniques that will best meet the needs of each individual student. "It is important to consider the role that mathematical beliefs play in student's problem-solving behaviors so that teachers can design instructional activities that promote positive mathematical beliefs" (Cifarelli, Goodson-Espy, & Chae, 2010, p. 206). A teacher must lead by example and instill a positive belief system in the classroom. Through the use of innovative teaching approaches that apply mathematics to real-world situations, students will perceive mathematics as relevant to their life. This relevance will help students better understand mathematical concepts; which in turn will increase motivation and positive attitudes (Walker & Plata, 2000).

Royster, Harris, & Schoeps (1999) suggest that future research should be conducted to examine how the attitudes of a teacher and the method of instruction impact a student throughout a semester college course. An attitudes and beliefs survey, similar to the one used in this study, should be administered at the beginning of the semester as well as at the end. A correlational study should then be conducted to examine the change that has occurred. Cifarelli, Goodson-Espy, & Chae (2010) are also in agreement and believe that these results will help mathematics teachers design and implement more effective teaching approaches. Educators have to be continuous reflective practitioners by analyzing their teaching experiences, adapting to unforeseen circumstances, and developing new strategies to best meet the needs of students;

especially those who harbor negative attitudes about mathematics. Failure to consistently seek ways to improve student attitudes could increase anxiety and "create barriers to life-long learning and growth" (Hollis-Sawyer, 2011, p. 303). Teachers are one of the most important role models in a child's life and they must dedicate all efforts to help promote positive thinking and show encouragement.

References

Ahin, K., & Erdogan, A. (2009, June). Predicting college students' mathematics anxiety by motivational beliefs and self-regulated learning strategies. *College Student Journal, 43*(2), 631-642.

Akin, A., & Kurbanoglu, I. N. (2011). The relationships between math anxiety, math attitudes, and self-efficacy: A structural equation model. *Studia Psychologica, 53*(3), 263-273.

Bai, H., Wang, L., Pan, W., & Frey, M. (2009, September). Measuring mathematics *anxiety*: Psychometric analysis of a bidimensional affective scale. *Journal of Instructional Psychology, 36*(3), 185-193.

Bettinger, E. P., & Long, B. T. (2009). Addressing the needs of underprepared student in higher education: Does college remediation work? *The Journal of Human Resources, 44*(3), 737-771.

Brady, P., & Bowd, A. (2005, February). Mathematics anxiety, prior experience and confidence to teach mathematics among preservice education students. *Teachers & Teaching, 11*(1), 37-46.

Bryk, A. S., & Treisman, U. (2010, April 23). Make math a gateway, not a gatekeeper. *Chronicle of Higher Education, 56*(32), 19-20.

Byrd, K. L., & MacDonald, G. (2005, Fall). Defining college readiness from the inside out: First-generation college student perspectives. *Community College Review, 33*(1), 22-37.

Cates, G. L., & Rhymer, K. N. (2003, March). Examining the relationship between mathematics anxiety and mathematics performance: An instructional hierarchy perspective. *Journal of Behavioral Education, 12*(1), 23-34.

Cifarelli, V., Goodson-Espy, T., & Chae, J. L. (2010, Winter). Associations of students' beliefs with self-regulated problem solving in college algebra. *Journal of Advanced Academics, 21*(2), 204-232.

Eccles, J. S. (1987). Gender roles and women's achievement-related decisions. *Psychology of Women Quarterly, 11*, 135-172.

Esch, C. (2009, September/October). Higher Ed's Bermuda Triangle: Vast numbers of students enter community college remedial classes every year. Few are ever heard from again. *Washington Monthly,* 38-46.

Fennema, E., & Peterson, P. (1985). Autonomous learning behavior: A possible explanation of gender-related differences in mathematics. In L.S. Wilkinson & C. B. Marrett (Eds.), *Gender influences in classroom interaction* (pp. 17-36). New York Academic.

Ferry, T.R., Fouad, N. A., & Smith, P.L. (2000). The role of family context in a social cognitive model for a career-related choice behavior: A math and science perspective. *Journal of Vocational Behavior*, 57, 348-364.

Frenzel, A. C., Pekrun, R., & Goetz, T. (2007, December). Girls and mathematics – A "hopeless issue? A control-value approach to gender differences in emotions towards mathematics. *European Journal of Psychology of Education – EJPE (Instituto Superior de Psicologia Aplicada, 22*(4), 497-514.

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology, 102*(4), 700-717.

Hollis-Sawyer, L. (2011). A math-related decrement stereotype threat reaction among older nontraditional college learners. *Educational Gerontology, 37*, 292-306.

Hyde, J. S., Fennema, E., Ryan, M., Frost, L. A., & Hopp, C. (1990). Gender comparisons of mathematics attitudes and affect: A meta-analysis. *Psychology of Women Quarterly, 14*, 299-324.

Jacobs, J. E., & Bleeker, M. M. (2004, Winter). Girls' and boys' developing interest in math and science: Do parents matter? *New Directions for Child and Adolescent Development, 106*, 5-21.

Micallef, S., & Prior, M. (2004, April). Arithmetic learning difficulties in children. *Educational Psychology, 24*(2), 175-200.

Papanastasiou, C. (2000). Effects of attitudes and beliefs on mathematics achievement. *Studies in Educational Evaluation, 26*, 27-42.

Perry, A. B. (2004, June). Decreasing math anxiety in college students. *College Student Journal, 38*(2), 321-324.

Rayneri, L. J., Gerber, B. L., & Wiley, L. P. (2006, Spring). The relationship between classroom environment and the learning style preferences of gifted middle school students and the impact on levels of performance. *Gifted Child Quarterly, 50*(2), 104-118.

Richardson, F. C., & Woolfolk, R.L. (1980). Mathematics anxiety. In I.G. Sarason (Ed.), *Test anxiety: Theory, research, and application* (pp. 271-288). Hillsdale, NJ: Erlbaum.

Royster, D. C., Harris, M. K., & Schoeps, N. (1999). Dispositions of college mathematics students. *International Journal of Mathematical Education in Science and Technology, 30*(3), 317-333.

Siegel, R. G., Galassi, J. P., & Ware, W. B. (1985). A comparison of two models for predicting mathematics performance: Social learning versus math aptitude-anxiety. *Journal of counseling Psychology, 32*, 531-538.

Schachter, R. (2008, December). Remedial nation: As two and four year colleges face onslaught of unprepared students, they are turning to new strategies. *University Business,* 52-56.

Steele, J. R., & Ambady, N. (2006). "Math is hard!" The effect of gender priming on women's attitudes. *Journal of Experimental Social Psychology, 42*, 428-436.

Tsui, J. M., & Mazzocco, M. M. (2007, Winter). Effects of math anxiety and perfectionism on timed versus unlimited math testing in mathematically gifted sixth graders. *Roeper Review, 29*(2), 132-139.

Walker, W., & Plata, M. (2000, Spring). Race, gender, and age differences in college mathematics students. *Journal of Developmental Education, 23*(3), 24-30.

Wilkins, J. L. M., & Ma, X. (2003, September/October). Modeling change in student attitude toward and beliefs about mathematics. *Journal of Educational Research, 97*(1), 52-63.

Zakaria, E., & Nordin, N. M. (2008, February). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Eurasia Journal of Mathematics, Science & Technology Education, 4*(1), 27-30.

Appendix: Survey

1) Are you male or female?

Male Female

2) What is your current type of college enrollment?

Full-Time Part-Time

3) What type of High School did you go to? Mark all that apply

Public Charter Private Non-Parochial Private Parochial

Magnet Vocational Home-School All-Male All-Female

4) What was the size of your graduating class?

≤25 26 – 75 76 – 200 201 – 400 401 – 600 601 – 800 801 – 1000 >1000

5) What was the highest level of education for your male parent or guardian?

Did not finish high school High School Some College

Four Years of College Graduate School

6) What was the highest level of education for your female parent or guardian?

Did not finish high school High School Some College

Four Years of College Graduate School

7) For each mathematics course listed below that you took, please indicate in what year in high school you took the course, what grade you earned in each course. (If you repeated a course, provide info only for the last time you too the course).

HS Course Subject	Last Year Taken in HS				Final Grade				
Algebra I	9	10	11	12	A	B	C	D	F
Geometry	9	10	11	12	A	B	C	D	F
Algebra 2 Trig	9	10	11	12	A	B	C	D	F
Pre-Calc	9	10	11	12	A	B	C	D	F
Calculus	9	10	11	12	A	B	C	D	F
Statistics	9	10	11	12	A	B	C	D	F
Business Math	9	10	11	12	A	B	C	D	F
Other: _____	9	10	11	12	A	B	C	D	F

8) How long has it been since you completed your most advanced high school mathematics course?

0 – 12 months 1 – 2 years 2 – 4 years 5 – 9 years 10+ years

9) Have you taken college level mathematics courses prior to this course?

Yes No

If you have had college level mathematics course, how long has it been since you have last taken a college course?

0 – 12 months 1 – 2 years 2 – 4 years 5 – 9 years 10+ years

10) Did you take MTH 104 Intermediate Algebra prior to this semester?

Yes No

11) Did you take a pre-algebra course prior to this semester (i.e. MTH 098)?

Yes No

12) Concerning Your Personal Thoughts and Feelings Towards Mathematics

	No, not at all					Yes, Very Much
I enjoy learning math.	1	2	3	4	5	6
Math is interesting.	1	2	3	4	5	6
Math makes me nervous.	1	2	3	4	5	6
Math is relevant to real life.	1	2	3	4	5	6
Setbacks discourage me.	1	2	3	4	5	6
I can do well on math exams.	1	2	3	4	5	6
I look forward to taking math.	1	2	3	4	5	6
I wish I did not have to take math.	1	2	3	4	5	6
I understand the math I have studied.	1	2	3	4	5	6

13) Do the following people see you as a mathematics person?

	No, not at all					Yes, Very Much
Yourself	1	2	3	4	5	6
Parents/Relatives/Friends	1	2	3	4	5	6
Mathematics Teacher	1	2	3	4	5	6

14) Was your home environment supportive of math?

Not supportive at all 1 2 3 4 5 6 Very Supportive

15) Who encouraged you to take mathematics classes? Mark all that apply.

No one	Siblings	Math Teacher
Mother/Female Guardian	Other Relative	Other Teacher
Father/Male Guardian	School Counselor	Coach