8-2001

Socioeconomic, Demographic, Attitudinal and Involvement Factors Associated with Math Achievement in Elementary School.

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A dissertation
presented to
the faculty of the Department of Educational Leadership and Policy Analysis
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Doctor of Education in Educational Leadership

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by
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August 2001

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Keywords: Math, Achievement, Predictors, Socioeconomic factors, Demographic factors, Parents' educational level, Family income, Elementary level, Student attitudes, Parent attitudes

ABSTRACT

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The purpose of this study was to determine the extent to which socioeconomic factors, demographic factors, parent and student attitudes, and parent involvement were associated with math achievement. Students in grade 5 from a school district in East Tennessee were selected as the population for this study. Random cluster sampling procedures were used to select the sample. Intact classrooms were randomly selected from a list of all 5th grade classrooms in the school system. All students from the selected classrooms were asked to complete a modified version of the Fennema-Sherman Mathematics Attitudes Scales. Normal Curve Equivalent Scores (NCEs) from the math scales on the TerraNova Standardized Achievement Test were obtained for all students from the individual school records. Parents of the students also participated by answering questions pertaining to their attitudes toward math, their level of involvement in the classroom, and socioeconomic and demographic characteristics.

The findings from this study suggested that each of the six scales used from the Fennema-Sherman Mathematics Attitudes Scales was significantly associated with the math scores, computation scores, and composite scores of the TerraNova Standardized Achievement Test. Family annual income, parents' educational level, and parent involvement were also significantly associated with math achievement. Four of the six attitudinal scales, the Mathematics as a Male Domain, Confidence in Learning Mathematics, Parent, and Mathematics Anxiety Scales, were significantly related to parents' educational level, family's annual income, and gender. Socioeconomic and attitudinal factors were the most powerful predictors of math achievement, whereas, student gender and parent involvement were not strong predictors.

DEDICATION

I would like to dedicate my dissertation to my family and friends who have been supportive and encouraging during my graduate work. Many hours have been put into my work and many times visits and conversations were cut short due to the amount of time put into my dissertation. My dissertation is dedicated to the following people:

To my parents, Brenda and Jon Broome, I am deeply grateful for your love and support. Your support and the values that you instilled in me as a child have gone a long way and have taken me to the top to fulfill my dreams. I would be lost without your guidance and support.

Thank you to my parents, Albert and Beth White, for your support in all that I venture out to do. Knowing I can always count on you and knowing you are always behind me gives me the confidence to keep trying new things and setting out on new adventures.

Without my grandmother Mee-Ma, life would be meaningless. Thank you for being a positive influence in my life and reminding me to keep my head up and see the good in everything. All the uplifting conversations that helped me to continue and pursue this degree will always remain close to my heart.

Thank you to my brothers and sister, Todd, Greg, Tim, and Jenny, for igniting the competitive spark within as we were growing up. I love all of you dearly.

To all of my friends who have encouraged me to continue with the doctoral program and who have supported my decision to pursue this degree and do my best, I also dedicate my dissertation to you.

ACKNOWLEDGMENTS

I would like to thank the faculty and staff of East Tennessee State University for their ongoing support, encouragement, and dedication throughout my experience in the doctoral program. I would also like to express my extreme gratitude to my committee chair, Dr. Russ West, who has been supportive and dedicated throughout the entire program. I would also like to thank Dr. West for challenging me to extend beyond what I thought possible. I would also like to extend a special thank you to my committee members, Dr. Ronald Lindahl, Dr. Russell Mays, and Dr. Elizabeth Ralston. Your suggestions and recommendations were very much appreciated and an integral part to my dissertation.

I am deeply grateful to Rob Younger for his ongoing support throughout the entire doctoral program. I thank him for always encouraging me that I can get through anything with determination and continuously telling me that I can and will finish and complete my dissertation.

I say thank you to my cohort group and the friendships that we have developed over the past several years. Without all of you, this process would have been much more difficult. I truly value all of your support and am thankful for all of you.

With gratitude, I further express recognition to the Sevier County School System. The entire research project was dependent upon the administrators, teachers, parents, and students. Thank you for your willingness to participate.

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CHAPTER 1

INTRODUCTION

During the 1990s, educational reformers called for increased expectations for all students. These calls for reform became educational focal points at the national, state, and district levels as greater emphasis was placed on the development and use of educational standards. During this time, a number of reformers called for a new focus on math instruction in schools and a commitment to higher levels of mathematics achievement. In 1997, President Clinton attempted to strengthen the nation's commitment to rigorous educational standards by proposing a voluntary program of national tests in mathematics at Grade 8 to ensure that individual students across the country are provided equal opportunities to achieve high standards.

A national concern with mathematics achievement has actually been evident for much of the last 25 years. Since 1969, the National Assessment of Educational Progress (NAEP) has had as its purpose the measurement of student progress toward higher achievement in several content areas, with mathematics being one of those (Campbell, Voelkl, & Donahue, 1997). Since 1969, the NAEP has conducted ongoing nationwide assessments of student achievement in various subjects, including mathematics. Their recent reports present the results of NAEP's long-term trend assessments in reading, mathematics, and science that were administered in 1999 to students aged 9, 13, and 17.

The NAEP has two national assessment programs. The long-term trend assessments make it possible to measure educational progress over time and develop new assessment instruments that can periodically reflect current educational content and assessment methodology. The long-term trend assessments have remained about the same since their first

administrations and make it possible to measure progress over time. The long-term studies use different instruments from those used in the main NAEP assessments and sample students by age rather than by grade level (Campbell, Hombo, & Mazzeo, 2000).

The NAEP executive summary provided an overview of major findings from nine administrations of the long-term trend mathematics assessment since 1973. After a period of stable performance in the 1970s, average math scores for 9-year-olds increased in the 1980s. Additional gains were evident in the 1990s, and the 1999 average score was higher than that in 1973. The average score in 1999 was also higher for 13-and 17-year-olds than in 1973 (Campbell et al. 2000).

These long-term trend studies of educational achievement also provide scores of students, by gender. Among male students, 9-and 13-year-olds have shown overall gains in mathematics between 1973 and 1999. Among female students, overall gains across the years are evident at each age. In 1999, the apparent differences between male and female students' average mathematics scores were not significant at any age. Among 17-year-olds, the score gap that had favored male students in the 1970s disappeared, and by 1999 the difference was no longer statistically significant (Campbell et al. 2000). While these results do indicate that progress has been made in mathematics achievement over the past 25 years and that former gender differences appear to be eroding, there continues to be concern that mathematics achievement needs to improve.

President Bush has proposed a framework to ensure that no child should be left behind and that every child should be educated to his or her full potential. He also stated that bipartisan education reform would be the cornerstone of his administration (U.S. Department of Education, 2001). He noted that if youth are educated, many other successes would follow. It has been said

that too many of the students with the greatest needs are being left behind. Today, nearly 70% of inner city fourth graders are unable to read at a basic level on national reading tests. High school seniors trail students in Cyprus and South Africa on international math tests. Nearly a third of college freshmen must take a remedial course before they are able to even begin regular college level courses (U.S. Department of Education, p. 2).

The United States Senate has passed a landmark education bill that will call for a massive increase in federal spending, strict testing requirements for many of the nation's students and sanctions for schools that fail to make the grade (Garvey, 2001a). The White House, Senate and House of Representatives agree on annual testing in reading and math for all students in grades three through eight, with one more test in high school The effort, approved on a 91-8 vote on the Senate floor, was held up by nearly all involved as a model for bipartisan cooperation (Garvey)

Federal spending represents a small amount of the cost of education in this country, accounting for less than 10 cents of every dollar spent on public education coming from Washington. Much of that money is targeted to low-income students. The amount going to individual schools varies widely, depending largely on the number of low-income students enrolled (Garvey, 2001a).

Increased money for low-income students is promised in all versions of the bill, but with strict standards and repercussions for failure. The legislation would most affect low-income families, giving poor parents a greater range of educational choices while stopping short of allowing federal funds to be used to pay for private education. Under the legislation, low-income students attending a school that failed to show adequate progress after two years would be allowed to transfer to another public school. Under both the Senate and House of

Representatives versions of the bill, a school would risk the loss of federal funds targeting low-income students if it failed to meet the standards for three years in a row (Garvey, 2001a).

Most senators agreed that the education measure was a case study in bipartisanship. Both sides worked together to find a compromise in the improvement of education (Zuckman, 2001). The effort has been publicized as both a triumph for the White House and a model for bipartisan agreement (Garvey, 2001b, p. 2).

Many variables have been thought to have an impact on students' mathematics achievement. For example, educators and parents have long considered the role gender plays in the development of attitude toward math and in math achievement. In 1992, Mattel Toys put the first talking Barbie doll in stores. Barbie's first words were, "Math class is tough." Mattel felt that Barbie's first words were a representation of the feelings of school-age girls. After many complaints from parents and teachers, Barbie stopped talking (Jovanovic & Dreves, 1995). The controversy with Mattel Toys in 1992 emphasized a concern in the United States about the role of gender in shaping the beliefs of children in their ability to do math and subsequent math achievement. In a study conducted by Eccles, Wigfield, Harold, and Blumenfeld (1993), girls and boys valued mathematics equally, but boys were more likely to believe that they were more competent than girls.

The self-confidence of students can also have a direct effect on their academic achievement. In addition to self-confidence, it has also been suggested that parent and student attitudes toward school are strongly related to achievement (Aiken, 1970).

Family structure has also been determined to be a predictor of math achievement. Results have suggested that children whose single parents have been involved in their academic life scored higher on mathematic achievement tests than those parents who were not involved. In

addition, children in single parent homes were at a higher academic risk than children from two-parent families (Fluty, 1997; Schaefer, 1991). Parents' socioeconomic status has also been suggested as a predictor of math achievement. The stress and lack of social support to parents in poor families may adversely affect parents' support for school success, and thus, children's intellectual development (National Commission on Children, 1991).

Parent involvement has also been shown to be a factor in academic achievement. Henderson (1988) provided evidence that higher student achievement is related to parents' involvement in the schools. Parents, not just educators, need to invest their time and interest to create the social force necessary for change. Clark (1983) discovered that parents of high-achieving students had distinct styles of interacting with their children. They created emotionally supportive home environments and provided reassurance when their children encountered failure. They viewed school performance as being accomplished through regular practice and work and accepted responsibility for assisting their children to acquire learning strategies. A substantial number of children are being born or are growing up in circumstances that put them at risk of low achievement and school failure. Low parent education has been shown to increase a child's chances of experiencing problems in school. Data have shown parent education to be a better predictor of grade repetition than family income, poverty status, or family structure (Klein, Thornburg, & Mumford, 1998).

The literature has shown that gender, family structure, parents' educational level, parents' socioeconomic status, parent attitudes toward school, student attitudes toward school, and parent involvement are directly related to school achievement, and specifically mathematics achievement (Campbell et al. 2000; Epstein, 1991; Fennema & Sherman, 1976, 1986; Fluty, 1997; National Commission on Children, 1991). Teachers who work with students from families

in which parents have a low socioeconomic status and educational level, have negative attitudes toward education, and are not involved in their child's school must have an understanding of the family dynamics in order to successfully educate these children.

Statement of the Problem

Fennema and Sherman (1977), AAUW (1992), and Sadker and Sadker (1994) have shown in earlier research, that there has been a gender gap in math achievement across all grade levels. Recent statistics from the NAEP suggest that this gap may be narrowing. Overall math achievement gains are evident in students whose parents' highest educational level was some education after high school (Campbell et al. 2000). Epstein (1987), Lareau (1987), and Stevenson and Baker (1987), concluded that parental involvement resulted in higher student achievement, positive attitudes toward school, and improvement in homework habits. The authors also suggested that parents of higher socioeconomic status are more involved in their child's education than parents of lower socioeconomic status. Because differences in mathematics achievement begin to occur at the elementary school level and no studies have been conducted in East Tennessee, it is important to discover if these same relationships and patterns of influence hold true in a population of fifth-grade students in East Tennessee. The purpose of this study, therefore, is to determine the extent to which socioeconomic factors, demographic factors, student and parent attitudes, and parent involvement are associated with math achievement.

Research Questions

The following research questions were investigated:

1. What are the socioeconomic and demographic characteristics of fifth-grade students in a rural county in East Tennessee?

2. Are there gender differences in the attitudes fifth-grade students hold toward mathematics and mathematics achievement?

3. What attitudes do parents have toward mathematics?

4. What level of involvement do parents maintain in the education of their children?

5. What relationships exist between student attitudes and mathematic achievement?

6. Are there differences in student attitudes toward mathematics based on family's annual level of income?

7. Are there differences in math achievement scores based on family's annual level of income?

8. Are there differences in student attitudes toward mathematics based on parents' educational level?

9. Are there differences in mathematic achievement based on parents' educational level?

10. Are there differences in student attitudes toward mathematics based on the number of parents or guardians living at home?

11. Are there differences in mathematic achievement based on the number of parents or guardians living at home?

12. Are there relationships between parent attitudes toward mathematics, parent involvement, and student's math achievement?

13. To what extent can socioeconomic factors, demographic factors, parent attitudes toward math, student attitudes toward math, and parent involvement predict mathematic achievement?

Limitations, Delimitations, and Assumptions

Research in this study was limited to students and parents who volunteered to participate in this study. The delimitations of this study were based on the population studied, which included all fifth-grade classes located in a single school system from East Tennessee during the 2000-2001 school year and the parents of the fifth-grade students. The Fennema-Sherman Mathematics Attitudes Scales were administered to determine students' attitudes toward mathematics. It was assumed that all students taking the Fennema-Sherman Mathematics Attitudes Scales answered honestly to the best of their ability. The parent survey consisted of questions pertaining to parent involvement, parents' attitudes toward mathematics, and socioeconomic and demographic questions. It was also assumed that the parent surveys distributed were answered honestly by parents and that the parents who responded were representative of the population.

Overview of the Study

Chapter 1 presented an introduction to the National Assessment of Educational Progress's findings in mathematics trend assessments. A summary of the education bill passed by the United States Senate and variables associated with mathematic achievement were also included. Chapter 1 also stated the purpose for conducting this study and the questions that guided this study. Chapter 2 provided a review of the literature beginning with demographic, socioeconomic, student and parent attitudes, and parent involvement factors related to mathematic achievement. Chapter 3 detailed the methods and procedures used in this study. Chapter 4 provided the results from the data analysis and Chapter 5 provided the summary and conclusions from the study and also recommendations for further research.

CHAPTER 2

REVIEW OF LITERATURE

In this chapter, research is examined on the impact of selected demographic, socioeconomic, student and parent attitudes, and parent involvement factors on mathematics achievement. The impact of gender, family structure, and parent's educational level on math achievement are reviewed as primary demographic factors. The impact of socioeconomic factors on mathematics achievement are also reviewed. The impact of self-esteem and beliefs about the efficacy of math instruction are reviewed as important student and parent attitudinal factors that impact mathematics achievement. The review also includes a discussion of the impact that parent involvement has on student mathematics achievement.

Demographic Factors Related to Mathematics Achievement

Various demographic factors have been known to be related to mathematics achievement. Gender, family structure, and parent's educational level are factors that have been analyzed in this study as predictors of math achievement.

Gender

Early adolescence can be a critical time for girls' development of academic interests and attitudes. Many girls think that being bright is in conflict with being popular. High academic success can easily be in direct conflict with the social aspects of adolescence concerning learning opportunities, student/teacher interactions, and mathematic performance (AAUW, 1992; Lee, 1996; Orenstein, 1994).

Learning Opportunities. Fennema and Peterson (1985) have suggested that learning habits that involve working independently on high-level tasks may enable some children to do better in math and science. Evidence also exists that males and females have different learning styles and that females excel at a higher rate when learning mathematics through rules (Fennema & Peterson, 1985; Hopkins, McGillicuddy-DeLisi, & DeLisi, 1997). Fennema and Peterson (1985) pointed out that young girls are socialized to be dependent, and they receive more protection and more assistance in doing tasks from their parents and teachers than boys receive. As a result of the reinforcement of dependence, when children enter school, females tend to be more dependent on others and males tend to be more self-reliant.

Females as young as Grade 6 and 7 rate being popular and well-liked as more important than being perceived as competent or independent. Boys, on the other hand, are more likely to rank independence and competence as important. It is clear that both girls and boys have learned to equate maleness with opportunity and femininity with constraint (AAUW, 1992; Orenstein, 1994; Sadker & Sadker, 1994).

A nationwide survey commissioned by the AAUW in 1990 found that an average of 69% of elementary school boys and 60% of elementary school girls reported that they were "happy the way I am"; among high school students, the percentages were 46% for boys and only 29% for girls (AAUW, 1992; Hannan, 1995, Sadker & Sadker, 1994). The survey revealed vast differences in males and females from the time they leave elementary school and enter high school. The developmental patterns of self-esteem, body image, and academic interests do not disappear as children grow older and mature.

Student/Teacher Interactions. According to a brief of the American Association of University Women, Equitable Treatment of Girls and Boys in the Classroom (1989), girls'

everyday interactions with teachers and with other students contributed significantly to the slow change that occurred in sex equity. According to authors of the report:

> Too often, classroom dynamics are laced with unconscious sex stereotypes, as when teachers spend more time with boys in math classes and more time with girls in reading classes. Such subtle but powerful messages have been shown to circumscribe girls' and women's choices regarding academic preparation, achievement, and careers (p. 1).

In order to provide opportunities for males and females, teachers need to learn how to implement effective strategies for providing an equitable and quality education for all children. Many teachers interact and behave with their students the way they were taught when they were children. It is common knowledge that schools today are very different from those that teachers knew when they were children. Issues of fairness and equity were once considered unimportant; however, this has changed due to legal obligation and moral necessity to provide an effective education to all students (Scott & McCollum, 1993).

Fennema and Sherman (1977) documented sex-related differences in achievement and participation in Grades 6 through 12. These researchers have had a major impact because they were published in highly accessible journals when the concern with gender and mathematics was growing internationally. After completing these studies, Fennema expanded her investigation to include other educational variables, particularly teachers, classrooms, and classroom organizations. Teacher-student interactions, teacher and student behaviors, and characteristics of classrooms and teaching behaviors were studied.

The studies dealing with educational variables suggested that it is relatively easy to identify differential teacher interactions with girls and boys (Fennema & Leder, 1990). Fennema and Leder found that teachers interacted more with boys than with girls, praised and scolded

boys more than girls, and called on boys more than girls. Although intervention programs have been designed to help teachers recognize how they treat boys and girls differently, such programs have not been successful in eliminating gender differences in mathematics. Fennema (1993) reported that differential treatment of boys and girls is a symptom of many other causes of gender differences in mathematics and that, as in medical practice, treating the symptom is not sufficient to change the underlying cause.

Sadker and Sadker (1994) have observed elementary schools through higher education that focused on how teachers and schools treat children. Using objective and systematic methodology, the Sadkers collected data on patterns of classroom instruction. In the first interaction study, trained raters observed in over 100 classrooms of fourth, sixth, and eighth graders in Connecticut, Maryland, Massachusetts, Virginia, and the District of Columbia. Thousands of observation sheets were recorded in rural, inner city, and prosperous suburban schools. After a year of analyzing data, shocking patterns of sexism were found in the schools. For example, it was found that females received less attention, less praise, less effective feedback, and less detailed instruction from teachers than boys (AAUW, 1992; Sadker & Sadker).

Some research suggests that student-teacher interactions positively impact girls' achievement and self-esteem. Other studies, however, have shown that student-teacher interactions obstruct girls' learning. Some teachers treat male and female students differently by providing precise feedback to males and vague feedback to females (AAUW, 1992; Sadker & Sadker, 1994). Sadker and Sadker found that teachers typically give students four types of responses. Teachers may praise, remediate, criticize, or accept that an answer is accurate. The researchers found that teachers praise students only 10% of the time. In many classrooms,

teachers do not use praise or criticism. About one third of teacher interactions are comprised of remediation in which students are encouraged to correct a wrong answer. More than half the time, however, teachers give the quickest, easiest, and least helpful feedback. During this particular observation, boys received both more instruction and better instruction than girls. For example, two male students were praised, a response that promotes their confidence and self-esteem and alerts them to what they do well. Another male student received constructive criticism and learned that he was not completing the assignment correctly. The teacher provided remediation to another male child, which helped in the development of ideas. The only feedback given to a female student was imprecise, without direction or information. Sadker and Sadker researched more than 100 classrooms and found that while males received more of all four responses, the gender gap between males and females was greatest in the most precise and valuable feedback that teachers gave to students. The male students were more likely to be praised, corrected, helped, and criticized, which are all reactions that cultivate student achievement. Females, however, received a more insignificant response, such as a verbal nod or "okay", which lacked clarity and direction.

As a result of these differences, females may feel powerless in the classroom and abandon academic tasks more easily (AAUW, 1992). It is important for teachers to examine both the style with which they relate to girls and the content area that is emphasized with females because it is very easy for teachers to be unaware of biased behaviors they exhibit through the verbal interactions, eye contact, and body language they display (Mann, 1994a; Sadker & Sadker, 1994; Sanders, 1997).

Sadker and Sadker (1994), who have studied student-teacher interactions for many years, found that when both boys and girls are misbehaving, teachers are three times as likely to

discipline the boys than the girls. Although this is considered negative attention, the males are still receiving the teacher's attention more often than females. Eccles and Blumenfeld (1985) found that teachers initiated 10% more communication with boys than with girls, again strengthening the boys' sense of dominance and importance. Sadker and Sadker also found that teachers asked boys more complex, abstract, and open-ended questions. Teachers were also more likely to give detailed instructions to boys on class projects and assignments while they were more likely to complete the task for girls:

> Differential treatment studies, with few exceptions, concluded that females and males do receive differential treatment in the classroom. Regardless of the grade level, length of observation, or observation scheme that was used, differences were found consistently. It appeared that these differences favored males since they had more interactions with the teachers, received more help and attention, and had more informal contacts with the teachers (Koehler, 1990, p. 134).

Math is a discipline that can be perceived by females as unrewarding, but through teaching techniques that make females feel welcome and confident, girls can begin to enjoy and achieve in math. Teachers can be major sources of motivation to encourage girls to pursue math and one teacher can have significant impact on a female's attitude toward math by providing active encouragement. In fact, students report teacher support as an important factor in decisions to pursue professional careers (AAUW, 1992).

Researchers such as Sadker and Sadker (1994), Koehler (1990), Eccles and Blumenfeld (1985), and Fennema and Sherman (1977) have found differences in the way that males and females are treated in the classroom. This is important, because a connection has been identified

between instruction and achievement. The link between a teacher's instruction and a student's achievement is also relevant in mathematics.

Mathematic Performance. The underachievement and non-participation of girls in mathematics has become a focus for concern in recent years. Boaler (1997) described particular ways in which girls are negatively affected by mathematics and the negative perceptions these girls held were due to the type of mathematics being taught. Boaler's study was conducted with 13- to 16-year-old students in two different schools. One school was textbook-based, whereas the other was an open, project-based school. At the open, project-based school, the students worked in mixed-ability groups consisting of a series of themes or projects. The results of this study suggested that females at the open, project-based school were more confident in their math abilities than the females at the textbook-based schools. It has been suggested that girls prefer cooperative, supportive working environments while boys work well in competitive environments (Fennema & Peterson, 1986; Mann, 1994b). Public schools need to make sure that learning environments meet the needs of all students.

Gender differences in mathematics have decreased over the past two decades; however, differences in performance do still exist (Shroyer, Borchers, Smith, & Wright, 1994). Female students have a tendency to approach mathematical concepts using rules or working in cooperative groups, whereas male students tend to favor competition in order to master mathematical concepts (AAUW, 1992; Fennema & Peterson, 1985; Hopkins, McGillicuddy-De Lisi, & De Lisi, 1997). When working cooperatively, students are able to develop their own justifications and reasoning to solve problems. Although cooperative learning is not the solution to gender equity problems, when the teacher carefully monitors group activities he or she can

ensure that the mathematical content and sex stereotyping is not reinforced and male and female achievement is not impaired (Jacobs & Becker, 1997).

In 1989 the National Science Board of the National Science Foundation reported that from 1982 to 1987, the average number of math credits that a male high school student received increased from 2.61 to 3.04. During the same time period, the average number of math credits that a female student received increased from 2.46 to 2.93. In 1982 males received 0.15 more math credits than females; in 1987, they received 0.11 more (AAUW, 1992). Not only were there differences in math course participation but also on math test scores from the NAEP and the SAT.

Math scores from the NAEP showed that 8th-grade girls and boys scored about the same; however, 4th-grade boys and 12th-grade boys outperformed girls. At both of these grade levels, boys were more apt to be at the "proficient" or "advanced" levels of achievement, while girls were more likely to be at the "basic" level. In 1984 and 1994, there was a gap of 41 points between boys' and girls' scores on the SAT math test. The SAT was renormed in 1996 and the gap narrowed but has remained at 35 points (Campbell & Clewell, 1999).

Mathematics acts as a critical filter limiting future choices in college attendance, college majors, and career possibilities (Campbell, 1992). Test scores label students and put a value on a student's intellect. Some people believe that test scores are a more genuine reflection of their intelligence than report card grades. The College Board reports that males in 1988 scored an average of 37 points higher than females on the Level I Math Achievement Test and 38 points higher on Level II Math Achievement Test (Sadker & Sadker, 1994, p. 141). The Scholastic Assessment Test (SAT) showed males receiving scores that are 50 to 60 points higher than females (Sadker & Sadker, p. 136). The American College Testing Program (ACT) assesses

academic achievement rather than aptitude measure. Females do outperform males on the English section by one point; however, males are ahead on the rest of the test (Sadker & Sadker, p. 141). Achievement tests appear to be dominated by males and in 1992 males achieved higher scores on 11 of 14 achievement tests, dominating in the sciences, social sciences, math, and most languages (AAUW, 1992; Campbell & Clewell, 1999; Kleinfeld, 1999; Sadker & Sadker).

Many graduate schools have used high grade point averages in correlation with standardized test scores when accepting applicants. In 1987 and 1988, the Educational Testing Service published information on the Graduate Record Examination (GRE). Males outscored females by 80 points on the quantitative math section. Males also scored 21 points higher than women on the verbal section and 26 points higher on the analytical section. Females scored lower than males on all sections of the GRE (Sadker & Sadker, 1994, p. 143). Because females face a gender gap in standardized test scores, they lose opportunities to be accepted into top programs, which could result in a limited choice of careers.

Females have made progress in mathematics during the 1990s. Females' math test scores have risen and enrollment in college math courses has increased over the past decade. In 1995, 47% of bachelor's degrees and 42% of master's degrees in math went to women (Sanders & Peterson, 1999, p. 47). Kleinfeld (1999) reported that American women received 45% of all doctoral degrees in 1994; however, a large gender gap remains in mathematics, where women received only 24% of the doctorates (p. 8). Although these changes have taken place in recent years, starting salaries for female graduates entering mathematics fields in 1993 were only 85% of the salaries paid to male graduates (Campbell & Clewell, 1999, p. 4).

There are many differences between males and females in education. Studies by Fennema and Sherman (1977) and Eccles and Blumenfeld (1985) have shown that females are

not receiving the same education as males. Fennema and Peterson (1985), AAUW (1992), and Sadker and Sadker (1994) also supported that males are achieving more in the area of mathematics than females. Although some changes have taken place and females have improved in various areas, more improvement is needed. Females deserve an education that is equitable to that of males. The more the topic of gender equity is examined, the more one sees the need for providing innovative instruction that is equitable to both sexes.

Although many studies have been conducted analyzing the effects of gender on achievement and suggesting gender does impact achievement, this particular study did not find gender differences in the attitudes fifth-grade students hold toward mathematics and mathematics achievement.

Family Structure

In the United States today, 16,334,000 children under age 18 live in single-mother homes; another 2,257,000 live in single-father homes. There are 48,084,000 children under age 18 who live with both of their parents (Fluty, 1997). Research has shown that adolescents in single-parent families do not do as well academically as adolescents in two-parent families (Kurdek & Fine, 1993; Mulkey, Crain, & Harrington, 1992; Zimiles & Lee, 1991).

Studying the parental factors that influence adolescents' academic achievement can provide insight to parents about how to enhance their behaviors toward their adolescents so that they may make the most of their academic experience. Understanding how behaviors and resources of single parents affect adolescents in households is important for families, school/home partnerships, and to serve as a basis for more appropriate family life education (Schaefer, 1991).

A study conducted by Fluty (1997) examined single-parent behavioral control, involvement, and interpersonal and educational resources in relation to adolescents' mathematic achievement test scores. More than 3,000 adolescents from single parent homes were used in the study. Educational resources (encyclopedias, atlas, or books located in the home), interpersonal resources, and parental school involvement positively influenced mathematics achievement scores. For example, the more involved parents were in their children's school lives, the higher the mathematics scores.

Marital status was inversely related to adolescents' mathematics achievement scores. Adolescents who lived in divorced or separated homes performed better in mathematics than adolescents from never married or widowed families. Socioeconomic status was positively related to mathematics scores. Adolescents who lived in homes where parents attended college and had a high socioeconomic status scored higher on mathematics achievement tests than adolescents who lived in homes where parents had not attended college. Results from the study indicated that adolescents whose single parents were involved in their school lives earned higher scores on mathematic achievement tests than parents who were less involved. Results also suggested that children in single-parent homes might be at an academic risk more so than children from two-parent families (Fluty, 1997).

Conservative politicians feel that changes in the traditional family structure have harmful effects for children in terms of their educational development. In 1990, almost one third of all children were born into single parent families (David, 1993). Many children spend time in a step-family or with parents who cohabitate rather than marry. All of these changes can have a profound impact upon a child's social and educational development.

The findings in this study did not agree with the research that stated children from single parent families do not do as well academically as children from two parent families (Kurdeck & Fine, 1993). In fact family structure did not have an impact on student attitudes toward mathematics or student's mathematic achievement.

Parents' Educational Level

A study conducted by Coleman (1966) demonstrated that student achievement was correlated highly with family background factors such as income, parents' educational attainment, and family structure. A child's attitude towards education may be shaped by the parents' attitude toward education or parents' level of education. Schwartz (1999) suggested that parents or guardians may be illiterate or have very little education, and, therefore, not see the importance of doing well in school and furthering education. They may not understand why it is important for their child to take advanced level courses as they progress through school. Although students can receive support and positive reinforcement at school, they may not receive the same support and reinforcement at home due to the lack of awareness from parents.

The NAEP (Campbell, Hombo, & Mazzeo, 2000) analyzed the highest level of education of either parent. Results on parent education level are available back to 1978 in the area of mathematics. In each subject area, math, reading, and science, and each age group, students who reported higher parental education levels tended to have higher average scores. Since reports of 9-year-olds about parent education level may not have been reliable, the results were not included in the executive summary. Among 13-and 17-year-old students at the highest level of parental education, college graduation, scores in 1999 were similar to those in 1978. Among those students whose parents' highest education level was some education after high school, 13-year-olds showed overall gains across the assessment years. Among students whose parents'

education did not go beyond high school graduation, score increases across the years were evident for 17-year-olds and for those students whose parents did not complete high school. The overall gains in math were evident at ages 13 and 17.

More schools and school systems are finding that in order to educate a student and break down barriers to learning, it is necessary to reach out to families and do all possible to involve and educate these families (Funkhouser & Gonzales, 1997). It is important to view the student as a whole person who is shaped by the entire family in order for students to be successful.

Research has shown that parents' educational level does impact student achievement. This study supports the research in that the parents' educational level significantly impacted each of the math achievement scores. The parents' educational level also impacted student attitudes toward mathematics.

Socioeconomic Factors Related to Mathematics Achievement

According to a report by the National Commission on Children (1991), poverty can affect educational outcomes in a variety of ways. Adolescents from poor families are more likely to lack basic academic skills and to have repeated a grade. The stress and lack of social support to parents in poor families may affect parents' support for school success, and thus, children's intellectual development. Poor families are likely to live in poor school districts with fewer resources to offer their students (National Commission on Children, 1991).

In 1995, one out of five children lived in poverty. Children from poor families had lower than average achievement and higher than average dropout rates. Certain family characteristics, such as family structure and poverty level, were associated with increased risk for dropping out

of high school or not attending college after high school graduation (U.S. Department of Education, 1997).

Luster and McAdoo (1991) studied the diversity of achievement of black children and found that high achievers (compared to low achievers) had relatively intelligent and educated mothers, came from smaller families that were financially more secure, and had a more supportive home environment. Those children whose family situations were more positive had better cognitive and social outcomes. Children exposed to multiple risks were more likely to experience academic and adjustment problems.

A number of studies have suggested that parents of higher socioeconomic status are more involved in their children's education than are parents of lower socioeconomic status and that greater involvement fosters more positive attitudes toward school, improves homework habits, reduces absenteeism and dropping out, and enhances academic achievement (Epstein, 1987; Lareau, 1987; Stevenson & Baker, 1987).

Lareau (1987) described three approaches that explained the variation in parental involvement along social class lines. The culture of poverty approach suggested that parental involvement varies because parents of different social classes have different values. For example, working class parents place less emphasis on the importance of schooling and maintain a greater separation between their roles and those of school staff than do middle class parents. The institutional approach stated that institutions are the source of variation because school's staff differ in their ability to involve working class parents or because of subtle discriminatory practices that discourage these parents' participation. The cultural capital thesis integrates the first two approaches in that it emphasizes the roles of both schools and parents. Children who are raised in middle class environments have a form of cultural capital that enables them to adapt

more readily to and to benefit from school life. Middle class parents are more likely to feel comfortable relating to teachers and being involved in school activities.

In a study conducted by Clark (1983), high achieving children had parents who had prepared them from an early age for the role of student. They fostered a positive attitude towards learning through their teaching behaviors at home (reading, communication skills, problem solving, and decision-making skills). These parents sacrificed, both financially and socially, for their children's education, stressed the value of education for their futures, monitored their academic progress closely, and fostered an internal sense of control and responsibility over academic outcomes.

This study discovered that the family's annual level of income significantly impacted the differences in math achievement scores. Significant differences also occurred with student attitudes toward mathematics. These differences suggested the more money families earned annually, the more positive attitudes children had towards learning math and the higher the achievement scores were than those families who earned less.

Student and Parent Attitude Factors Related to Mathematics Achievement

While the influence of parental beliefs on student achievement may appear to be very subtle, it can be a powerful predictor of academic success. Often, subtle aspects of beliefs and behavior can be very influential on student achievement. Pollard (1989) found that successful students were more likely than unsuccessful students to have a higher self-perception of ability and report more support for educational endeavors from parents and others. Each of these factors has been known to be related to mathematic achievement.

Self-Esteem

As males and females face the challenges of adolescence, each child physically, emotionally, and mentally develops at different levels and speeds. All children face different challenges and do their best to overcome them; however, as children face adolescence and the changes ahead of them, self-esteem plays a large role in how males and females achieve in school.

On the surface, females seem to be doing well when it comes to achievement in school. They get better grades and receive fewer punishments than males. Girls start school full of enthusiasm and ready to excel. They have a developmental edge over boys from birth, and they score higher on standardized tests at the beginning of their education than boys do. They are generally more mature and ready to learn. As they progress through middle and high school something changes. Their scores on standardized tests and their self-esteem are lower than boys (AAUW, 1992; Campbell & Clewell, 1999; Mann, 1994a; Sadker & Sadker, 1994).

During the elementary years, children spend their day with one teacher in the same classroom and are surrounded by the same peers with whom they have grown up. Females in lower and middle elementary school have a strong sense of self-esteem. This structure provides reliability and consistency for the student. As adolescent children ascend into puberty, they are promoted from the elementary school and are transferred to a middle school. Females begin to restrict their interests, confine their talents, and pull back on their dreams. Students may have a difficult time adjusting to new halls, different teachers, different teaching styles, and different grading systems. Many school systems move sixth graders into large middle schools, which also separates friendships. A strong peer support system can make the difference in a young female to have the courage to speak out or to risk an incorrect answer (Kleinfeld, 1999; Mann, 1994a;

Sadker & Sadker, 1994). This time period is when the self-esteem of girls often begins to plunge.

During the time that males go through puberty, they learn that they can do more through the changes in the size, growth, and strength of their bodies. On the contrary, compared to most boys, girls are now smaller, weaker, slower, not as good in sports, and no longer in control. Females move "from self-confidence to self-consciousness" (Sadker & Sadker, 1994, p. 78).

Males and females can receive two different types of education sitting in the same classroom and being taught the same lessons. It has been observed that teachers interact with males more frequently, ask them better questions, and give them more precise and helpful feedback than they give females. In some cases, teachers are not aware of the preferential treatment they give their male students or the dismissal of their female students (AAUW, 1992, 1998; Sadker & Sadker, 1994). Many teachers and parents know it is easier to take over and do something for a child than to show the child what they are supposed to do. The Sadkers' observations have shown that after repeatedly "taking over" for females, females eventually lose faith in their skill and acquiesce while boys take over. "When a teacher or a parent does for a girl instead of teaching her how to do for herself, education is turned off and independence and self-esteem are short-circuited as well" (Sadker & Sadker, p. 81).

In 1990, almost 1,100 children in Michigan were asked to write an essay about what life would be like if they experienced a gender change. Forty-two percent of the females stated they would feel more secure and less worried about what other people thought, they would be treated with more respect, and they would look forward to earning more money at better jobs. Ninety-five percent of the 565 males saw no advantage at all to being female. Only 5% of the males polled saw benefits. Sixteen percent of the males wrote about fantasy escapes from their female

bodies, with suicide being the most popular escape. The analysis showed that males took imaginative, desperate measures to get out of being female. Part of the reason appeared to be the boys' perceptions of the female body as fragile, limited, and incompetent, especially in athletics and sports. In fact, one regret that frequently emerged in fifth- and sixth- grade boys' essays of gender change was loss of the ability to play sports, which varied greatly from the opinions of females who saw being a male as access to succeed in sports (Sadker & Sadker, 1994, p. 84). These results should cause a major concern to teachers and parents.

A connection between self-esteem and academic achievement has been established, especially in math and science. Males and females who enjoy science and math consider themselves more important, like themselves more, and feel better about their schoolwork and family relationships than those who do not enjoy science and math. Gender biased attitudes are strengthened by the fact that many females attribute their success to luck, while many males attribute theirs to ability. Gender differences are also evident in confidence and attitudes. This explains how many females, although they may excel in performance in some areas, suffer from low self-confidence (AAUW, 1992; Sadker & Sadker, 1994; Sanders, 1997; Shroyer et. al, 1994).

The Educational Testing Service reported that 64% of third-grade females, compared to 66% third-grade males, evaluated themselves as being good at mathematics. By 11th grade, 48% of females and 60% of males said they were good at mathematics (Mullis & Jenkins, 1988). Males maintain this high self-concept, even when they receive low grades, while females continue to have low self-concept, even when they receive higher grades. When females lose confidence in their ability to learn math and science, they avoid these subjects. According to the AAUW (1992), in elementary school, 81% females and 84% males reported they like

mathematics. In high school, 61% females and 72% males said they liked mathematics. As a girl's feeling of competence deteriorates, so does her self-esteem. The decrease in confidence occurs first and is then followed by a drop in achievement. These gender differences emerging in adolescence are attributed to lower levels of confidence and comfort with mathematics (Hopkins et al. 1997; Sadker & Sadker, 1994; Shroyer et al. 1994).

For females, emerging into adolescence involves more than a changing body and new emotions. It is also a time when a loss of self-confidence occurs in science and math. Females also develop a critical attitude toward themselves and a feeling of inadequacy. Many females fall into patterns of low self-image, self-doubt, and self-censorship of their creative and intellectual potential. All children encounter confusion at adolescence; however, females' self-regard drops further than boys' and never catches up. According to the AAUW survey (1992), middle school is the beginning of the transition from girlhood to womanhood and, not coincidentally, the time of greatest self-esteem loss. Because females suffer through the loss of self-confidence and the lack of desire to experience new things, schools need to do their part in making the transition of adolescence a smooth one.

Parent Beliefs

Public Agenda issued many surveys of attitudes regarding education, parent attitudes toward school reform, and student attitudes about schooling. Some of the major findings suggested that parents and teachers do have positive relationships; nevertheless, teachers are dissatisfied with the overall performance of parents. Other findings included how parents and teachers supported parent involvement when parents were volunteering or helping the school; however, 72% of parents surveyed agreed that students whose parents were not involved at school "sometimes get shortchanged and fall through the cracks" (Lewis, 1999, p. 65). Many

parents were concerned about their children's success in school; however, less than one fourth said they knew a lot about how to motivate their children to learn. Teachers believed that they could not do their best because students lacked the basic upbringing and supervision. Parents and teachers agreed the most essential job for parents is raising well-behaved children who want to learn. "Many parents admitted they needed help, but very few schools acknowledged the problem as teachers and parents describe it" (Lewis, 1999, p. 65).

Epstein (1990) conducted research that focused on the integration of family and educational policies. She stated:

> All the years that children attend school, they also attend home. The simultaneous influence of schools and families on students is undeniable, but too often ignored in research and in practice. In research, social scientists who study one environment rarely give serious attention to another. Sociologists of the family rarely study how family practices affect student success in school, or how school practices affect family attitudes, interactions, and practices. Sociologists of education who study school and classroom organizations rarely examine how school practices affect home environments, or how family cultures, attitudes, and practices affect school practices and effects (p. 99).

The influence of parental beliefs on student achievement can be a powerful predictor of academic success. Ames and Archer (1987), Entwisle and Hayduk (1988), and Miller (1986) have provided evidence that suggests parents' attitudes, expectancies, and beliefs about schooling and learning guide their behavior with their children and have a causal influence on their children's developing achievement attitudes and behaviors.

Although many studies have been conducted on gender, parental involvement, and achievement, few studies have examined the impact of parental involvement on gender

differences in mathematics. Baker and Stevenson (1986) indicated that mothers with more education were more likely to intervene in school decisions about their children's course taking and that boys' mothers were more likely than girls' mothers to intervene to influence their children's placement in mathematics courses.

Adams (1998) suggested actions that parents can take to help ease gender related differences in mathematics: (a) Give praise to their male and female children, (b) Support extracurricular activities that promote gender equity and mathematical applications, (c) Acknowledge and value the use of mathematics in the home (p. 184). By addressing these suggestions, parents and educators can work together to promote gender equity in mathematics.

Student Beliefs

Studies have been conducted to examine students' beliefs and attitudes toward mathematics. McLeod (1992) assumed that positive affect might lead to positive achievement behavior. The existing research on affect in mathematics education at the elementary level suggests that most children like mathematics and that there are no significant differences in the attitudes of males and females.

Students' attitudes toward school appear to be shaped by teachers, learning environment, self-concept, peers, and parental influence (Glick, 1970; Haladyna, Olsen, & Shaughnessy, 1983). Each of these factors can have a valuable impact on elementary students. Glick (1970) and Harty, Beall, and Scharmann (1985) suggest that attitude is related to students' achievement, motivation, and interest. It has also been suggested that students in upper grades have less positive attitudes toward school when compared with students in lower grades (Berliner & Casanova, 1985; Finson & Enochs, 1987; Glick, 1970). Haladyna and Thomas (1979) examined

the attitudes of 2,845 first through eighth graders toward school and found that with increasing grade level there was a decline in attitudes toward school.

Many factors contribute to the formation of attitudes towards mathematics. Some of these include peer relationships, learning styles, previous mathematical experiences, and student self-concept. Another important factor to be considered is teachers' enthusiasm and instructional styles (Suydam, 1984). Schofield (1982) concluded that:

> Teachers and other mathematics educators generally believe that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics. Therefore, continual attention should be directed towards creating, developing, maintaining and reinforcing positive attitudes (p. 45).

Researchers have assumed that achievement is strongly related to attitudes towards school and school subjects. Some reviews on studies addressing attitudes to school subjects and achievement indicated that the relationship between attitude and achievement are not conclusive (Aiken, 1970; Wilson, 1983). Other researchers have found that the two constructs are significantly correlated (Marsh, 1989; Marsh & Yeung, 1998; Schofield, 1982).

Abu-Hilal (2000) suggested that positive attitudes towards school subjects would help in raising one's level of aspiration, while negative attitudes would lower the level of aspiration. The researcher concluded that educators and counselors should not focus on the development of positive attitudes towards school subjects by itself as a means to improve academic achievement, but to allow teachers to help students develop positive attitudes and set high goals, which in turn will result in better student achievement.

This study discovered that parents responded positively regarding math achievement. Parent responses from the survey suggested that learning mathematics would help their children

earn a living, was a necessary subject, would be used by their children in adulthood, and would be relevant to their children later in life. All of the relationships between math achievement and student attitudes were statistically significant. The relationships suggested that attitudes of fifth-grade students were related to their achievement.

Parent Involvement as a Factor Related to Mathematics Achievement

Many politicians and educational policy makers disagree on how to improve the educational process and raise educational standards; however, both liberals and conservatives agree on a central role for parents. Conservatives believe that parents should be allowed the freedom to choose schools in an educational marketplace and that their demands will then improve educational standards. Liberals argue that parents should be given a greater role in education to ensure that schools are more effective. They agreed with the conservatives who believe that parents will push for better standards for their children if they are more involved (David, 1993).

Many parents do not know enough about their child's school or teacher. According to a report from Public Agenda, a nonprofit public opinion and education research organization, only 24% of parents said they knew a lot about the qualifications of their children's teachers and only 39% knew how their children's school ranked compared to other schools in the district (Lewis, 1999, p. 64).

Epstein (1991) conducted a study that used data from 293 third- and fifth-grade students in Baltimore City who took the California Achievement Test in the fall and spring of the 1980-1981 school year. The students were in the classrooms of 14 teachers who varied in their use of techniques to involve parents in learning activities at home. The effects of parent involvement

on student achievement were examined through data collection from parents, students, and teachers over an extended period of time. The study concluded that parental involvement resulted in higher student achievement, attitudes, homework, report card grades, and aspirations. Results from the study suggested that when teachers guided involvement and interaction, more parents became involved in ways that benefited children.

Epstein (1991) observed that parents' interactions with teachers and the school were an important predictor of elementary school students' achievement. By creating school, family, and community partnerships children will begin to succeed in school and in later life. When parents, teachers, students, and others view one another as partners in education, a caring community forms around students (Epstein, 1995).

Parents' involvement may influence children's attitudes, including self-concept, which may, in turn, affect academic performance. In studying the socialization of school age boys and girls, Block (1983), found that parents are more restrictive and more nurturing with daughters but encourage sons to be free and to explore more widely outside the family. Entwisle, Alexander, and Olson (1994) noted that parents' stronger encouragement of sons to explore and take advantage of neighborhood resources contributes to the gender gap in mathematics achievement.

Kellaghan, Sloane, Alvarez, and Bloom (1993) reported that there is a positive relationship between children's academic learning and work habits of the family. In a review of over 300 studies investigating the relationship between home environments and educational outcomes, high achieving students lived in homes where there was a regular family routine and priority was given to schoolwork.

Clark (1983) found that monitoring the use of children's out-of-school time and daily activities was a positive correlate of higher student achievement. When parents monitored the

completion of homework and kept close track of students' performance in school, student grades were significantly higher than those students whose parents did not monitor closely (Clark, 1983).

Strategies have been developed at local, state, and national levels for improving parent involvement in the schools. Parental involvement has become an important element of school reform. Various types of parenting practices and behaviors have been associated with positive student outcomes, such as high expectations and aspirations, parent-teacher communication, participation in school events, and strong parent social networks (Desimone, 1999; Epstein, 1991, 1995).

The level of parent involvement was significantly related to the achievement scores in this study. However, when parent involvement was used to measure the extent it predicted math achievement the percentage of variance did not change, which indicated that parental involvement was not a strong predictor of math achievement.

Summary

Recent research has identified several important predictors of student achievement in mathematics. Socioeconomic, demographic, attitudinal, and involvement factors have been associated with math achievement in elementary school. The National Commission on Children (1991) suggested that adolescents from poor families are more likely to lack basic academic skills and to have repeated a grade. The lack of support to parents from low socioeconomic backgrounds may affect parent's support for school success.

The demographic factors analyzed in this study focused on the impact of gender, family structure, and parent's educational level on math achievement. Gender differences in

mathematics achievement has been a concern internationally since Fennema and Sherman began their studies in 1977. The controversy with Mattel Toys in 1992 emphasized a concern in the United States about male and female differences in math. In addition to gender, results have suggested that children whose single parents were involved in their academic life scored higher on mathematic achievement tests than those parents who were not involved. However, children in single-parent homes where the parent was not involved were at a higher academic risk than children from two-parent families (Schaefer, 1991).

A child's attitude towards education may be shaped by the parent's attitude toward education or parents' level of education. Coleman (1966) suggested that student achievement correlated highly with family background factors such as income, parents' educational attainment, and family structure.

Bloom (1985) and Phillips (1987) suggested that parent attitudes and their expectancies of their children have influence on their children's academic achievement. It is important to keep in mind that students' attitudes toward school appear to be shaped by teachers, learning environment, self-concept, peers, and parental influence (Glick, 1970; Haladyna, Olsen, & Shaughnessy, 1983). Glick (1970) and Harty, Beall, and Scharmann (1985) suggested that attitude is related to students' achievement, motivation, and interest.

Parental beliefs can also be powerful predictors of academic success. Epstein (1991) concluded that parental involvement resulted in higher student achievement, attitudes, homework, report card grades, and aspirations.

CHAPTER 3

RESEARCH METHODOLOGY

The purpose of this study was to determine the extent to which socioeconomic factors, demographic factors, parent and student attitudes, and parent involvement were associated with math achievement. This chapter describes the research design, population and sample, instrumentation, data collection methods, and methods of analysis used in the study.

Research Design

According to Gall, Borg, and Gall (1996), a correlational design is used to discover relationships between variables through the use of correlational statistics. In this study, a correlational research design was used to identify the socioeconomic, demographic, attitudinal, and parent involvement factors associated with math achievement in elementary school.

Population and Sample

Students in Grade 5, located in a single school system from East Tennessee, were selected as the population for this study. During January 2001, the population of 5th grade students was reported as 1,037. The appropriate sample size was estimated using the sample size formula given by Schaeffer and Mendenhall (1995). In an effort to achieve a tolerable error rate of 5%, with a 95% level of confidence, a desired sample of 285 was sought. Because it was assumed that some students or parents would not respond, students were over-sampled, with a target total of 321 students.

The school system provided a list of all 5th grade teachers representing 42 classrooms from 10 schools. A random sample was used to select the participants from 27 classrooms. An average class size of 25 was assumed. A total of 624 students and their parents from these 27 classrooms were invited to participate in this study. Of this number, 261 parent/student units responded. This yielded a return rate of 42%. Because a sample of 285 parent/student units was needed to achieve a 95% level of confidence, an additional five classrooms were selected randomly and an additional 125 parent/student units were invited to participate in this study. Of this sample, 60 (48%) parents and students responded. Of all the parents and students who responded, usable data were analyzed for 321 students and parents. This sample yielded an overall return rate of 43%. The students chosen for the study completed the Fennema-Sherman Mathematics Attitudes Scales in each of their classrooms. Achievement data using the Normal Curve Equivalent Scores (NCEs) from the math scales on the TerraNova Standardized Achievement Test were obtained for all students from the individual school records.

The parents of the students also participated in the study. Student and parent participation was on a voluntary basis. Parents answered questions pertaining to their own perceptions and attitudes toward math, their level of involvement in their child's classroom, and socioeconomic and demographic factors.

Instrumentation

Developed by Fennema and Sherman (1976, 1986), the Fennema-Sherman Mathematics Attitudes Scales were used to gather data pertaining to the attitudes students hold toward mathematics. The parent survey used the Fennema-Sherman Mathematics Attitudes Scales (1976, 1986), Epstein and Salinas' (1993) School and Family Partnerships: Questionnaires for

Teachers and Parents in Elementary and Middle Grades, and also demographic and socioeconomic questions pertaining to parents' educational level, the family's annual level of income, and family structure. Achievement scores from the TerraNova Standardized Achievement Test were used to measure student achievement in mathematics.

Fennema-Sherman Mathematics Attitudes Scales

Developed by Dr. Elizabeth Fennema and Dr. Julia Sherman (1976), the Fennema-Sherman Mathematics Attitudes Scales were used to gather data to measure the attitudes of 5th grade students toward the learning of mathematics. The attitudes scales consist of nine, domain specific, Likert-type scales measuring important attitudes related to mathematics learning. The scales can be used individually or as a total package to assess a variety of attitudes toward the learning of mathematics (Fennema & Sherman, 1976, 1986). The scales include confidence in learning mathematics; father, mother, and teacher scales measuring perceptions of attitudes toward one as a learner of mathematics; effectance motivation in mathematics; attitude toward success in mathematics; mathematics as a male domain; usefulness of mathematics; and mathematics anxiety scale. The mother and father scale were combined and labeled as a parent scale to avoid discomfort students may have had when answering questions that pertained to their mother or father specifically. For purposes of this study, six of the nine scales were used as the total survey, excluding the usefulness of mathematics scale and effectance motivation in mathematics scale (See Appendix A).

In order to establish content validity, each scale dimension was defined. Each author wrote items representing the dimension and judged the validity of the other authors' items. Items that were agreed upon as measuring an aspect of the dimension were selected with attention being given to covering the range of the dimension. Eighteen to 22 items were selected for each

scale during the initial test, with approximately half being stated positively and half negatively. The resulting 173 items were randomly distributed into one instrument (Fennema & Sherman, 1976, 1986).

The 173-item instrument was administered to 367 subjects representing Grades 9 through 12 in a middle class, suburban/rural high school. Both mathematics students and non-mathematics students served as subjects, as one purpose of the scales was to differentiate between those who elected to study math and those who did not. The data resulting from the administration of the preliminary scales were machine scored and item means, standard deviations, and correlations with the total scale scores were computed for the combined population as well as by grade, sex, and mathematics or non-mathematics groups (Fennema & Sherman, 1976, 1986).

After final selection, a total of 12 items, 6 positive and 6 negative, were chosen for each scale. Split half reliabilities were calculated for each scale. Fennema and Sherman (1976, 1986) reported the confidence in learning mathematics scale to have a reliability coefficient of .93, father scale .91, mother scale .86, teacher scale .88, attitude toward success in mathematics .87, mathematics as a male domain .87, and mathematics anxiety .89.

The scales used for this study consisted of a total eight items, four positive and four negative. Cronbach's alpha coefficient was computed for each of the six scales used in this study. Confidence in learning mathematics had a reliability coefficient of .88, parent scale .78, teacher scale .71, attitude toward success in mathematics .85, mathematics as a male domain .80, and mathematics anxiety .89.

Parent Survey

A parent survey was designed for the parents of the 5th grade students who took the Fennema-Sherman Mathematics Attitudes Scales. The survey included questions about family structure, the educational level of parents, and annual family income. The questions on the survey were measured as possible predictors of math achievement. The survey also used six questions from the usefulness of mathematics scale. The scale is one of the nine, domain-specific scales from the Fennema-Sherman Mathematics Attitudes Scales. Fennema and Sherman (1976, 1986) reported the usefulness of mathematics scale, consisting of 12 items, six positive and six negative, to have a reliability coefficient of .88. The usefulness of mathematics scale used in this study consisted of six items, three positive and three negative. Reliability analysis was conducted for the scale and the reliability coefficient was .67. A copy of the survey instrument is provided in Appendix B.

The survey also asked parents to answer questions pertaining to parent involvement. Developed by Epstein and Salinas (1993), the School and Family Partnerships: Questionnaires for Teachers and Parents in Elementary and Middle Grades was used to gather data on parent involvement. On the original instrument a seven-page teacher survey included 12 sections with 131 items of information on teacher attitudes about involvement, school program, and teacher practices to involve families. A six-page parent survey included 10 sections with 79 items of information on family attitudes about school, family practices of involvement in the child's education, school practices to inform and involve families, information desired by families about children, classes, schools, and community services, homework patterns, family background and experiences, and open-ended comments.

For purposes of this study, survey items were linked to Epstein's (1997) typologies of parent involvement. The parent survey had five questions pertaining to Epstein's six typologies. Type 1 Parent Involvement- Parenting (item a). Families must provide for the health and safety of children and maintain a home environment that encourages learning and good behavior in school. Type 2 Parent Involvement- Communication (item d). Schools must reach out to families with information about school programs and student progress. This includes the traditional phone calls, report cards, and parent conferences. Type 3 Parent Involvement-Volunteering (item b). Parents can make significant contributions to the environment and functions of a school. Type 4 Parent Involvement- Learning at Home (items c and e). With the guidance and support of teachers, family members can supervise and assist their children at home with homework assignments and other school-related activities (Epstein, 1997).

Section 3, family practices of involvement, was used in the parent survey. This section included 18 items in which parents indicated their level of participation or involvement. For purposes of this study, five items representing four of the six typologies was used. Survey items were linked to Epstein's (1997) typologies of parent involvement. The four typologies were: Type 1 Parent Involvement-Parenting (item a); Type 2 Parent Involvement-Communication (item d); Type 3 Parent Involvement-Volunteering (item b); and Type 4 Parent Involvement-Learning at Home (items c and e).

The reliability of the scale was reported in terms of internal consistency of scores on items that purport to measure the same concept. Cronbach's alpha was used because the survey included Likert-type items. The alpha reliability formula reflected the intercorrelations between the items. According to Epstein, Salinas, and Horsey (1994), Section 3 of the parent survey reported a reliability coefficient of .77 based on analyses of data collected in 1992. The research

sample that provided the data on which the scales were based included 243 teachers and 2,115 parents in 15 elementary and middle schools in Baltimore, Maryland. The schools were in economically depressed areas in the inner city (Epstein et al. 1994).

Mathematics Achievement

TerraNova assessment is a norm-referenced, as well as a criterion-referenced, test designed to measure achievement in the basic skills found in state and district curriculum. The achievement scores used in this study were the Normal Curve Equivalents (NCEs) for the Math Scales on the TerraNova Standardized Achievement Test. The mathematics portion of the TerraNova consists of number and number relations, computation and numerical estimation, operation concepts, measurement, geometry and spatial sense, data analysis, statistics, and probability, patterns, functions, algebra, problem solving and reasoning. The math computation portion consists of adding, subtracting, multiplying, and dividing whole numbers, decimals and fractions. The math composite is a single score used to express the combination, by averaging or summation, of the scores on the math and math computation tests.

NCEs are based on an equal-interval scale ranging from 1 to 99 with a mean of 50 and a standard deviation of approximately 21. Development of the TerraNova Mathematics test was aligned with the National Council of Teachers of Mathematics (NCTM) Standards. More emphasis was placed on a balance of skills, concepts, knowledge, and problem solving than on procedural and computational processes (CTB McGraw-Hill, 1997). For this study the mathematics, math computation, and math composite NCE scores were used to measure student achievement.

Procedures

Before data collection began, approval to initiate this study was obtained from the Institutional Review Board at East Tennessee State University. Permission to conduct this study was obtained from the Director of Schools in the targeted school system and the individual principals of the schools selected for the study (See Appendix C and D). Permission to use and modify the Fennema-Sherman Mathematics Attitudes Scales with fifth grade students was received from Dr. Elizabeth Fennema (See Appendix E). A teacher's cover letter (See Appendix F), parent questionnaires, and the Fennema-Sherman Mathematics Attitudes Scales were given to each teacher whose classroom was selected.

The classroom teachers sent the informed consent and parent questionnaire home to each parent and requested the completed questionnaire and informed consent be returned within one week. The parent questionnaires were coded to match the responses on the Fennema-Sherman Mathematics Attitudes Scales and student achievement scores in order to determine relationships between the family's annual level of income, demographic factors, attitudinal factors, parent involvement, and math achievement. To ensure teacher cooperation and understanding, each teacher packet was delivered personally and explained to the teacher. Parent confidentiality was assured and the privacy of students was protected.

Analysis of Data

As an initial step in the data analysis, descriptive statistics were performed to provide a background of the sample in relation to the variables being studied. The number of parents or guardians living at home, parents' educational level, and socioeconomic status were stated and the frequency and percent were provided for each variable. Attitudes parents have toward

mathematics and the level of parent involvement were also provided through descriptive statistics.

A series of t-tests were conducted to determine if there were significant gender differences in the attitudes of fifth-grade students toward mathematics and math achievement. The number of cases, means, and standard deviations were computed for males and females. The scores were compared on each of the six-attitudinal scales and three achievement scales using t-tests.

Spearman's rho was used to describe the relationship between the Fennema-Sherman Mathematics Attitudes Scales and math achievement. Each of the six-attitudinal scales was correlated to the math, computation, and composite scores of each of the participants. Spearman's rho was also used to examine the relationships between parent attitudes toward mathematics, parent involvement, and student's math achievement.

The Kruskal-Wallis Analysis of Variance Test was used to determine differences in student attitudes toward mathematics and in math achievement based on family income and parents' educational background. When significant differences were found with the Kruskal-Wallace Test, the Mann-Whitney U test was used to determine pairwise differences between the groups, and thus served as a nonparametric post hoc test.

Hierarchical multiple regression analysis was conducted to measure the extent to which socioeconomic factors, demographic factors, parent attitudes toward math, student attitudes toward math, and parent involvement predict math achievement. Each of the independent variables was measured against the dependent variables of the math, computation, and composite scores from the TerraNova Achievement Test. Stepwise regression was conducted to determine the best predictors against the dependent variables.

CHAPTER 4

RESULTS

The purpose of this study was to determine the extent to which socioeconomic factors, demographic factors, parent and student attitudes toward mathematics, and parent involvement are associated with math achievement of fifth-grade students in the Sevier County School System. The Fennema- Sherman Mathematics Attitudes Scales (1976) were used to determine student and parent attitudes toward mathematics. Students' Mathematics, Computation, and Composite NCE (Normal Curve Equivalent) scores on the TerraNova were used to measure student achievement and the Epstein (1997) typologies were used to measure parent involvement.

There were approximately 1,037 fifth grade students in the Sevier County School System during January 2001. Random sampling was used to select 27 classrooms in the Sevier County School System. A total of 624 students and their parents from these 27 classrooms were invited to participate in this study. Of this number, 261 parent/student units responded. This yielded a return rate of 42%. Because a sample of 285 parent/student units was needed to achieve a 95% level of confidence, an additional five classrooms were selected randomly and an additional 125 parent/student units were invited to participate in this study. Of this sample, 60 (48%) parents and students responded. Of all the parents and students who responded, usable data were analyzed for 321 students and parents. This sample yielded an overall return rate of 43%.

The data analysis is presented in the pages that follow as a series of responses to the research questions.

Research Question # 1: What are the socioeconomic and demographic characteristics of fifth-grade students in a rural county in East Tennessee?

Table 1 presents the descriptive statistics representing the socioeconomic and demographic characteristics of fifth-grade students in the Sevier County School System. The number of parents or guardians living at home, parents' educational level, and family's annual income level are described.

TABLE 1

FREQUENCY DISTRIBUTION OF THE NUMBER OF PARENTS OR GUARDIANS AT HOME, PARENTS' EDUCATIONAL LEVEL, AND FAMILY'S ANNUAL INCOME LEVEL

	f	%
Number of Parents or Guardians Living At Home:		
One	69	21.5
Two	249	77.6
More than two	3	.9
TOTAL	321	100.0
Parents' Educational Level:		
Some High School	28	8.7
Completed High School	78	24.3
Some College or Training	127	39.6
College Degree	88	27.4
TOTAL	321	100.0
Socioeconomic Status		
10,000-19,999	51	16.0
20,000-29,999	52	16.4
30,000-39,999	48	15.4
40,000-49,999	45	14.2
50,000 or more	121	38.1
TOTAL	318	100.0

The majority of the students in this study lived in homes in which two parents were present (77.6%). Twenty-one percent of the students lived in single parent homes. Sixty-seven

percent of the parents had engaged in some post-secondary education. Twenty-seven percent were college graduates. Over 91% of the students' parents had completed high school.

The largest number of families had incomes of $50,000 or more (38.1%), followed by those who reported $20,000-$29,999 (16.4%), and $10,000-$19,999 (16.0%). Fifty-two percent of the parents earned $40,000 or more annually, while 32.4% earned below $30,000 annually.

Research Question # 2: Are there gender differences in the attitudes fifth-grade students hold toward mathematics and mathematics achievement?

Independent groups t-tests were conducted to determine if significant gender differences occurred in the attitudes of fifth-grade students toward mathematics. Table 2 presents the t-test results for attitudes of fifth-grade students toward mathematics by gender for the sample.

TABLE 2

t-TEST FOR MEAN DIFFERENCES IN ATTITUDES OF FIFTH-GRADE STUDENTS TOWARD MATHEMATICS BY GENDER

	Males			Females				
	n	M	SD	n	M	SD	t	p
Confidence in Learning Mathematics	143	26.61	4.67	176	26.05	4.42	1.10	.27
Parent Scale	144	27.20	3.57	173	27.27	3.43	-.16	.87
Attitude Toward Success in Mathematics	138	31.97	4.24	174	32.18	4.01	-.44	.66
Teacher Scale	139	26.14	3.95	171	26.60	3.64	-1.05	.30
Mathematics as a Male Domain	136	24.22	4.40	172	26.77	3.99	-5.31	.00*
Mathematics Anxiety Scale	144	24.06	5.59	174	22.87	5.11	1.97	.05

*p<.05

Although significant differences did not occur in five of the six scales, a significant difference did occur in the Mathematics as a Male Domain Scale ($t=5.31$, $p<.01$). The Mathematics as a Male Domain Scale was the only scale that varied significantly in relation to gender. This scale is intended to measure the degree to which students see mathematics as a male, neutral, or female domain. Females scored significantly higher in this scale ($M=26.77$) than males ($M=24.22$), indicating that they were more likely than males to see mathematics as a "male domain."

Independent groups t-tests were conducted to determine if significant differences occurred in the math achievement scores of males and females. Table 3 presents the t-test results for the gender differences in math achievement.

TABLE 3

t-TEST FOR MEAN DIFFERENCES IN MATH ACHIEVEMENT OF FIFTH-GRADE STUDENTS BY GENDER

	Males			Females				
	n	M	SD	n	M	SD	t	p
TerraNova Math Score	145	62.92	21.98	175	60.79	20.80	.88	.38
TerraNova Computation	145	64.03	22.83	175	63.78	19.09	.11	.92
TerraNova Composite	145	65.13	22.78	175	63.78	19.65	.56	.57

*p<.05

As shown in Table 3, there were no statistically significant differences between the math achievement scores of males and females. Although the males had slightly higher means on the Math Score (62.92 vs. 60.79), Computation (64.03 vs. 63.78), and Composite (65.13 vs. 63.78)

scales, the differences in the means were not statistically significant, indicating that such differences could have occurred by chance.

Research Question # 3: What attitudes do parents have toward mathematics?

Table 4 presents a frequency distribution of parents' attitudes toward mathematics. As shown in Table 4, the majority of the parents answered the statements in a positive manner. When parents were asked if learning mathematics would help their child earn a living, 70.7% strongly agreed, and 29% agreed with the statement. Seventy-six percent strongly agreed that mathematics was a worthwhile and necessary subject, and 72% strongly agreed that their child would use mathematics in many ways as an adult. Nearly 75% of the parents strongly agreed that mathematics would be relevant to their children later in life. Most (94.7%) parents disagreed or strongly disagreed that mathematics would rarely be used in their child's daily life as an adult. Nearly all (99.7%) of the parents strongly disagreed that mathematics was a waste of time.

TABLE 4

FREQUENCY AND PERCENT OF PARENT RESPONSES TO THE ATTITUDES TOWARD MATHEMATICS SCALE

	f	%
Knowing mathematics will help my child earn a living.		
Strongly agree	227	70.7
Agree	93	29.0
Disagree	1	.3
Strongly disagree	0	0
TOTAL	321	100.0
Mathematics is a worthwhile and necessary subject.		
Strongly agree	244	76.0
Agree	76	23.7
Disagree	0	0
Strongly disagree	1	.3
TOTAL	321	100.0

Table 4 continued

	f	%
My child will use mathematics in many ways as an adult.		
Strongly agree	231	72.0
Agree	89	27.7
Disagree	0	0
Strongly disagree	1	.3
TOTAL	321	100.0
Mathematics is of no relevance to my child's life.		
Strongly agree	3	.9
Agree	78	24.3
Disagree	0	0
Strongly disagree	240	74.8
TOTAL	321	100.0
I see mathematics as a subject my child will rarely use in his/her daily life as an adult.		
Strongly agree	6	1.9
Agree	11	3.4
Disagree	77	24.0
Strongly disagree	227	70.7
TOTAL	321	100.0
Taking mathematics is a waste of time.		
Strongly agree	0	0
Agree	1	.3
Disagree	49	15.3
Strongly disagree	271	84.4
TOTAL	321	100.0

Research Question # 4: What level of involvement do parents maintain in the education of their children?

Parent involvement was measured using Epstein's (1997) typologies of parent involvement. The Family Practices of Involvement Questionnaire was used to measure parent involvement. Table 5 provides the number and percent of parent responses for each item on the survey.

TABLE 5

FREQUENCY AND PERCENT OF PARENT RESPONSES TO THE FAMILY PRACTICES OF INVOLVEMENT QUESTIONNAIRE

	f	%
Talk to my child about school		
Never	0	0
1-2 times	0	0
Few times	8	2.5
Many times	313	97.5
TOTAL	321	100.0
Visit my child's classroom		
Never	13	4.1
1-2 times	65	20.3
Few times	158	49.4
Many times	84	26.3
TOTAL	320	100.0
Help my child with homework		
Never	0	0
1-2 times	4	1.2
Few times	44	13.7
Many times	273	85.0
TOTAL	321	100.0
Talk with my child's teacher at school		
Never	12	3.7
1-2 times	59	18.4
Few times	146	45.5
Many times	104	32.4
TOTAL	321	100.0
Check to see that my child has done his/her homework		
Never	0	0
1-2 times	4	1.2
Few times	19	5.9
Many times	298	92.8
TOTAL	321	100.0

As shown in the table, 97.5% of the parent respondents reported that they talk to their child many times about school. Eighty-five percent reported that they help their children with

homework many times and 92.8% reported checking many times that their child has done his/her homework. In contrast, only 26% reported that they visited their children's classrooms many times during the course of the school year and 32.4% reported talking with their children's teachers at school many times.

Research Question # 5: What relationships exist between student attitudes and mathematics achievement?

The initial research question examined the relationship between student attitudes and math achievement. Spearman's rho was used to describe the relationship between the variables. Table 6 presents the correlation coefficients.

TABLE 6

RELATIONSHIPS BETWEEN STUDENT ATTITUDES TOWARD MATHEMATICS AND MATH ACHIEVEMENT SCORES

	MS	COMP	CP	CF	P	A	T	M	MAS
MS									
COMP	.73*								
CP	.93*	.91*							
CF	.46*	.48*	.50*						
P	.28*	.26*	.29*	.57*					
A	.28*	.29*	.30*	.53*	.60*				
T	.27*	.29*	.30*	.55*	.62*	.64*			
M	.26*	.18*	.23*	.36*	.43*	.48*	.52*		
MAS	.37*	.47*	.44*	.75*	.42*	.44*	.50*	.25*	

Key: MS=Math score; COMP=Computation; CP=Composite; CF=Confidence in Learning Mathematics; P=Parent Scale; A=Attitude Toward Success in Mathematics Scale; T=Teacher Scale; M=Mathematics as a Male Domain; MAS=Mathematics Anxiety Scale
*$p<.05$

As shown in Table 6, all the relationships between math achievement and attitudes were statistically significant. Confidence in Learning Mathematics was positively related to the Math Score (r_s=.46), Computation Score (r_s=.48), and Composite Score (r_s=.50).

The relationship between scores on the Parent Scale and the Math Score was significant (r_s=.28). The correlation between scores on the Parent Scale and Computation Score was significant (r_s=.26), as was the relationship between scores on Parent Scale and the Composite Score (r_s=.29).

A significant relationship existed between the Attitude Toward Success in Mathematics Scale and the Math (r_s=.28), Computation (r_s=.29), and the Composite (r_s=.30) scores.

A significant relationship existed between the scores on the Teacher Scale and Math Scores (r_s=.27), Computation Scores (r_s=.29), and Composite Scores (r_s=.30).

Scores on the Mathematics as a Male Domain Scale were significantly related to the Math Scores (r_s=.26), Computation Scores (r_s=.18), and the Composite Scores (r_s=.23).

Scores on the Mathematics Anxiety Scale were significantly related to the Math Scores (r_s=.37), Computation Scores (r_s=.47), and Composite Scores (r_s=.44).

Research Question # 6: Are there differences in student attitudes toward mathematics based on family's annual level of income?

In order to determine if there were differences in student attitudes toward mathematics based on the family's annual level of income, the Kruskal-Wallis Analysis of Variance Test was conducted. Table 7 presents the results for three of the six attitudinal scales: Confidence in Learning Mathematics, Parent Scale, and the Attitude Toward Success in Mathematics Scale based on the family's annual level of income.

The mean and standard deviations are reported for each of the three attitude scales, by income groups. The overall Kruskal-Wallis Test was used to determine whether there were overall attitude differences by family income. As shown in Table 7, a significant difference did

occur with the Confidence in Learning Mathematics Scale (X^2=18.82, p=<.01). Significant differences were also found on the Parent Scale (X^2=8.15, p=.02).

On the attitude scales where there was an overall significant Kruskal-Wallis Test, the Mann-Whitney U test was used to identify the significant pairwise differences. On both the Confidence in Learning Mathematics and Parent Scales, students from families with annual incomes of $10,000-$29,999 had significantly lower attitude scores than those who reported an income of $30,000-$49,999 and greater than $50,000.

TABLE 7

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN CONFIDENCE IN LEARNING MATHEMATICS, PARENT, AND ATTITUDE TOWARD SUCCESS IN MATHEMATICS, BY FAMILY INCOME

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Confidence in Learning Mathematics:						
$10,000-$29,999 (1)	102	24.61	4.95	18.82	.00*	1<2
$30,000-$49,999 (2)	94	26.73	4.23			1<3
Greater than $50,000 (3)	120	27.33	4.04			2<3
TOTAL	316	26.27	4.54			
Parent Scale:						
$10,000-$29,999 (1)	103	26.33	3.86	8.15	.02*	1<2
$30,000-$49,999 (2)	91	27.76	3.02			1<3
Greater than $50,000 (3)	120	27.57	3.39			2>3
TOTAL	314	27.22	3.50			
Attitude Toward Success in Mathematics:						
$10,000-$29,999 (1)	98	31.23	4.70	3.69	.16	
$30,000-$49,999 (2)	93	32.58	3.30			
Greater than $50,000 (3)	118	32.36	4.10			
TOTAL	309	32.07	4.11			

p<.05

Table 8 presents the results for three of the six attitudinal scales: Teacher Scale, Mathematics as a Male Domain, and Mathematics Anxiety Scale based on the family's annual level of income.

The mean and standard deviations are reported for each of the three attitude scales, by income groups. The overall Kruskal-Wallis Test was used to determine whether there were overall attitude differences, by family income. As shown in Table 8, a significant difference did occur with the Mathematics as a Male Domain (X^2=9.32, p=.01). A significant difference was also found on the Mathematics Anxiety Scale (X^2=17.92, p=.00).

TABLE 8

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN TEACHER, MATHEMATICS AS A MALE DOMAIN, AND MATHEMATICS ANXIETY, BY FAMILY INCOME

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Teacher Scale:						
$10,000-$29,999 (1)	101	25.79	3.90	4.51	.11	
$30,000-$49,999 (2)	89	26.54	3.51			
Greater than $50,000 (3)	118	26.70	3.81			
TOTAL	308	26.36	3.76			
Mathematics as a Male Domain:						
$10,000-$29,999 (1)	99	24.54	4.50	9.32	.01*	1<2
$30,000-$49,999 (2)	90	26.03	3.76			1<3
Greater than $50,000 (3)	116	26.22	4.52			2<3
TOTAL	305	25.62	4.36			
Mathematics Anxiety Scale:						
$10,000-$29,999 (1)	103	21.65	5.37	17.92	.00*	1<2
$30,000-$49,999 (2)	93	24.11	4.86			1<3
Greater than $50,000 (3)	119	24.28	5.40			2<3
TOTAL	315	23.37	5.36			

p<.05

On the attitude scales where there was an overall significant Kruskal-Wallis Test, the Mann-Whitney U test was used to identify pairwise differences. On the Mathematics as a Male Domain and Mathematics Anxiety Scale, students from families with annual incomes of $10,000-$29,999 had significantly lower attitude scores than those who reported an income of $30,000-$49,999 and greater than $50,000.

Research Question # 7: Are there differences in math achievement scores based on the family's annual income?

In order to determine if there were differences in math achievement scores based on family's annual income, the Kruskal-Wallis Analysis of Variance Test was conducted. Table 9 presents the results for the math, computation, and composite scores.

TABLE 9

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN MATH ACHIEVEMENT BY FAMILY INCOME

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Math Score:						
$10,000-$29,999 (1)	103	53.52	21.60	30.72	.00*	1<2
$30,000-$49,999 (2)	94	61.52	20.90			1<3
Greater than $50,000 (3)	121	69.24	18.83			2<3
TOTAL	318	61.87	21.35			
Computation Score:						
$10,000-$29,999 (1)	103	53.91	20.62	39.90	.00*	1<2
$30,000-$49,999 (2)	94	64.45	20.07			1<3
Greater than $50,000 (3)	121	72.09	18.01			2<3
TOTAL	318	63.94	20.88			
Composite Score:						
$10,000-$29,999 (1)	103	54.59	21.43	41.15	.00*	1<2
$30,000-$49,999 (2)	94	64.34	20.24			1<3
Greater than $50,000 (3)	121	73.02	17.75			2<3
TOTAL	318	64.48	21.14			

The mean and standard deviations are reported for each of the three math scores, by income group. The overall Kruskal-Wallis Test was used to determine whether there were differences in the math achievement scores, by family income. As shown in Table 9, a significant difference did occur with the Math Score (X^2=30.72, p=.00). Significant differences were also found on the Computation (X^2=39.90, p=.00), and Composite (X^2=41.15, p=.00) scores.

On the math achievement scores where there was an overall significant Kruskal-Wallis Test, the Mann-Whitney U test was used to identify pairwise differences. On each of the math achievement scales, students from families with annual incomes of $10,000-$29,999 had significantly lower achievement scores than those who reported an income of $30,000-$49,999 and greater than $50,000.

Research Question # 8: Are there differences in student attitudes toward mathematics based on parents' educational level?

In order to determine if there were differences in student attitudes toward mathematics based on parents' educational level, the Kruskal-Wallis Analysis of Variance Test was conducted. Table 10 presents the results for the Confidence in Learning Mathematics, Parent, and Attitude Toward Success in Mathematics Scale based on parents' educational level.

The mean and standard deviations are reported for each of the three attitude scales, by parents' educational level. The overall Kruskal-Wallis Test was used to determine whether there were overall attitude differences, by parents' educational level. As shown in Table 10, a significant difference did occur with the Confidence in Learning Mathematics Scale (X^2=10.67, p=.01).

The Mann-Whitney U test was used to identify the pairwise differences on the Confidence in Learning Mathematics Scale. As shown in Table 10, students from families who did not have a high school degree had significantly lower attitude scores than those who reported having a high school degree or some college and a college degree.

TABLE 10

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN CONFIDENCE IN LEARNING MATHEMATICS, PARENT, AND ATTITUDE TOWARD SUCCESS IN MATHEMATICS, BY PARENTS' EDUCATIONAL BACKGROUND

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Confidence in Learning Mathematics:						
Some High School (1)	28	24.43	4.66	10.67	.01*	1<2
Completed High School or Some College (2)	203	26.08	4.58			1<3
College Degree (3)	88	27.39	4.16			2<3
TOTAL	319	26.30	4.54			
Parent Scale:						
Some High School (1)	28	26.75	3.56	4.26	.12	
Completed High School or Some College (2)	202	27.06	3.49			
College Degree (3)	87	27.80	3.45			
TOTAL	317	27.24	3.49			
Attitude Toward Success in Mathematics:						
Some High School (1)	26	31.58	3.26	3.11	.21	
Completed High School or Some College (2)	199	32.05	4.09			
College Degree (3)	87	32.33	4.40			
TOTAL	312	32.09	4.11			

$p<.05$

Table 11 presents the results of the test for differences on the Teacher, Mathematics as a Male Domain, and Mathematics Anxiety Scales based on the parents' educational level.

The mean and standard deviations are reported for each of the three attitude scales, by parents' educational level. The Kruskal-Wallis Test was used to determine whether there were overall attitude differences, by parents' educational level. As shown in Table 11, a significant difference did occur with the Mathematics as a Male Domain Scale (X^2=8.30, p=.02) and the Mathematics Anxiety Scale (X^2=9.71, p=.01). The Mann-Whitney U test was used to identify pairwise differences. On the Mathematics as a Male Domain and Mathematics Anxiety Scales, students from homes where parents did not have a high school degree had lower scores than those who reported their parents having a high school degree or higher level of education.

TABLE 11

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN TEACHER, MATHEMATICS AS A MALE DOMAIN, AND MATHEMATICS ANXIETY, BY PARENTS' EDUCATIONAL BACKGROUND

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Teacher Scale:						
Some High School (1)	28	25.86	2.88	2.63	.27	
Completed High School or Some College (2)	197	26.28	3.86			
College Degree (3)	85	26.82	3.86			
TOTAL	310	26.39	3.78			
Mathematics as a Male Domain:						
Some High School (1)	28	25.25	3.31	8.30	.02*	1<2
Completed High School or Some College (2)	198	25.19	4.53			1<3
College Degree (3)	82	26.88	4.04			2<3
TOTAL	308	25.64	4.36			
Mathematics Anxiety Scale:						
Some High School (1)	28	21.36	4.37	9.71	.01*	1<2
Completed High School or Some College (2)	202	23.20	5.32			1<3
College Degree (3)	88	24.53	5.51			2<3
TOTAL	318	23.41	5.36			

Research Question # 9: Are there differences in mathematics achievement based on parents' educational level?

In order to determine if there were differences in math achievement based on parents' educational level, the Kruskal-Wallis Analysis of Variance Test was conducted. Table 12 presents the results for the math, computation, and composite scores as related to parents' educational level.

TABLE 12

KRUSKAL-WALLIS ANALYSIS OF VARIANCE TEST FOR DIFFERENCES IN MATH ACHIEVEMENT BY PARENTS' EDUCATIONAL BACKGROUND

	n	M	SD	X^2	p	Mann-Whitney Post Hoc Test
Math Score:						
Some High School (1)	27	51.26	24.26	21.41	.00*	1<2
Completed High School or Some College (2)	205	59.54	20.59			1<3
College Degree (3)	88	70.15	19.54			2<3
TOTAL	320	61.76	21.34			
Computation Score:						
Some High School (1)	27	53.00	20.74	15.16	.00*	1<2
Completed High School or Some College (2)	205	62.69	20.81			1<3
College Degree (3)	88	70.05	19.21			2<3
TOTAL	320	63.90	20.83			
Composite Score:						
Some High School (1)	27	53.33	22.85	19.66	.00*	1<2
Completed High School or Some College (2)	205	62.53	20.81			1<3
College Degree (3)	88	72.12	18.84			2<3
TOTAL	320	64.39	21.10			

p<.05

The mean and standard deviations are reported for each of the three math scores, by parents' educational level. The overall Kruskal-Wallis Test was used to determine whether there were overall achievement differences in the math scores, by parents' educational level. As

shown in Table 12, a significant difference did occur with the Math Score (X^2=21.41, p=.00). Significant differences were also found on the Computation Score (X^2=15.16, p=.00) and the Composite Score (X^2=19.66, p=.00).

The Mann-Whitney U test was used to identify pairwise differences on each of the three scales. The results indicate that students from homes were parents did not have a high school degree had significantly lower achievement scores than those who reported having parents who had completed a high school degree or a higher level of education.

Research Question # 10: Are there differences in student attitudes toward mathematics based on the number of parents or guardians living at home?

Table 13 presents Mann-Whitney U Test results for differences in student attitudes toward math based on the number of parents or guardians living at home. Each of the six scales from the Fennema-Sherman Mathematics Attitudes Scales is represented in the table.

The mean and standard deviations for each case were reported for the number of parents or guardians living at home based on the Fennema-Sherman Mathematics Attitudes Scales: Confidence in Learning Mathematics, Parent, Attitude Toward Success in Mathematics, Teacher, Mathematics as a Male Domain, and Mathematics Anxiety Scale.

As shown in Table 13, there were no significant differences on any of the Fennema-Sherman Mathematics Attitudes Scales based on the number of parents or guardians living at home.

TABLE 13

MANN-WHITNEY U TEST FOR DIFFERENCES IN CONFIDENCE IN LEARNING MATHEMATICS, PARENT, ATTITUDE TOWARD SUCCESS IN MATHEMATICS, TEACHER, MATHEMATICS AS A MALE DOMAIN, AND MATHEMATICS ANXIETY SCALES BASED ON THE NUMBER OF PARENTS OR GUARDIANS LIVING AT HOME

	n	M	SD	Mann-Whitney U Test (z approximation)	p
Confidence in Learning Mathematics:					
One	68	25.90	4.39	-1.02	.31
Two	251	26.41	4.58		
TOTAL	319	26.30	4.54		
Parent Scale:					
One	69	26.84	3.65	-.93	.35
Two	248	27.35	3.44		
TOTAL	317	27.24	3.49		
Attitude Toward Success in Mathematics:					
One	67	32.07	4.35	-.21	.84
Two	245	32.09	4.05		
TOTAL	312	32.09	4.11		
Teacher Scale:					
One	66	25.89	4.29	-1.23	.22
Two	244	26.53	3.63		
TOTAL	310	26.39	3.78		
Mathematics as a Male Domain:					
One	68	25.01	4.70	-1.22	.22
Two	240	25.82	4.25		
TOTAL	308	25.64	4.36		
Mathematics Anxiety Scale:					
One	69	22.28	5.45	-1.92	.06
Two	249	23.72	5.30		
TOTAL	318	23.41	5.36		

*p<.05

Research Question # 11: Are there differences in mathematics achievement based on the number of parents or guardians living at home?

Table 14 presents the Mann-Whitney U Test for differences in math achievement based on the number of parents or guardians living at home. Each of the math achievement scores is represented in the table.

TABLE 14

MANN-WHITNEY U TEST FOR DIFFERENCES IN MATH ACHIEVEMENT BASED ON THE NUMBER OF PARNETS OR GUARDIANS LIVING AT HOME

	n	M	SD	Mann-Whitney U Test (z approximation	p
Math Score:					
One	69	58.94	21.57	-1.12	.26
Two	251	62.53	21.25		
TOTAL	320	61.76	21.34		
Computation Score:					
One	69	59.28	19.93	-1.97	.05
Two	251	65.17	20.94		
TOTAL	320	63.90	20.94		
Composite Score:					
One	69	60.33	20.27	-1.84	.07
Two	251	65.51	21.23		
TOTAL	320	64.39	21.10		

*p<.05

The means and standard deviations for each math scale are shown in Table 14, by the number of parents or guardians living in the home. As shown in Table 14, there were no significant differences in math achievement, based on the number of parents or guardians living at home.

Research Question # 12: Are there relationships between parent attitudes toward mathematics, parent involvement, and student's math achievement?

Spearman's rho was used to identify the relationships between parent attitudes toward mathematics, parent involvement, and student's math achievement. The correlations are presented in Table 15.

TABLE 15

RELATIONSHIPS BETWEEN PARENT ATTITUDES TOWARD MATHEMATICS, PARENT INVOLVEMENT, AND STUDENT'S MATH ACHIEVEMENT

	Parent Involvement	Parent Attitudes Toward Mathematics	Math Score	Computation	Composite
Parent Involvement					
Parent Attitudes Toward Mathematics	.03				
Math score	.12*	.08			
Computation	.12*	.11	.73*		
Composite	.12*	.10	.93*	.91*	

*p<.05

As shown in the table, the level of parent involvement was significantly related to the Math Score (r_s=.12), Computation Score (r^s=.12), and Composite Score (r^s=.12). The level of involvement is related to achievement, although the magnitude of the observed relationships was not strong. Children whose parents were more involved tended to achieve at a higher level.

Research Question # 13: To what extent can socioeconomic factors, demographic factors, parent attitudes toward math, student attitudes toward math, and parent involvement predict math achievement?

In order to answer this research question, a hierarchical multiple regression was performed to analyze the effects of the independent variables on the dependent variable Math Score. For purposes of this study, the hierarchical multiple regression was a four-step process.

The first step tested the effect of demographic variables (gender, the number of parents or guardians living at home and the parents' educational level) on the math score. Step two tested for the effects of the demographic and socioeconomic (family's annual level of income) variables on the math score. Step three tested for the effects of the demographic, socioeconomic, and attitudinal variables on the dependent variable. The attitudinal variables consisted of the parent and student attitudes. The student attitudes were based on the six subscales of the Fennema-Sherman Mathematics Attitudes Scales: Confidence in Learning Mathematics, Parent Scale, Attitude Toward Success in Mathematics, Teacher Scale, Mathematics as a Male Domain, and Mathematics Anxiety Scale. The final step tested for the effects of the demographic, socioeconomic, attitudinal, and parent involvement variables on the dependent variable.

The results of this hierarchical linear regression analysis, with math score as the dependent variable, are shown in Table 16.

As shown in Table 16, gender, the number of parents or guardians living in the home and the parents' educational level explained 8% of the variance on the math score of the TerraNova Achievement Test. The demographic variable, parents' educational level, was significant at the .05 level (p=.00). With the addition of the socioeconomic variable (family income) the percentage of explained variance (R^2) increased to 12%. This indicated that demographic variables plus socioeconomic variables had more impact on the math score than demographic variables alone. Two independent variables were statistically significant: parents' educational level (p=.00) and family's annual level of income (p=.00). The percentage of explained variance increased to 25% with the addition of demographic, socioeconomic, and attitudinal variables.

TABLE 16

HIERARCHICAL MULTIPLE REGRESSION ANALYSIS OF THE EFFECTS OF INDEPENDENT VARIABLES ON THE MATH SCORE OF THE TERRANOVA ACHIEVEMENT TEST

	Demographic Predictors			Demographic and Socioeconomic Predictors			Demographic, Socioeconomic, and Attitudinal Predictors			Demographic, Socioeconomic, Attitudinal, and Parent Involvement Predictors		
	b	B	p	b	B	p	b	B	p	b	B	p
Demographic variables												
Gender	-1.98	-.05	.39	-1.39	-.03	.54	-2.08	-.05	.38	-2.08	-.05	.39
Parents or guardians at home	3.05	.06	.28	-1.37	-.03	.64	-1.40	-.03	.64	-1.40	-.03	.64
Parents' educational level	9.77	.26	.00	6.53	.17	.00	4.25	.12	.05	4.26	.12	.05
Socioeconomic variable												
Annual income				6.44	.25	.00	4.59	.18	.01	4.60	.18	.01
Attitudinal variables												
Parent							-.39	-.04	.43	-.39	-.04	.43
Student												
Confidence in Learning Mathematics							1.23	.27	.00	1.23	.27	.00
Parent Scale							-.35	-.06	.46	-.35	-.06	.46
Attitude Toward Success in Mathematics							.38	.08	.33	.38	.08	.33
Teacher Scale							.05	.01	.89	.05	.01	.89
Mathematics as a Male Domain							.46	.10	.15	.46	.10	.16
Mathematics Anxiety Scale							.25	.06	.43	.25	.06	.43
Involvement variable												
Parent										-.01	-.00	.98
		R^2=.08 F=8.55 p=.00			R^2=.12 F=11.08 p=.00			R^2=.25 F=8.08 p=.00			R^2=.25 F=7.38 p=.00	

The demographic, socioeconomic, and attitudinal variables had a greater impact on the math score than the demographic and socioeconomic variables alone. The family's annual level of income remained statistically significant (p=.01) and the student attitudinal variable of Confidence in Learning Mathematics was also significant (p=.00). When the parent involvement variable was included in the regression, the percentage of variance remained at 25%, indicating that the parent involvement variable had no additional effect on the math score of the TerraNova Achievement Test. The student's gender had no significant effect in any of the equations.

Stepwise regression was used to find the best set of predictors for the math score. The student attitudinal variable (Confidence in Learning Mathematics), family income, and parents' educational level were the three best predictors of the math score (R^2=.23, F=27.54, and p=.00).

Table 17 shows a hierarchical multiple regression analysis of the effects of the independent variables on the TerraNova Computation Score.

As Table 17 shows, the demographic variables accounted for 6% of the variance on the Math Computation Score on the TerraNova Achievement Test. The independent variable of parents' educational level was statistically significant (p=.00). With the addition of the socioeconomic variable, the percentage of explained variance increased to 14%. Parents' educational level was no longer significant; however, family income was statistically significant (p=.00). The percentage of explained more than doubled (32%) when attitudinal variables were added to the demographic and socioeconomic variables. Statistical significances occurred with family income (p=.00), and student attitudinal variables: Confidence in Learning Mathematics (p=.00), and Mathematics Anxiety Scale (p=.01).

TABLE 17

HIERARCHICAL MULTIPLE REGRESSION ANALYSIS OF THE EFFECTS OF INDEPENDENT VARIABLES ON THE COMPUTATION SCORE OF THE TERRANOVA ACHIEVEMENT TEST

	Demographic Predictors			Demographic and Socioeconomic Predictors			Demographic, Socioeconomic, and Attitudinal Predictors			Demographic, Socioeconomic, Attitudinal, and Parent Involvement Predictors		
	b	B	p	b	B	p	b	B	p	b	B	p
Demographic variables												
Gender	-.17	-.00	.94	.41	.01	.85	2.57	.06	.25	2.71	.06	.23
Parents or guardians at home	5.43	.11	.05	-.28	-.01	.92	-.01	.00	.99	-.08	-.00	.98
Parents' educational level	7.91	.22	.00	3.88	.11	.06	1.47	.04	.46	1.31	.04	.52
Socioeconomic variable												
Annual income				8.15	.33	.00	6.30	.25	.00	6.15	.25	.00
Attitudinal variables												
Parent							.03	.00	.94	.05	.01	.91
Student												
Confidence in Learning Mathematics							1.20	.26	.00	1.19	.26	.00
Parent Scale							-.48	-.00	.29	-.47	-.08	.29
Attitude Toward Success in Mathematics							.29	.06	.43	.29	.06	.43
Teacher Scale							.36	.07	.34	.36	.07	.35
Mathematics as a Male Domain							-.35	-.07	.24	-.37	-.08	.22
Mathematics Anxiety Scale							.76	.20	.01	.76	.20	.01
Involvement variable												
Parent										.31	.03	.61
		R^2=.06			R^2=.14			R^2=.32			R^2=.32	
		F=6.76			F=12.97			F=11.70			F=10.72	
		p=.00			p=.00			p=.00			p=.00	

The percentage of explained variance (32%) and statistical significance remained the same when the parent involvement variable was added to the regression. The student's gender had no significant effect in any of the equations.

Stepwise regression was performed for the Math Computation Score. The student attitude scale, Confidence in Learning Mathematics, family income, and the Mathematics Anxiety Scale were the three best predictors of the computation score (R^2=.31, F=42.04, and p=.00).

Table 18 provides an analysis of the effects of independent variables on the Math Composite Score. As indicated in Table 18, demographic variables accounted for 7% of the explained variance on the Math Composite Score of the TerraNova Achievement Test, with the parents' educational level (p=.00) having a statistically significant effect on the Math Composite Scores. With the addition of the socioeconomic variables, the percentage of explained variance increased to 15%. Two of the three independent variables had a statistically significant impact on the dependent variable in this model: the parents' educational level (p=.01) and family income (p=.00). When variables such as parent and student attitudinal variables were added to the regression, the percentage of explained variance increased to 31%. Family income remained significant (p=.00) and the student attitude scale (Confidence in Learning Mathematics) was also significant (p=.00). The percentage of variance did not change when the parent involvement variable was added to the regression model and the same two independent variables remained significant at the same levels (p=.00).

Stepwise regression was used to determine the best predictors for the Math Composite Score. The Confidence in Learning Mathematics Attitude Scale, family income, and the Mathematics Anxiety Scale were the three best predictors (R^2=.30, F=40.71, and p=.00).

TABLE 18

HIERARCHICAL MULTIPLE REGRESSION ANALYSIS OF THE EFFECTS OF INDEPENDENT VARIABLES ON THE COMPOSITE SCORE OF THE TERRANOVA ACHIEVEMENT TEST

	Demographic Predictors			Demographic and Socioeconomic Predictors			Demographic, Socioeconomic, and Attitudinal Predictors			Demographic, Socioeconomic, Attitudinal, and Parent Involvement Predictors		
	b	B	p	b	B	p	b	B	p	b	B	p
Demographic variables												
Gender	-1.24	-.03	.59	-.58	-.01	.79	.24	.01	.92	.31	.01	.89
Parents or guardians at home	4.65	.09	.10	-.92	-.02	.75	-.94	-.02	.74	-.97	-.02	.73
Parents' educational level	9.31	.25	.00	5.30	.14	.01	2.79	.08	.17	2.70	.07	.19
Socioeconomic variable												
Annual income				8.03	.32	.00	6.22	.25	.00	6.14	.25	.00
Attitudinal variables												
Parent							-.26	-.03	.58	-.25	-.03	.60
Student												
Confidence in Learning Mathematics							1.31	.28	.00	1.30	.28	.00
Parent Scale							-.39	-.07	.39	-.39	-.07	.39
Attitude Toward Success in Mathematics							.31	.06	.40	.32	.06	.40
Teacher Scale							.22	.04	.57	.22	.04	.57
Mathematics as a Male Domain							.06	.01	.84	.05	.01	.87
Mathematics Anxiety Scale							.53	.14	.08	.53	.14	.08
Involvement variable												
Parent										.16	.01	.79
		R^2=.07 F=8.45 p=.00			R^2=.15 F=14.01 p=.00			R^2=.31 F=11.35 p=.00			R^2=.31 F=10.37 p=.00	

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine the extent to which socioeconomic factors, demographic factors, parent and student attitudes, and parent involvement were associated with math achievement. Students in Grade 5, located in a school system from East Tennessee, were selected as the population for this study. Parents of the fifth-grade students were also included in the study. Several different analytical procedures were used to determine the extent that these variables were associated with math achievement.

Summary

The analysis centered on 13 research questions. The independent variables for this study were the Fennema-Sherman Mathematics Attitudes Scales (measuring student and parent attitudes toward mathematics), Epstein's typologies measuring parent involvement, student gender, family structure, parent's educational level, and family's annual level of income. The dependent variables included the math achievement scales from the TerraNova Achievement Test. The sample consisted of 321 students in Grade 5. The results are summarized below.

Research Question # 1: What are the socioeconomic and demographic characteristics of fifth-grade students in a rural county in East Tennessee?

The students came from households with one, two, or more than two parents or guardians living at home. A large portion of the sample lived in homes with two parents and almost a fourth of the sample lived in single-parent homes. Less than 1% of the students listed "other" as the family structure.

Research Question # 2: Are there gender differences in the attitudes fifth-grade students hold toward mathematics and mathematics achievement?

Mathematics as a Male Domain was the only attitudinal scale to suggest a gender difference among males and females. The females scored higher on this scale than the males, which indicated they were more likely than males to see mathematics as a "male domain." Fennema and Sherman (1976) suggested when mathematics is perceived to be a male domain, females may be less willing to pursue studies in this area.

Although the males scored slightly higher than females on each of the mathematics achievement tests, the scores were not significantly different, indicating that the observed differences might have been due to chance. It cannot be concluded that there are gender differences in achievement based on these results.

Research Question # 3: What attitudes do parents have toward mathematics?

Parents were asked to answer questions about their own beliefs regarding mathematics. The majority of the parents answered positively to each of the questions. Results from the parent survey suggested that learning mathematics would help their child earn a living, that mathematics was a necessary subject, and that mathematics would be used by their children in adulthood. Almost all of the parents disagreed that mathematics was a waste of time and that mathematics had no relevance to their child's life.

Research Question # 4: What level of involvement do parents maintain in the education of their children.

The majority of the parents were involved with the education of their children through conversations and working at home with their children, as opposed to being in the school or having conversations with teachers. More than three fourths of the parents talk to their children about school, help with homework, and check to see that their children's homework is complete.

Approximately one fourth of the parents visit their children's classrooms or talk with their children's teachers.

Research Question # 5: What relationships exist between student attitudes and mathematics achievement?

Relationships were found between the attitudinal scales and each of the mathematic achievement tests. These relationships suggest that attitudes of fifth-grade students are related to their achievement in math. The causal ordering of this relationship was not determined in this study, although it is important to note this clear association between attitude and performance.

The Confidence in Learning Mathematics Scale was developed to measure the confidence in one's ability to learn and to perform well on mathematical tasks. The level of confidence students have is directly related to their achievement scores. The higher level of confidence that children have, the higher the achievement scores tend to be.

The Parent Scale was developed to assess students' perceptions of their parents' attitudes toward the relevance of mathematics. Childrens' perceptions of how their parents view math was related to their achievement scores. If the children had positive perceptions of their parents' views on math, they achieved at a higher level in math.

The Attitude Toward Success in Mathematics Scale was developed to assess the motive to avoid success in mathematics. When students anticipate positive consequences as a result of their success in mathematics, they tend to have higher math achievement scores. The more positive their attitude is toward math, the better they did on the achievement scales.

The Teacher Scale was developed to assess student perceptions of how their teachers feel about them as students of mathematics. Students who perceived they had their teachers' confidence scored higher on the achievement tests than those who did not.

The Mathematics as a Male Domain Scale reflects evidence that each sex is likely to perform better on intellectual tasks that are perceived to be appropriate to their gender. Scores on this scale were significantly related to each of the achievement scales, although the observed relationships were not as high as they were in some of the other attitude/achievement relationships.

The Mathematics Anxiety Scale was used to measure feelings of anxiety or nervousness related to doing mathematics. This scale also significantly impacted the math achievement scores. Interestingly, those with higher levels of math anxiety performed better on the math achievement tests.

Research Question # 6: Are there differences in student attitudes toward mathematics based on family's annual level of income?

The findings of this study were consistent with Sanders and Peterson (1999), who stated that differences in math achievement were not biological, but the product of social and cultural factors, expectations, and confidence levels. Differences were also identified in student attitudes toward mathematics, based on the family's annual income. Students from families in higher income categories had more confidence in their ability to learn mathematics, perceived their parents as interested and encouraging, had more self-confidence, saw mathematics as a male domain, and expressed more anxiety or nervousness about math.

Research Question # 7: Are there differences in math achievement scores based on family's annual level of income?

Results suggested that students from families with incomes greater than $50,000 annually scored higher on the math, computation, and composite scores of the TerraNova Achievement Test than those students whose families earned $49,999 or less. Students from families with

incomes less than $30,000 scored lower than students with incomes in either the $30,000-49,999 or $50,000 and higher ranges.

Research Question # 8: Are there differences in student attitudes toward mathematics based on parents' educational level?

Differences were found in three of attitudinal scales based on parents' educational level. Students from families who had a college degree had higher confidence levels towards math than those who reported having a high school degree or some college. Students from families where parents had a college degree had significantly higher attitude scores on the Mathematics as a Male Domain and Mathematics Anxiety Scales; i.e., they perceived math as being more of a male oriented field and had more math anxiety.

Research Question # 9: Are there differences in mathematics achievement based on parents' educational level?

There were clear differences on the math, computation, and composite scores of the TerraNova Achievement Test, based on parents' educational level. Parents who reported having a college degree had children who scored higher on each of the three achievement tests than those parents who completed some college, high school or some high school.

Research Question # 10: Are there differences in student attitudes toward mathematics based on the number of parents or guardians living at home?

There were no differences in student attitudes toward mathematics, based on the number of parents or guardians living at home.

Research Question # 11: Are there differences in mathematics achievement based on the number of parents or guardians living at home?

There were no differences in mathematics achievement, based on the number of parents or guardians living at home.

Research Question # 12: Are there relationships between parent attitudes toward mathematics, parent involvement, and student's math achievement?

Parent involvement was related to the Math Score, Computation Score, and Composite Score. As Epstein (1991) stated, parents' interactions with teachers and the school were an important predictor of elementary school students' achievement. Children whose parents are more involved with school achieved at a higher level than those parents who are not involved. Parent attitudes were not strongly associated with students' achievement scores.

Research Question # 13: To what extent can socioeconomic factors, demographic factors, parent attitudes toward math, student attitudes toward math, and parent involvement predict mathematics achievement?

Parents' educational level, family's annual level of income, and the Confidence in Learning Mathematics Scale all had an impact on the Math Score and the Composite Score of the TerraNova Achievement Test. This is consistent with the National Commission on Children (1991), that stated that the mother's educational attainment was a significant predictor of test scores, and that adolescents from poor families were more likely to lack basic academic skills.

Parents' educational level, family's annual level of income, Confidence in Learning Mathematics Scale, and Mathematics Anxiety Scale were all directly related to the Computation Score of the TerraNova Achievement Test.

Other findings as reported in previous studies were contradictory. Dornbusch, Ritter, Leiderman, Roberts, and Fraleigh (1987) reported that adolescents in single parent and step-family households have lower grades than those in two-parent households. Milne, Myers, Rosenthal, and Ginsburg (1986) found that achievement test scores are lower for students in single-parent families, but the family structure differences in scores are statistically significant only for younger students. Fagan and Rector (2000) suggested that children of divorced parents

more frequently demonstrate a diminished learning capacity and perform more poorly than their peers from intact two-parent families in reading, spelling, and math. These findings were contradictory with the findings from this research, which did not suggest family structure had a significant impact on achievement scores. Findings from this research did correlate with a national, multi-ethnic study conducted at Cornell that found that there was no relationship between children's scores and the type of household from which they came, single or two-parent (Jet, 1999).

The results of this study also contradicted the findings of a study by McGrath and Repetti (2000), who investigated mothers' and fathers' attitudes toward their child's academic performance. Their results suggested that parents' attitudes played a central role in shaping their child's self-perception and achievement. Statistically significant, but weak, correlations were found between parent attitude and achievement, parent attitude did not emerge as a major predictor of achievement in the regression models. These findings, to some extent, did stand in contrast to the results of the McGrath and Repetti (2000) study, where parent attitude was found to play a more important role in predicting mathematics achievement. However, part of the difference might be attributed to the way the extent of involvement was measured.

Conclusions

Seven broad conclusions have been developed as a result of the data analysis and interpretation. Each of these is presented below.

Conclusion # 1: Socioeconomic factors do play a significant role in the formation of attitudes toward mathematics and mathematics achievement of fifth-graders. The results of this study suggest very clearly that socioeconomic background is a major predictor of a child's

attitude toward math. The results indicate that families who earn more money annually have children who score higher on achievement tests. Likewise, students from families where parents had completed a college education also had more positive attitudes toward math and higher levels of math achievement.

Conclusion # 2: Parents perceive their children using mathematics in their future education, other activities, and as adults. The results of the parent survey suggested that nearly all parents answered positively to the questions regarding the usefulness of mathematics and results also suggested that mathematics will play an important role in the lives of their children.

Conclusion # 3: The involvement of parents is most likely to be limited to discussion of school at home with their children, rather than involvement at the school. The majority of the parents in this study were not actively involved in the school setting. They did, however, speak to their children about school and reviewed their homework.

Conclusion # 4: The number of parents or guardians living in the home does not impact student attitudes toward math or math achievement scores. The results from this study did not suggest that there were any differences in attitude or achievement based on family structure.

Conclusion # 5: Attitudinal factors are important predictors of math achievement above and beyond the effects of demographic and socioeconomic factors. All of the attitudinal scales were significantly related to math achievement scores, whereas parents' educational level was the only demographic factor significantly related to achievement.

Conclusion # 6: Parent involvement is not as effective in predicting math achievement as are demographic, socioeconomic, and attitudinal factors. The results of this study suggested that demographic variables, economic variables, and attitudinal factors significantly impacted each of the math achievement scores.

Conclusion # 7: Student confidence is a major predictor of math achievement. Confidence in learning mathematics was a continuous predictor of math achievement in all analyses conducted in this study.

Recommendations for Practice

This study added considerable support to basic theories that have been suggested by Fennema and Sherman (1976, 1986). As a result, the following recommendations were made to create an awareness of the value that student confidence and self-esteem play in the achievement of mathematics.

Schools have an opportunity to improve communication by providing a school-wide communication plan. This plan should let parents know how their children are progressing in the classroom. By providing parents with written and visual information pertaining to the school and how the school is doing all that can be done to enhance student performance, students, parents, and teachers may reap significant benefits and work more closely together.

In order to increase parent awareness, schools should make parent participation a school-wide priority through programs that already exist within the school or by initiating new ones, such as parent education programs. It is the responsibility of the school to provide parents with information and to communicate the importance of the parents' own educational development in helping their children achieve. Perhaps instructional sessions could be offered for parents that help them develop the math skills needed to work with their children at home. In addition to information sessions regarding math achievement, it should be the responsibility of the school to provide information to parents on how to further their own education through GED programs, college degrees, or graduate studies.

Administrators, teachers, and other educational professionals should conduct studies that focus on the attitudes of students toward math in order to improve the learning of mathematics within schools. Since self-confidence was found to be an important predictor in this study, developing school-wide programs to build and enhance self-esteem and confidence within all students could prove beneficial. School-wide programs should strive to build positive attitudes toward math in all students. These programs should begin at the primary level and continue throughout the school career, producing positive results in the long run.

It would also be beneficial to administrators, teachers, and other educational professionals to develop programs that would help females to understand that mathematics is not dominated by males. Since the Mathematics as a Male Domain Scale was the only attitudinal scale to suggest a gender difference, females need to understand and see math as a domain for both sexes.

Recommendations for Further Research

The following recommendations offered are areas in which further research is needed to explicate the relationships between socioeconomic factors, demographic factors, parent, and student attitudes, and parent involvement on math achievement.

Future replications of this study would benefit from increasing the population size and expanding the study to other counties, which would provide a more diverse target population in terms of demographic and socioeconomic status. It would also be helpful to increase the sample size within the county or in additional counties to decrease the tolerable error rate and increase the level of confidence.

A researcher can conduct replication studies by expanding the population to additional grade levels, rather than at one grade level, to provide more in-depth results. Another idea for a replication study would be to examine predictors of student achievement rather than math achievement or to conduct a study at the primary, middle, or high school level to examine predictors of math achievement.

Researchers might consider using a similar model that also includes teachers' attitudes toward mathematics in addition to the attitudes of students and parents. It is quite possible that the lack of a strong correlation between parent involvement and student achievement may increase if teachers' attitudes were considered. A suggestion to provide more depth to the parent survey is to increase the number of questions, which would include all six of Epstein's typologies pertaining to parent involvement.

Researchers should take the time to encourage schools to communicate with parents that parent involvement could be a strong predictor of student's math achievement. It could prove to be beneficial to explain to parents various ways they can become involved in school and provide specific strategies as to what they can do to help their children, which may involve helping with homework, volunteering in the classroom, or accompanying teachers on educational field trips.

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APPENDICES

Appendix A
Fennema-Sherman Mathematics Attitudes Scale

On the following pages is a series of statements. There are no correct answers for these statements. They have been set up in a way which permits you to indicate the extent to which you agree or disagree with the ideas expressed. **This is not a test and will not affect your math grade.** Your answers will be kept confidential. Neither your teacher nor your parents will know your responses.

Please read the statement and circle one answer per statement. Be sure to answer every statement.

FENNEMA-SHERMAN MATHEMATICS ATTITUDES SCALE

1. Generally I have felt secure about attempting mathematics.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

2. I am sure that I can learn mathematics.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

3. I can get good grades in mathematics.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

4. I have a lot of self-confidence when it comes to math.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

5. I'm no good in math.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

6. I'm not the type to do well in math.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

7. Most subjects I can handle O.K., but I have a knack for flubbing up math.

   Strongly agree *Agree* *Disagree* *Strongly disagree*

8. Math has been my worst subject.

Strongly agree *Agree* *Disagree* *Strongly disagree*

9. My parents think I'm the kind of person who could do well in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

10. My parents think I could be good in math.

Strongly agree *Agree* *Disagree* *Strongly disagree*

11. My parents have always been interested in my progress in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

12. My parents have strongly encouraged me to do well in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

13. My parents think that math is one of the most important subjects I have studied.

Strongly agree *Agree* *Disagree* *Strongly disagree*

14. As long as I have passed, my parents haven't cared how I have done in math.

Strongly agree *Agree* *Disagree* *Strongly disagree*

15. My parents have shown no interest in whether I do well in math or not.

Strongly agree *Agree* *Disagree* *Strongly disagree*

16. My parents hate to do math.

Strongly agree *Agree* *Disagree* *Strongly disagree*

17. It would make me happy to be recognized as an excellent student in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

18. I'd be proud to be the outstanding student in math.

Strongly agree *Agree* *Disagree* *Strongly disagree*

19. I'd be happy to get top grades in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

20. Being regarded as smart in mathematics would be a great thing.

Strongly agree *Agree* *Disagree* *Strongly disagree*

21. People would think I was some kind of nerd if I got A's in math.

S*trongly agree* *Agree* *Disagree* *Strongly disagree*

22. If I had good grades in math, I would try to hide it.

Strongly agree *Agree* *Disagree* *Strongly disagree*

23. It would make people like me less if I were a really good math student.

Strongly agree *Agree* *Disagree* *Strongly disagree*

24. I don't like people to think I'm smart in math.

Strongly agree *Agree* *Disagree* *Strongly disagree*

25. My teachers have encouraged me to study more mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

26. My teachers think I'm the kind of person who could do well in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

27. Math teachers have made me feel I have the ability to do well in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

28. My math teachers have been interested in my progress in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

29. When it comes to anything serious I have felt ignored when talking to math teachers.

Strongly agree *Agree* *Disagree* *Strongly disagree*

30. I have found it hard to win the respect of math teachers.

Strongly agree *Agree* *Disagree* *Strongly disagree*

31. My teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

32. I have had a hard time getting teachers to talk seriously with me about mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

33. Females are as good as males in geometry.

Strongly agree *Agree* *Disagree* *Strongly disagree*

34. Studying mathematics is just as appropriate for women as for men.

Strongly agree *Agree* *Disagree* *Strongly disagree*

35. Girls can do just as well as boys in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

36. Males are not naturally better than females in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

37. It's hard to believe a female could be a genius in mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

38. I would have more faith in the answer for a math problem solved by a man than a woman.

Strongly agree *Agree* *Disagree* *Strongly disagree*

39. Girls who enjoy studying math are a bit peculiar.

Strongly agree *Agree* *Disagree* *Strongly disagree*

40. I would expect a woman mathematician to be a masculine type of person.

Strongly agree *Agree* *Disagree* *Strongly disagree*

41. Math doesn't scare me at all.

Strongly agree *Agree* *Disagree* *Strongly disagree*

42. I haven't usually worried about being able to solve math problems.

Strongly agree *Agree* *Disagree* *Strongly disagree*

43. I almost never have gotten nervous during a math test.

Strongly agree *Agree* *Disagree* *Strongly disagree*

44. I usually have been at ease in math class.

Strongly agree *Agree* *Disagree* *Strongly disagree*

45. Mathematics usually makes me feel uncomfortable.

Strongly agree *Agree* *Disagree* *Strongly disagree*

46. I get a sinking feeling when I think of trying hard math problems.

Strongly agree *Agree* *Disagree* *Strongly disagree*

47. My mind goes blank and I am unable to think clearly when working mathematics.

Strongly agree *Agree* *Disagree* *Strongly disagree*

48. A math test would scare me.

Strongly agree *Agree* *Disagree* *Strongly disagree*

Appendix B

PARENT SURVEY

Please check one answer for the following questions.

1. How many parents/guardians of this child live at your home? (Check one)
_____ One
_____ Two
_____ Other (Specify_____)

2. What is your highest level of education? (Check one)
_____ Some high school
_____ Completed high school
_____ Some college or training
_____ College degree

3. Which best describes your family's annual level of income? (Check one)
_____10,000-19,999
_____20,000-29,999
_____30,000-39,999
_____40,000-49,999
_____50,000 or more

Please read the statement and circle one answer per statement.

4. Knowing mathematics will help my child earn a living.
Strongly agree Agree Disagree Strongly disagree

5. Mathematics is a worthwhile and necessary subject.
Strongly agree Agree Disagree Strongly disagree

6. My child will use mathematics in many ways as an adult.
Strongly agree Agree Disagree Strongly disagree

7. Mathematics is of no relevance to my child's life.
Strongly agree Agree Disagree Strongly disagree

8. I see mathematics as a subject my child will rarely use in his/her daily life as an adult.
Strongly agree Agree Disagree Strongly disagree

9. Taking mathematics is a waste of time.
Strongly agree Agree Disagree Strongly disagree

Please identify which of the following you do in an average school year with your child at school. Please circle one choice for each item.

NEVER	means you do not do this
1-2 TIMES	means you do this one or two times per year
A FEW TIMES	means you do this a few times during the year
MANY TIMES	means you have done this many times

a. Talk to my child about school
Never 1-2 times Few times Many times

b. Visit my child's classroom
Never 1-2 times Few times Many times

c. Help my child with homework
Never 1-2 times Few times Many times

d. Talk with my child's teacher at school
Never 1-2 times Few times Many times

e. Check to see that my child has done his/her homework
Never 1-2 times Few times Many times

PLEASE HAVE YOUR CHILD RETURN THIS TO THE TEACHER TOMORROW OR AS SOON AS POSSIBLE.

THANK YOU VERY MUCH FOR YOUR HELP!

Appendix C

Director of Schools Approval

Jennifer White
Xxxx xxxxx xxxxxx
Xxx xxxx xxxx
Xxxxx, TN xxxxx

December 19, 2000

Xxxxxx xxxxxx
Director of Schools
Xxx xxxxx xxxx
Xxxx, TN xxxxx

Dear Xxxxxx:

As a student at East Tennessee State University, I am currently involved in my dissertation phase of the Educational Leadership and Policy Analysis doctoral program. My dissertation will focus on various socioeconomic factors that predict math achievement among students located in Xxxx County.

I would like your permission to survey fifth-grade students and their parents within your school system. Teachers will be asked to administer the Fennema-Sherman Mathematics Attitudes Scales developed by Fennema and Sherman (1976, 1986). The instrument was designed to measure attitudes toward the learning of mathematics by females and males. Parents of these students will be asked to complete a brief survey indicating their educational experience, number of parents living in the home, and the family's annual income. Parents will not be asked to sign the survey or identify their child's name in any way.

I am also seeking permission to utilize non-identifiable scores on the 1999-2000 TerraNova from the individual schools chosen. The scores and surveys will be assigned a random number to prevent the identification of any student or parent.

In preparation for the study, I plan to request permission to conduct my study from each principal and discuss the appropriate means of survey distribution. Distribution and collection of data will be conducted in a manner as to limit the disruption of normal school activities.

Thank you for your cooperation.

Sincerely,

Jennifer N. White

Appendix D

Principal Approval

Jennifer N. White
Xxx xxxx xxxxxx
Xxxxxxx, TN xxxxx

December 20, 2000

Xx. Xxxxx Xxxxxx
xxxxxxx xxxxx xxxxx
xxxx xxxx xxxxxx
Xxxx, TN xxxxx

Dear Xx. Xxxxxx:

As a student at East Tennessee State University, I am currently involved in my dissertation phase of the Educational Leadership and Policy Analysis doctoral program. My dissertation will focus on various socioeconomic factors that predict math achievement among students located in Xxxx County.

I would like your permission to survey fifth-grade students and their parents within your school. Teachers will be asked to administer the Fennema-Sherman Mathematics Attitude Scale developed by Fennema and Sherman (1976, 1986). The instrument was designed to measure attitudes toward the learning of mathematics by females and males. Parents of these students will be asked to complete a brief survey indicating their educational experience, number of parents living in the home, and the family's annual income. Parents will not be asked to sign the survey or identify their child's name in any way.

I am also seeking permission to utilize non-identifiable scores on the 1999-2000 Terra Nova from your school. The scores and surveys will be assigned a random number to prevent the identification of any student or parent.

In preparation for the study, I plan to discuss the appropriate means of survey distribution with you. Distribution and collection of data will be conducted in a manner as to limit the disruption of normal school activities.

Thank you for your cooperation.

Sincerely,

Jennifer N. White

Appendix E

Dr. Elizabeth Fennema's Approval

Re: Permission of Fennema-Sherman Tests
Date: 5/25/00 12:41:37 AM
From: (Elizabeth Fennema)
To: Jennifer White

Hi Jennifer. The email of the person you can get information about the Fennema-Sherman scales is: cherylew@soemadison.wisc.edu You have my permission to use the scales in your research and modify them as needed. Just be sure you reference them accurately. Elizabeth Fennema At 02:14 PM 5/24/00

Appendix F

Teacher Cover Letter

Dear Teachers,

Your classroom has been randomly chosen to help in a study that I am conducting. I know you are very busy at this time of year; however, I would appreciate your help at this time.

There are several tasks that I am asking you to do:

1. Please send home a parent packet with each of your students. There are six pages in this packet. Please ask that the students bring the packet back to school ASAP. The parent(s) and student will need to sign the form along with answering several survey questions.
2. When the child brings back the survey (signed), you may administer the Fennema-Sherman Mathematics Attitude Scale. (The student must have parent permission to participate in this study.) It will probably be easier to administer the survey as a class after all parent packets are returned.

All surveys are coded to identify the student and parent surveys for the purpose of matching student achievement scores. In order to properly match each parent and student survey with achievement scores, I need you to hand out the surveys in alphabetical order by using your grade book or class list. The number on the surveys should correspond with your grade book. For example, if Susan Adams was the first student on your class roster, Susan Adams should be given the parent and student survey that have the number one on the last page.

If you have any questions, please do not hesitate to call me at home, xxx-xxxx or at work, xxx-xxxx.

Thank you so much for your help!

Jennifer White

VITA

Jennifer N. White

Personal Data:	Date of Birth: December 23, 1971 Place of Birth: Tampa, Florida
Education:	Public Schools, Tampa, Florida St. Andrews Presbyterian College, Laurinburg, North Carolina; Elementary Education, B.A. 1993 Lincoln Memorial University, Harrogate, Tennessee; Curriculum and Instruction, M.S. 1997 Lincoln Memorial University, Harrogate, Tennessee; Administration and Supervision, Ed.S. 1998 East Tennessee State University, Johnson City, Tennessee; Educational Leadership and Policy Analysis, Ed.D., 2001
Professional Experience:	Associate Teacher, The Jewish Day School of Charlotte, Charlotte, North Carolina, 1994-1995 Teacher, Sevierville Intermediate School, Sevierville, Tennessee, 1995-2000 Vice-Principal, Sevierville Intermediate School, Sevierville, Tennessee, 2000-Present
Honors and Awards:	2000 Teacher of the Year, Sevierville Intermediate School, Sevierville, Tennessee Phi Kappa Phi, East Tennessee State University, Johnson City, Tennessee