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Relationship between attitudes toward mathematics and career choice

Maurice LeVell Wilson
University of Tennessee

To the Graduate Council:

I am submitting herewith a dissertation written by Maurice LeVell Wilson entitled "Relationship between attitudes toward mathematics and career choice." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Education.

John Ray, Major Professor

We have read this dissertation and recommend its acceptance:

Russell French, Schuyler Huck, Lawrence Husch

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Relationship between Attitudes towards Mathematics and Career Choice

A Dissertation Presented for the Doctor of Education Degree

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Maurice LeVell Wilson

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Abstract

This study examined the attitudes and career choice for eighth grade students at one East Tennessee middle school. Each participant completed the Modified Aiken Mathematics Attitude Scale Survey and a Career Selection form. The attitude scale and the career selection form were both administered by the researcher. Percentage comparisons were made to see if attitudes towards mathematics made an impact on the future career choice. The participants' were compared to see if male attitudes towards mathematics were different from female attitudes towards mathematics. Finally, male and female results on the attitude scale were compared within assigned groups as defined in this study.

Students in this school system are required to choose a career track as they leave the eighth grade. Evaluation of students' career selections had previously been examined and programs had been put in place to help students make better career choices. The study made no attempt to evaluate the programs that are in place or attitudes of the teachers in the school.

Participants were divided into three groups (Groups I, II and III) depending on the career they selected. The participants in groups had differences in percentages of yes/no responses on eighteen of twenty statements. However, differences between pairs of groups were less frequent. Group I females and males revealed negative attitudes toward two of the statements whereas groups II and III were positive. In many of the statements both the females and the males agreed, whether it was positively or negatively. Overall, both females and males were positive toward mathematics. Group I participants' revealed

negative attitudes toward three of the statements whereas groups II and III were positive. Groups I and II both revealed negative attitudes toward three statements and groups I and III both revealed negative attitudes toward one statement. Overall, the attitudes from group I was negative towards mathematics but groups II and III were positive.

In all categories the participants in groups III marked all positive for approximately two-thirds of the statements. This could be due to the number of participants in the group, which was relatively small as compared to the other groups.

There was no statistical difference found between the male attitudes towards mathematics and the female attitudes towards mathematics. Both the male and female average attitudes towards mathematics were positive. There also was no statistical difference between the attitudes of the participants in each group. The group means are relatively the same and the group means shows that the participants are positive towards mathematics.

Differences in percentages of yes/no responses were found; thus, the researcher concluded that attitude towards mathematics is related to career choice. The statistical test that was run showed that no difference exist between participants in each group. The researcher concluded that due to number of schools studied (one) and number of grade levels (one) studied such as the absence of a true experimental and control situation, this study could not demonstrate that the attitudes towards mathematics had any significant impact on career choices; the conclusion that males attitudes towards mathematics is significantly different than females attitudes towards mathematics was not be found to be statistically consistent in this study.

Recommendations included conducting a longitudinal study which can document student attitudes towards mathematics change as they pursue their education; conduct a study which can examine the achievement differences between a true experimental and control group; comparing attitude results between students in a low income area to students not in a low income area; examine different career paths chosen for students in different middle schools; and, evaluating the career programs that are in place, other than achievement differences, such as teacher morale, discipline issues, grade retention, and student motivation.

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Chapter I

Introduction

One of the greatest challenges facing American education in the 2000's is that of making sure that each student has ample opportunity to meet his/her potential. Potential is most often measured by an individual's progress. To measure progress, the East Tennessee County school system (county) in this study uses the Tennessee Comprehensive Assessment Program (TCAP) test battery to evaluate students from grades three through eight. The TCAP tests, which include multiple choice questions in five subject areas, math, science, reading, language arts and social studies are designed to measure student achievement and development of skills in those areas. The test is administered in this county in April of each year.

Each year the state compiles data, which is available to the public, that is composed of the average scores for the schools in the state and also average scores for the county school districts in the state. Although the scores reported in the 2000 State Report Card reflected each area middle school's average score, the scores and data that were presented is misleading. One example showed the school in this study to be failing in three of the five areas tested, but the promotion rate of this school was high. One would believe that if many students were failing on the tests, then these students would not progress to the next grade level but the promotion shows otherwise.

The county school system in this study provides education to students in grades K-12. In the 2000-2001 academic school year, the system consisted of 86 schools and 51,708 students. 6,995 of those students were African-American. There are 13 high schools and only one that is predominantly African-American. This county had a grade of

B during that year, above average, on the ACT (American College Testing) and also in the mathematics section of the Competency Test for grades 9-12. The above average score was very positive for the County if it represented the performance of all students, both majority and minority, but that was not the case. The only predominantly African American high school received a grade of F, (Deficient), on the ACT and also in the mathematics section of the Competency Test for grades 9-12. There are five middle schools that feed students into this school each year, School 1 (D in math); School 2 (F in math); School 3 (B in math); School 4 (F in math); and School 5 (D in math), with School 2 sending the largest percentage of students. The students that enter this high school each year are unprepared in mathematics. It seems that while the County as a whole is doing a good job educating students in mathematics, it is failing to educate the minorities, in this case African-Americans.

In the 1998-1999 school year, 71.3% of the ninth graders in this county taking the competency test in mathematics passed. In spring 1999, 1795 seniors in this county had to take the test again, and 51.7% failed and were not eligible for a regular diploma. Even more alarming is the fact that 3,470 students had to retake the math subtest their senior year. In their freshmen year, when they first took the test, 71% of their total class passed the math subtest. In 1998-1999, 49% of these high school ninth graders met the requirement in mathematics, which was well below the county average of 75% and the state average of 71%. The low average for this high school and the fact that this school educates the majority of the African-American high school students in the County is the reason this study was chosen.

Researchers have said that African-Americans or Blacks tend to do worse on standardized tests in mathematics than their white counterparts (Nicoladis, Taylor, Lambert, & Cazabon, 1998). Although that is true, the investigator does not agree with the reasons that some state that African-Americans cannot think as logically as other races. Achievement at the eighth grade level clears the way for students to take rigorous high school mathematics and science courses, which are the keys to college entrance and success in the labor force. As seen from the results of the 2000 State Report Card, the middle schools that send students into this high school are not achieving at the standards set by the County. Since the middle schools are not performing up to standard, the investigator wanted to know if attitudes towards mathematics were a factor. School 2 is a middle school located in a low socioeconomic area and is the school that sends most of the freshmen to the only predominantly African American high school. Several studies have shown that socioeconomic status is a factor in how well students perform on tests (French and Bobbett, 1995), but the investigator believes that mathematics achievement should depend on the courses a student takes, not the type of school the student attends or the location of that school. Middle school is when many students begin to think about their future, and it is at the end of this level of education when students select career paths. The Third Mathematics and Science Study (TIMMS) revealed that the middle school mathematics curriculum was the weak link in the education system in the United States.

Previous Research

Groman (1989) investigated math achievement, attitudes, and plans of black and white, male and female high school students. Groman found a consistent, positive correlation between self-concept of mathematical ability and achievement in the subject. In addition, Groman's study showed that measures of academic self-concept could be used to predict the number of mathematics courses female black students might take in the future.

Hale-Benson (1986) argued that most African-American students process information in ways that are very different from those of whites. Hale-Benson found that African-American students tend to be field-dependent and intuitive rather than analytical. Rech (1991) found those same traits in African-American students, including external locus control and field-dependency was associated with low mathematics achievement. Groman and Benson's research also concludes that if the students are confident in their mathematical ability, then they are likely to take more mathematics classes.

Several studies that investigate the achievement of African-Americans in mathematics are being used as references in this paper.

Problem

Peng and others (1995) found that at early ages all students have equally positive attitudes towards science and mathematics learning in school. The students have similar aspirations for science and mathematics-related careers, but as they get older, more minority students become less prepared to enter those fields as they fall behind in mathematics and science learning. Peng also found that a large percentage of minority students come from poor families that have fewer learning materials, such as books and

computers, at home. Their parents are more likely to have low education levels, to be unemployed, and less likely to be adequate mentors or role models for mathematics and science learning. The Institute for Independent Education Inc. (1989) found that most African Americans in urban areas are trapped in schools that are below the national norms for reading, mathematics, or both.

Many factors other than race contribute to the low math scores of African-Americans. Many studies have shown that socioeconomic status plays a major role in mathematics success (French and Bobbett, 1995). In 1989 the Research Advisory Committee (RAC) of the National Council of Teachers of Mathematics recommended that researchers develop useful concepts of how minority (African-Americans in this case) students learn mathematics. They also recommended that researchers conduct school-based research that addresses teacher-minority student interactions and changes in the classroom teaching methods and learning environment. A common problem that each study above addressed is the lack of success for minority students in mathematics, which is the focus for this study.

Purpose

The purpose of this study is to answer the following two questions:

1. How do 8th grade middle school student attitudes towards mathematics relate to their career choices?
2. How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

It is important to study the relationship between attitudes towards mathematics and career selection because many careers require a solid mathematics foundation.

The State Board of Education adopted Tennessee's Education Edge Program (TEEP) several years ago. The program is designed to give middle school students an opportunity to explore career options first hand through internships, visits to offices, and other means because as students leave the eighth grade, they select a path for high school, i.e., university path, technical path, or dual path. The purpose of this study was to investigate the relationship between middle school student attitudes towards mathematics and the career choices the students make.

Design of the study

Two research questions served as the foundation for the study:

1. How do 8th grade middle school student attitudes towards mathematics relate to their career choices?
2. How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

The participants for this study were 8th grade students. They were chosen not only because eighth graders in this particular county choose a career path, but also because some studies have shown that eighth grade is when students tend to fall behind academically.

The investigator chose this middle school for two reasons: 1) this school represents the only predominantly African-American middle school in the county, and 2) this school has continual low mathematics scores on the TCAP tests.

First, the investigator submitted a complete overview of the study to the County board. After receiving permission to enter the school, the investigator set up a meeting in May to discuss the study with the principal and a representative from the math department. The school was reluctant to grant permission for fear of misrepresentation. The investigator assured both the principal and the math teachers that no false possibilities or demeaning information would be reported. Upon approval, the investigator met with each 8th grade mathematics class and was introduced to the students. The investigator told the students that this study was absolutely voluntary and that their participation or non-participation would not affect their assessment in the class in any way. The investigator explained that the researcher was looking for honest answers to each question and that only the investigator's committee chair and the investigator would see their responses. Then the investigator informed the students that the purpose of the study was to help the investigator, as well as interested teachers, understand how students associate their academic ability with their career choices. Afterwards, the investigator gave each student a consent form to be taken home and filled out by his or her parents or guardians.

After two days, the investigator returned to each class and collected the consent forms and then explained the study again to the students. Then the investigator gave out assent forms to each student who returned a consent form from their parent or guardian. Once the investigator had all approved forms, the questionnaire was administered. The sample for the study came from students who brought a consent form approving their participation and signed an assent form in class agreeing to participate. Thus, only the students who were present in the mathematics classes on the day the researcher was

present could become participants. Then only the students who brought back the forms were allowed to participate.

The instruments used in this study consisted of the Modified Aiken Mathematics Attitude Scale (MAMAS) and a list of 100 careers from a book by Nicholas Basta. The MAMAS is a 20-question opinionnaire to which the respondents circle "yes" or "no" to express a feeling or attitude toward mathematics. This opinionnaire is a modified version of the original Aiken Mathematics Attitude scale (Aiken, 1963) and has been used in many studies. This instrument was chosen because it does not take much time.

The second instrument used in this study was a list of the 100 most popular, dynamic, and profitable careers in America today as composed by Nicholas Basta and reported in the book *Top Professions* (1998). This instrument listed many careers that are prevalent in society today. It was chosen because of the variety of careers it listed. This instrument was not a measuring device, but simply a way to divide the participants. The investigator told the participants that if they did not see their career on the list, then they could write it at the bottom of the page.

The investigator entered each 8^{th} grade mathematics class and collected all of the consent and assent forms from the students. The teacher instructed the students who were not participating in the study to work on a worksheet. The investigator passed out the MAMAS, which had the 100 career list stapled to the back of it, to all of the participants. The participants were instructed to respond honestly to each question and to select only one career from the list or write only one career down at the bottom of the page. Both the questionnaire and the career selection took the students about 15 minutes

to complete. After everyone submitted his/her questionnaire, the investigator exited the classroom.

Importance of the Study

In recent years there has been a surge toward technology and other advanced technical occupations. The need for mathematics has increased with that surge, and if minorities, African-Americans, do not increase the rate of success in mathematics, then those jobs will not be offered to them. Computers have taken learning to a higher level, a level that requires critical thinking and good analytical skills, which come with processes associated with mathematics. Yarnevich (1994) investigated how mathematics courses taken in high school and college affect future salaries of students. Yarnevich found that the more mathematics courses taken the higher starting pay received. Tennessee tracks its students; therefore, the students that are in the eighth grade are being asked a vital question that may affect their future: the academic path they want to take as they enter high school. The students choose a path that entails college prep, vocational curricula, or dual path. It is important to know which careers eighth graders are considering and how their attitudes towards mathematics relate to those choices, if there are to be increased efforts to recruit minorities into technical fields.

With the surge of technology comes the need for higher education degrees. The Measuring Up 2000: State Profiles showed between 16-18% of the state of Tennessee is African-American and 15% of students enrolled in higher education in Tennessee are African-American as well. That rate of 15% in higher education is misleading because many of those students may not have actually attended high school in the state (Measuring Up 2000). This study is very important to the African-American students

who grow-up, go to school, attend higher education institutions, and eventually reside in the city of the study because if the eighth grade students understand the type of mathematical skills that are necessary for the careers they choose, then the students may be able to make an informed decision. The information about careers may come from a school guidance counselor, teachers, representatives on a career day, or different guests who visit the school and explain which skills are needed for certain jobs.

Assumptions

This study assumes that 1) the procedure for selecting participants provided a representative sample of 8th grade students in this school and 2) that students who are given background information on the skills needed for specific careers will make wiser decisions that will ultimately prepare them for a better career. If these students are aware of the mathematics needed for their futures, they will take more interest in the mathematics classes, as well as choose careers that accommodate their ability, desire, and preparedness.

This study also assumes that TCAP test scores are valid instruments for measuring a student's ability to perform in mathematics. In other words, it is assumed that the students have done their best to answer the questions correctly and that the subjects responded honestly to the questionnaire administered.

Limitations

This study has four limitations:

1. This study was limited to eighth grade students who were presently enrolled in a middle school East Tennessee during the 2000-2001 school year.
2. This study was limited to the measures provided by the instruments selected.

3. The study was limited in time to the last week before summer vacation.
4. The results of the study cannot be generalized beyond the eighth graders at this middle school that particular year.

Delimitations

This study was delimited to eighth graders who were presently enrolled in a mathematics class at the middle school selected.

Definition of Terms

The following definitions of terms will be used in this study:

1. Tennessee Comprehensive Assessment Program (TCAP): A state assessment program that provides information on student academic progress from scores in each of five subjects (math, science, reading, language, and social studies).
2. African-American: A classification of a race that is also referred to as Black.
3. Achievement: Student performance on the standardized tests, TCAP.
4. Attitude: A learned pre-disposition to respond in a consistently favorable or unfavorable manner with respect to a given object (Fishbein & Ajzen, 1975, p. 6).
5. Attitude Scale: An instrument that numerically measures the direction and intensity of an individual's attitude toward an object (Anastasi, 1976).
6. Likert Scale: A standard attitude scaling technique developed by Likert wherein respondents react to given statements by choosing one from among the following five response categories- (SD) strongly disagree, (D) disagree, (U) undecided, (A) agree, and (SA) strongly agree.
7. ACT: American College Testing program.

Organization of the Study

This study is organized into five chapters.

Chapter I introduces the study and contains the following components: previous research, statement of the problem, purpose of the study, design of the study, importance of the study, assumptions, limitations, delimitations, and definitions. Chapter II contains a review of literature relevant to the study. Chapter III contains the methods and procedures of the investigation. Chapter IV presents the findings of the study, organized by research questions. Chapter V includes a summary of the study, conclusions, and recommendations for future research.

Chapter II

Review of Literature

This chapter contains the following four sections of research:

1. Students' attitudes and achievement in mathematics
2. Gender differences in students' attitudes and achievement in mathematics
3. Racial differences in students' attitudes and achievement in mathematics
4. Students' attitudes toward school and career choice

Research on Attitudes and Achievement

With the continued increase in technology, it is vital for each student to improve skills and to develop a positive attitude toward mathematics if he/she expects to be successful and productive in life. Attitude and achievement are closely related (Fennema & Sherman, 1976) and both are required to be successful in mathematics. It is hoped that students acquire a strong background in mathematics, develop positive feelings as a result of success, and pursue the study of mathematics throughout their school years. It is vital that the attitudes remain positive all through school, beginning as early as kindergarten. Starting as early as kindergarten will allow the students to grow stronger by continually seeking knowledge and understanding (Rancifer & Pinchback, 1988).

Previous research indicates that positive student attitudes and achievement are integral to understanding the causes of differential mathematics achievement. Matthew (1984) found several factors that influenced the quality as well as the success of minority

students' mathematics education. Furthermore, the factors can be grouped into three categories: attitudes, socioeconomic status, and gender. This research uses only one factor from his study-attitude. Examples of student attitudes that are important in mathematics include: confidence in learning mathematics, enjoyment of mathematics, perceived usefulness of mathematics, belief in the appropriateness of mathematics as an area of study, and attributions of success and failure in mathematics (Hart & Stanic, 1989). Examples of achievement related behaviors include: persistence, independence, and the desire to enroll in optional mathematics courses (Hart & Stanic, 1989).

In learning mathematics, confidence – the belief that one can learn and perform well – is most important. Students who are sure of their mathematical ability usually continue to take mathematics courses after they leave middle school even if those courses are not required. Further, they often choose mathematical related careers (Wagstaff, Melton, Lawless, & Combs, 1998).

Confidence in learning mathematics is an important component of positive self-perception, which is specific to mathematics success. Academic self-perception consists of an individual's concept of self as related to achievement in school. Rubin (1978) found a positive relationship between self-concept and mathematics achievement. In a sample of 380 children ages 9-12, Rubin found that correlations between Coopersmith Self-Esteem Inventory (SEI) and school achievement scores increased over the range of ages from 9 to 12 during a 3-year longitudinal study.

The first study of confidence in learning mathematics was the National Longitudinal Study of Mathematics Abilities (Crosswhite, 1972). Crosswhite reported correlations between confidence and mathematics achievement scores ranging from .19

to .37. A study by Hart & Stanic (1989) of sixth and seventh graders revealed females demonstrated more confidence than males.

African American students vary in how useful they perceive mathematics to be for both their present and future needs. Ajose (1995) found that there is a significant positive correlation for African American's between perceived usefulness of mathematics and mathematics achievement, i.e., if it is perceived as useful they will strive for it. Perceived usefulness is an important factor in a student's decision to continue in advanced mathematics courses once the courses become optional. Frequently, students who do not perceive mathematics to be useful in everyday life or future careers quit taking mathematics classes once they become optional, thus closing the door to opportunities for better jobs.

In a study by Yarnevich (1994) concerning the relationship between mathematics courses taken in high school and college and how those courses affect future salaries of students, it was found that perceived usefulness of mathematics was not ranked high on the list of reasons given by the students. The students did not understand the impact that a solid background in mathematics would have on their future careers and salaries. Groman (1989), in a study that focused on middle school black students found that usefulness of mathematics was an important predictor in mathematics achievement and career plans. Groman's study further showed that measures of academic self-concept could be used to predict the number of mathematics courses female black students might take in the future. It seems that self-confidence is very influential in decisions black students make concerning their mathematics education.

Tartre and Fennema (1995) conducted a longitudinal study that dealt with mathematics achievement as it relates to student attitude toward mathematics. An attitude scale was administered to 60 students progressing from the 6^{th} to 12^{th} grade. This study found consistent gender differences in stereotyping mathematics as a male domain but the only significant difference was the correlation between achievement and confidence for males and females. This study revealed a drop in female confidence and achievement in the middle school years yet found that the teachers rated the same females more effective learners and more hardworking than males, but the males had more interaction of all kinds with the teachers.

This section on attitudes and achievement has shown the following points that are relevant to this study:

1. Both positive attitude and achievement are required to be successful in mathematics.
2. Confidence in learning mathematics is an integral part of positive self-perception, which is specific to mathematics.
3. Students who view mathematics as useful will achieve in mathematics and will take more mathematics courses.

Research on Gender Differences in Student Attitude and Achievement in Mathematics

Traditionally, mathematics has been considered a male subject. Males have been encouraged to follow a mathematics track throughout their school years and to prepare for careers related to mathematics. Now women are also preparing for and receiving

those careers. More and more women are working in technical fields and with those occupations come the need for more mathematics.

Conversations continue over the existence and possible outcomes of differences between male and female mathematical skills and attitudes toward mathematics. Reports and studies indicate that much difference exists between males and females performance in the classroom. Differing expectations have an impact on achievement, self-esteem, and educational and career attainment.

A study by Ingels (1994) revealed that although gender differences were small, male and female high school students did differ in mathematics achievement in accordance with socioeconomic status and high school program placement. There was no significant difference between males and females with same class but there was a big difference between gender opposites in opposing classes.

Mathematics education research based on attributing factors deals with perceptions of the causes of student success or failure on mathematics tasks (Reyes & Stanic, 1988). The major purpose of this research was to understand sex-related differences in mathematics course taking and achievement. There appears to be little difference in reasons that male and female give for success or failure in mathematics. Male students attribute their success to effort and their failure in mathematics to a lack of effort; whereas females attribute their success to effort and their failure to a lack of ability and difficulty of the task (Fennema, Peterson, Carpenter, & Lubinski, 1990). The male students seem to have more confidence in mathematics, whether they do well or not, but the female students lack the confidence and blame their lack of knowledge on factors

other than confidence. Mathematics is not gender dependent. It is a discipline that takes patience, determination, and most of all confidence.

From kindergarten through graduate school, female students appear to be junior partners in the educational process, i.e., they don't assert themselves. Females do just as much work as males, but when it comes to physically presenting the results the females take a back seat and allow the males center stage.

When teaching mathematics, teachers initiate more academic contact with males – even when females and males initiate the same amount of teacher contact (Campbell, 1986). Further, teachers from grade school to graduate school ask males more questions, give males more precise feedback, criticize them more, and give them more time to respond to questions (Sadker, Sadker, & Steindam, 1989). In a study by Sadker and Sadker (1985a), it was found that male students had more opportunity to interact in classroom discussions, received more praise, and were given more academic help than females. In addition, teachers give male students extended directions on how to complete tasks for themselves. Unfortunately, teachers are more likely to actually do the work for females (Sadker & Sadker, 1985a). According to Sadker and Sadker (1986), males are eight times as likely as females to call out an answer and demand a teacher's attention. When males call out answers, teachers tend to accept their answers; however, when females call out answers, teachers remediate their behavior and advise them to raise their hands (Sadker & Sadker, 1986). Whether the attention is positive or negative, the fact of the matter is that males get more attention in the classroom. This frequently results in males becoming more assertive and females becoming more passive. Past research

reveals that students who talk in class and receive teacher attention are most likely to achieve academically and develop positive attitudes toward school (Campbell, 1986).

The middle school years are viewed as being particularly important in the development of attitude toward mathematics (Allen & Chambers, 1977). As early as the seventh grade, the majority of males and females view mathematics as more useful for males (Fennema, 1983). Compared to male students, females have lower achievement expectancies in mathematics, lower self-concepts of their mathematical ability, and slightly higher levels of mathematics anxiety (Fennema & Sherman, 1977). In middle school, even when females and males are in the same mathematics classes, females, as a group, show little difference from males in mathematics achievement. However by the time these students reach the eleventh grade, the females are not achieving as well in mathematics as the males (Fennema & Carpenter, 1981). While gender differences in mathematics achievement and attitudes overall have been declining during the past two decades, there still exists a disparity in advanced mathematics achievement and upper-level mathematics course-taking patterns, which contributes to fewer females than males choosing professions in math, science, and technology fields (Johnson, 2000). Johnson's study examined factors such as the relationship between time spent watching television and the attitude of students towards testing and coursework. The study revealed the more time spent watching T.V. the less they liked testing and coursework.

Females enter school academically ahead of males, but twelve years later they leave school academically behind males in key areas, such as higher level of mathematics and measures of self-esteem (Sadker & Sadker 1992). Although females start out with an educational advantage, their scores on achievement tests decline as they progress through

school. From middle school on, females express more negative attitudes toward mathematics and rate their ability in mathematics lower than do males even though objective indices suggest they are performing at comparable levels (Yee & Eccles, 1988). A study by Fennema and Tartre (1995) reveals a drop in female confidence and achievement in the middle school years.

Research indicates that a student's attitude toward mathematics is important in determining whether he/she elects to take more courses in mathematics and engage in mathematics activities (Yarnevich, 1994). Other studies reveal that females are less likely than males to elect advanced level mathematics courses in high school and college, are more likely to be found in introductory and lower-level mathematics courses, and are underrepresented in the mathematics professions (Yee & Eccles, 1988).

A discrepancy exists between males and females national standardized test scores. Males outperform females at the middle school level, but females outperform males on report card grades (Sadker & Sadker, 1989). Females repeatedly receive better grades in school, but males outscore the females on standardized tests. Kaiser (1993) found gender differences in degree of interest in mathematics for students aged 14-19. The results of his study also showed differences in the perceived importance of mathematics achievement between the genders. Males were more likely than females to know which careers demand a solid background in mathematics.

Another longitudinal study by Fennema (1983) examined the relationship between spatial visualization and confidence. The purpose of this study was to investigate sex-related differences in mathematics achievement and enrollment in higher-level mathematics courses. In the first study, 33 boys and 36 girls from grades 6-8, who were

deficient in their spatial and verbal skills, were interviewed to determine how efficiently they used spatial visualization to solve word and symbol mathematical problems. In the second study, 31 boys and 32 girls from grades 6-8, who were above the mean in mathematics achievement and in lower or upper extremes of the quartile in confidence in learning mathematics were interviewed about the types of questions they prefer to be asked on math tests, the different perceived respondents, and other mathematical situations. The results indicate differences in the ways boys and girls use their spatial skills, with girls who are low in such skills tending to use them less than all of the other groups. Furthermore, expectation of success in mathematics diminishes for girls from grade 6 to grade 8, while it increases for boys.

Stipek and Gralinski (1991) conducted a study with 194 third graders (94 girls and 100 boys) and 279 middle school students (143 girls and 136 boys). The middle schools in the study were fed by the elementary schools; thus the students in Stipek's and Gralinski's study were drawn from the same community population. Students completed questionnaires that measured achievement- related beliefs before and after the students took a regularly scheduled exam. Boys rated their competence in mathematics higher than the girls, and the girls claimed mathematics was more difficult than the boys did. Girls were more likely than males to claim that they would like to avoid future mathematics courses and mathematics tests. Gender differences in expectancies were found in middle school but not in the third grade. Boys had higher expectations of mathematics than girls did in middle school ($p < .001$).

In a study by Seitsinger, Barboza, and Hird (1998) 63 sixth and seventh graders were grouped into single-sex mathematics classes (SSMC) to improve girls' achievement

in mathematics (AIM) and attitudes toward mathematics (ATM) with no negative impact on the boys. The statistical test he used in this study showed no significant difference in mean scores for females and males on the Metropolitan Achievement Test-7 standardized test.

This section on gender differences shows the following key points relevant to this study:

1. Mathematics has typically been an area in which males feel comfortable but females feel uncomfortable.
2. Males usually outperform females in mathematics on standardized tests.
3. Males are more likely than females to know what careers demand a solid background in mathematics; thus, they are thought to know more about the importance of mathematics.
4. Males rate their attitude towards mathematics higher than females do.

Research on Racial Differences in Student Attitudes and Achievement in Mathematics

There is growing concern about the under representation of minorities in mathematics, the causes of under-achievement of black students and other minorities in mathematics and how schools can rectify the gross racial inequity in mathematics education outcomes. These concerns have remained for decades.

The different backgrounds and experiences of children affect their attitudes and achievement. Surprisingly, in the past, students from minority populations did better in mathematics and mathematics-related activities than their abilities predicted (Allen &

Chambers, 1977; Fennema, 1974; Fennema & Sherman, 1977; Jones, 1984; Meece, Parsons (Eccles), Kaczala, Goff, and Futterman, 1982).

Traditionally, a wide range of variables has been used to investigate mathematics success of minorities. These variables include socioeconomic status, parents' education, and location of schools attended. More recently such factors as cognitive, affective, and unique cultural characteristics are being considered (Ajose, 1995).

For many African-Americans, the Hale-Benson report (1986) confirmed what had been thought for years: a strong relationship exists between external locus of control and field dependency. Hale-Benson found that African Americans tended to try to find a link between themselves and the material they were studying. Moreover Hale-Benson also found that African-Americans performed better in subjects that were taught by African-Americans and used books that showed pictures of African-Americans.

The existence and strength of the relationship between race and achievement is so widely accepted that it is often cited as a self-evident fact. Reports and studies often make the following conclusions based upon this acceptance: 1) test scores for minorities on standardized tests are the most powerful predictor of school performance and 2) the higher percentage of African Americans in the population, the lower the average scores (Nicoladis, Taylor, Lambert, and Cazabon, 1998). This relationship between race and achievement has been documented in numerous studies and seems to hold no matter how the grades are factored. However, to categorize students according to race is to rank them on the extent of their historical participation and degree of success in the American educational system; therefore the research is not valid because other studies, for example, by the Institute for Independent Education, Inc., contradict these findings. "Race does not

predict grades, achievement and intelligence, retention at grade level, course failures, suspensions from school, high school dropouts, plans for college attendance, or total amount of formal schooling" (Institute for Independent Education, Incorporated, 1989).

Although there is a great deal of literature concerning race and achievement, there is a limited amount concerning students' attitudes and race. A study by Reyes (1984) examined the relationship between affective variables, such as self-concept, and math education for middle school students. Reyes concluded that self-concept of mathematical ability does affect achievement. The results of the study indicate that parents determine the initial attitudes and performance in mathematics: parental expectations of children's achievement, parental encouragement regarding mathematics, and parents' own attitudes toward mathematics are all factors that affect a student's performance in mathematics. A conclusion from the study was that, assuming ability is present, children of parents who expect them to do well in mathematics tend to do better than children whose parents expect them to do poorly (Reyes, 1984).

A study by Melear and Alcock (1999) involved four predominantly rural counties in eastern North Carolina in which most public school students are African-American. Three of these counties are ranked among the lowest counties in the state on 11 quality-of-life indicators. Melear and Alcock compared the performance on Myers-Briggs Type Indicator (MBTI) of 204 African American high school males to the norm group of 3,503 high school students in college preparatory classes. Results showed that the type and temperament preferences in these counties of African American students and white students were not consistent; neither group valued school, but the college preparatory students perceived school as positive while the African American students did not. The

study supports the idea that differences exist among African American students and white students. This study shows that there is a difference in perceptions between the African American students and the control group of students preparing to enter college.

Urdan and Davis (1998) examined the differences by race and grade level in motivation for taking standardized achievement tests. The study included 111 fifth graders, 35 African American and 76 white, and 274 eighth graders, 204 African American and 70 white, in Atlanta, Georgia. The study revealed that the eighth graders as a whole perceived the tests as less valid than the fifth graders did in measuring their ability. The eighth graders prepared less for the tests and expected to do less well than did the fifth graders. On the other hand, the fifth graders as a whole were more anxious than the eighth graders, but no racial differences in anxiety were found. Differences by race and grade level suggest that there may be other reasons to how students do on the tests other than what they learn in school. There may be some relationship between how motivated the students are for the tests and how prepared they are to take the tests. Other factors may include the degree of significance or validity parents give to the test.

A longitudinal study by Ingels (1994) described test achievement of sophomores in mathematics and their patterns of course taking in mathematics. This study revealed that, overall, students did differ in mathematics achievement by socioeconomic status and by academic or vocational tracking. While black and white students had similar educational expectations, blacks were much less likely to have taken geometry and foreign languages. These results support what French and Bobbett (1995) found in the schools in the southeast, where socioeconomic class was the determining factor for the low scores on standardized tests.

Fenwick (1996) studied race equity and science and math education in middle schools in Atlanta, GA as part of the Georgia Initiative in Mathematics and Science. Fenwick found that a student's status as minority or poor or female severely impairs that student's likelihood of acquiring a quality educational experience, particularly with regard to science and math. Fenwick found significant differences in teacher qualifications and teacher attitudes towards mathematics and other subjects in the low socioeconomic area schools.

The following points summarize the relevance to this study:

1. African American students do not value mathematics the same as other races. African Americans tend to value mathematics more negatively than other races.
2. African American students tend to have negative attitudes towards school and towards classes such as science and mathematics.
3. African American students do not typically get the same quality mathematics education as other races.

Research on Students Attitudes towards School and Career Choice

Historically, the students who looked forward to going to school were the students who performed best in school. School was thought of as a place to go and acquire all the knowledge you need to live a productive and successful life. However, increased violence and over crowdedness in the schools have influenced the attitudes of students.

There is a rise in the proportion of students who have not experienced any career education at the middle school level. A study by Wells and Gaus (1991) investigated middle school students' knowledge of career options. The results showed that 40 percent

of the sample had not received any career education. Approximately three-fourths of the sample did not see the relevance of English, science, or social studies to successful performance in their career choice, and approximately 60 percent did not see the relevance of mathematics.

Since 1980, the national dropout rate has been on the decline. The 2000 State Report Card showed that the Dropout Cohort, percentage of students dropping out before their eighteenth birthday, in the county in this study was above average and that the attendance was exemplary. The low percentage in Dropout Cohort shows that the students in this county are not dropping out of high school as much as students in other school districts in the State of Tennessee. Actually, they are attending school quite regularly. The students are attending school but are they made aware the relationship between school and careers? The 2000 State Report Card shows that the students are going to school, but the overall grades for the schools in this study reflect that the students are not performing at even an average level. One promising thing about the high attendance and low dropout rate is that it shows that these students are not giving up. Mathematics teaches us problem-solving and critical thinking skills that are mandatory in a technical society. In a society that is dependent upon technology, one must possess those necessary skills to stay competitive for the high paying jobs. The eighth grade is early for students to pick a career, but it is not too early for them to start thinking about careers. Of course, they have ample time to explore other options and possibly change their minds about their futures, but they need to start thinking.

The Ohio Department of Education, Columbus (2000) released a document that explained the purpose and content of the Individual Career Plan (ICP) and also provided

activities through which parents could help their children begin to think about career choice. The document consisted of suggestions that enable parents to help their children by teaching them about their own career choices, choosing relevant high school courses, and exploring whether certain careers matched the students skills and abilities. A similar document, Journey to the future, Today...Tomorrow...Forever (1996), serves as a guide to help middle school students plan career paths. The guide provides career clusters and employment opportunities along with the required skills and knowledge to maintain those jobs. All of the previous information and documents are provided through the middle schools and offers students an opportunity to see relationships between school and careers.

Outen (1995) developed a career education program model for middle school students that would improve career and vocational decision-making. Outen found that students were not able to identify careers they were interested in pursuing, nor did they understand the importance training plays in being successful in future careers. Analysis of the data revealed overwhelmingly that a career education program is a win-win solution for middle school students. It also revealed that all academic levels, social skills, gender, ethnicity, and economic status could benefit from a career program. Several years ago the state of Tennessee implemented a career-based program, Education Edge. The goal of the program is to better equip students for life and work by strengthening the connection between school and work, resulting in stronger motivation for school success. It enables students to identify career goals and choose a course path for high school. It also provides an opportunity to students for real work place experience. In contrast, this year the only funding that was allotted to the middle schools was bus transportation to the

career fair. The programs that are in place claim, in their descriptions that they offer student support in career choices but sometimes due to lack of funds which are out of a schools control, students do not get the full benefit of the program. Mason (1992) explored the teachers' role in helping middle school students make career choices. He developed a program to provide students with a caring adult who will help them while they are in middle school. Most of the adults that participated in the program were teachers and due to the time constraints put on each teacher the program has not been very successful.

The key points of this section include:

1. Middle school students do not typically understand the careers they choose nor do they pick careers that accommodate their skills and knowledge.
2. There are programs in place to help middle school students that rely on parent/teacher participation.
3. Funding is a problem when finding programs to help middle school students.

Summary

This chapter examines how a student's attitude directly affects her/his achievement in mathematics as well as in other subject areas. Fennema (1976) shows that to be successful in mathematics, students must have a positive attitude. There are many females who, for reasons of reluctance or shyness, do not perform as well as males in mathematics. Although the gender gap is closing, it still exists. Campbell (1986) shows that the low response females get as compared to the high response males get from teachers affect how well females perform in mathematics.

There are a large number of African Americans who believe mathematics is a subject in which they cannot perform well no matter how hard they try. That attitude reflects the negativity that is very prevalent in the low-income, African American communities. It is that attitude that so many African American students of all ages have adopted as an excuse for not being able to do or not trying to achieve in mathematics. Kim and Hocevar (1998) found that African American students perceive themselves as having less experience and less exposure to instruction than did European American counterparts.

As shown in this chapter, a solid educational background is mandatory for productive careers. Students need to start planning their future during the middle school years so they will have the knowledge and skills needed when time comes to prove themselves in the workplace.

As seen in this chapter, student attitudes towards mathematics are closely associated with achievement. This chapter outlines the following key points that are relevant to this study.

1. Research shows that both positive attitude and achievement are required for a student to be successful.
2. Male students are more comfortable than female students in mathematics, and males rate their attitudes towards mathematics as more positive than females do.
3. African American students have negative attitudes towards mathematics.
4. Middle school students are not aware of the type of skills and degree of background knowledge they will need in their future careers.

This chapter includes research on attitudes and achievement, research on gender differences in student attitudes and achievement, research on racial differences in student attitudes and achievement, and research on student attitudes toward school and career choice. The next chapter will include the methods and procedures used in this study.

Chapter III

Methodology

The purpose of this study was to investigate the relationship between student attitudes towards mathematics and career choice. Two research questions provided the framework for the study.

1. How do 8th grade middle school student attitudes towards mathematics relate to their career choices?
2. How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

Percentages and a statistical method were used to investigate the relationship between attitudes towards mathematics and career choices. It was important to assess comparisons of students according to the number of mathematics classes needed to determine if career choice was a variable that impacted student attitudes towards mathematics. It was also important to explore the relationship between male attitudes towards mathematics and female attitudes mathematics. This chapter describes the procedures used in this study. The sections include subjects, instruments, data collection, and data analysis.

Subjects

The population consisted of eighth grade middle school students from one East Tennessee County school system. The middle school used in this study represents the only predominantly African American middle school in the county. Middle school students were chosen because research indicates that while attitudes toward mathematics develop throughout the school grades, more typically, gender development occurs in the intermediate and junior high grades (Aiken, 1972). Furthermore, studies show that in the middle school grades, more specifically eighth grade, students start to choose their careers for the future (Hart, 1989). In the State of Tennessee it is policy for all students to declare a career path by the end of their eighth grade year. Since data were collected in the spring, an eighth grade middle school student was considered to be a student who was near completion of the eighth grade. Since the researcher was interested in attitude towards mathematics, only students who were enrolled in mathematics classes were participants in the study. Everyone who wanted to participate, who parents/guardians allowed them to participate, and was present on the day the researcher went into the eighth grade mathematics classes became participants in the study.

Permission to use human subjects for this project was granted through the Human Subjects Committee at the University of Tennessee. Written permission to go into this public school to collect data was obtained from the county office, and the principal of the school. Last, written permission was also obtained from the students and their parents/guardians. Copies of the consent and assent forms may be found in Appendix B. The Human Research Committee of the county, the University of Tennessee, and the parents were guaranteed in writing that all information would be kept confidential and

that all subjects would be guaranteed complete anonymity. Also, permission from the school Research Committee to do the project was obtained (Appendix D).

A decision was made by the researcher to conduct a sample study because of the time of year the data was collected which was one week from summer break. The researcher conducted the study during the last two weeks of the school year. If a student was absent, then that student had to be excluded due to the fact that final tests are given at the end of the school year and the researcher would not be allowed to interrupt another class session. In that case, results cannot be generalized to the entire eighth grade population of the middle school selected.

Instruments

Numerous reports indicate that student attitudes toward mathematics develop throughout the school years, although most development occurs in the middle school years. Therefore, it is important to create an instrument to measure development for the middle school level. Methods measuring attitudes and behaviors toward mathematics that have been used in the past include: behavioral observations, interviews, questionnaires, attitude scales, and picture preferences (Aiken, 1972). The most popular of these methods has been the Fennema-Sherman Mathematics Attitudes Scale (FSMAS), which asks the respondents to rate their attitude toward mathematics on a likert scale. The questionnaire ask about how students feel about mathematics, how they feel when working on mathematics, and how they rate mathematics courses as compared to other subject areas. However, the FAMAS requires the students to rate themselves on a scale and the researcher was only concerned about whether the students felt that way about

mathematics or not and not on the degree they felt about mathematics so the researcher decided to use the Modified Aiken Mathematics Attitude scale.

Two instruments were used in this project. The first, the Modified Aiken Mathematics Attitude Scale (MAMAS) 1980 (Appendix C), which is considered reliable, easy to administer, and often used with eighth grade middle school students. The MAMAS asks the same questions as FSMAS but it allows the respondents to respond with "yes" or "no" rather than giving a scaled response. The disadvantage of this scale is that it does not allow for intermediate values. The respondents answer "yes" or "no" to all twenty questions. The MAMAS (1980) measures the affective dimension of a student and has been used in numerous studies.

The second instrument that the researcher used in this study was a list entitled "The100 most popular, dynamic, and profitable careers in America today", as composed by Nicholas Basta (Appendix C). This list is composed of various careers in various areas, but the students were told that if they did not see their career choices on the list they were to write it at the bottom of the list. The researcher selected this instrument because it gave the most inclusive list of careers that are prevalent today.

Data Collection

Each of the subjects in this study participated in an attitude scale survey that consisted of 20 statements. In addition a career selection form was also administered to each student. Both were administered in the spring of 2001 during their respective mathematics class.

There was no time limit given to the participants to complete both instruments; however, the instruments usually took approximately 10 to 15 minutes to administer. The

researcher spent approximately 5 to 10 minutes explaining the questionnaire to each group of participants, answering all questions, and in general, helping the participants feel at ease and comfortable. The participants were assured that no teachers, administrators, or parents/guardians would see the questionnaires, as this appeared to be a major concern.

The researcher explained all careers the participants were not familiar with and all words and phrases the participants did not understand. The career selection form was stapled to the questionnaire when both forms were given to the participants. The students completed the questionnaires, which were then turned in to the researcher and kept in a secure place.

Data Analysis

There were 40 boys and 56 girls who participated in the study. The researcher identified each participant's career choice, and then assigned the participants to one of three groups according to the number of mathematics classes required for the careers chosen (0-2 mathematics classes; 3-4 mathematics classes; and 5+ mathematics classes) on the career selection form. The University of Tennessee 2000-2001 undergraduate catalog was used for reporting the hours based on majors. This catalog was chosen because the University of Tennessee represents the only university inside the city limits, and it is a comprehensive university having a wide array of majors. Each group was further divided according to gender. Group I (0-2 math classes) consisted of eighteen girls and eleven boys, group II (3- 4 math classes) consisted of thirty-two girls and nineteen boys, and group III (5+ math classes) consisted of six girls and ten boys. Group I consisted of twelve students with extremely positive attitudes toward mathematics, four

with positive attitudes toward mathematics, four with neutral attitudes toward mathematics, none with negative attitudes, and nine students with extremely negative attitudes towards mathematics. Group II consisted of twenty-four students with extremely positive attitudes toward mathematics, two with positive attitudes toward mathematics, fourteen with neutral attitudes toward mathematics, six with negative attitudes toward mathematics, and five with extremely negative attitudes toward mathematics. Group III consisted of ten students with extremely positive attitudes toward mathematics, none with positive attitudes, four with neutral attitudes toward mathematics, none with negative attitudes, and two with extremely negative attitudes toward mathematics.

The nature of the research questions required the researcher to examine student responses carefully and compare them to the statements on the MAMAS. In order to answer the research questions, a comparative study using percentages and a statistical method (ANOVA) was chosen. After all data were collected, the groups were compared on every question on the MAMAS.

Negative and positive statements on the attitude scale were identified and compared using percentages for students in the three groups as identified by the Career Selection form. The groups were further compared according to gender.

The data were compared for each group using ANOVA as well as calculated percentages for each question. Then male attitude towards mathematics was compared to the female attitude towards mathematics using an ANOVA test.

In addition to the ANOVA tests run, percentages were also used to interpret the data from both research questions. This method was chosen because it was frequently used in previous research studies, it was clearer, and it fit the data since population

studies frequently use percentages to compare data. In the group comparison, each percentage represents the summed number of "yes" responses divided by the total number of participants. The findings from the attitude scale and career selection form, along with current literature and research in the area of student attitudes and achievement in mathematics were the basis for the development of the conclusions presented in the final chapter.

Summary

The participants of the study consisted of ninety-six eighth grade students who agreed to participate and whose parents/guardians also agreed. Students who were absent on the day the researcher passed out consent forms or who did not bring in the consent form were asked by the teacher to sit quietly and work on a handout while the researcher administered the questionnaire to the other students. The participants were given a math attitude scale and a career selection sheet to fill out; both forms were stapled together. After the participants completed both forms, they returned them to the researcher. After the researcher collected all of the instruments from a mathematics class, the researcher went to the next math class and repeated the process. Once all of the data were collected from all eighth grade mathematics classes, the researcher separated the participants into groups according to careers chosen using the University of Tennessee catalog as a guide.

After the groups were categorized, the researcher calculated percentages for each question in each group by adding the number of "yes" responses to each question and dividing that number by the total group population. The researcher also ran an ANOVA on the data, comparing male and female attitudes towards mathematics. The tables are presented in greater detail in the next chapter.

This chapter restated that participants were eighth grade students who attend a middle school located in East Tennessee, and that the participants were selected on the basis of whether or not they brought back consent forms from their parents/guardians who agreed to participate themselves. Also, this chapter presents the composition of the subjects of the project, which came from the eighth grade teachers who allowed the researcher to interrupt their classes to collect data. Procedures which involved explaining the project to all of the students who were present that day and giving each one a consent form to take home to gain permission to participate, data collection where the researcher passed out an assent form (student approval) to each student who brought back a signed consent form and then re-explained the study. The researcher then passed out the MAMAS and the career selection form for each willing participant to fill out. Last, this chapter presents the data analysis the researcher used to compare the data using percentages, descriptive analysis, and Analysis of Variance (ANOVA). The next chapter will present the data presentation and analysis.

Chapter IV

Data Presentation and Analysis

Introduction

This study was designed to look at how attitudes towards mathematics relate to career choice. Ninety-six students from a middle school in East Tennessee participated in the study by answering an attitude scale questionnaire and a career selection form.

The researcher administered the attitude scale and career selection form at the middle school during a one-week period of time in the spring of 2001. Participants responded to statements concerning mathematics on the MAMAS (Aiken, 1980) by marking "yes" or "no" according to how they felt about each of the 20 statements. Participants were then placed into one of three groups according to the career major they selected on the career selection form.

Although students may major in areas that do not relate to their eventual careers, the researcher assumed that, for this study, the participants would major in an area directly related to their career interest.

Presentation and analysis of the three groups of data are as follows:

1. Participant responses were looked at using descriptive analysis, which gave the mean, standard deviation, minimum score, and maximum score. That analysis serves as a descriptive comparison of the groups.
2. Participant responses by groups (group I, group II, and group III) were compared using percentages according to hours of mathematics needed for major. For each statement on the attitude scale the percentage of participants marking "yes" to the statements were compared to the other groups.

3. The scores for male participants' attitudes towards mathematics were compared to the scores for female participants' attitudes towards mathematics using an Analysis of Variance (ANOVA) test.
4. An ANOVA was run with the data from all three groups using the total scores for each individual in the group, and the p-value was compared using $\alpha = .05$.

Student responses to the MAMAS were compared using calculated percentages for the three groups.

The data analyses procedure were guided by the following questions:

1. How do 8th grade middle school student attitudes towards mathematics relate to their career choices?
2. How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

Descriptive Analysis of the three groups

The groups were based on the number of mathematics classes that are needed for the career that each one selected. Students in group I need 0-2 mathematics classes, those in group II need 3-4 mathematics classes, and those in group III need 5+ mathematics classes. The groups were then analyzed using Stat-Star and the results are presented below. The minimum score a participant could have is -20 and the maximum score is 20. These scores are based on the sum of all 20 responses for each participant on the MAMAS. Table 1 is presented below.

Table 1. Descriptive analysis for the three groups:

	Group I (0-2 classes)	Group II (3-4 classes)	Group III (5+ classes)
N:	29	51	16
M:	2.345	4.667	8.375
SD:	14.404	10.880	10.588
Min:	-20	-16	-12
Max:	20	20	20

Attitudes and Careers

How does 8th grade middle school student attitudes towards mathematics relate to their career choice?

Student respondents were divided into three career groups based on the number of mathematics courses needed in the major as defined by the University of Tennessee 2000-2001 curriculum catalogue although it is known that not each and every student will attend the University of Tennessee. Different universities and colleges have different requirements for majors, but the University of Tennessee was chosen because of its proximity to the city where the project was carried out.

The statements on the MAMAS are written below, as well as the responses of the participants.

Differences in percentages in this study are considered to be more than 5% difference.

Statement 1: I am always under a terrible strain in mathematics class (Table A1, Appendix A).

No differences in the percentages of yes/no responses were found among groups I (14%), II (12%), III (12.5%) participants. Majority of the participants in each group disagreed that they were under a terrible strain in mathematics class.

Statement 2: Mathematics is very interesting to me, and I enjoy mathematics courses (Table A2, Appendix A).

No differences in the percentages of yes/no responses were found between groups I (48%) and II (51%); however, there was a difference in percentage of yes/no responses for group III (75%). The majority of participants in this group agreed that mathematics was interesting and that they enjoyed taking mathematics courses.

Statement 3: I do not like mathematics, and it scares me to have to take it (Table A3, Appendix A).

No differences in percentages of yes/no responses were found between groups I (17%), and II (18%), but group III (0%) participants did show a difference from the other two groups. Participants agreed that they did like mathematics and were not afraid to take it; Group III participants all agreed (100%) that they like mathematics.

Statement 4: Mathematics is fascinating and fun (Table A4, Appendix A).

There was a difference in the percentages of yes/no responses for the groups. Only 27% of the participants in group II felt mathematics was fascinating and fun, whereas yes responses in group III were 69% and in group I 59%.

Statement 5: Mathematics makes me feel secure, and at the same time it is stimulating (Table A5, Appendix A).

No differences in percentages were found among groups I (41%), II (44%), and III (39%). A majority of participants in all groups did not express a secure feeling toward mathematics, and they agreed that mathematics was not stimulating.

Statement 6: My mind goes blank and I am unable to think clearly when working on mathematics (Table A6, Appendix A).

There were differences in the percentages of yes/no responses for the three groups. Group I (38%) group II (22%), and group III (31%).

Statement 7: I feel a sense of insecurity when attempting mathematics (Table A7, Appendix A).

No differences in the percentages of yes/no responses were found among group III (25%) and group I (28%). There was a difference in the percentages of yes/no responses for group II (14%).

Statement 8: Mathematics makes me feel uncomfortable, restless, irritable, and impatient (Table A8, Appendix A).

There were differences in percentages of yes/no responses were found between all the groups. Participants in group I (41%) participants revealed more negative attitudes than groups II (18%) and III (25%) participants who were more positive and comfortable, and had less restlessness, irritability, and impatience when doing mathematics.

Statement 9: The feeling that I have toward mathematics is a good feeling (Table A9, Appendix A).

There were differences in percentages of yes/no responses found among groups I (76%), II (55%), and III (87.5%). However, group III percentages are misleading because of the size of the group. There was only one participant who did not agree with the statement.

Statement 10: Mathematics makes me feel as though I am lost in a jungle of numbers and can't find my way out (Table A10, Appendix A).

Differences in percentages of yes/no responses were found among groups II (4%), III (12.5%), and group I (31%). The percentage of participants agreeing that mathematics makes them feel lost in a jungle of numbers.

Statement 11: Mathematics is something, which I enjoy a great deal (Table A11, Appendix A).

There were no differences in percentages of yes/no responses for group I (41%) and group II (39%). However, there was a difference in percentages of yes/no responses for group III (62.5%).

Statement 12: When I hear the word mathematics, I have a feeling of dislike (Table A12, Appendix A).

Differences were found among group I (48%), group II (29%), and group III (37.5%). Nearly half of the participants from group I agree that when they hear the word mathematics they have a feeling of dislike.

Statement 13: I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics (Table A13, Appendix A).

No differences in percentages of yes/no responses were found for group II (25%) and group III (25%). Differences in percentages of yes/no responses were found for group I (31%). The majority of participants disagree with having a feeling of hesitation, resulting from a fear of not being able to do mathematics.

Statement 14: I really like mathematics (Table A14, Appendix A).

No difference in percentages was found among group I (41%) and group II (43%). However, there was a substantial difference in percentages of yes/no responses between groups II, and I and group III (75%) of the participants agreeing that they really like mathematics.

Statement 15: Mathematics is a course in school which I have always enjoyed studying (Table A15, Appendix A).

Differences in percentages of yes/no responses were found among the three groups. Although, half of the participants from group III (50%) agreed with the statement, and only groups I (21%) and II (39%). Majority of the participants from groups II and I agree that mathematics is not a course in school which they have always enjoyed studying.

Statement 16: It makes me nervous to even think about having to do a mathematics problem (Table A16, Appendix A).

Differences in percentages of yes/no responses were found between group I (28%) and the other groups. Group II (10%) and group III (12.5%) showed no difference in percentages of yes/no responses. The majority of the participants disagreed that it made them nervous to do mathematics.

Statement 17: I never liked mathematics, and it is my most dreaded subject (Table A17, Appendix A).

Nearly every participant from group III (87% of 16) disagreed that they never liked mathematics but the percentages of yes/no responses were smaller for the other two groups (group I 59% and group II 69%).

Statement 18: I am happier in mathematics class than in any other class (Table A18, Appendix A).

Again nearly every participant from group III, 94%, disagreed with being happier in mathematics class than in any other class, but 75% of the students from each of the

other two groups disagreed with being happier in mathematics class than in any other class.

Statement 19: I feel at ease in mathematics, and I like it very much (Table A19, Appendix A).

A high percentage, 75%, of group III agreed that they felt at ease in mathematics and liked it as compared to group I (41%), and group II (47%).

Statement 20: I feel a definite positive reaction to mathematics; it is enjoyable (Table A20, Appendix A).

Differences in percentages of yes/no responses were found for group III (69%) between the other two groups. However, no difference in percentages of yes/no responses were found between group I (48%), and group II (47%).

Findings of the Attitudes/Career Comparison:

In the analysis of attitudes towards mathematics and how it relates to career choice differences in percentages of yes/no responses were found for all of the statements except two. Statements one and five showed no differences in percentages of yes/no responses for the three groups. However, no differences in percentages of yes/no responses were found more often for pairs of groups.

Analysis of Variance for Males vs. Females

A One-Way ANOVA was run to compare the total scores of the males to the scores of the females from the Aiken Mathematics Attitude scale. The Null hypothesis $H_0 : M_1 = M_2$ showed that no significant difference exist between the mean of the males and the mean of the females regarding their attitudes towards mathematics.

Table 2 shows the number of males and the number of females in the study. The mean score on the Modified Aiken Mathematics Attitude scale for the males was 3 and 5.714 was the mean for the females on the same attitude scale. The $\rho > .05$, therefore we accept the null. Thus there is no significant difference in the attitudes towards mathematics for males vs. females.

The next section examined the relationship between males' attitudes towards mathematics and females' attitudes towards mathematics within the assigned groups.

Table 2 Analysis of Variance Source Table:

Descriptive Statistics	**N**	**Means**	**Standard Deviation**	**F**	**Probability (ρ)**
Males	40	3	12.954	1.150	0.28630
Females	56	5.714	11.448		

Females vs. Males

Differences in percentages are considered in this study to be differences of 5% or more.

How do 8th grade middle school males' attitudes towards mathematics compare to 8th grade middle school females' attitudes towards mathematics?

Since there were twice as many females as males the percentages may be misleading.

Statement 1: I am always under a terrible strain in mathematics class (Table A21, Appendix A).

There were differences in percentages of yes/no responses for the females versus the males. Group I females' (11%) and group I males' (18%), group II females (9%) and group II males' (16%), and group III females (0%) and group III males (20%). The females from all of the groups had smaller percentages of yes/no responses than that of the males.

Statement 2: Mathematics is very interesting to me, and I enjoy mathematics courses (Table A22, Appendix A).

Differences in percentages of yes/no responses exist for group I females (61%) with group I males (27%). Also there was a difference in percentages of yes/no responses for group III females (67%) with group III males (80%). Group II females (50%) and males (53%) showed no difference in percentages of yes/no responses.

Statement 3: I do not like mathematics, and it scares me to have to take it (Table A23, Appendix A).

There was no difference in percentages of yes/no responses between group I females (17%) and group I males (18%) or with group III females (0%) and group III males (0%). However there was a difference in percentages of yes/no responses for group II females (12.5%) and group II males (26%). As seen by the percentages above, majority of the females and the males replied that mathematics does not scare them and that they like it some.

Statement 4: Mathematics is fascinating and fun (Table A24, Appendix A).

There is a difference in percentages of yes/no responses between group I females (72%) and group I males (36%) as well as group III females (50%) and group III males (80%). There is no difference in percentages of yes/no responses between groups' II females (28%) and males (26%).

Statement 5: Mathematics makes me feel secure, and at the same time it is stimulating (Table A25, Appendix A).

All three groups had a difference in percentages of yes/no responses for females and males. Group I females (61%) and males (28%), groups II females (34%) and males (47%), and groups III females (33%) and males (50%).

Statement 6: My mind goes blank and I am unable to think clearly when working on mathematics (Table A26, Appendix A).

Differences in percentages of yes/no responses exist for males and females in all three groups. The percentages for groups I females (28%) and males (55%), groups' III females (50%) and males (20%), and groups' II females (19%) and males (26%).

Statement 7: I feel a sense of insecurity when attempting mathematics (Table A27, Appendix A).

Differences in percentages of yes/no responses were found for all three groups. In group I, the females (17%) and males (45%) had the largest difference of percentages of yes/no responses. However, groups' II females (9%) and males (21%), and groups III females (17%) and males (30%) were also different.

Statement 8: Mathematics makes me feel uncomfortable, restless, irritable, and impatient (Table A28, Appendix A).

Groups I females (28%) and males (64%) showed a difference in percentages of yes/no responses. The other groups also showed differences in percentages of yes/no responses, with groups II females (12.5%) and males (26%) and groups' III females (33%) and males (20%).

Statement 9: The feeling that I have toward mathematics is a good feeling (Table A29, Appendix A).

Differences in percentages of yes/no responses exist for all three groups. Groups I females (83%) and males (45%)differences in percentages of yes/no responses were

larger than groups II females (62.5%) and males (53%), and groups' III females (83%) and males (90%).

Statement 10: Mathematics makes me feel as though I am lost in a jungle of numbers and can't find my way out (Table A30, Appendix A).

Differences in percentages of yes/no responses exist in group I females (22%) and males (45%) and group III females (17%) and males (10%). However, no differences in percentages of yes/no responses were found between group II females (3%) and group II males (5%).

Statement 11: Mathematics is something, which I enjoy a great deal (Table A31, Appendix A).

Differences in percentages of yes/no responses exist within group I with the females (50%) and the males (27%) and group III with females (67%) and males (60%). Group II females (47%) and males (42%) did not have a difference in percentage of yes/no responses.

Statement 12: When I hear the word mathematics, I have a feeling of dislike (Table A32, Appendix A).

Differences in percentages of yes/no responses exist for all three groups. Group I females (39%) and males (64%) had the largest difference in percentages. Group's II females (25%) and males (37%) and group III females (33%) and males (40%) had a difference in percentages of yes/no responses.

Statement 13: I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics (Table A33, Appendix A).

Differences in percentages of yes/no responses exist for all three groups, with groups I females (22%) and males (45%), groups' II females (22%) and males (32%), and groups III females (17%) and males (30%).

Statement 14: I really like mathematics (Table A34, Appendix A).

Differences in percentages of yes/no responses were found for all three groups. Group I females (50%) and males (27%), and group's III females (67%) and males (80%) and groups' II females (41%) and males (47%).

Statement 15: Mathematics is a course in school which I have always enjoyed studying (Table A35, Appendix A).

There are differences in percentages of yes/no responses for groups I females' (39%) and males (9%), also with groups' II females (31%) and males (42%). There was not a difference in percentages of yes/no responses for groups' III females (50%) and males (50%).

Statement 16: It makes me nervous to even think about having to do a mathematics problem (Table A36, Appendix A).

Differences in percentages of yes/no responses exist for all three groups with groups I females (17%) and males (45%), groups' II females (6%) and males (16%), and groups' III females (0%) and males (20%).

Statement 17: I never liked mathematics, and it is my most dreaded subject (Table A37, Appendix A).

Differences in percentages of yes/no responses exist for groups' II females (28%) and males (42%) and groups' III females (17%) and males (10%). Groups I females (39%) and males (36%) did not show a difference in percentages of yes/no responses.

Statement 18: I am happier in mathematics class than in any other class (Table A38, Appendix A).

Differences in percentages of yes/no responses exist within all groups. Groups I females (33%) and males (9%), groups II females (22%) and males (37%), and groups III females (0%) and males (10%) all showed differences in percentages.

Statement 19: I feel at ease in mathematics, and I like it very much (Table A39, Appendix A).

Differences in percentages of yes/no responses exist for groups I females (56%) and males (18%), and with groups III females (67%) and males (80%). Groups' II females (47%) and males (47%) did not have a difference in percentages of yes/no responses.

Statement 20: I feel a definite positive reaction to mathematics; it is enjoyable (Table A40, Appendix A).

Differences in percentages of yes/no responses exist for groups I females (56%) and males (36%), and groups' III females (50%) and males (80%). There was no difference in percentages of yes/no responses for groups' II females (47%) and males (47%).

Findings of the Male/Female Comparison:

Group I females and males had no differences in percentages of yes/no responses on statements three and seventeen. Differences in percentages of yes/no responses exist on the other eighteen statements.

Group II females and males had no differences in percentages of yes/no responses on statements two, four, ten, eleven, nineteen, and twenty. Differences in percentages of yes/no responses exist on the other fourteen statements.

Group III females and males had no differences in percentages of yes/no responses on statements three and fifteen. Differences in percentages of yes/no responses exist on the other eighteen statements.

Analysis of Variance of three assigned groups

A One-Way ANOVA was run to compare the means of the total scores on the Modified Aiken Mathematics attitude scale for each group. The Null hypothesis H_0: $M_1 = M_2 = M_3$ showed that no significant difference exist in the means for the groups.

Table 3 Analysis of Variance Source Table

Source	**df**	**Sum of Squares**	**Mean square**	**F**	**Prob**
Bet Grps	2	375.698	187.849	1.262	0.28801
W/I Grps	93	13847.635	148.899		
Total	95	14223.333			
Eta sq =	0.026				

The p = 0.28801 $> \alpha = .05$; therefore, there is no significant difference in the means for groups II, III, and I in their attitudes towards mathematics.

Chapter V

Summary, Conclusions, and Recommendations for Future Research

Summary

Student attitudes and achievement in mathematics have received increased attention in recent years. Numerous studies and articles have been written that show the growing concern and increased importance of student attitudes toward their mathematical achievement. Though much has been written concerning student attitudes and achievement in mathematics, the low achievement in mathematics still exists.

Improving attitude toward mathematics and mathematics achievement has been the focal point of many organizations, including the National Council of Teachers of Mathematics (NCTM), the American Educational Research Association (AERA), and the National Research Council (NRC), who continue to try to explain the diminishing groups from which tomorrow's leaders will be drawn. To help today's students prepare for tomorrow's world, the goal of school mathematics must be appropriate for the demands of a global economy in the information age (Steen, 1989). In order to improve the attitude and achievement of students, more needs to be learned about the effects of attitude on achievement.

The Problem:

Numerous studies indicate that there are serious deficiencies in the mathematical performance of U.S. students. These problems begin when children are very young and continue throughout their school years. Although students perceive mathematics to be important in their everyday lives and future career plans, and believe it is necessary to get a good job, less than half expect to work in an area that requires mathematical skills

(Brown, 1988). They see mathematics as important to society but less important to them personally. Therefore, it is important that students have positive experiences in school that encourage achievement. Mathematics is a part of every occupation imaginable; therefore, it is necessary that students become aware of the need for mathematics, the value that it has for them, and continue to study mathematics throughout their entire school years.

This study was designed to investigate possible relationships between eighth grade student attitudes and their career choices. This research was guided by the following questions:

1. How do 8th grade middle school student attitudes towards mathematics relate to their career choices?
2. How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

Procedures:

Ninety-six eighth grade students from one middle school participated in the study. The participants were from a school, that has shown to be failing in mathematics and also on value gained (measures improvement over past year) in mathematics as reported by the school district on the state standardized tests.

The participants in the study completed an attitude survey and a career selection form. The participants were divided into three groups according to number of mathematics courses needed for the major associated with their career choice. The researcher administered both the attitude scale and the career selection form. The data

were collected and analyzed. Presentation and analysis of the data were organized based upon three groups and subdivision of those groups as determined from the career selection from.

Conclusions

Research Question 1:

How do 8th grade middle school student attitudes towards mathematics relate to their career choices?

Differences in percentages of yes/no responses were found among the three groups for all but two statements; statements one and five. On statement one majority of the participants responded "no" to being under a terrible strain in mathematics class, and on statement five a larger percentage of the participants in each group (Group I 41.4%, Group II 39%, and Group III 44%) responded "yes" to mathematics makes them feel secure and stimulates them (Table 4). Thus the investigator concluded from this study that middle school students' attitudes towards mathematics are related to career choice using this method.

A pattern emerged with a large number of group I participants responding negatively to many of the statements. This could possibly be due to group I not really understanding the statements; thus, they marked no.

**Only no differences in percentages of yes/no responses are shown in tables 4, and 5.

No differences are considered for this study to be 5% or less. Blank boxes mean that there were differences in percentages of yes/no responses. "P" means that majority of the group was positive and "N" means majority of the group was negative.

Table 4 Attitude vs. Career Choice

Statement	Group I	Group II	Group III
1) I am always under a terrible strain in mathematics class.	P	P	P
2) Mathematics is very interesting to me, and I enjoy mathematics courses			
3) I do not like mathematics, and it scares me to have to take it.			
4) Mathematics is fascinating and fun			
5) Mathematics makes me feel secure, and at the same time it is stimulating.	N	N	N
6) My mind goes blank and I am unable to think clearly when working on mathematics.			
7) I feel a sense of insecurity when attempting mathematics.			
8) Mathematics makes me feel uncomfortable, restless, irritable, and impatient.			
9) The feeling that I have toward mathematics is a good feeling.			
10) Mathematics makes me feel as though I am lost in a jungle of numbers and can't find my way out.			
11) Mathematics is something, which I enjoy a great deal.			
12) When I hear the word mathematics, I have a feeling of dislike.			
13) I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics.			
14) I really like mathematics.			
15) Mathematics is a courses in school which I have always enjoyed studying.			
16) It makes me nervous to even think about having to do a mathematics problem.			
17) I never liked mathematics, and it is my most dreaded subject.			
18) I am happier in mathematics class than in any other class.			
19) I feel at ease in mathematics, and I like it very much.			
20) I feel a definite positive reaction to mathematics; it is enjoyable			

The ANOVA test that was run on the total scores for each group revealed that there was no significant difference in the means for group I, group II, and group III. Thus the investigator concluded that there is not a significant difference but as shown from the other method of comparison, there is a difference.

Research Question 2:

How do male African American 8th grade middle school student attitudes towards mathematics compare to female African American 8th grade middle school student attitudes towards mathematics?

The ANOVA test showed no statistical difference found between the male attitudes towards mathematics and the female attitudes towards mathematics. Overall, both the male and the female attitudes towards mathematics were positive. Thus the investigator concluded that there is not a difference between the male attitudes towards mathematics and the female attitudes towards mathematics.

The next analysis was done on the same research question and done to see if there was a difference in percentages of yes/no responses between male and female within the assigned groups.

How do male African American 8th grade middle school students' attitudes towards mathematics compare to female African American 8th grade middle school students' attitudes towards mathematics?

No differences in percentages of yes/no responses were found between males and females in group I on statements three and seventeen. Group II males and females had no differences in percentages of yes/no responses on statements two, four, ten, eleven, nineteen, and twenty. Group III males and females had no differences in percentages of

yes/no responses on statements three and fifteen. Thus the investigator concluded that there is a difference in attitudes towards mathematics for males and females within the assigned groups using this method of comparison.

The lack of difference between males and females using the ANOVA does not support the findings in the literature. Overall, female and male attitudes were both positive toward mathematics. This does not concur with the findings in the literature that males have a more positive attitude toward mathematics than females do (Table 5).

The researcher was interested in whether there was a significant difference in the total scores on the MAMAS for students who needed 0-2 mathematics classes, 3-4 mathematics classes, and 5+ mathematics classes.

There were no significant differences found with $F = 1.262$ from the data collected. The means for the participants in the assigned groups are relatively the same and the participants have positive attitudes towards mathematics.

Table 5 Summary-Females vs. Males

Statement	GIf	GIm	GIIf	GIIm	GIIIf	GIIIm
1) I am always under a terrible strain in mathematics class.						
2) Mathematics is very interesting to me, and I enjoy mathematics courses			P	P		
3) I do not like mathematics, and it scares me to have to take it.	P	P			P	P
4) Mathematics is fascinating and fun			N	N		
5) Mathematics makes me feel secure, and at the same time it is stimulating.						
6) My mind goes blank and I am unable to think clearly when working on mathematics.						
7) I feel a sense of insecurity when attempting mathematics.						
8) Mathematics makes me feel uncomfortable, restless, irritable, and impatient.						
9) The feeling that I have toward mathematics is a good feeling.						
10) Mathematics makes me feel as though I am lost in a jungle of numbers and can't find my way out.			P	P		
11) Mathematics is something, which I enjoy a great deal.			N	N		
12) When I hear the word mathematics, I have a feeling of dislike.						
13) I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics.						
14) I really like mathematics.						
15) Mathematics is a courses in school which I have always enjoyed studying.						
16) It makes me nervous to even think about having to do a mathematics problem.						
17) I never liked mathematics, and it is my most dreaded subject.	P	P			P	P
18) I am happier in mathematics class than in any other class.						
19) I feel at ease in mathematics, and I like it very much.			N	N		
20) I feel a definite positive reaction to mathematics; it is enjoyable			N	N		

Recommendations for Future Research

An examination of the findings and conclusions identified in this study leads to the following recommendations for future research:

1. A longitudinal study of middle school students in predominantly low income areas and student achievement and attitudes toward mathematics should be conducted to determine if these student attitudes toward mathematics change as they pursue their education.
2. Further study of mathematics attitudes and careers should be conducted in multiple middle schools.
3. This study should be replicated with subjects from a high school to see if student attitudes towards mathematics change, as they get closer to graduation.
4. Further studies need to compare teacher attitudes and student attitudes in middle school mathematics classes to see if the teacher attitudes are related to the student attitudes.
5. Further study into how much attitudes towards mathematics relates to career choice.

This study has looked at eighth grade student attitudes towards mathematics and career choice. Attitudes were analyzed for three different groups according to gender and major for desired career.

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Appendixes

Appendix A
Tables

Table A1: Question 1: Attitudes and Careers

	Yes	No
Groups		
I	14%	86%
II	12%	88%
III	12.5%	87.5%

Table A2: Question 2: Attitudes and Careers

	Yes	No
Groups		
I	48%	52%
II	51%	49%
III	75%	25%

Table A3: Question 3: Attitudes and Careers

	Yes	No
Groups		
I	17%	83%
II	18%	82%
III	0%	100%

Table A4: Question 4: Attitudes and Careers

	Yes	No
Groups		
I	59%	41%
II	27%	73%
III	69%	31%

Table A5: Question 5: Attitudes and Careers

	Yes	No
Groups		
I	41.4%	58.6%
II	39%	61%
III	44%	56%

Table A6: Question 6: Attitudes and Careers

	Yes	No
Groups		
I	38%	62%
II	22%	78%
III	31%	69%

Table A7: Question 7: Attitudes and Careers

	Yes	No
Groups		
I	28%	72%
II	14%	86%
III	25%	75%

Table A8: Question 8: Attitudes and Careers

	Yes	No
Groups		
I	41%	59%
II	18%	82%
III	25%	75%

Table A9: Question 9: Attitudes and Careers

	Yes	No
Groups		
I	76%	24%
II	55%	45%
III	87.5%	12.5%

Table A10: Question 10: Attitudes and Careers

	Yes	No
Groups		
I	31%	69%
II	4%	96%
III	12.5%	87.5%

Table A11: Question 11: Attitudes and Careers

	Yes	No
Groups		
I	41%	59%
II	39%	61%
III	62.5%	37.5%

Table A12: Question 12: Attitudes and Careers

	Yes	No
Groups		
I	48%	52%
II	29%	71%
III	37.5%	62.5%

Table A13: Question 13: Attitudes and Careers

	Yes	No
Groups		
I	31%	69%
II	25%	75%
III	25%	75%

Table A14: Question 14: Attitudes and Careers

	Yes	No
Groups		
I	41%	59%
II	43%	57%
III	75%	25%

Table A15: Question 15: Attitudes and Careers

	Yes	No
Groups		
I	21%	79%
II	39%	61%
III	50%	50%

Table A16: Question 16: Attitudes and Careers

	Yes	No
Groups		
I	28%	72%
II	10%	90%
III	12.5%	87.5%

Table A17: Question 17: Attitudes and Careers

	Yes	No
Groups		
I	41%	59%
II	31%	69%
III	12.5%	87.5%

Table A18: Question 18: Attitudes and Careers

	Yes	No
Groups		
I	24%	76%
II	27%	73%
III	6%	94%

Table A19: Question 19: Attitudes and Careers

	Yes	No
Groups		
I	41%	59%
II	47%	53%
III	75%	25%

Table A20: Question 20: Attitudes and Careers

	Yes	No
Groups		
I	48%	52%
II	47%	53%
III	69%	31%

Table A21: Question 1: Females vs. Males

Females	Yes	No
Groups		
I	11%	89%
II	9%	91%
III	0%	100%
Males		
I	18%	82%
II	16%	84%
III	20%	80%

Table A22: Question 2: Females vs. Males

Females	Yes	No
Groups		
I	61%	39%
II	50%	50%
III	67%	33%
Males		
I	27%	73%
II	53%	47%
III	80%	20%

Table A23: Question 3: Females vs. Males

Females	Yes	No
Groups		
I	17%	83%
II	12.5%	87.5%
III	0%	100%
Males		
I	18%	82%
II	26%	74%
III	0%	100%

Table A24: Question 4: Females vs. Males

Females	Yes	No
Groups		
I	72%	28%
II	28%	72%
III	50%	50%
Males		
I	36%	64%
II	26%	74%
III	80%	20%

Table A25: Question 5: Females vs. Males

Females	Yes	No
Groups		
I	61%	39%
II	34%	66%
III	33%	67%
Males		
I	9%	91%
II	47%	53%
III	50%	50%

Table A26: Question 6: Females vs. Males

Females	Yes	No
Groups		
I	28%	72%
II	19%	81%
III	50%	50%
Males		
I	55%	45%
II	26%	74%
III	20%	80%

Table A27: Question 7: Females vs. Males

Females	Yes	No
Groups		
I	17%	83%
II	9%	91%
III	17%	83%
Males		
I	45%	55%
II	21%	79%
III	30%	70%

Table A28: Question 8: Females vs. Males

Females	Yes	No
Groups		
I	28%	72%
II	12.5%	87.5%
III	33%	67%
Males		
I	64%	36%
II	26%	74%
III	20%	80%

Table A29: Question 9: Females vs. Males

Females	Yes	No
Groups		
I	83%	17%
II	62.5%	37.5%
III	83%	17%
Males		
I	45%	55%
II	53%	47%
III	90%	10%

Table A30: Question 10: Females vs. Males

Females	Yes	No
Groups		
I	22%	78%
II	3%	97%
III	17%	83%
Males		
I	45%	55%
II	5%	95%
III	10%	90%

Table A31: Question 11: Females vs. Males

Females	Yes	No
Groups		
I	50%	50%
II	47%	53%
III	67%	33%
Males		
I	27%	73%
II	42%	58%
III	60%	40%

Table A32: Question 12: Females vs. Males

Females	Yes	No
Groups		
I	39%	61%
II	25%	75%
III	33%	67%
Males		
I	64%	36%
II	37%	63%
III	40%	60%

Table A33: Question 13: Females vs. Males

Females	Yes	No
Groups		
I	22%	78%
II	22%	78%
III	17%	83%
Males		
I	45%	55%
II	32%	68%
III	30%	70%

Table A34: Question 14: Females vs. Males

Females	Yes	No
Groups		
I	50%	50%
II	41%	59%
III	67%	33%
Males		
I	27%	73%
II	47%	53%
III	80%	20%

Table A35: Question 15: Females vs. Males

Females	Yes	No
Groups		
I	39%	61%
II	31%	69%
III	50%	50%
Males		
I	9%	91%
II	42%	58%
III	50%	50%

Table A36: Question 16: Females vs. Males

Females	Yes	No
Groups		
I	17%	83%
II	6%	94%
III	0%	100%
Males		
I	45%	55%
II	16%	84%
III	20%	80%

Table A37: Question 17: Females vs. Males

Females	Yes	No
Groups		
I	39%	61%
II	28%	72%
III	17%	83%
Males		
I	36%	64%
II	42%	58%
III	10%	90%

Table A38: Question 18: Females vs. Males

Females	Yes	No
Groups		
I	33%	67%
II	22%	78%
III	0%	100%
Males		
I	9%	91%
II	37%	63%
III	10%	90%

Table A39: Question 19: Females vs. Males

Females	Yes	No
Groups		
I	56%	44%
II	47%	53%
III	67%	33%
Males		
I	18%	82%
II	47%	53%
III	80%	20%

Table A40: Question 20: Females vs. Males

Females	Yes	No
Groups		
I	56%	44%
II	47%	53%
III	50%	50%
Males		
I	36%	64%
II	47%	53%
III	80%	20%

Appendix B
Consent Forms

Assent Form

Hello, my name is Maurice Wilson. Your parent/legal guardian and your principal, Dr. Jones, gave me permission to come in and talk to you about my research project. This is a research project that looks at the relationship between your attitudes towards mathematics and your career choice. All you have to do is read and answer the questions on the forms provided. I ask that you read each question carefully and mark your responses honestly. The questionnaire and the career selection forms should take you no longer than 30 minutes to complete. During the 30-minute session I ask that you not talk to anyone else. After you finish please turn the forms face down, and lay them on the desk beside me. I think that what we will learn from your responses will help other students at Vine Middle School and those who are planning to attend Vine Middle School. The forms will be distributed to you while you are in this class. Your responses will be kept confidential and marked so that they are anonymous. This project is strictly voluntary, you may begin and then decide to stop and that is okay. Please answer "yes" or "no" to the following questions. Are you willing to help me with this project? _____. Remember, if you decide that you do not want to participate anymore, all you have to do is tell me. Please understand that there will not be any penalties for your choosing not to participate. You can just say, "I do not want to participate." Okay? _____.

I really appreciate your help! I am now going to pass out the forms for you to complete.

Informed Consent Form

Relationship between Attitudes towards Mathematics and Career Choice

This form has been sent home to you because your child is in the eighth grade at Vine Middle School and I am seeking permission for your child to participate in a research project. Dr. Jones has agreed to let me enter the school to collect data for my dissertation. All eighth grade mathematics classes at Vine Middle School are invited to participate in this research project. The purpose of this project is to examine the relationship between how your child feels about his/her own academic ability and their choice of possible careers.

The students who return this form signed by their parent or guardian will then be asked to sign a form stating that they agree to participate. After both of these forms have been submitted, your child will be given a questionnaire and career choice form to complete. The students will be given 30 minutes to respond to these two forms. No grades or bonus of any kind will be given for your childs' participation. The number of participants will depend on the students who return this consent form and also sign an assent form agreeing to participate. The questionnaire will be administered in mathematics classes at a time deemed appropriate by the respective classroom teacher. Students not participating in the research project will be given mathematics problems to solve which will not be counted toward their regular mathematics grades. The questionnaire will ask them to rate their attitude towards mathematics and the career choice form will ask them to choose possible careers from a list.

After completing the forms, each student will bring them to the front of the room, turn them face down, and place them on a table next to me.

I am asking each student to answer the questions honestly so that their responses reflect only what they think. During the 30-minute session each student will be asked not to talk to anyone else.

No one will know the individual results from the participants. All of the analysis will be conducted using group data only. The results may serve as a tool to teachers that may allow them to help motivate future students based on their particular career choice.

The information in this research project will be kept confidential. Data will be stored securely and will be made available only to persons conducting the research project. No reference will be made in oral or written reports, which could link participants to the research project.

_____ Parent or Legal Guardian's initials

If you have any questions at any time about the research project or the procedures, or your child experience adverse effects as a result of participating in this project you may contact the researcher, Maurice LeVell Wilson, at A530 Claxton Addition, College

of Education, University of Tennessee, Knoxville, TN 37996, (865) 974-5037. If you have questions about your child's rights as a participant, contact the Compliance Section of the Office of Research at (865) 974-3466.

Your child's participation in this research project is voluntary; you may decline to let him or her participate without penalty. If you decide to let them participate, they may withdraw from the research project at anytime without penalty.

I have read the above information. I have received a copy of this form. I agree to let my child participate in this research project.

Parent/Legal Guardian's signature _____
Date_____

Investigator's signature _____ Date_____

Appendix C
Superintendents Permission

KNOX COUNTY SCHOOLS
ANDREW JOHNSON BUILDING

Dr. Charles Q. Lindsey, Superintendent

May 10, 2001

Maurice L. Wilson
4010 Ivy Avenue
Knoxville, TN 37914

Dear Mr. Wilson:

You are granted permission to contact appropriate building-level administrators concerning the conduct of your proposed research study entitled, "Relationship Between Self-Perception of Academic Ability and Career Choice." In the Knox County schools final approval of any research study is contingent upon acceptance by the principal(s) at the site(s) where the study will be conducted.

In all research studies names of individuals, groups, or schools may not appear in the text of the study unless *specific* permission has been granted through this office. The principal researcher is required to furnish this office with one copy of the completed research document.

Good luck with your study. Do not hesitate to contact me if you need further assistance or clarification.

Yours truly,

Mike S. Winstead

Mike S. Winstead, Ph.D.
Coordinator of Research and Evaluation
Phone: (865) 594-1740
Fax: (865) 594-1709

Project No. 144

Appendix D
Instruments

Modified Aiken Mathematics Attitude Scale

Directions: Each of the statements on this opinionnaire expresses a feeling or attitude toward mathematics. Draw a circle around the word giving the best indication of how closely you agree or disagree with the attitude expressed in each statement.

1. I am always under a terrible strain in mathematics class.	YES	NO
2. Mathematics is very interesting to me, and I enjoy mathematics courses.	YES	NO
3. I do not like mathematics, and it scares me to have to take it.	YES	NO
4. Mathematics is fascinating and fun.	YES	NO
5. Mathematics makes me feel secure, and at the same time it is stimulating.	YES	NO
6. My mind goes blank and I am unable to think clearly when working on mathematics.	YES	NO
7. I feel a sense of insecurity when attempting mathematics.	YES	NO
8. Mathematics makes me feel uncomfortable, restless, irritable, and impatient.	YES	NO
9. The feeling that I have toward mathematics is a good feeling.	YES	NO
10. Mathematics makes me feel as though I am lost in a jungle of numbers and can't find my way out.	YES	NO
11. Mathematics is something, which I enjoy a great deal.	YES	NO
12. When I hear the word mathematics, I have a feeling of dislike.	YES	NO
13. I approach mathematics with a feeling of hesitation, resulting from a fear of not being able to do mathematics.	YES	NO
14. I really like mathematics.	YES	NO
15. Mathematics is a course in school which I have always enjoyed studying.	YES	NO
16. It makes me nervous to even think about having to do a mathematics problem.	YES	NO
17. I never liked mathematics, and it is my most dreaded subject.	YES	NO
18. I am happier in mathematics class than in any other class.	YES	NO
19. I feel at ease in mathematics, and I like it very much.	YES	NO
20. I feel a definite positive reaction to mathematics; it is enjoyable.	YES	NO

Below is a list of the 100 most popular, dynamic, and profitable careers in America today as composed by Nicholas Basta and reported in the book Top Professions (1998).

The careers listed below are listed categories based on general type but they are not listed from best to worst or worst to best. The list is completely random. If the career you want is not in this list, please list it at the bottom of the page. Please circle the number to the career that you are planning to have in the future. This selection in no way binds you to a career; at any time you may change your mind.

***********Please circle only one career in the list or list only one career at the bottom of the page.**

The Money Handlers: Finance, Insurance, and Banking

1. Stockbroker
2. Financial Analyst
3. Underwriter and Actuary
4. Risk Manager
5. Insurance Agent
6. Bank Officer
7. Investment Banker
8. Financial Planner/Tax Adviser
9. Financial Information Researcher

Shuffling Paper for Fun and Profit: Business, Public Administration, and Consulting

10. Public Administrator
11. Cost Estimator
12. Business Consultant
13. Accountant
14. Human Resources Manager
15. Purchasing Agent
16. Import/Export Trade Manager
17. Operations/Systems Researcher
18. Telecommunications Specialist
19. Association Executive

Lawyers, Law Enforcement, and Security

20. Lawyer
21. Corporate Lawyer
22. Paralegal/Law Office Manager
23. Police Officer
24. Detective, Private or Government
25. Security Specialist

I Can Get It for You Wholesale: Marketing and Sales

26. Consumer Product Manager
27. Industrial Product Manager
28. Retail Buyer
29. Market Researcher
30. Marketing Manager
31. Franchise Manager

Getting There in Style: Travel and Transportation

32. Travel Agent
33. Conference/Meeting Planner
34. Airline Pilot
35. Corporate Shipping Manager

The Art of the Deal: Real Estate Management

36. Real Estate Broker
37. Developer
38. Urban Planner
39. Building Manager
40. Architect

The Good Earth: Earth Sciences and Farming

41. Farm Manager
42. Environmental Technologist
43. Geoscientist
44. Landscape Architect

What's Up, Doc?: The Hard Sciences

45. Chemist
46. Mathematician/Statistician
47. Biologist
48. Agricultural and Food Scientist
49. Veterinarian
50. Physicist

My Brother's Keepers: The Social Sciences and Services

51. Psychologist
52. Social Worker
53. Recreational Worker and Therapist
54. Job Counselor/Recruiter
55. Economist

Do Not Fold, Spindle, or Mutilate: A Look at Computers and Data Processing

56. Computer Programmer
57. Systems Analyst
58. Management Information Systems (MIS) Specialist
59. Library Scientist/Information Broker
60. Technical Services Specialist
61. Computer Engineer

The Technocrats: Engineering and Technology

62. Electrical/Electronics Engineer
63. Mechanical Engineer
64. Civil Engineer
65. Industrial/Manufacturing Engineer
66. Engineering/Industrial Technologist
67. Chemical Engineer
68. Metallurgical and Materials Engineer
69. Aerospace Engineer
70. Energy Engineer
71. Laboratory Specialist

First, Do No Harm: The Medical Professions

72. Medical Doctor
73. Dentist
74. Optometrist
75. Registered Dietitian/Nutritionist
76. Hospital Administrator
77. Registered Nurse
78. Pharmacist
79. Therapist
80. Industrial Hygienist

Hello, Mr. Chips: Teaching

81. Elementary School Teacher
82. Secondary School Teacher
83. College Professor
84. College Administrator
85. Corporate Training Specialist

The Fine Art of Persuasion: Advertising and Public Relations

86. Public Relations Specialist
87. Advertising Account Executive

88. Copywriter
89. Media Planner

Talking Heads: Arts and Media

90. Commercial Artist
91. Designer
92. Photographer/Cinematographer
93. Journalist
94. Media Producer
95. Musician
96. Radio/TV Announcer

The Good Life: Leisure, Eating, and Sports

97. Hotel Administrator
98. Restaurant Chef
99. Restaurant Manager
100. Sports/Recreation Manager

Vita

Maurice LeVell Wilson was born in Knoxville, Tennessee, on August 22, 1971. His parents are Benjamin Wilson and Jamesena Porter from Knoxville, Tennessee. He attended elementary school, middle school and high school in Knoxville, Tennessee. He graduated from Fulton High School in Knoxville, Tennessee in 1989. He received the Bachelor of Science Degree in Mathematics with a minor in Computer Science from Tennessee State University in May 1994. In August of 1996, he received the Master of Science Degree in Mathematics with an emphasis in Topology from Tennessee State University. In August of 2002, he received the Doctor of Education Degree at the University of Tennessee, Knoxville with a primary concentration in Educational Research and a secondary education in Mathematics Education.

He began teaching developmental mathematics at Tennessee State University and at Nashville State Technical Institute in August 1996. In August 1998 he began teaching developmental and college level mathematics at Pellissippi State Technical Community College. Presently, he is an Assistant Professor of Developmental Studies at Middle Tennessee State University in Murfreesboro, Tennessee.

The author is a member of the Tennessee Association of Developmental Education (TNADE), a member of the American Educational Research Association (AERA), and a dedicated member of the Tennessee State University Alumni Association.