Math Attitudes of Gifted Students: A Focus on Gifted Girls in the Elementary Grades

Rosalie Marie Martin

Dissertation submitted to the faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

Doctor of Education

in

Educational Leadership and Policy Studies

Travis Twiford, Chair

Jean Crockett

Steve Janosik

Robert Richards

Richard Salmon

November 13, 2002

Virginia Beach, Virginia

Keywords: Mathematics, Attitude, Gifted, Social Learning, Environment

Math Attitudes of Gifted Students: A Focus on Gifted Girls in the Elementary Grades

Rosalie Marie Martin

Travis Twiford, Chair

(Abstract)

This study explored the math attitudes of gifted students in grades three, four, five, and six participating in an accelerated math program with a focus on gifted girls in the elementary grades. Eight of the nine domains of the Fennema-Sherman Mathematics Attitudes Scale (MAS) were used to survey the math attitudes of 267 gifted boys and girls, in grades three through six. The domains explored the math attitudes of students within the following areas; attitude towards success, mother's attitude, father's attitude, anxiety, motivation, usefulness, teacher's attitude, and confidence. This study includes research involving gifted education; math attitudes, and educational applications of Bandura's social learning theory.

Survey responses were used to compile descriptive and inferential statistics. Using the Statistical Package for the Social Sciences (SPSS) and a predetermined alpha level of .05, a multivariate analysis of variance (MANOVA) compared the groups within the domain clusters. Data analysis yielded two significant main effects in anxiety (.002) and motivation (.008). Anxiety emerged as the most significant finding of the study. Girls revealed more negative math attitudes compared to the boys at all grade levels. Interaction in motivation between fourth and sixth grade and fifth and sixth grade were significant at the.05 level.

The results of this study may be used as a vehicle or catalyst for the implementation of a school or district wide training program for teachers of gifted students. These results could be used to spawn discussions with guidance counselors and others investigating the emotional and academic implications of accelerated math programs.

Dedication

This work is dedicated to my family, especially my husband, Bob.

Your love, support, and faith will always inspire me. I thank God for each of you and for His continued blessings in our lives.

Acknowledgements

Confidence, encouragement, faith, and inspiration are just some of the gifts and blessings bestowed on me throughout this journey. As I compose this section, I am humbled and grateful to those of you that supported and motivated me. I grew protected in the safety of your shadow while you sheltered me from potentially debilitating discouragement. Your emotional embrace kept me centered and focused. You taught me to open my heart and my eyes to others along the way, witnessed my transformation, and were there to celebrate the successes.

Throughout any journey you rely on those close to you for sustenance, assistance, comfort, and encouragement. To all of my committee members, professors, and classmates, thank you for your support, guidance, insight, and friendship. I would like to especially pay tribute to my committee for your help and guidance. Dr. Twiford, you inspire me. As my chair, you masterfully conducted me through a symphony of chaos. Instinctually, you knew when to gently nudge me, when I required encouragement, and when to put me back on track. I am so grateful for your insight, expertise, and advice. You are the professional I aspire to be. To my other committee members; Dr. Crockett, Dr. Janosik, and Dr. Salmon, your standards for excellence motivated me to challenge myself. I learned to value precision, embrace clarity, and reflect on my beliefs. Dr. Richards, you introduced and encouraged me to pursue the program, were confident in my abilities to succeed, and saw me through to the end, thank you. To Mary Yakimowski, you taught me so much about research and prepared me so well for the journey. I want you to know how thankful I am for your advice, contacts, and expertise.

Every once in awhile we are fortunate enough for our paths to cross with people who make significant impacts on our lives, who catch a glimpse of something in us that we do not recognize in ourselves. They nurture and encourage us to push beyond our self-imposed limits,

rejoicing with us as we experience the possibilities around the corner. There are two individuals I want to recognize. First, I want to acknowledge my friend Jane, who has unconditionally supported, helped and encouraged me along the way. You are the best. Also, I would like to thank Ed Holler. Through his leadership, in the dual role of mentor and friend, he recognized something in me and prompted this journey. I hope you both know how much I admire you and appreciate your faith in me.

As a little girl, I can remember my parents (Robert and Rosalie White), emphasizing the importance of an education. We would dream about the endless possibilities that an education could provide. They maintained a fervent commitment to excellence and encouraged me to reach a little further. Yet, I always knew that I was not alone. Their strong arms were always extended; ready to catch me when I stumbled. It was important to achieve personal milestones with a sense of compassion and sensitivity to others. I was raised to make the world a better place, demonstrate kindness toward others, and treat each endeavor as if it was the most important thing I would ever encounter and subsequently accomplish. My parents taught through example, with an unwavering faith in God, commitment to family, and encouraged this dream to become a reality. This is for you mom and dad.

Through your love, example and encouragement, I learned to embrace life with honest, hard work. I remember you telling me, “The decisions I would regret most are the ones I would let other people make for me”. That advice was a lifelong lesson that I never learned in a textbook and still live by today. I am so proud of you and honored to be your daughter. You are my inspiration and my heroes. I am reaching, dreaming, and still becoming the woman you tenderly cradled as a child.

To the rest of my family (Teri, Bob, Trudy, Stacie, their spouses, and children); our pursuit for advanced degrees has come to an end for me. You have each been significant role models, contributing much to my success. I am proud of your personal and professional achievements. However, what I treasure most is our time together, the laughter, and the closeness that we share. I thank God for the gift of family and have always felt your prayers on my behalf. My admiration, love, and respect for each of you are only surpassed by our collective love for each other.

Finally, I want to thank my husband, Bob. Each day I love you more and cherish spending time with you more than anything else. Your unconditional love has transformed me. I appreciate your endless sacrifices; the working weekends, planning our wedding around the class schedule, enjoying many bowls of cereal for dinner without complaining, and especially for holding me close. The reassurance of your tender arms kept my spirit alive. I want the world to know that God answered my prayers when he brought you into my life.

With every ending there's a new beginning (no Dad, I am not going back to school). To those of you reading this wondering if you could do this, you can. In the words of one of the smartest men I know, my dad, "You will only regret what you never try".

Table of Contents

Abstract………………………………………………………………………………. ii

List of Tables………………………………………………………………………… ix

List of Figures……………………………………………………………………….. xi

Chapter I The Problem and Its Context

Problem Statement……………………………………………………………. 3

Research Questions……………………………………………………………. 6

Definitions………………………….…………………………………………. 7

Social Learning Theory………………………………………………………. 9

Limitations/Delimitations ……………………………………….……………. 12

Conceptual Model ………………………………………….…………………. 13

Significance of the Study……………………………………………………… 14

Chapter II Review of the Literature

Historical Perspective…………………………………………………………. 16

Virginia Plan for the Gifted……………………………….…………..……..… 17

Local Plan for the Gifted…………………………………………..………. 20

Gifted Learners…………………………………………………….…………..… 22

Attitudes in Mathematics……………………………………………………… 28

Social Learning Theory…………………………………………………….….. 44

Summary………………………………………………………………………. 47

Chapter III Methodology

Population…………………………………………………………………..…. 51

Instrumentation……………………………………………………………………….. 54

Research Design…..……………………………………………………….……….….. 63

Conclusion………………………………………………………………………. 64

Chapter IV Results

Descriptive Analysis ……………………………………………………………..…. 68

Domain Analysis ……………………………………………………………..… 71

Inferential Analysis ………………………………………………………………….. 84

Multivariate Analysis of Variance ………………………………………….……..…. 84

Summary ………………………………………………………………………….. 95

Chapter V Conclusions, Discussions, Implications, and Recommendations

Discussion ………………………………………………………………………. 101

Implications for Practice …………………………………………………………….. 106

Recommendations for Further Study ……………………………………………..... 106

Summary…………………………………………………………………………. 107

References…………………………………………………………………………..…. 108

Appendices

A. Student Directions……………………………………………………….…….…. 123

B. Fennema- Sherman Mathematics Attitudes Scales…………………………....…. 124

C. Scoring Forms…………………………………………………………..……….. 128

D. Consent Forms……………………………………………………….….……….. 131

E IRB approvals……………………………………………………………………. 132

F Vita………………………………………………………………………………. 134

List of Tables

Table 1	Domains of the Fennema-Sherman Mathematics Attitudes Scales……..	7
Table 2	Components of Bandura’s Social Learning Theory…………..………..	9
Table 3	The effect of task strategies………………………………………………	11
Table 4	Virginia Department of Education activities for gifted education……….	19
Table 5	Local five year goal plan for gifted education ……………...…………...	21
Table 6	Local program offerings for gifted education……………………………	23
Table 7	Attributes of appropriate instructional settings………………………….	27
Table 8	Posttest scores of experimental and control groups……………………..	31
Table 9	Research review of attitudes in mathematics…………………………….	32
Table 10	Social learning theorists and theoretical constructs……………………..	45
Table 11	Literature summary of theory……………………………………………	46
Table 12	Student demographic data …………………...………………...…….	53
Table 13	Sample used for item selection………………………………………..	55
Table 14	Reported means and standard deviations on the MAS ………………..….	56
Table 15	MAS sample: F values of grade and sex analyses of variance ………….	57
Table 16	MAS split-half reliabilities ………………………………………………	58
Table 17	Correlations among MAS ……………………………………………….	60
Table 18	Results of principal components factor analysis…………………………	62
Table 19	Grade level summary data ……………………………………………….	68
Table 20	Means and standard deviations for domain responses ………………….	69
Table 21	Grade level domain scores ………………………………………………	70
Table 22	Grade level means and standard deviations …………………………….	73

Table 23 Grade level domain means and overall attitude scores …………………. 74

Table 24 Multivariate tests ……………………………………………………….. 84

Table 25 Levene's test of equality of error variances …………………….……. 85

Table 26 Tests of between-subjects effects ……………………………..……. 87

Table 27 Post hoc- Bonferroni ……………………………………………………. 89

List of Figures

Figure 1	Domains of math attitudes………………………………………….….….	13
Figure 2	Characteristics of gifted girls…………………………………….….….	25
Figure 3	Grade level means for the most negative responses……………….….	71
Figure 4	Reported mean totals for surveyed population………………………….	72
Figure 5	Graphic depiction of mean scores for attitude…………………………..	75
Figure 6	Graphic depiction of mean scores for mother's attitude………………..	76
Figure 7	Graphic depiction of mean scores for father's attitude………………….	77
Figure 8	Graphic depiction of mean scores for anxiety………………………..….	78
Figure 9	Graphic depiction of mean scores for motivation……………………….	79
Figure 10	Graphic depiction of mean scores for usefulness…………………..….	80
Figure 11	Graphic depiction of mean scores for teacher's attitude………………..	81
Figure 12	Graphic depiction of mean scores for confidence……………………….	82
Figure 13	Summary means for all domains………………………………………..	83

Chapter I

The Problem

“All of us do not have equal talent, but all of us should have an equal opportunity to develop our talent”. John F. Kennedy’s words over 30 years ago echo the passion of researchers committed to gifted education today. Equal opportunity in education has not always been readily available or supported. In earlier times, girls did not attend school because people presumed they could not grasp abstract concepts. In some eras, girls who demonstrated unusual capabilities, were feared as witches and put to death. In 584 AD, a debate declared that women were human. Sixty-three clergymen debated the question at great length and voted. By one vote, women were declared human (Bowman, 1983). In sharp contrast to our ancestors, contemporary children exhibiting extraordinary capabilities are identified gifted. Leta Stetter Hollingworth, a Nebraska farm girl born in 1886 made it her life's work as an educator, psychologist, researcher, and curriculum developer to focus attention on gifted children and provide them with opportunities to develop their talents.

Study of gifted females has only recently been given more attention. The generalized study of giftedness began with Sir Francis Galton, whose 1869 work examined individual differences and mental measurements. He furnished scientific proof of the prejudices that existed during his time. He invented a mental test, assessed over 9,000 participants, and reported men outperformed women on every dimension (Pearson, 1924). In 1879, LeBon, a famous social psychologist claimed women had brains the size of gorillas and were an inferior form of human evolution (Goud, 1879). Charles Darwin (1871) encouraged the inferior perception of women by emphasizing his view of males as advanced on the evolutionary scale. Lewis Terman (1926) conducted a large study of rapid learners called, “Terman's Termites”. He studied over 1,500 men and women and discovered characteristics that he used to identify “rapid learners”. Terman studied and analyzed data for a group of students over their lifetime, whereas Leta Hollingworth simultaneously studied and developed curriculum for gifted students. She believed that acceleration in homogenous groups provided an appropriate instructional program for gifted children. Her instructional beliefs exist in programs for gifted students today.

As a champion for gifted females, Leta Hollingworth earned her place next to Terman and Galton. Determined to dispel myths regarding women, she argued that, “eminence and superior mental abilities are not identical” (Hollingworth, 1926). She persuaded the New York City Board of Education to establish the Speyer School in Manhattan as a laboratory school for exceptional children. Admired for her pioneering efforts in gifted education, Hollingworth taught the first courses on the nature and needs of the gifted. She authored the first major textbook in the field of gifted education; conducted dozens of significant studies with gifted children, founded the celebrated Speyer School, and developed curriculum and counseling pedagogical techniques that are in use today.

Hollingworth's vision of how gifted children should be educated became the foundation of today’s theories. VanTassel-Baska, Reis, Renzulli, Callahan, Silverman, Roeper, Sternberg, and others have made it their life's work to educate society on gifted education issues. Research contributions include information relative to the identification of gifted learners, theories of giftedness, appropriate curriculum models, and gender differences. Studies in self-efficacy, math anxiety, and achievement of older students are prevalent in the literature (Ames, 1984; Reis 1995). Researchers, educators, and others interested in the needs of gifted students have a plethora of resources available to them, including journals e.g., (Gifted Child Quarterly), research centers National Center for Gifted Children (NCGC), and opportunity for personal contacts (M. Piechowski, personal communication June 27, 2000) available to them.

Given the current social and economic context, today's gifted girl will enter the work world if not out of choice, but economic necessity. She will do so in a world of uncertainties and a social context that is non-traditional (Seeley, 1987). Some doors will be open; others closed (Betz & Hackett, 1983). If we hope to open the career pipeline for gifted women, it is prudent to address their needs and gifts as children. Gifted girls constitute America's largest group of gifted underachievers (Reis, 1989). An analysis of literature yielded that by the fourth grade, gifted girls begin to lose confidence, decrease effort, and consequently, reduce their expectations (Bell, 1989). Attitudes, perceived competence, cultural stereotyping, and the lack of appropriate models contribute to the problem (Meyer & Fennema, 1990).

Problem Statement

Haladyna, Shaughnessy, & Shaughnessy (1983) encouraged researchers to determine the underlying causes of math attitudes. This study explores the math attitudes of elementary age gifted boys and girls who attend a full time center for gifted students and who are currently participating in an accelerated math program. It examines the math attitudes of third, fourth, fifth, and sixth grade gifted students using eight domains of the Fennema-Sherman Math Attitudes Scales. Framed within Bandura's social learning theory, the study is grounded in gifted education research from VanTassel-Baska, Reis, Callahan and others. The MAS measure important domain specific attitudes related to the learning of mathematics and cognitive performance of girls (Fennema & Peterson, 1986). The domains examined in the study include; attitude towards success, mother’s attitude, father’s attitude, anxiety, motivation, usefulness, teacher’s attitude, and confidence.

Researchers studying the psychology of women in the 1970s suggested that female intellectual development may be adversely affected when inconsistencies exist between intellectual excellence and traditional female sex-role expectations (Horner, 1972; Stein & Bailey, 1973). These expectations often interfere with the mathematical understanding that is a critical filter for entrance into careers (Sells, 1973). For example, currently in Virginia, algebra is a high school graduation requirement. Attitudes affect studying and learning mathematics and in turn, impact learning (Tocci & Engelhard, 1991). It is prudent to explore student attitudes toward mathematics to improve the learning of and benefit from math. Student interactions and direct experiences affect attitudes (Triandis, 1971). Achievement in mathematics involves direct experiences. Those experiences provide students with information that affects their belief systems, feelings, and behaviors (Tocci & Englehard, 1991). Gifted girls experience the greatest difficulty in schooling at key transition periods of third, fourth, and fifth grade. Self-image may suffer by seventh and eighth grade since internal and external expectations increase. These expectations make it difficult to perform at higher levels which require more effort at a time when confidence may be waning (VanTassel-Baska, 1998). Finding balance between cognitive ability, developmental maturation, and appropriate curriculum for gifted children is where the importance of this study lies for me.

Gifted children often feel differently than their peers (Freeman, 1979). Freeman believes individuals incorrectly presume that advanced intellectual ability implies a positive self-concept. In challenging that belief, she contends that the feeling actually fosters a sense of loneliness and isolation. The stereotypical titles of, “egghead,” “nerd,” and others distress gifted children. Overemphasis by teachers and parents on intellectual performance actually produces a narrow orientation to life, a crippling sense of superiority, and alienation from other children

(Hollingworth, 1942). Gifted children share a complex problem. When they maximize their potential, they feel different and are penalized socially for acting as though they are superior. Children and adults dislike self-aggrandizing children. As a result, their fragile sense of self is wounded by the social experiences they encounter everyday. These children require assistance to obtain a balanced view of their self-worth in a social as well as intellectual context (Janos, Fung, & Robinson, 1985).

This study explores math attitudes in elementary age gifted students who are in an accelerated math program. The study examines the math attitudes of third, fourth, fifth, and sixth grade gifted boys and girls using eight domains of the Fennema-Sherman Math Attitudes Scales (MAS). Framed within Bandura's social learning theory, the study is grounded in gifted education research from Hollingworth, VanTassel-Baska, Reis, Callahan and others. The MAS measure important domain specific attitudes related to mathematics and cognitive performance (Fennema & Peterson, 1986). This study offers information related to the math attitudes of gifted elementary aged students in an accelerated math program.

America's most vulnerable population of gifted learners is gifted girls (Robinson & Noble, 1991). Gifted girls may express poor attitudes toward the study of mathematics. Fennema (1980) suggests that a lack of confidence may lead to fewer math course selections, which may result in an underdevelopment of potential. Selecting fewer courses may be significant because mathematics is a critical component of scientific, technical, and social science fields. An acute shortage of women in these fields may be attributed to poor self-concept regarding ability, as well as academic achievement (Byrne, 1984). Mathematical self-concept varies from general self-concept, as well as academic achievement (Byrne, 1984).

The purpose for the study, based on any attitudinal affect an accelerated math curriculum has on gifted children, explores the math attitudes of gifted third, fourth, fifth, and sixth grade gifted students focusing on elementary grade gifted girls. The research questions address the purpose of the study and the tool chosen for analysis.

Research Questions

The following research questions are the core of the study:

1. What are the math attitudes of third, fourth, fifth, and sixth grade gifted students on eight domains of the Fennema-Sherman Math Attitudes Scales?
2. How do gifted boys and girls in grades three through six differ in their attitudes toward math?
3. What are the most significant math attitudes of third, fourth, fifth, and sixth, grade gifted girls?

This study offers research to others interested in exploring the math attitudes of gifted elementary age students, especially those in accelerated programs. Tocci and Engelhard (1991) encouraged researchers to examine the attitudes toward math as independent and dependent variables. They sought the commitment of future researchers to place an emphasis on determining how attitudes are developed, how to recognize the stability of the attitudes over time, and how to identify specific differences among subgroups.

Studies in standards, accountability, performance, remediation, self-efficacy, math anxiety, and achievement of older students are prevalent in current literature (Ames, 1984; Wood, 1988; Bell, 1989; Lamb & Daniels, 1993; & Reis 1995). This study explores of math attitudes of gifted students placed in an accelerated math program two years above grade level.

Definitions

Table 1 describes the domains of the Fennema-Sherman Mathematics Attitudes Scales.

Table 1

Domains of the Fennema-Sherman Mathematics Attitudes Scales

Domain	Description
Attitude toward success	This domain measures the degree to which students anticipate positive or negative consequences as a result of success in mathematics.
Mother's math attitude	This domain measures the support from the mother.
Father's math attitude	The parent domain measures the support from the father.
Mathematics anxiety	This domain measures the feelings of anxiety, dread, nervousness, and other physical symptoms related to doing mathematics.
Effective motivation	This domain measures perseverance when faced with challenging problems. It is not intended to measure interest or enjoyment of mathematics.
Usefulness in math	This domain measures beliefs about the usefulness of mathematics and in relationship to their future education.
Teacher attitude	This domain measures students' perceptions of their teachers' attitudes toward them as learners.
Confidence in learning math	This domain measures confidence to learn and perform well on mathematical tasks.

Note. From the Fennema-Sherman Mathematics Scale pg. 2

Social Learning Theory

Effective social learning requires both adequate generalization and sharp discrimination (Bandura, 1977). Social learning theory provides the foundation for this study. Social learning implies people learning from one another. Learning occurs through observation, often without a change in behavior. Social learning theory is the bridge between behaviorist learning theory and cognitive learning theory. Bandura's work addresses behaviors resulting from social interactions, subsequent experiences, models, oral discussions, and disciplinary encounters (Bandura, 1977). Details of Bandura's social learning theory are in Table 2.

Gifted girls excel at imitation and adaptation. They model the behaviors that result in positive feedback. Modeling, a foundation of social learning theory (Bandura, 1977, Rotter, 1954) suggests new behaviors, elicits new actions, and holds a promise for changing self-defeating behaviors. Gifted girls often blend into a group rather than demonstrate their unusual abilities. These gifted girls may require the safety of other gifted girls to acknowledge, demonstrate, and value talents (Silverman, 1991). Over-socialization may inhibit giftedness when students choose to mimic behaviors. Leta Hollingworth wrote, “I was intellectually curious, I worked hard, was honest, except for those benign chicaneries which are occasionally necessary when authority is stupid, disliked waste, and was never afraid to undertake an experiment or to change my mind” (Hollingworth, 1940a). Change is nothing to fear; it is only change, something different.

Table 2

Components of Albert Bandura's Social Learning Theory

Component	Action	Description
Attention	Student observes the model.	The learner notices something in the environment and identifies key components to imitate.
Retention	Student remembers the model.	The learner remembers observed behavior and stores it in memory.
Reproduction	Student performs the response.	The learner mimics the modeled behavior.
Motivation	Student is inclined to perform the response.	The learner experiences a consequence that reinforces the behavior and determines subsequent actions.

Various studies examine contemporary educational applications for social learning theory in mathematics (Siegel, Galassi, & Ware, 1985). Siegel et al. (1985) sought to test the variables of social learning theory as they relate to mathematics. Their findings suggest that confidence and motivation are highly predictive of performance and interventions based on social learning theory. Increased skills and confidences are likely to result in positive performance changes. Performance changes relate to modeled behaviors (Bandura, 1986), attitudes of parents and teachers, confidence, motivation, and anxiety (Fennema-Peterson, 1986).

Bandura's social learning theory; attention, retention, reproduction, and motivation complement the tools needed for gifted children to maximize their academic potential. Gifted girls excel at imitation and adaptation. They may blend into a group instead of demonstrating their abilities (Silverman, 1991) and need the safety of other gifted girls to validate their talents. The modeling and socialization of ability-level peers are important in the development of their talents (Silverman, 1991).

Modeling is a common educational practice and an observational source of efficacy information (Bandura, 1977). Research (Bandura, 1971; Rosenthal & Bandura, 1978; Rosenthal & Zimmerman, 1978), suggests that modeling can help teach skills, general rules, and problem-solving strategies in the classroom setting. Children influence each other by mimicking the behaviors modeled for them. Self-efficacy is found in experiences, vicarious reinforcement, and encouragement from others. It affects choosing what to model, willingness to persist, and learning. Students believing in their ability to accomplish a task affects performance and the level of success they ultimately achieve (Piechowski, 1998).

In a study exploring the effects of modeling on self-efficacy, Schunk (1981) explored the effect of modeling task strategy, self-efficacy and skillful performance. He questioned whether modeling positive achievement beliefs increased self-efficacy and skill development. The participants included 40 students from five classrooms with age ranges from nine to 11. The 18 boys and 22 girls had deficiencies in basic division. Three model groups were established distinguished by emphasis on: (1) the importance of using task strategies, (2) the importance of positive achievement beliefs, and, (3) the importance of task strategy and positive achievement beliefs. Students completed a pretest judging their problem-solving ability rather than whether they actually solved the problems. They recorded their responses and completed a skill test. Following the pretest, students within the 3 groups were randomly assigned to one of the four treatment groups; cognitive modeling, modeled importance of task strategies, modeled importance of achievement beliefs, and modeled importance of task strategies and achievement beliefs. Each group sat for the appropriate treatment and completed post-test. Results indicated that modeling the importance of using task strategies enhanced students' motivation and skill development. Emphasizing both task strategy and achievement beliefs led to the highest self-efficacy. Table 3 displays the data from the study.

Table 3

The Effect of Task Strategies and Achievement Beliefs on Self-Efficacy and Skill Development Means and Standard Deviations

		Experimental Condition							
Measure	Phase	Cognitive modeling		Task strategies		Achievement beliefs		Strategies	
Self-efficacy	Pretest	35.7	(12.2)	33.8	(11.2)	29.6	(8.9)	31.4	(7.9)
	Posttest	50.7	(14.1)	69.7	(10.1)	55.3	(15.3)	85.2	(8.0)
Skill	Pretest	1.8	(1.6)	1.9	(2.5)	1.8	(1.4)	2.1	(1.7)
	Posttest	5.4	(2.6)	9.6	(4.0)	4.9	(2.2)	10.5	(3.0)
Training		29.1	(8.2)	48.3	(9.1)	25.2	(9.8)	45.3	(8.6)

Note. Data taken from Schunk, D. H. & Gunn, T. P. (1985) p. 254.

Gifted students rely on information about potential careers and strengths from role models, mentors, and the study of heroes. The work of Bandura (1989a) reminds us of the powerful role choreographed by role models in shaping behavior. Rosenthal & Bandura (1978) reminds us that we practice psychological modeling without even trying. Mathematical self-efficacy can be separated from other measures of attitudes toward mathematics in that mathematics self-efficacy is a situational or problem specific assessment of an individual's confidence in his or her own ability. Self-efficacy should be assessed specifically, rather than globally. The Fennema-Sherman confidence scale measures specific attitudes in learning math. It does not measure interest, enjoyment, or other global topics.

Bandura's works in self-efficacy suggests people with a weak belief in their self-efficacy often shy away from difficult tasks, have low aspirations, dwell on personal deficiencies, are slow to recover their sense of efficacy after setbacks, and are prone to depression. Conversely, people with a strong belief in their efficacy set challenging goals, attribute failures to insufficient effort, quickly recover their sense of efficacy after setbacks, and display low vulnerability to stress. Perceived self-efficacy anchors the intellectual process. Bandura states, “Of the cues that influence behavior, at any point in time, none is more common than the actions of others” (Bandura, 1986, p. 206). Using this premise, the MAS are an appropriate tool for this analysis due to the specificity of the detailed domains it contains.

Figure 1 contains the conceptual model of domain specific variables from the Fennema-Sherman Mathematics Attitudes Scales.

Limitations/Delimitations

This research contains inherent limitations and delimitations. Participants represented all areas of the city. This large zone translated into a variance in socio-economic factors, diverse backgrounds, and math experiences. The sixth grade was located on a different site. They experienced a tumultuous year and had a change of math teacher mid year. All students in the study participated in an accelerated math curriculum. Designed 18 months to two years above grade level, it was differentiated for gifted students. These factors coupled with the fact that all participants were not identified as gifted in math, contributed to the limitations and delimitations.

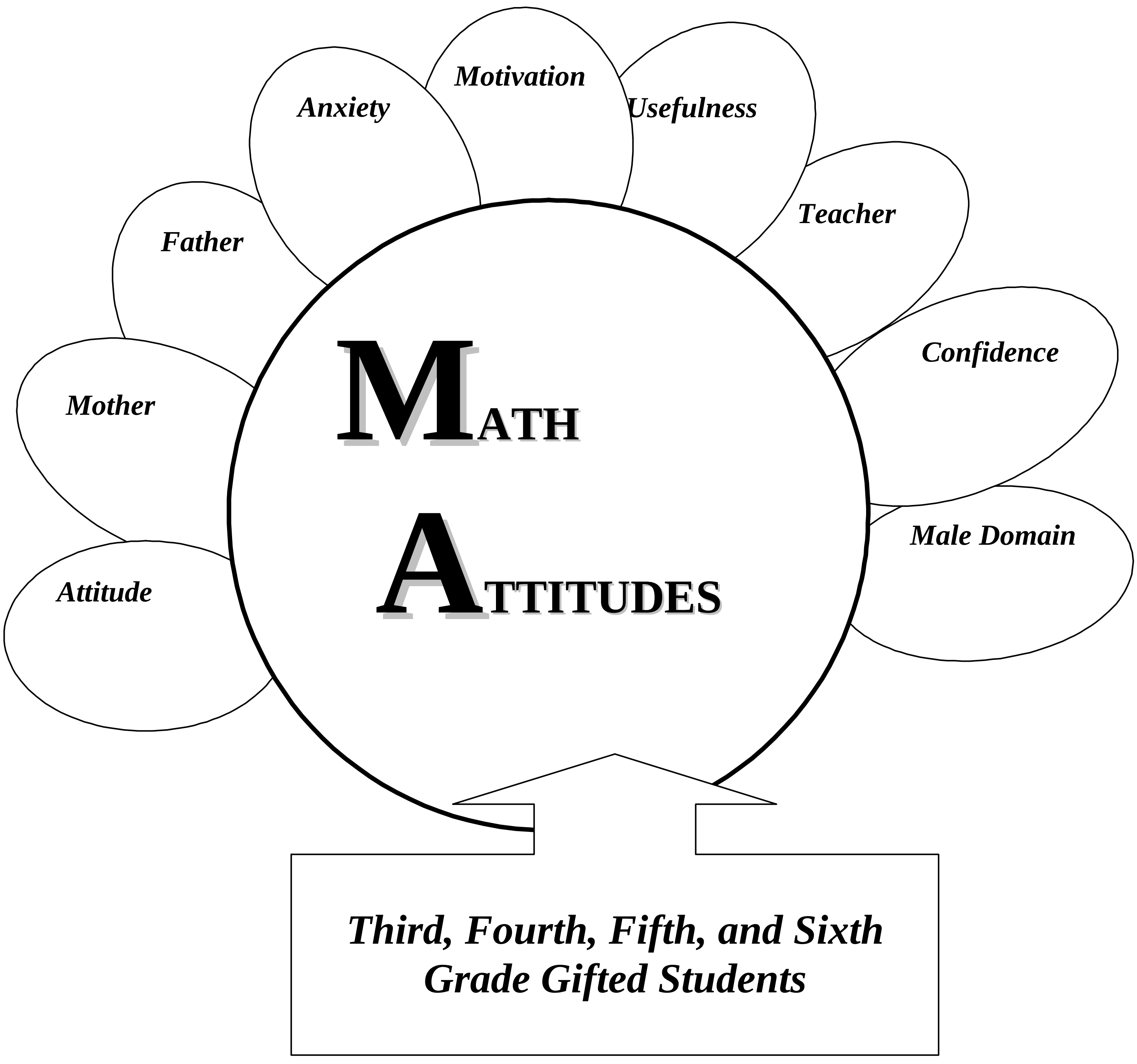


Figure 1. Domains of the Fennema-Sherman Math Attitudes Scales.

Significance of Study

Comparisons of research findings concur (Hollingworth, 1935: Navarre, 1980; Terman, 1916) that giftedness in girls emerges early in life. It seems to mysteriously vanish as they mature. Gifted children are prone to the same anxieties and stresses experienced by all children. Altman (1983) maintains that albeit professionals promote the extraordinary characteristics of gifted children, while the public harbors suspect views regarding gifted children and their social adjustment. He suggests teachers and other school personnel associate personality peculiarities with giftedness. A vast majority of challenging, high-status career options will be eliminated for gifted girls who underestimate their intellectual abilities, value career status less than their male counterparts, and accept occupational stereotypes as valid (Hollinger, 1991). This study examines the attitudinal affect an accelerated math curriculum has on gifted children. Designed 18 months to two years above grade level, it is differentiated for the needs of the student. The study explores the math attitudes of gifted third, fourth, fifth, and sixth grade gifted students with a focus on gifted girls in the elementary grades.

Groth (1969) declared that only one in 300 gifted girls went on to receive their doctorate degrees. Researchers interested in the effects of motivation, environment, underachievement, parental attitudes, and gender differences on achievement sense a downward trend in school attitudes, especially toward mathematics. Negative attitudes are not a new phenomenon. Studies spanning the last 70 years, when, in 1930, Terman ascertained girls had a considerable drop in ability scores. The struggles gifted girls face as they balance their ability, attitudes, and challenges of the societal pressures of growing up is confirmed. Terman's original work, replicated by Hollingworth in the 1930s, re-examined in the 1940s by Terman and Oden (1947), and considered again in the 60s and 70s by Pierce (1961), Rossi (1965), Fennema-Sherman

(1976), and others, authenticates his original findings. Robinson and Noble (1991) continued the work of Leta Hollingworth and others by examining the math attitudes of gifted girls. Identifying and reporting student attitudes about math provides educators with the opportunity to examine educational needs, programs, and environments. The physical and psychological characteristics of the classroom have a significant impact on learning (Finn, 1971). According to VanTassel-Baska (1998), gifted children need appropriate curriculum and models within the school environment to maximize their potential. The significance of this study is achieved through the exploration of the math attitudes of gifted children placed in accelerated math programs. Research warrants the need to broaden our efforts and focus on the successful development of these fragile gifted learners.

Chapter II

Review of the Literature

Analysis of the literature for the study contains historic and legal information related to the education of gifted students; girls as gifted learners; instructional settings; attitudes in mathematics based on the domains of the Fennema Sherman Math Attitudes Scales (MAS), and social learning theory. This research builds upon the work involving gifted girls (Reis, 1987), attitudes about math (Fennema-Sherman, 1976), and educational applications of Bandura's Social Learning Theory (1977). Robinson and Noble (1991) ascertained that gifted girls are one of the most vulnerable special populations of gifted learners.

Historical Perspective

Sir Francis Galton furnished scientific proof of the prejudices of his time. During the late 1860s he invented a mental test, assessed over 9,000 people, and noted that men outperformed women on every dimension (Pearson, 1924). The study examined individual differences, mental measurements, the nature/nurture controversy, and the field of eugenics. In 1879, LeBon, a famous social psychologist, claimed that women had brains the size of gorillas and were obviously an inferior form of human evolution (Goud, 1879). Charles Darwin (1871) promulgated the myth that female intellectual capabilities were inferior by emphasizing his view that males were more advanced on the evolutionary scale. He met with little resistance; for centuries people saw it as true. Social learning theory tells us an observer's behavior changes either negatively or positively, after viewing the behavior of the model. Our society has come a long way from devaluing women to modern day theorists committed to making change in the lives of gifted girls. If, as Vygotskian theorists believe, learning and development are connected from birth and social interaction and environmental factors determine who women are as individuals, women would not have achieved their status in society. Today's women were fortunate to have had a young girl from Nebraska challenge the status quo.

Recognized for her work in gifted education, Leta Hollingworth earned her place next to Lewis Terman and Galton. Hollingworth worked with determination to dispel myths regarding gifted children and argued that, "eminence and superior mental ability are not identical" (Hollingworth, 1926). Hollingworth's design of an experimental school to study both slow learners (the "Binet" group) and rapid learners (the "Terman" group) established her credibility. She convinced the New York City Board of Education to support the Speyer School in Manhattan as a laboratory school for exceptional children. Hollingworth designed her first choice curriculum, "The Evolution of Common Things," stressing initiative and originality (Hollingworth, 1939). She believed the "best thinkers" should be educated with those curriculum concepts as an underlying premise to everything else. As a compelling speaker and writer, she found a way to combat the prejudices that existed in her era (Willinsky, 1996). Leta Hollingworth's vision of how gifted children might be educated started the research that continues today. In addition, sixty years of research on gifted children confirms Terman's observations (Dauber & Benbow, 1990: Robinson & Noble, 1991). The difference between the child's abilities and the abilities of others in the social group increases the potential for loneliness and social maladjustment (Fox, Sadker, & Engle, 1999). Hollingworth's school initiated the beginning of a much-needed differentiated program for gifted students.

Virginia Plan for the Gifted

Adopted by the Board of Education on February 25, 1993, the Virginia Plan for the Gifted is a guide for the development of effective programs and services for gifted students. The requirements contain procedures for the development of division-wide special services for gifted children. The state defines gifted students as, “those students in public elementary and secondary schools whose abilities and potential for accomplishment are so outstanding that they require special programs to meet their educational needs”. Local school divisions are required to establish uniform procedures for identification, determine eligibility based on multiple criteria (established by the school division and not governed by the state), submit a local plan to the Department of Education for approval, and establish a local advisory committee.

Article VIII, Section 1 of the Virginia Constitution delineates the General Assembly’s responsibility for education states that it “…shall provide for a system of free public elementary and secondary schools for all children of school age throughout the Commonwealth and shall seek to ensure that a high quality educational program is established and continually maintained”. Table 4 details the goals and activities of the State Department.

Section 2 of Article VIII requires the Board of Education to prescribe, “…each school division shall offer appropriately differentiated instructional opportunities in accordance with guidelines of the Board of Education for identified gifted and talented students”. The Standards of Quality for Public Schools in Virginia mandate that each school division must: develop criteria for the early identification of gifted students, assist in the preparation of teachers and other support staff that serve the educational needs of gifted students, and establish and evaluate differentiated programs following the Board of Education approved regulations.

Table 4

Virginia Department of Education Goal and Activities in Gifted Education

Goal	Activities
The state will establish and maintain services of the gifted to facilitate the implementation and improvement of The Virginia Plan for the Gifted.	The state will provide support to varied agencies, organizations and the public.
	The state will provide technical assistance and support to localities in the delivery of services to gifted students.
	The state will develop a budget for maintaining and expanding program services for gifted students.
	The state will support the maintenance and expansion of Governor's School programs.
	The state will evaluate local plans for the education of gifted students.

Note. From Virginia Plan for the Education of the Gifted, 2001, pp. 7-8.

The Commonwealth of Virginia provides each locality with an apportioned share of funds to support local program services. Funding received by the state must be used to support services identified in the local plan only. Localities are required to match state funds with local funds based on the composite index formula. Localities are advised to appropriate funds within their programs in the following areas:

1. The identification and placement of students.
2. The purchasing assessment materials.
3. The salaries and fringe benefits for full-time or part-time personnel working with gifted students.
4. The costs of gifted education staff development and development of curriculum modification guides.
5. The costs of specialized instructional materials and equipment.
6. The student tuition for college or post-secondary classes when appropriate.
7. The development and implementation of a program evaluation model.
8. The dissemination of information to and communication with the local advisory committee, parents, and the community.

Local Plan for Gifted Education

The mission of the school division is to create school experiences that ensure all students learn and demonstrate skills needed for lifelong learning. It is the local belief that students should be given equal opportunity for nurturing and developing strengths and talents in settings that allow them to display their abilities. The school division recognizes that talents are present in children and youth from all cultural groups, across all socio-economic strata, and in all areas of human endeavors. They further acknowledge that gifted students require individualized as well as differentiated programs beyond those provided by the regular school curriculum and classroom structure. Each gifted program's focus is on the introduction and elaboration of complex and abstract ideas, development of products that reflect the identification and solution of real problems, and the refinement of research skills and methods. The social and emotional needs of gifted students are met through an affective strand written into the gifted curriculum. Table 5 contains the Local five-year goals needed for compliance with state regulations.

Table 5

Virginia State Requirements and Local Five-Year Goals in Gifted Education.

State goals	Local goals
Identification	The school division will develop specific provisions for gifted students in the primary grades.
Delivery of services	The school division will strengthen high school honors and AP instructional strategies to ensure they remain appropriate options for identified students.
Curriculum development	The school division will revise honors and AP offerings at the high school level to ensure rigor, depth, and complexity.
Staff development	The school division will provide appropriate staff development opportunities for teachers aligned with best instructional practices in gifted education.
Parent and community involvement	The school division will explore ways to recruit a broader spectrum of community members to serve on committees, especially business members who do not have children currently in the school system.

Note. From the Local Plan for the Education of the Gifted, 2001, pp.2-3.

The local plan addresses the needs of gifted children in grades K-12. The curriculum for gifted learners has been accelerated and differentiated from the standard curriculum in content, process, products and conceptual orientation. A curriculum framework is in place. It includes a toolbox of appropriate teaching strategies, an understanding of learning styles and the Virginia Standards of Learning (SOLs). Table 6 synthesizes the offerings for gifted students attending the school division in this study. The school division selected for the study has designed and implemented a fully differentiated and accelerated math program for gifted students who attend the gifted centers.

Gifted Learners

Leta Hollingworth believed that acceleration in homogenous groups provided an appropriate instructional program for gifted children. She recognized giftedness in young women and brought them into focus. Her integrity, her respect for children, and her courage in the face of adversity earned her a prestigious place in history as a pioneer in gifted education. Gifted girls fear social rejection if they appear to be too bright or too competent (Callahan, 1979). Rodenstein & Glickauf-Hughes (1977) echoed the struggle: Gifted women are expected to behave one way because they are gifted and another way because they are women. Traditional identifiers of gifted girls include achievement tests, aptitude batteries, and nomination forms (VanTassel-Baska, 1998). Although the number of girls identified in elementary school is commensurate with the number of boys, research indicates a decline in girls identified for special programs in secondary school (Richert, 1982). Studies in the area of self-efficacy indicate that girls often experience self-defeating causal attributions (Cramer & Oshma, 1992). They exhibit low expectations, and may avoid challenging curriculum (Dweck, 1986). Girls suffer from secondary effects of teachers with math anxiety (Wood, 1988) and possess erroneous beliefs about their own potential (Tobias, 1978). Figure 2 shows a synthesis of research on the characteristics of gifted girls.

Table 6

Gifted Program Offerings

Grade	Program	Program description
K-2	LEAP	The program provides differentiated learning experiences for primary children in mathematics, science, language arts, and creative problem solving. LEAP teachers and K-2 classroom teachers develop strategies for students in the regular classroom setting.
3-5	Challenge	The program focuses on strategies and content within the on grade-level curriculum. The curriculum is presented through mini-lessons by a gifted specialist and enhanced by the classroom teacher.
3-5	Gifted center	This program is a full-time educational center for students identified as simultaneous processors, needing a fully differentiated and accelerated academic experience. The center focuses on depth and complexity of the curriculum, including the SOLs and material within the local curriculum. The theoretical framework focuses on the dynamic relationship between content and instruction.

Grade	Program	Program description
6	Gifted magnet middle school	The program is an extension of the elementary program housed at a middle school offering students an authentic middle school experience.
Middle school 7-8	Zoned schools	The program places differentiation strategies in appropriate level content areas. Students with specific academic and intellectual talent are provided academic classes that are appropriate to their current needs.
High school 9-12	Zoned schools	The program, International Baccalaureate (IB) contains, advanced placement classes, Governor's School, or dual enrollment with a local university.

Note. From the Local Plan for the Education of the Gifted, 2001, pp. 18-19.

.

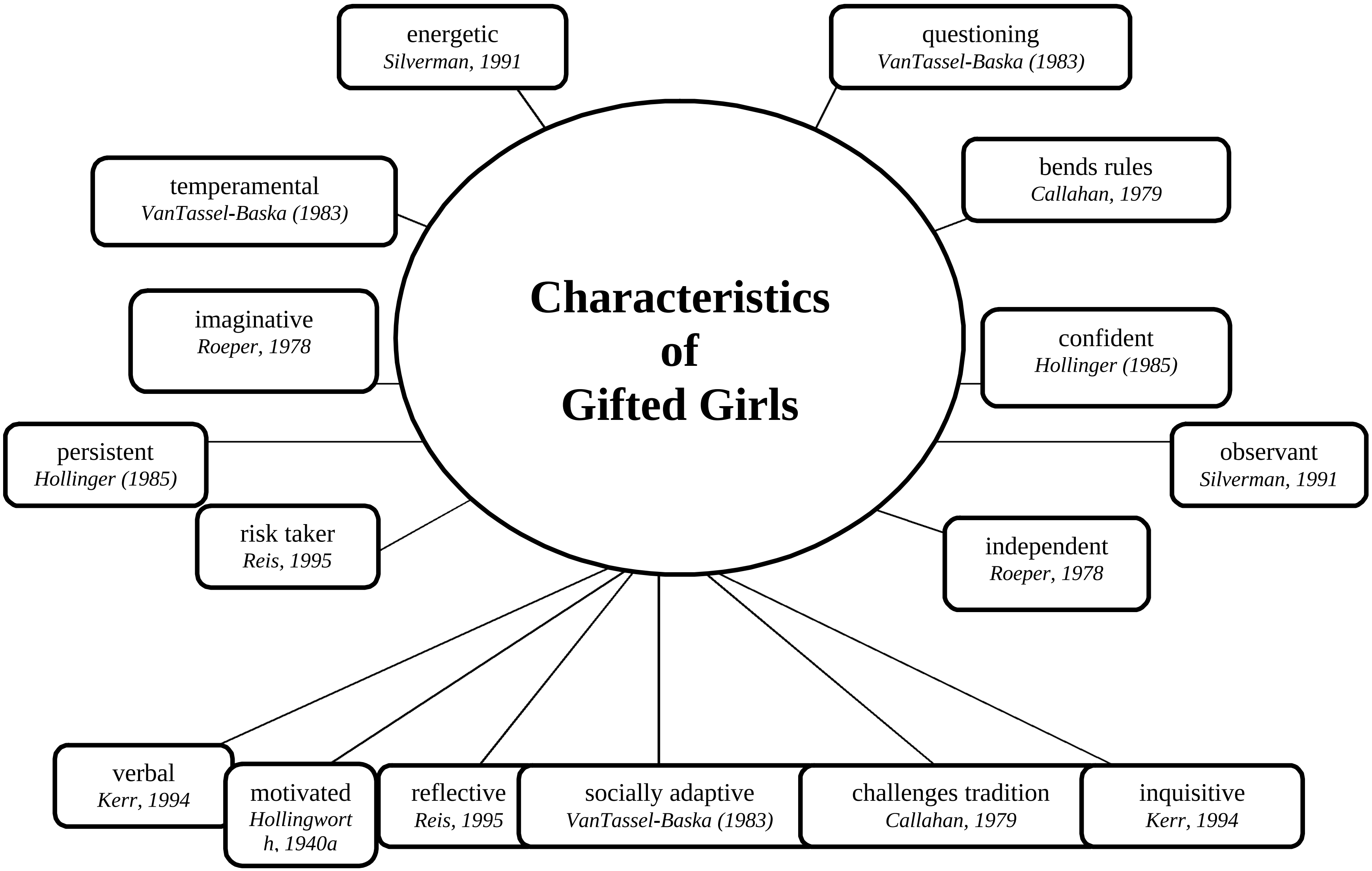


Figure 2. Synthesis of research showing characteristics of gifted girls.

Instructional Setting

Students need to take an active role in the classroom. Doing so contributes to the classroom climate and sets the emotional tone (Wilson, 1992). Goodlad (1984), Lapan (1989), and Wilson (1992), view the gifted classroom as an opportunity for questioning and rigorous thinking. The focus is on learning and instruction, not teaching (Finn, 1971). The gifted programs selected for the study were designed around this philosophy. The staff participated in professional development with Michael Piechowski. They learned the art of creating a nurturing environment, encouraging a sense of humor and risk-taking, while creating a positive classroom climate (Piechowski, 1984). Torrance (1992) adds that valuing humor and risk-taking in the classroom improve achievement. Since the time of Piaget's cognitive development theory to modern day proponents of constructivism, educators strive to balance classroom engagement, learning theory, and social dynamics to maximize student achievement.

Fulton (1991) suggests that the physical surroundings in the classroom offer a symbolic message of what one expects to happen in a particular place. Historically, classroom space and aesthetic value has been debated since the 1800s (McGuffey, 1978). Burrage wrote in 1899, "Of course a Wilton velvet carpet would be out of place beneath the restless feet of sixty children; upholstered furniture would be absurd in a room hourly powdered with chalk dust; and lace curtains would be ridiculous with window gardens and a man janitor". The building should inspire children (Barnard, 1849). Environmental factors, thermal efficiency, maintenance concerns, room size, noise, lighting and color continue to be researched. Fulton (1991) believed that students need open spaces to maximize intellectual activities. Goodlad (1984) agreed that students need a flexible learning space with a great deal of student interaction and movement. Facilities designed to accommodate individual learning styles and encourage open communication are the appropriate setting for gifted students (Jolivet, 1988). Additional findings of researchers investigating appropriate classroom learning environments are listed in Table 7.

Table 7

Attributes of Historical Instructional Settings

Author	Findings
Brown (1998)	The environment should contain colors, patterns, and materials to strengthen energy and productivity.
Burrage (1899)	The furniture should consist of adjustable desks so as not to interfere with respiration. Children could breathe easier with their heads and bodies in alignment.
Chase (1868)	The windows should be located on the long walls so artificial light is not needed. Pictures should be hung following the rules of symmetry. Only works of art recommended for each grade level should be placed on the wall. Everything should be balanced. Teachers should rearrange classroom furniture if light shines in the pupils' eyes because rooms illuminated with light from many sides causes confusion.
Clark (1988)	The classroom should contain a variety of work areas and learning centers, personal storage spaces (not necessarily desks), colorful murals, common areas, elaborate playgrounds, and inviting landscapes. Students voluntarily group and regroup themselves.

Author	Findings
Goodlad (1984)	The classroom should be a flexible learning space with a great deal of student interaction and movement.
Jolivet (1988)	The appropriate learning environment would include a facility design with behavioral settings including aesthetic satisfaction, openness, and respect, individual learning styles that foster communication among students, teachers, administrators, and parents.
Kellogg (1916)	The environment should contain automatically controlled ventilation systems, large study rooms, small closets for teacher use, and platform for his/her desk.
Mills (1915)	The school will have smooth finished painted rooms for easy cleaning. The windows should have an opaque shade to match the outside color of the building. No venetian blinds are to be used as they are unsanitary. Toilet rooms are allowed only if they have outside ventilation and windows.
Torrance (1992)	The learning climate should favor creativity, invention, and adventure.

Attitudes Toward Math

Two of the five goals from the Curriculum and Evaluation Standards for NCTM (National Council of Teachers of Mathematics, 2000) focus on student attitudes valuing mathematics and becoming confident in one’s ability. Attitude toward mathematics contributes to achievement (Brush, 1985; Fennema & Sherman, 1976). Fox (1980) found attitude toward mathematics to be particularly acute among gifted girls. Reyes (1984) echoed this finding and added that math anxiety and perceived usefulness were among the most studied variables in the area of math.

Fennema-Sherman developed domain specific scales to measure important attitudes related to mathematics. The attitude toward success in mathematics domain (AS) assesses the motive to avoid success in mathematics. The mathematics as a male domain (MD) reflects evidence presented by Stein & Bailey (1973), & Carey (1958). They concur that students perform higher on intellectual tasks perceived to be appropriate to their sex. Hence, when mathematics is perceived to be a male domain (Stein & Smithells, 1969), girls may be less willing to pursue studies thought to be for boys. The attitudes of significant others are important to the learning of mathematics. The mother's attitude (M), father's attitude (F), and teacher's attitude (T) domains were developed to assess students' perceptions of these persons' attitudes toward them as learners of mathematics. The titles were shortened for convenience.

Girls often feel as if teachers belittle their intellectual performance and tend to emphasize the traditional "feminine" attributes (Sells, 1973). The teacher's attitude scale assesses the students' perceptions of how teachers feel about them as learners of mathematics. Confidence is related to what one is willing to attempt. Girls tend to underestimate their own intellectual activities including mathematics.

Math preferences may already be in place by the end of elementary school (Wilson, Stocking, & Goldstein, 1993). A lack of female role models in mathematics contributes to negative math attitudes (Callahan & Reis, 1996). However, attitudes can be changed. Lamb & Daniels (1993) conducted a study that indicated significant gains in math attitudes were attained in the fourth and fifth grade. Their study consisted of 48 fourth to seventh grade gifted girls. The design included 24 girls in an experimental group with an intervention program, and 24 in a control group. The girls came from the same rural school district. A quasi-experimental design using a pretest, posttest, and control group controlled for threats to internal validity of maturation and selection. All participants took a pretest using the Mathematics Attitude Inventory (MAI) (Sandman, 1980) to control for possible variations between the control and experimental groups.

The MAI is a 48-item (192 points possible) self-rating scale. According to Sandman (1980), the instrument reported attitude toward math teachers, anxiety toward math, value of math in society, self-concept in math, enjoyment of math, and motivation in math. Analysis of the 48-item instrument using r –test scores revealed no significant differences between the experimental and the control group. The total mean scores for the pretest were 140.38 for the experimental group and 142.17 for the control group, resulting in an r –test score of .26.

The experimental group received an 18-week intervention program including individual and small group attitude and career awareness activities. The girls met daily for 30 minutes and developed problems of the week, created games and math puzzles, debated the effects of self-perception as it relates to task-commitment, and made lists of ways to improve areas of low confidence. The students explored the importance of a positive attitude and developed a “Math Appreciation Day”. After completing the intervention, the groups completed the MAI as a post-test. Table 8 illustrates the results of the posttest scores.

Table 8

Post-test Scores of Experimental and Control Groups of Gifted Girls

	Experimental		Control			
Math attitude	Mean	SD	Mean	SD	t	p
Attitude towards teacher	25.96	6.45	23.33	5.17	1.56	.126
Anxiety	29.49	2.41	24.71	4.51	4.55	.001*
Value of math in society	30.46	1.77	25.42	3.94	5.71	.0001*
Self-concept in math	28.83	2.04	23.96	3.91	5.42	.0001*
Enjoyment of math	28.13	2.69	21.13	3.36	7.96	.0001*
Motivation	26.17	3.20	21.00	4.59	4.53	.001*
Total	169.00	14.77	139.54	21.85	5.47	.0001*

Note. Data taken from Lamb & Daniels (1993) p. 4.

* $p < .05$

Results indicated that an intervention program designed to improve the math attitudes of gifted girls made a significant difference. Kerr (1988) asserts that stereotypical expectations placed on girls are the most influential factor affecting their attitudes in math.

The Fennema-Sherman Math Attitudes Scales contains nine domains with questions related to role models. Table 9 contains a synthesis of research related to attitudes in mathematics.

Table 9

Research Review of Attitudes in Mathematics

Author	Findings
Cramer & Oshima (1992)	Interventions for gifted girls are necessary to remediate self-defeating causal attributions for math performance.
Dweck (1986)	Gifted girls exhibit low expectancies, avoidance of challenge, ability attributions for failure, and debilitation under failure. Competence does not predict confidence. Significant discrepancy between actual and perceived competence exists.
Fennema (2001)	Males are more likely to report abstract strategies that reflect a deep understanding of mathematics than females who were more likely to report concrete strategies.
Li and Adamson (1995)	Gifted girls attributed greater success and failure in math to effort and strategy.
Strauss & Subotnik (1991)	Gifted girls have higher levels of test anxiety and tend to underestimate their abilities.
Tobias (1978)	Math anxiety results from erroneous beliefs that transfer into poor performance. Beliefs and behaviors prevent performance in math.
Wood (1988)	Students feel math anxiety among elementary teachers. Girls are affected more than boys.

Note. Information Compiled from Literature Review.

Attitude Toward Success

A study conducted by Miserandino (1996) investigated perceived competence and autonomy in above-average children. She wanted to look inside the child at the process of self-regulation to determine what above average children need to become oriented toward learning. The children in this study were ones who perceived themselves to be lacking in competence or autonomy despite having high ability.

Miserandino hypothesized that high ability children disengage from school if their competence or autonomy needs are unfulfilled. Specifically, if the child has a low perceived competence and is externally motivated (low autonomy) he or she would show a loss of interest and disengage throughout the year. She did not predict any differences in gender and acknowledged limitations and delimitations related to student effort, motivation, and teacher relationship.

Miserandino's participants were 77 above-average students (40 boys and 37 girls) in grades three and four from a suburban elementary school outside Rochester, NY. The Stanford Achievement Test (SAT) identified above average students. Each study participant demonstrated ability one year above grade level.

Multiple regression analysis yielded no gender differences in perceived competence (possessing the ability to do well in school) and perceived autonomy (autonomous versus external motivation) on 368- item Rochester Assessment of Intellectual and Social Engagement (RAISE). Analysis of perceived competence yielded students averaging 6.48 years on the subject composite of the SAT (SD = 1.17), third graders averaged 6.36 (SD =1.24); and fourth graders averaged 6.81 (SD = .89). On the competence measure, [indicating they were less certain they had ability] 30 participants scored at or below the median (M = 3.13, SD = .46); 47 scored above the median indicating they believed that they had ability (M = 3.92, SD = .12). The difference between these two groups yielded a significant effect, t (75) = -9.16, p < .001. Although all students were above average in ability, students less certain of their ability had lower SAT scores than students confident in their ability.

Of the 77 participants, 50 reported being autonomously motivated (M= 1.11, SD = .70), whereas 27 reported being externally motivated (M = -1.01, SD = .78). The difference between these two groups was significant, t (75) = -12.14, p < .001. The two groups did not differ on SAT scores (mean autonomous = 6.24, SD = 1.14; mean external = 6.62, SD = 1.17), t (75) = -1.34, ns.

Differences in autonomy and competence between the third and fourth grade students surprised Miserandino. She concluded that children are more sensitive to or ready to process competence information than autonomy. Her results conclude that children are keenly aware of how others around them are doing and may adjust their perceived competence and perceived autonomy beliefs based upon social comparison information from peers. Her study shows that merely having ability or potential is not enough. Miserandino contends that talent and potential are wasted unless children believe they possess ability and have the freedom to use and develop their talents.

Mother's Math Attitude

Dickens and Cornell (1990) discovered mothers' and fathers' expectations of their gifted girls had significant impact in the girls' belief about their abilities. Parsons, Adler, & Kaczala, (1982) and Parson et al. (1982) concur that a mothers' and fathers' belief about their own abilities impact girls more than her own past performance. Expectations and attitudes that parents have concerning their children's performance impact achievement. Parson et al. also concluded that mothers' attitudes about their own mathematics abilities are communicated to their children, thus influencing their daughters' mathematical self-concept through modeling. Tocci and Engelhard (1991) found that mothers and fathers are among the most influential reference groups in attitude formation. Student perceptions of parental behaviors toward mathematics form their math attitudes, beliefs, and behaviors.

Mothers and fathers can meet the specific needs of their gifted daughters during the elementary years (Kerr, 1994). She suggests (a) purchasing books, especially books that represent women in a variety of roles, (b) encourage reading, (c) provide help when she asks, (d) give her math puzzles, and (e) buy a computer. Whatever her interests do not over-schedule her. Allow time for imagination, play, and fantasy. Watch for signs of boredom at school. Provide role models, support her emotionally, and help her feel special by acknowledging her abilities. Likewise, Silverman (1991) encourages mothers to acknowledge and nurture her own abilities, providing a role model for their daughters.

Father's Math Attitude

Fathers need to realize the important role they play in affecting their daughters' aspirations (Silverman, 1991). A summary of research and recommendations on influences in math achievement (Bearvais, Mickelson, and Pokay 1985) suggest that fathers and school personnel encourage girls in mathematics by doing the following:

1. Discuss the value of mathematics.
2. Attribute girls' success in math to ability and interest, not just hard work.
3. Be aware of potential and bias with regard to math.
4. Encourage daughters/students to pursue math interests.
5. Use cooperative learning models with real world applications.

6. Stress the importance of four years of math in secondary school.

Tocci and Engelhard (1991) write that family members, particularly fathers, are among the most influential reference groups in attitude formation. Student perception of parental attitudes toward math and observed behaviors regarding math significantly contribute to student attitudes in math. Silverman (1991) suggests that daughters spend alone time with dad in typically masculine activities.

Anxiety

Appropriate levels of stress can have a positive influence on gifted children. Dirkes (1983) believes that when gifted students learn to use anxiety to their advantage, they are able to integrate their uniqueness into their environment. The ability to respond to conflict with problem solving strategies fosters a healthy self-image and positive learning attitude.

Gifted girls seem to be particularly vulnerable to cultural stereotyping when it comes to math. Spencer and Steel (1994) suggest that girls are frustrated with the difficulty of math problems. They associate the frustration with the belief that they, as women, are not supposed to be able to do math. These beliefs lead to performance impaling anxiety.

In 1957, Dreger and Aiken suspected that "number anxiety" predicted mathematical performance. Surprisingly, math anxiety is a minimal predictor of poor performance when self-efficacy, self-concept, prior experience, and perceived usefulness are controlled (Meece, Wigfield, & Eccles, 1990). This lack of predictability is due to the positive impact self-concept, self-efficacy, and prior experience have on performance. Hackett (1985) investigated the effects of math self-efficacy on math anxiety using path analyses with relationships hypothesized from social cognitive theory and concluded that self-efficacy had a direct effect. It also had a stronger direct effect on the choice of math careers.

Bandura (1977) explains the phenomenon and states that self-efficacy is related to persistence. Bandura (1986) contends that people fear events only when they cannot predict or control them. The level of confidence used to complete a task determines anxiety. Efficacy beliefs predict how well people cope with threats and how much fear they experience. Self-efficacy continues to predict performance even when the effects of anxiety are controlled. The effect of anxiety should dissipate when self-efficacy precepts are controlled (Bandura, 1986). Girls who persist at mathematics in the face of frustration are more likely to arrive at the correct answers.

Various studies have demonstrated a negative correlation between math anxiety and math performance (Schwarzer, Seipp, & Schwarzer, 1989). Correlates of anxiety suggest that appropriate levels of stress can have a positive influence on gifted children (Dirkes, 1983). When gifted children learn to respond to conflict with problem solving and relaxation strategies, they are able to integrate their uniqueness into their environment. They can use anxiety to their advantage. Since the abilities of the gifted are not in synchrony with their age peers, they invite ambiguous expectations for performance (Dirkes, 1983). Whatever the source, loss of control and a sense of inadequacy create anxiety. Symptoms of undesirable levels of anxiety identified by Dirkes (1983) include:

1. Expressed desire to be like age peers
2. Decreased performance
3. Reluctance to work in a team
4. Expressions of low self-concept
5. Excessive sadness or rebellion
6. Repetition of rules and directions to ensure they are followed

7. Reluctance to make choices or suggestions

8. Avoidance of new ventures unless certain of the outcome

9. Extremes of activity or inactivity

Motivation

One of the basic human drives is effective motivation (White, 1959). White described it as behavior showing lasting focalization that has the characteristics of exploration and experimentation. It is selective, directed, and persistent. Effectance motivation is similar to problem solving attitude (Kagan, 1964). Schunk (1987) presented a model of motivational learning in which self-efficacy played the central role. Schunk suggested that, because of attitude and past experiences, children develop a sense of efficacy and expectations for tasks. These expectations influence students' motivation, which helps to determine performance. Beliefs and expectations in one's ability to be successful are a foundation of Bandura's theory of self-efficacy (Bandura, 1977).

Usefulness

Children's differences in the perception of mathematics' usefulness in the future of education make it a critical assessment component (Hilton & Berglund, 1971). In today's society, participation in mathematics classes through calculus is an important base for mathematical competence for professional careers, including the social sciences. Therefore, gifted girls can see the usefulness as it applies to their career goals. Armstrong (1985) found math performance relates to perceived usefulness. Brush (1985) suggests that supporting evidence exists in schools where a conscious effort has been made to work with changing the future usefulness of math attitudes of gifted girls and their parents.

Teacher's Attitude

An investigation in teacher's attitude toward the gifted female student found a change in attitude in the educational setting (Kerr, 1994). A survey of results administered to teachers revealed that teachers of gifted students showed that male teachers still had a tendency to view female students in a more traditional way. They are often viewed as emotional, high strung, gullible, less imaginative, curious, inventive, and individualistic. Teachers with no special preparation or background in gifted education were uninterested in or even hostile toward gifted students (Weiner, 1986). In contrast, teachers with experience working in gifted programs or doing in-service presentations related to gifted education tended to be more enthusiastic about them (Weiner, 1986). Thomas (1973) found that general education classroom teachers' attitudes were frequently negative and filled with misconceptions concerning giftedness. Implications suggested biased attitudes were forcing gifted students to modify their classroom behavior, hide their real talents, and imitate the modeled behavior of other children. Fox (1977) suggested that young gifted girls perform better in math if they have a female teacher and are placed in predominantly female classes. Teachers need a high degree of intelligence and knowledge about the subject matter, emotional maturity, and a strong self-concept to be effective with gifted children (Maker, 1995).

The following list of behaviors describes mathematically gifted children (VanTassel-Baska, 1998):

1. They show early curiosity and understanding about the quantitative aspects of things.
2. They demonstrate the ability to think logically and symbolically about quantitative and spatial relationships.

3. They possess the ability to perceive and generalize about mathematical patterns, structures, relations, and operations
4. They reason analytically, deductively, and inductively.
5. They use flexibility and reversibility of mental processes in mathematical activity.
6. They have the ability to remember mathematical symbols, relationships, proofs, & methods of solutions.
7. They demonstrate energy and persistence in solving mathematical problems.
8. They have a mathematical perception of the world.

A teacher’s attitude towards math, their self-efficacy regarding their own math ability, and the messages they send to their students, influence performance of the students. Woods (1988) believed that students feel a teacher’s anxiety while girls are more affected than boys. Because achievement in mathematics represents direct experiences, providing students with authentic experiences equips them with the necessary tools for success. Educators at all levels need to be informed of the vulnerability of gifted girls giving specific guidance in how to detect and nurture high abilities (Silverman, 1991). Teachers need regular in-service training to effectively meet the needs of the gifted learners in their classes. Specific recommendations for in-service topics offered by Silverman (1991) include; (a) becoming familiar with the characteristics of giftedness, (b) understanding why girls tend to hide their abilities, (c) knowing when to refer children for diagnostic testing, (d) learning the research on early entrance and acceleration, (e) exposing students to advanced learning opportunities, (f) enabling students to progress academically and learn with other gifted peers, (g) encouraging independence and risk-taking in girls, (h) monitoring sexism in the classroom, (i) encouraging girls to contribute in class, (j) encouraging girls to take as many math classes as possible, (k) teaching students to make educated guesses, (l) cluster grouping of gifted students, (m) believing in gifted girls' abilities and being an advocate for them.

Confidence in Learning Math

Confidence in learning mathematics, a conceptual forerunner to math self-efficacy, predicts math-related performance (Hackett, 1985). Hackett and Betz (1989) defined mathematics self-efficacy as "a situational or problem-specific assessment of an individual's confidence in her ability to successfully perform or accomplish a particular math task or problem: (p.262). Bandura (1986) cautions that because judgments of self-efficacy are task specific, ways of assessing confidence will correspond differently with performance. Self-efficacy must be assessed specifically, rather than globally. The Fennema-Sherman confidence scale measures specific attitudes in learning math, avoiding confusion, interest, enjoyment, or other global topics.

Concurring with Bandura's (1986) guidelines regarding consistency of self-efficacy and performance assessment, Hackett and Betz agree that individual judgments to solve math problems, to perform or to succeed in math-related tasks, were related to a significant difference in math confidence. Even when they are successful in school, girls' confidence often remains low (Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1985; Fennema & Sherman, 1976; Meyer & Fennema, 1990).

If girls believe that they are incapable of performing well in math class, they may experience a sense of helplessness in the classroom (Covington & Berry, 1976; Dweck & Repucci, 1973). Girls who have little faith in their own ability tend to attribute success in math class to external causes (Eccles-Parsons, Adler & Kacala, 1982; Ryckman & Peckham, 1987).

A lack of confidence may be responsible for the girls taking fewer high-level math courses (Chipman & Thomas, 1985). The more confident students are of their ability to do well in mathematics, the more likely they are to continue with higher-level courses (Hackett, 1985; Lantz & Smith, 1981; Meece, Eccles, Futterman, Goff & Kaczala, 1982). The decision to enroll in upper level math courses has a stronger correlation with perceived ability versus actual ability (Eccles, 1984).

Male Domain

Gender differences in mathematics learning continue to attract research attention (Leder, 1992). Studies have addressed gender differences in achievement. Benbow and Stanley (1980) hold that biological differences between the sexes may account for the differential achievement patterns in mathematics. Waber (1977) explored the idea that early maturation of girls in comparison to boys may account for differences in mathematical abilities, particularly abilities of a spatial nature. Meta-analysis in mathematics achievement by Friedman (1989) and Hyde, Fennema, and Lamon (1990) suggest that gender differences are small and as girls get older, they decrease. Other researchers concur that the differences are small when girls are young. However, they hold a contradictory opinion surmising that girls begin to fall behind boys during the intermediate school years, and that the gap increases during high school (Armstrong, 1985; Fennema, 1974, 1980; Fox, 1980; Leder, 1992; Maccoby & Jacklin, 1974; Fennema & Peterson, 1985). Findings from more current studies indicate that the gap is narrowing over time (Hyde, Fennema, & Lamon, 1990). Feingold (1992) sees declines in recent decades, believing that cultural forces cause changes in the variability of boys and girls. Studies suggest that the performance of boys and girls depend on the skill assessed. For example, boys outperform girls in measurement and geometry (Fennema, Peterson, Carpenter, & Lubinski, 1990), while others show that girls outperform boys in computation (Fennema, 1974, Brandon, Newton, & Hammond, 1987).

There are several issues to consider when looking at gender differences in mathematics achievement. Research findings are not always consistent on when gender differences emerge nor do the findings exist in all areas of mathematics (Ma, 1995). Since the 1980s, researchers have been looking into behavioral components that also affect the gender differences (Glass & Hopkins, 1984). Behavioral research conducted by Glass and Hopkins (1984) focused on assessing interaction effects between girls and mathematics. A synthesis of research conducted by Misderandino, (1996), and Dweck and Elliot (1983), yielded the premise that children with learning goals seek mastery and performance.

The ability of the individual girl to monitor her own learning appears to be a key variable in much of the gender research currently done (VanTassel-Baska, 1998). VanTassel-Baska contends that if we affect the motivation pattern of gifted girls and their faulty perceptions of their own abilities, we can make progress in helping girls develop their potential at appropriate levels. Zinker (1977) suggests that blocks to creativity, such as stereo-typed reactions with an emphasis on conformity, fear of failure, avoidance of frustration, and a failure to see their own strengths, contribute to the plight of gifted girls.

Addressing vulnerability, Reis (1995), a noted researcher in the area of talented women, has written extensively on the promise of gifted girls by studying gifted women. She contends that interventions designed and implemented to address the specific needs of gifted girls when they are young, will translate into significant contributions made by gifted women. Pajares and Miller (1994) would prescribe a triangular formula of self-efficacy, self-concept, and belief in math problem solving ability for success. Gifted girls fall into the category of students with underutilized potential (VanTassel-Baska, 1998). Growth (1969) suggests that one in 300 gifted women maximize their potential.

Social Learning Theory

Albert Bandura, Richard Walters, Skinner, Piaget, Bruner, and others going back as far as the mid 1800s, have sought to blend behavior and learning. Table 10 highlights theorists of social learning and their theoretical constructs. Each theory reflects a world-view. A synthesis of the theoretical constructs yields differences in the view of the experts. Bandura's views are mechanistic, modeling the behaviors of others. Piaget subscribes to an organismic, highly scientific paradigm. Vygotsky's ideas are contextualized, deriving meaning from the context of all of our experiences. Each theory has educational applications, yet they are incompatible with each other. Each theorist believed that the social world played a role in individual development. Piaget (1981) and Bandura (1977) believed that environmental influences existed. They disagreed in how processes (Bandura, 1977) make sense of external world influences (Piaget, 1981). Table 11 contains brief summaries of learning theories.

Table 10

Social Learning Theorists and Theoretical Constructs

Theorist	Theoretical constructs
Bandura (1977)	Children learn through imitation of models in their social environment.
Piaget (1932)	Children are like scientists. They work alone to make sense of their environment and construct knowledge through actions in the world. Observational learning is the prevalent technique.
Piechowski (1998)	Learners use transpersonal knowledge and spiritual giftedness. The ability of children and adults to do inner work or transformation toward compassion is evident.
Rotter (1954)	Personality represents an interaction of the individual with their environment.
Vygotsky (1929)	Social interaction leads to cognition.

The learning theories in table 11 expand on the foundational constructs presented in table 10. The foundation principles describing how learning occurs are foundation principals of the theoretical constructs.

Table 11

Literature Summary of Theory

Theory	Researcher/year	Summary
Self-Determination Theory	Deci & Ryan (1985)	Desired outcomes have unintended consequences of decreasing intrinsic motivation, limiting self-determination. People feel controlled by rewards.
Self-Worth Theory	Covington & Berry (1976)	The desire to protect their own self-esteem motivates students who equate ability and achievement.
Social Learning Theory	Rotter (1954) Bandura (1977)	Observational learning occurs when an observer's behavior changes after viewing the behavior of the model.
Vygotskian Theory	Vygotsky (1929)	Children develop as individuals as they grow and learn. Connections exist between learning, social interaction, and environmental factors.
The Balance Theory of Wisdom	Sternberg (2000)	Wisdom balances intrapersonal, interpersonal, and extra-personal interests.

By the fourth grade gifted girls start to lose confidence and lower their effort and expectations (Bell, 1989). They are America's largest group of underachievers in gifted education (Reis, 1989). Many researchers have studied women in gifted education (Callahan, 1980; Kerr, 1985; Reis, 1987; Silverman, 1986), finding the effects of cultural stereotyping, avoidance of frustration, and a perceived lack of general respect from teachers (Wood, 1988), contribute to mixed messages.

Role models and mentors are crucial, if for no other reason than that, “no child will choose a career that she does not know about or cannot identify with” (Higham & Navarre, 1984, p. 52). There are fewer same sex role models for women to observe in daily life, literature, the arts, and the media. Sex-role stereotyping is still evident in educational materials (Robinson & Noble, 1991). Opportunities to interact with role models and mentors can significantly enhance a gifted woman’s acceptance of her own abilities and career possibilities (Fox 1983; Navarre, 1980; Schwartz, 1980).

Summary

Gifted girls comprise roughly half of the gifted population in elementary schools (VanTassel-Baska, 1983). This statistic mirrors the gifted center population selected for this study (171M, 138F). Gifted girls have a keen sense of humor and an acute sense of social knowledge (Kerr, 1994). Confident in their opinions and willing to argue their point of view, they have high career goals and often express wishes and needs for self-esteem by the age of ten (Kerr, 1994). These are however, the same girls who may lack confidence in certain social situations, can be insecure about math, fear success, and fall apart when they fail (Coleman & Fults, 1983). Temperamental and imaginative, gifted girls are risk-takers who keenly observe their social surroundings and adapt accordingly. Subtle traps snag gifted children. They are taught to capitalize on their academic superiority but are often alienated when they demonstrate their intellectual ability (Janos, Fung, & Robinson, 1985). These conflicting messages contribute to the frustration of gifted girls.

Forgasz & Leder (1996a) studied gender stereotyping of mathematics and first-language influence (i.e., English or Swedish). Grade 9 students judged if men or women were better at mathematics and explained their choices. Three years later, the cohort participated in another survey (77M, 105F). In each setting, students responded to the same questions. Most of male and female respondents considered the two groups to be equally capable (M=47%, F=71%). Data from this study indicate that although students consider men and women equally capable in mathematics, there are students who stereotyped mathematics as a gendered domain.

In the early 1990s (Forgasz & Leder, 1996a) conducted a large-scale study (386M, 396F). One of the variables used included mathematics as a male domain. The study used a modified six-item (three negatively and three positively worded) version of the MD for the survey. Large gender differences existed (p<. 001, effect size = .68) with females' mean score (29.09) higher than the males' (27.72). Thus, females were less likely than males to perceive mathematics as a male domain. A reliability check revealed a Cronbach alpha value of .67 for the scale. This value is considerably lower than the published Fennema and Sherman (1976) split-half reliability value of .87. The lower alpha value may have been reflective of societal changes over time or perhaps the items were not valid.

The Leder (1995) study examined, as part of a larger study, the social context of the variables. Five electronic mailing lists posted a 35-item questionnaire on gender-role orientation with themes related to the social context of learning, gender, and teacher research. Replies included 34 males and 125 females from more than 20 countries. One of the items, "Women are certainly logical enough to do well in mathematics," came directly from the MD. Most respondents strongly agreed (80%) or agreed (15%) with the item. The electronic format encouraged elaboration on ratings. Participant responses revealed difficulty with the item, the wording, and opportunity for multiple interpretations. These studies suggest the clear definition for the MAS when developed over two decades ago. A contemporary perspective requires a re-examination using current, more credible data. Mathematical self-concept is a separate, measurable construct distinguishable from general self-concept, and academic achievement.

Conclusion

The purpose of the study, based on any attitudinal affect an accelerated math curriculum has on gifted children (accelerated and differentiated from the standard curriculum in content, process, products and conceptual orientation), explored the math attitudes of gifted third, fourth, fifth, and sixth grade gifted students with a focus on gifted girls in the elementary grades. The tool used to explore the students' attitudes was the MAS. It contained domain specific, Likert – type scales that measured the students' perceptions of attitudes as learners of mathematics. The specific domains included; attitude towards success, mother's attitude, father's attitude, anxiety, motivation, usefulness, teacher's attitude, confidence, and male domain. This study explored the math attitudes of gifted students, focusing on gifted girls in the elementary grades.

Bandura (1977) believed that self-efficacy is related to persistence and people fear events only when they cannot predict or control them. Studies have demonstrated a negative correlation between math anxiety and math performance (Schwarzer, Seipp, & Schwarzer, 1989). This study does not examine performance but the attitudes that may precipitate it. Correlates of anxiety suggest that appropriate levels of stress can have a positive influence on gifted children (Dirkes, 1983). When they learn to respond to conflict with problem solving and relaxation strategies, they can use anxiety to their advantage. Since the abilities of the gifted are not in synchrony with their age peers, they invite ambiguous expectations for performance (Dirkes, 1983). Whatever the source, loss of control and a sense of inadequacy create anxiety. This study examines the attitudes of gifted students in an accelerated math program and explores findings in math anxiety and motivation.

Chapter III describes the methodology used for this study. The study used eight of the nine domains of the MAS as the investigative tool. Dr. Elizabeth Fennema advised the elimination of the MD scale in a phone conversation about the study (E. Fennema, personal communication, September 21, 2001). During our conversation, she told me that the scale had no allowance for beliefs that mathematics might be a gender specific domain when developed and that although the assumption agreed with societal views in the 1970s, it was not valid today (Fennema, 2001). Recent studies evaluating the male domain scale significance and applicability in contemporary society (Forgasz & Leder, 1996a; Forgasz, Leder, & Taylor, 1996; Leder, 1995) support the researcher and author’s recommendation to eliminate it from the study.

Chapter III

Methodology

This chapter includes a description of the setting, the methodology, the instrumentation or tool used to collect student data, and research design used for analysis. The first section details the population for the study and contains demographic characteristics of the school setting. The purpose for the study, based on the attitudinal math curriculum acceleration in the gifted program explores the math attitudes of gifted third, fourth, fifth, and sixth grade gifted students with a focus on gifted girls. Examining the attitudes reported by the students offers data that can be evaluated. This data may be applicable to making instructional decisions relative to acceleration, differentiation, and teacher training programs in gifted education. The research questions address the purpose of the study and the tool chosen for analysis. The research questions addressed by this study are:

1. What are the math attitudes of third, fourth, fifth, and sixth grade students on eight domains of the Fennema-Sherman Math Attitudes Scales?
2. How do gifted students in grades three through six differ in their attitudes toward math?
3. What are the most significant math attitudes of third, fourth, fifth, and sixth, grade gifted girls?

Population

Participants included 267 gifted girls (N=124) and boys (N= 143) in third grade (N= 95), fourth grade (N=80), fifth grade (N=70), and sixth grade (N=22) within two centers. The first center, a full time gifted program for grades three through five, represented 245 students. The other, representing 22 sixth grade students, was a full time gifted program within one of the middle school buildings. The elementary center is nestled in a pocket on the banks of a creek on the southeastern coast of the United States. Shipbuilding is a major industry in the community. There is a large military presence (Navy, Air Force, and Army) in the area.

The centers, in the third year of operation, offer differentiated instructional programs for identified gifted children. The math curriculum is accelerated two years above grade level. The population represents all areas of the city, as the students have come from 25 elementary schools. Demographically, student representation parallels the school division in SES, free and reduced lunch, and families in federally subsidized housing. Mui, Yeung, Low, & Jin, (2000) believe that school programs are successful when designed around the belief that self-concept of gifted children is influenced by social comparison. When placed in a homogenous group with strong expectations of academic performance, gifted children thrive. Children thrive with high expectations. This opinion is echoed in the philosophy of Bandura's social learning theory.

The centers offered a differentiated, innovative gifted program to students in a full-time setting. Students participated in a rigorous, accelerated, differentiated curriculum. Using a departmentalized design, each student realized the benefit of instruction from content experts. For example, all students in third grade have the same math teacher and switch classes for their other core subjects. Sixth grade uses the same model. The participants selected were a diverse group of students representing the entire school division. In addition, they included home-schooled children and transfers from private schools. The students had varied backgrounds and varied math experiences. Table 12 depicts demographic data of the students.

Data yielded significant findings for boys and girls. Although the focus of the study centered on the math attitudes of gifted girls, data revealed by the boys on all domains provided insight into the analysis. The boys added great comparisons and depth to the study.

Table 12

Student Demographic Data

Home school	Students attending elementary center	Students attending middle center	Total
1.	4		4
2.	26	14	40
3.	28	12	40
4.	26	10	36
5.	4		4
6.	10	3	13
7.	16	8	24
8.	11	2	13
9.	1		1
10.	8	2	10
11.	22	9	31
12.	21	8	29
13.	10	2	12
14.	7	1	8
15.	12	2	14
16.	8	2	10
17.	10	3	13
18.	4		4

19.	18	11	29
20.	6		6
21.	3		3
22.	20		20
23.	2		2
24.	5		5
Total	283	88	371

Instrumentation

It is important to study mathematics attitudes in order to improve mathematics learning. The Fennema-Sherman Mathematics Attitudes Scales (MAS) are one of the most frequently used instruments for measuring attitudes in mathematics (Mayer & Koeler, 1990). The scale, developed in 1976 consists of nine Likert type domains that measure attitude related to the student perception of learning math. The domains are: (a) attitude toward success in math, (b) mother's attitude toward math, (c) father's attitude toward math, (d) math anxiety, (e) motivation, (f) usefulness of math, (g) teacher's attitude toward the learner, (h) confidence in learning math, and (i) math as a male domain (Broadbooks, Elmore, Pederson, & Bleyer, 1981). Domain specific attitudes relating to cognitive performance and learning mathematics are the foundation of the scale. Some domains are not technically "attitude" but have been termed as such to facilitate communication. Table 1 on page 6 contains the domain descriptive information.

Reliability/validity.

The definition of each scale dimension established content validity. During the initial design phase, each author (Fennema & Sherman) independently wrote items the other author judged representing the dimension and the validity. The authors selected items that measured an aspect of the domain and covering the range of the domain. Eighteen to 22 items per domain were selected for the initial test with approximately half stated positively and half negatively resulting in a 173-item instrument. The initial administration included 367 math students in a middle-class suburban high school (Fennema-Sherman, 1976). The original study sought, as one of its purposes, to differentiate between students who elected to study mathematics and students who did not. Participants included math students and non-math students. Table 13 shows the original sample.

Table 13

Sample Used for Item Selection.

	Grade	9		10		11		12		Total	
	Sex	M	F	M	F	M	F	M	F	M	F
Enrolled in mathematics		29	47	56	51	46	38	23	24	154	160
Not enrolled in mathematics				2		8	14	16	13	26	27
										180	187

Note. Data taken from Fennema-Sherman Mathematics Attitudes Scales. *JSAS Catalog of Selected Documents in Psychology*, 1976, 6, 31

The modified instrument contained 12 items per scale with six items stated positively, six stated negatively, and five Likert-type response alternatives: strongly agree, agree, undecided, disagree, and strongly disagree. In 1975, four high schools in Madison, Wisconsin, participated in a revised version. The authors did not use the anxiety scale. Table 14 displays mean scores and standard deviations for the population noted by the authors.

Table 14

Reported Means and Standard Deviations on the Fennema-Sherman Mathematics Attitudes Scales

	M (female)	M (male)	SD (female)	SD (male)
Attitude toward success in math	47.24	46.74	6.78	6.02
Math as a male domain	52.94	45.24	5.98	7.78
Mother's attitude toward math	43.86	45.85	7.90	6.15
Father's attitude toward math	44.72	46.47	7.90	6.86
Anxiety toward math		Not reported		
Effectance motivation	38.48	38.78	9.09	7.75
Usefulness of math	45.68	46.90	8.56	7.62
Teacher's attitude toward math	41.69	42.57	7.32	6.68
Confidence in learning math	41.66	44.05	9.99	9.86

Note. Data taken from the Fennema-Sherman Mathematics Attitudes Scales. *JSAS Catalog of Selected Documents in Psychology*, 1976, 6, 30.

N= 219 female students, N= 194 male students

Table 15 reports the Analyses of Variance computed for each scale using grade and sex as variables.

Table 15

Fennema-Sherman Mathematics Attitudes Scales main sample: F Values of Grade and Sex Analyses of Variance

Scale	df	Sex	df	Grade	Sex/grade
Attitude toward success	1,1230	.82	3,1230	5.03**	.01
Confidence	1,1230	12.16**	3,1230	12.25**	2.69**
Mother's attitude	1,1227	8.25**	3,1227	1.71	.19
Father's attitude	1,1230	5.44*	3,1230	6.27**	.65
Anxiety		Not Reported			
Effectance motivation	1,1230	.32	3,1230	14.15**	.30
Usefulness of mathematics	1,1222	4.28*	3,1222	9.82**	.32
Teacher's attitude	1,1230	.72	3,1230	2.71*	1.56
Confidence in learning mathematics	1,1230	12.16**	3,1230	12.25**	2.69**
Mathematics as a male domain	1,1229	332.42**	3,1229	2.73*	.53

Note. Data taken from the Fennema-Sherman Mathematics Attitudes Scales. *JSAS Catalog of Selected Documents in Psychology*, 1976, 6, 31.

** = p <.01 * = p <. 05

The authors calculated split-half reliabilities for each scale. The Cronbach alpha coefficients ranged from a low of .86 to a high of .93, shown in Table 16.

Table 16

Split-Half Reliabilities on the Fennema-Sherman Mathematics Attitudes Scales

Scale	Reliability
Attitudes toward success (AS)	.87
Mother's attitude (M)	.86
Father's attitude (F)	.91
Anxiety (A)	.89
Effectance motivation in (E)	.87
Usefulness of mathematics (U)	.88
Teacher's attitude (T)	.88
Confidence in learning mathematics (C)	.93
Mathematics as a male domain (MD)	.87

Note. Data taken from the Fennema-Sherman Mathematics Attitudes Scales.

JSAS Catalog of Selected Documents in Psychology, 1976, 6, 32.

N= 589 female students, N= 644 male students

Broadbooks, Elmore, Pedersen, & Bleyer (1981) conducted a construct validation study of the domains to determine the extent to which the instrument assessed student attitudes toward math. Factor analysis on the responses from 1,541 students yielded two factors that accounted for 68.7% of the total variance in student's attitude toward mathematics. Broadbooks et al. indicated that factor one focused on external factors such as the perceptions of others, while factor two focused on the internal factors such as individual feelings. The authors surmised, "…evidence existed to support the theoretical structure of the Fennema-Sherman Mathematics Attitudes Scales" (p. 556).

The Republic of Ireland conducted a validity analysis using 196 secondary students. The study yielded virtually identical Cronbach alpha coefficients to the original 1978 study. Coefficients for each scale in the study ranged from a low of .83 to a high of .91. This result led to the creation of a shortened instrument. No difference emerged between the nine-scale version alpha coefficients and the shortened instrument. The modified version included: attitude toward success scale, confidence in learning scale, usefulness of math scale, and effectance motivation scale. Analysis yielded a Cronbach alpha coefficient (Borg & Gall, 1996) of a .96 for the nine-scale version and .93 for the modified version. This analysis indicated that using fewer domains would not lower the reliability of the instrument (Borg & Gall, 1996).

Table 17 displays correlations between scale scores. The inter-scale correlations indicate that although the domains are interrelated, each scale measures a somewhat different construct. The inter-scale correlations were similar between sexes with all differences between the sexes yielding non-significant results.

Table 17

Correlation's among Fennema-Sherman Mathematics Attitudes Scales

		Confidence		Mother		Father		Success		Teacher		Male domain		Usefulness	
Scale	Sex	F	M	F	M	F	M	F	M	F	M	F	M	F	M
Confidence in learning math															
Mother's attitude	.38	.48													
Father's attitude	.34	.38	.57	.65									.		
Attitude toward success	.37	.23	.42	.33	.35	.33									
Teacher's attitude	.61	.64	.45	.52	.37	.46	.39	.32							
Male domain	.23	.22	.23	.25	.18	.23	.30	.34	.38	.25					
Usefulness	.46	.44	.53	.58	.51	.58	.40	.36	.50	.44	.27	.25			
Effectance motivation	.66	.61	.37	.46	.33	.37	.40	.34	.53	.50	.23	.17	.50	.55	

Note. Data taken from the Fennema-Sherman Mathematics Attitudes Scales. *JSAS Catalog of Selected Documents in Psychology*, 1976, 6, 31.

N= 589 (females); 644 (males)

Table 18 contains factor loadings and principal component factor analysis. Four main factors emerged. Factor A is comprised of confidence in learning mathematics, teacher, and effectance motivation in mathematics. Factor B is comprised of mother, father, and usefulness in mathematics. For females, Factor C is an attitude toward success factor with smaller loadings for usefulness of mathematics and effectance mathematics motivation. Attitude toward success appeared for males in Factor D. Factor C for males, mathematics as a male domain, emerged as factor D for females. Factors C and D appear to be sex role factors. Factor loadings of .50 or higher are underlined and considered an important part of each domain.

Table 18

Results of Principal Components Factor Analysis

	Factor	A		B		C		D	
Scale	Gender	F	M	F	M	F	M	F	M
Attitude		.12	.23	.19	.25	.90	.15	.22	.92
Mother		.34	.21	.80	.79	.09	.10	.12	.23
Father		.16	.14	.88	.87	.10	.04	.10	.08
Anxiety		Not reported							
Motivation		.75	.84	.23	.19	.38	.02	.11	.20
Usefulness		.36	.44	.66	.64	.33	.14	.01	.12
Teacher		.73	.68	.35	.32	.05	.37	.21	.07
Confidence		.88	.87	.22	.19	.01	.07	.12	.12
Male domain		.11	.13	.12	.10	.18	.96	.95	.13

Note. Data taken from the Fennema-Sherman Mathematics Attitudes Scales.

JSAS Catalog of Selected Documents in Psychology, 1976, 6, 32.

N= 589 (females); 644 (males)

Research Design

Classroom teachers administered the 96-item instrument to students on the same day. The majority of the students finished within 30 minutes. The 96-item instrument contained 12 items for each of the eight domains used for this study (attitude toward success in mathematics, mother's attitude, father's attitude, anxiety, motivation, usefulness, teacher attitude, confidence in learning mathematics, and male domain). Dr. Fennema, author of the instrument advised omitting the math as a male domain scale because it had not shown significant results in prior studies and it was not designed for the ages of the students in the current study. Her reasons included; earlier studies had yielded non-significant results, a different political and social climate existed in 1976, the children for this study were significantly younger than the high school students in the original study, and it would be a redundant waste of time. A Fry, SMOG, and Flesch-Kincaid readability study conducted on the instrument yielded a grade level readability of 3.8. Each of the students surveyed is reading at or above the fourth grade reading level. The readability study confirmed the appropriateness of the content for this study. Each domain contained 12 items. Six items were positive items and six were negative items. This resulted in 96 items per student. The Likert-type responses were; strongly agree, agree, not sure, disagree, and strongly disagree. Dr. Fennema suggested the format for simplicity and avoidance of confusion. When consulted, Dr. Lawrence Cross, a faculty member with Virginia Tech in the Research and Evaluation department, believed the integrity of the instrument and validity of the results would remain intact with the format changes. Each response has a score from 1-5. The total score is the cumulative total for each student. A lower score equates to a more positive individual math attitude. The school system research review board granted approval for the study, as did the IRB of Virginia Tech. In addition, each student and parent signed a permission form.

Students received specific oral and written directions. Teachers told them the activity is not timed and to record their first impression for each item. Other directions included the following: mark every statement; there is no right or wrong answers; whenever possible let things that have happened to you make your decision. Teachers reminded students that their names would be kept confidential and that their parents gave permission for their participation in the study. Students who chose not to participate received an alternate math activity with no penalty attached. For coding purposes, the instrument asked for gender and grade level. Each student received a numerical score calculated by totaling the response points for each item. The Statistical Package for the Social Sciences (SPSS) was used to calculate individual and domain scores. Descriptive and inferential statistics are reported and interpreted in chapter IV. Mean scores, standard deviations, and results of the MANOVA analysis are reported in tables.

Conclusion

Bandura (1989) hypothesized that self-efficacy is the central mediator of experience and performance as well as a major predictor of future performance. Self-efficacy influences choice of activities, amount of effort expended, and perseverance. According to his social learning theory, psychological events change behavior by creating and strengthening perceived self-efficacy (Bandura, 1977). The information tapped by assessing the math attitudes of gifted girls should, theoretically, encompass information from past experiences, parents, peers, and environment. Acknowledging gifted girls as a vulnerable population, this study has the potential to make a significant impact in the field of gifted education. Once the information necessary to make meaningful decisions is available, we can change. (Terman & Oden, 1947). This research can potentially be replicated in situations for other researchers studying gifted children, can be replicated in the future to see if attitudes change with this population, and can be used by other schools interested in the math attitudes of gifted students. Knowing the attitudes of the gifted girls can offer valuable insight when making instructional decisions for gifted learners. The attitudes discovered from this research provide insight and information to help school divisions. Educators can make their own judgments. The ultimate test of whether a judgment is wise is in how the judgment is made, rather than the judgment itself. (Sternberg, 2000) This study offers educators data on the math attitudes held by gifted students in third, fourth, fifth, and sixth grade. Acknowledging and recognizing the existence of the math attitudes enables educators to inform staff and parents and develop a differentiated math curriculum commensurate with the Virginia Plan for the Gifted. `

Some might question the purpose of exploring the math education of gifted girls. Perhaps because, they believe gifted girls will remain gifted and fulfill their educational needs on their own. All gifted children, girls included, deserve an appropriate education. It is the law. The Virginia Board of Education adopted the Virginia Plan for the Gifted in 1993 ensuring the Commonwealth provides statutory guidelines for Gifted Education in Virginia.

Gifted girls need positive role models to ensure achievement in mathematics (Lent, Lopez, & Bieschke, 1991). They deserve a stimulating educational experience appropriate to their level of ability to realize their potential. As gifted girls move through school into adulthood, society has a responsibility to intervene, ensuring their abilities are developed commensurate with their potential (VanTassel-Baska, 1998).

The wisdom of Leta Hollingworth can help guide and inspire us. Her courage changed the course of history for women and gifted girls. During her time, Leta Hollingworth wrote:

> I was intellectually curious, I worked hard, was honest except for those benign chicaneries; that are occasionally necessary when authority is stupid, disliked waste, and was never afraid to undertake an experiment or to change my mind. My family motto translated from Latin, reads, - I love to test. (Hollingworth, 1940)

Her vision gave birth to the field of gifted education. Today, parents and educators hold the generational torch that nurtures and develops the potential of this vulnerable population. When John F. Kennedy spoke about talent and having the opportunity to develop it, he may have been speaking to us.

Chapter IV

Results

This study explored the math attitudes of 267 gifted boys and girls using the Fennema-Sherman Math Attitudes Scales (MAS), a tool designed to measure a variety of mathematics learning attitudes. The instrument contains domain specific sections which were; attitude towards success, mother's attitude, father's attitude, anxiety, motivation, usefulness, teacher's attitude, confidence, and male domain. The study used eight of the nine domains. Instrument author, Dr. Elizabeth Fennema advised the elimination of the male domain because it had not shown significant results in prior studies and was not designed for the study participants. A multivariate analysis of variance compared the groups within the domain question clusters and found significance in the anxiety (.002) and motivation (.008) domains. The data yielded similarities and differences between the boys and girls and among the grade levels. The data is reported in tables and in narrative form.

Chapter IV contains the findings of the three research questions examining the math attitudes of gifted students on the MAS:

1. What are the math attitudes of third, fourth, fifth, and sixth grade gifted students on eight domains of the Fennema-Sherman Math Attitudes Scales?
2. How do gifted boys and girls in grades three through six differ in their attitudes towards math?
3. What are the most significant math attitudes of third, fourth, fifth, and sixth, grade gifted girls?

Analyses, including descriptive and inferential statistics are included in the chapter. The descriptive statistics present domain summary data, mean scores, standard deviations, and graphic representations of the data. The inferential statistics section includes the results of the MANOVA analysis in tabular form and these statistics are interpreted. All analyses were performed using the Statistical Package for the Social Sciences.

Descriptive Analysis

Data were collected on 267 of the 371 gifted students in grades three through six, attending a full day gifted program at the elementary or middle school center. The single math teacher at each grade level administered the MAS to her students. The third, fourth, and fifth grade teachers were endorsed in gifted education. At the time of this study, the sixth grade teacher did not hold a gifted endorsement Teacher experience varied. The fourth grade teacher, the newest, has less than five years of teaching experience. The teachers in third and fifth grade have 15 and 20 years of experience respectively. The sixth grade teacher was replaced mid-year. Therefore, the students had two teachers for math in the sixth grade. Of the 267 participants, 143 were boys and 124 were girls. The summary data for each grade level is reported in Table 19. Of the 267 students in the study, 95 (35.6%) were in the third grade, 80 (30%) were in the fourth grade, 70 (26.2%) were in the fifth grade, and 22 (8.2%) were in the sixth grade.

Table 19

Grade Level Summary Data

		Boys	Girls	Frequency	Percent	Valid percent	Cumulative percent
Valid	3rd grade	52	43	95	35.6	35.6	35.6
	4th grade	50	30	80	30.0	30.0	65.5
	5th grade	33	37	70	26.2	26.2	91.8
	6th grade	8	14	22	8.2	8.2	100.0
	Total	143	124	267	100.0	100.0	

Note. Data taken from student totals on the Fennema-Sherman Math Attitudes Scales

N=124 (females); 143 (males)

Each student response item received a score of one to five. Each domain had 12 items, 6 positively scored and six negatively or reverse scored. All responses were summed for a domain total. A higher score indicates a more negative math attitude. A lower score indicates fewer reported negative attitudes towards math, hence, a better math attitude. The anxiety domain received the highest score (28.18) indicating negative math attitudes by students who participated in the study. Anxiety (.002) and motivation (.008) emerged as significant findings. Mean scores and standard deviations are displayed in Table 20.

Table 20

Mean Scores and Standard Deviations for Domain Responses for all Grades

	Attitude	Mother	Father	Anxiety	Motivation	Usefulness	Teacher	Confidence
N Valid	267	266	261	266	266	264	267	236
Missing	0	1	6	1	1	3	0	31
Mean	19.20	20.32	20.13	28.18	27.64	19.94	17.96	21.64
SD	6.84	6.31	7.11	14.31	11.84	10.06	8.29	11.77

Note. Data taken from student responses on the Fennema-Sherman Math Attitudes Scales.

N=124 (females); 143 (males)

Domain scores reflected variance across grade levels. Third grade students reported the best math attitude in teacher’s attitude (17.45) and negative attitudes in the anxiety domain (28.44) and likewise, fourth grade students reported the best attitude in teacher’s attitude (16.70) negative attitudes in the anxiety domain (24.67). Fifth grade students reported usefulness as the most positive attitude (17.97) and shared anxiety (30.26) as the most negative with the third and fourth grade sample. The sixth grade students, with the smallest number of participants (n=22), reported the most positive math attitude in attitude towards success (20.23) and the most negative attitude in motivation (34.09). Sixth grade students reported more negative attitudes across all domains. The mean domain scores of all students in grades three though six identified the teacher's attitude for grade 4 (16.70) as the most positive math attitude. The domain reported with the most negative math attitude was motivation (34.09) in grade 6. Table 21 reports the scores by grade level in order of most positive math attitude to the most negative math attitude. Grade level mean results for each domain and the summed attitude scores for each grade level are displayed in Table 21. Figure 3 is a graphic depiction of mean scores for anxiety and motivation.

Table 21

Student Domain Means Scores by Grade Level

Grade 3		Grade 4		Grade 5		Grade 6	
Domain	Mean score	Domain	Mean score	Domain	Mean score	Domain	Mean score
teacher	17.45	teacher	16.70	usefulness	17.97	attitude	20.23
attitude	18.46	usefulness	18.92	teacher	18.81	mother	21.32
mother	20.84	attitude	19.31	father	19.00	father	21.36
father	21.27	father	19.35	attitude	19.74	teacher	22.00
usefulness	21.32	mother	19.87	mother	19.81	usefulness	23.73
confidence	21.47	confidence	20.22	confidence	22.56	confidence	24.48
motivation	28.44	motivation	23.90	motivation	27.86	anxiety	31.05
anxiety	28.44	anxiety	24.67	anxiety	30.26	motivation	34.09
Total	175.65	Total	158.63	Total	172.66	Total	197.14

Domain Analysis

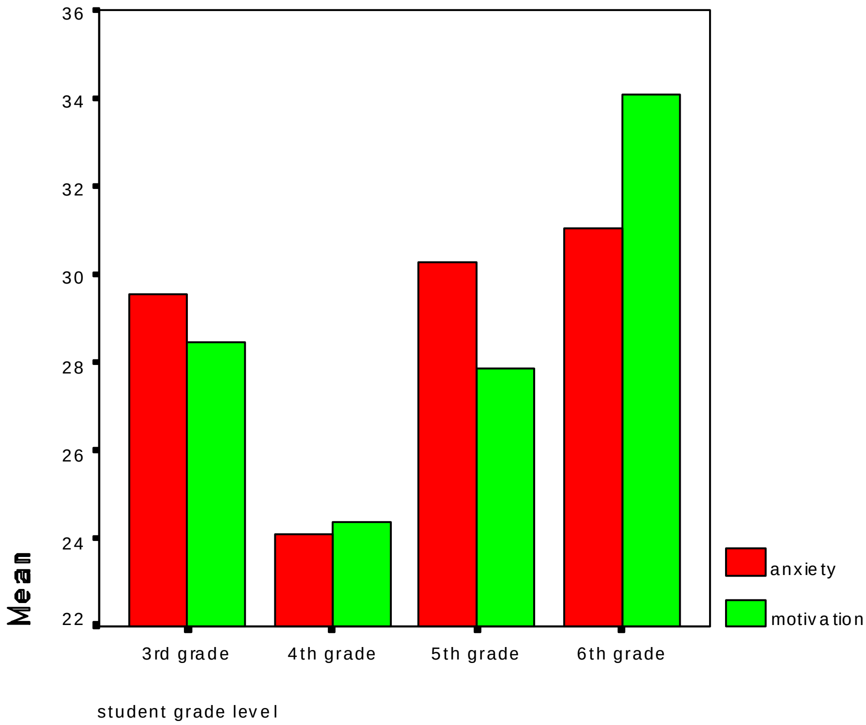


Figure 3. Grade level mean scores for the most negative responses.

Anxiety and motivation emerged as the two significant findings of the study. All but the fourth grade showed elevated math anxiety and negative attitudes toward motivation. Boys and girls in third grade showed similar attitudes on all domains. Fourth grade data did not show the same elevated levels of negative anxiety or motivation attitudes as the other grade levels. In addition, data yielded fewer negative math attitudes on the domains than any other grade level data. Fifth grade boys' and girls' responses indicated different levels of anxiety, motivation, and perception of teacher's attitude. The study revealed more negative math attitude among the sixth grade students than the other grade levels. Figure 4 depicts the response totals by grade level.

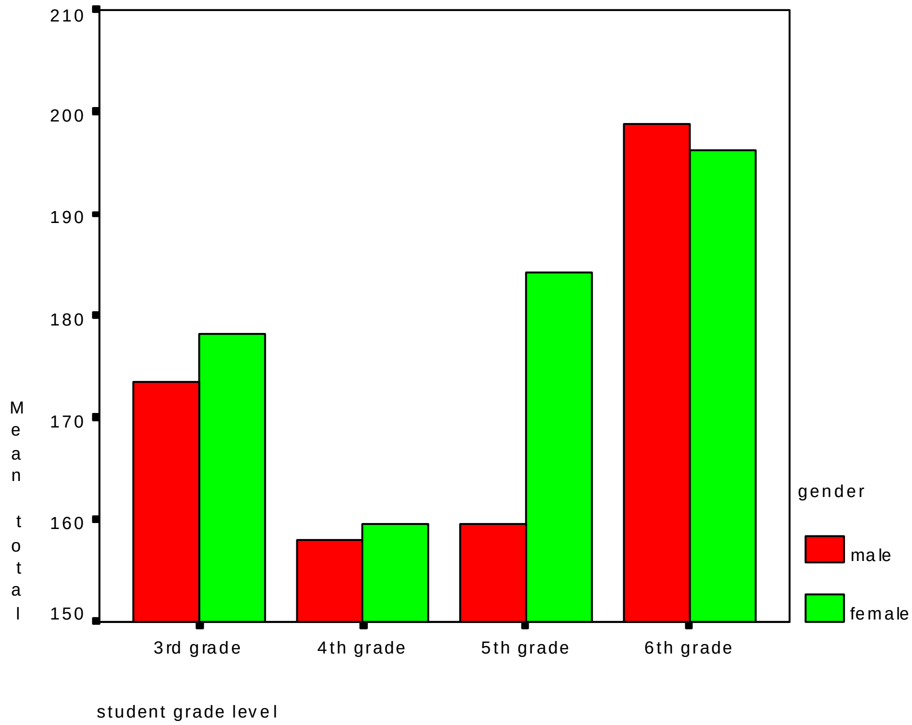


Figure 4. Total responses for surveyed population by grade level.

Negative attitudes varied by grade gender and grade level. Data compiled by averaging mean scores by gender for all domains across grade levels indicated fewer negative math attitudes for boys than girls in the third, fourth, and fifth grade. Fourth grade student data revealed the fewest of negative attitudes in any of the domains. In the fifth grade, girls' data showed more negative math attitudes than the boys. Data revealed the most negative attitudes in math were shown by sixth grade boys and girls. Table 22 reports grade level mean and standard deviations.

Table 22

Grade Level Means and Standard Deviations

Grade level	Mean average	N	SD
3rd grade	175.65	95	58.11
4th grade	158.63	80	53.55
5th grade	172.66	70	52.30
6th grade	197.14	22	48.25

Table 22 reports standard deviations to correspond with the data presented in figure 4. Like figure 4, results in the table display the fewest negative math attitudes amongst the fourth grade and more negative attitudes amongst third and sixth grade. Table 23 displays grade level domain mean, standard deviations and overall totals.

Table 23

Grade Level Domain Mean and Overall Math Attitude Scores

Grade level		attitude	mother	father	anxiety	motivation	usefulness	teacher	confidence	overall
3	Mean	18.46	20.84	21.27	29.56	28.44	21.32	17.45	21.47	175.65
	N	95	95	95	95	95	95	95	81	95
	SD	6.58	7.06	7.51	14.86	12.10	11.34	8.69	11.79	58.11
4	Mean	19.31	19.87	19.35	23.90	24.67	18.92	16.70	20.22	158.63
	N	80	79	75	79	79	79	80	72	80
	SD	7.32	4.81	6.08	13.14	10.91	9.02	7.42	11.80	53.55
5	Mean	19.74	19.81	19.00	30.26	27.86	17.97	18.81	22.56	172.66
	N	70	70	69	70	70	68	70	62	70
	SD	6.48	6.39	6.77	15.10	12.33	8.98	8.47	12.56	52.30
6	Mean	20.23	21.32	21.36	31.05	34.09	23.73	22.00	24.48	197.14
	N	22	22	22	22	22	22	22	21	22
	SD	7.44	7.44	9.03	10.12	9.60	9.62	7.87	8.89	48.25
Total	Mean	19.20	20.32	20.13	28.18	27.64	19.94	17.96	21.64	171.54
	N	267	266	261	266	266	264	267	236	267
	SD	6.84	6.31	7.11	14.31	11.84	10.06	8.29	11.77	55.22

Note. Data taken from student responses on the Fennema-Sherman Math Attitudes Scales.

N=124 (females); 143 (males)

Attitude Towards Success

The attitude towards success domain was designed to measure the degree to which students anticipated positive or negative consequences as a result of success in mathematics. The data revealed that third and fourth grade boys and girls have similar attitudes in this domain. However, fifth grade responses show differences between boys and girls. Data reveals an increase in sixth grade boys' negative attitudes. Boys' negative attitudes increases in each grade level with the highest variance occurring in the sixth grade. In contrast, the responses from the sixth grade girls revealed the fewest negative attitudes in the study. Figure 5 depicts the mean scores by gender and grade level reported for the attitude towards success domain.

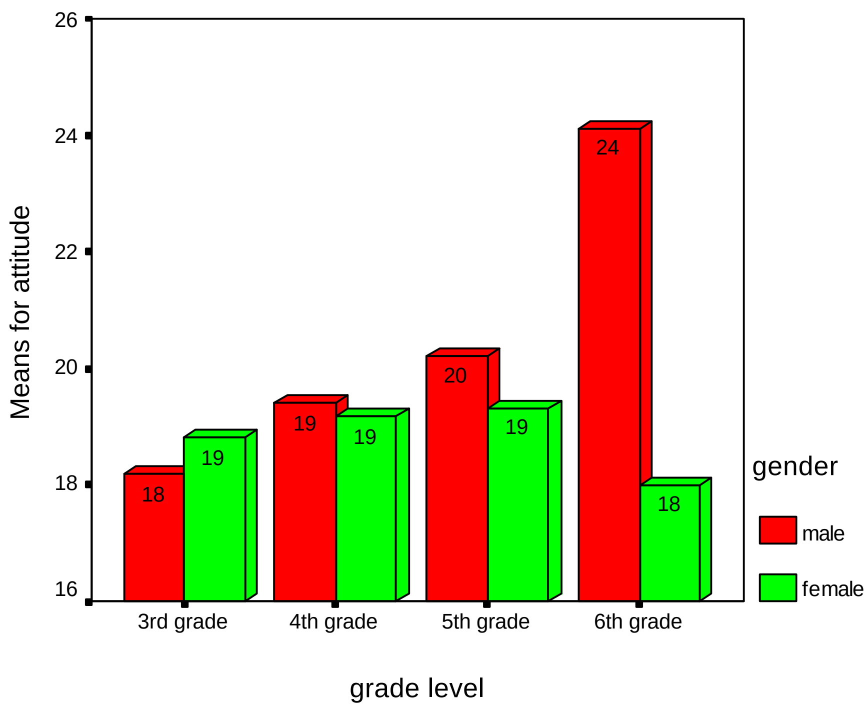


Figure 5. Graphic depiction of mean scores for attitude towards success.

Mother's Attitude

The mother's attitude domain was designed to measure perceived mother's attitude towards the children as learners of mathematics. The data reveals that third, fourth, and fifth grade girls have fewer negative attitudes than boys in this domain. Data from third grade boys and girls showed the greatest discrepancy. Negative attitudes were highest amongst third grade boys with sixth grade boys closely following. There was little variance between boys and girls in the fifth grade. Fourth and sixth grade girls' responses showed more negative attitudes than the other girls in the study. Data indicated third grade boys and sixth grade girls have the most negative perception of their mother's attitude toward them as learners of mathematics. Figure 6 depicts the mean scores by gender and grade level reported for the mother's attitude domain.

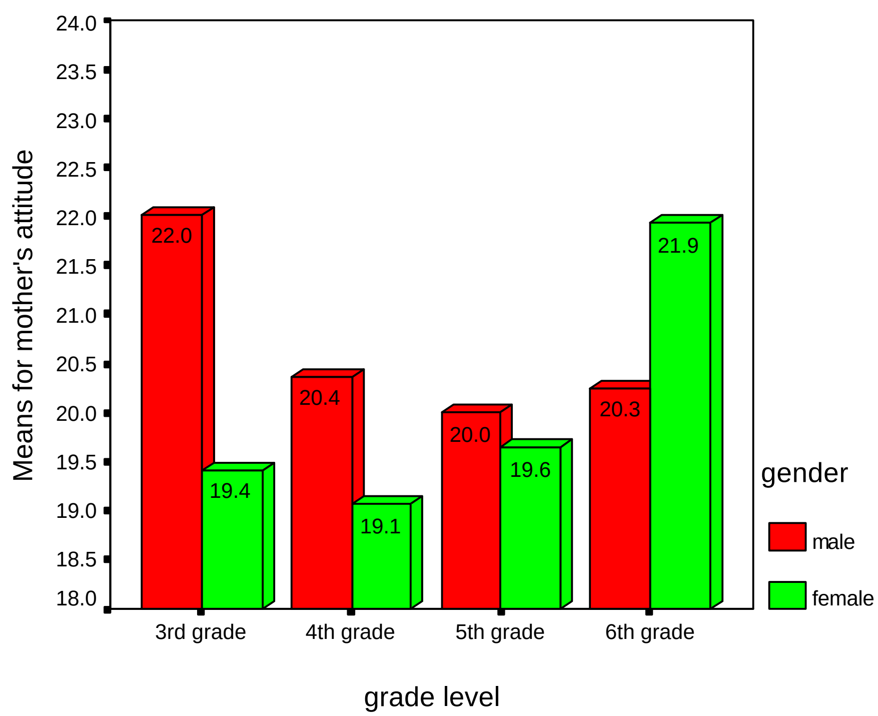


Figure 6.

Graphic depiction of mean scores for mother's attitude.

Father's Attitude

The father's attitude domain was designed to measure perceived father's attitude towards the children as learners of mathematics. The data revealed third grade boys and sixth grade girls have the most negative attitudes. Fourth grade girls' responses show positive feelings about their father's attitude towards them. In fifth grade, boys and girls share a similar perception of their father's math attitude. Sixth grade girls' responses show the negative perceptions of any boy or girl in the study. The sixth grade boys share similar perceptions of their father's math attitude with boys in third, fourth, and fifth grade. The greatest discrepancy between boys and girls in father's attitude occurred in sixth grade. Figure 6 depicts the mean scores by gender and grade level reported for the father's attitude domain.

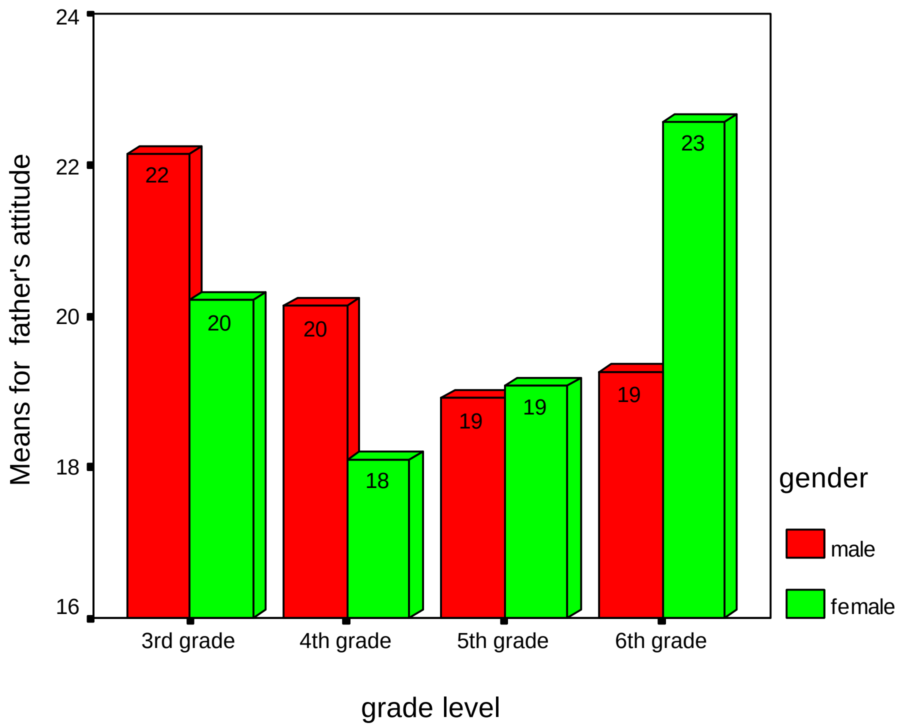


Figure 7. Graphic depiction of mean scores for father's attitude.

Anxiety

The anxiety domain was designed to measure feelings of anxiety, dread, nervousness, and other physical symptoms related to doing mathematics. The study revealed anxiety as the most statistically significant domain (.002) affecting all students. Receiving the most negative responses, it affected all students. Although fourth grade girls showed fewer negative attitudes, girls' responses exceeded boys at all levels. The greatest discrepancy between boys and girls in the anxiety domain occurred in fifth grade. Figure 8 depicts the mean scores by gender and grade level for the anxiety domain.

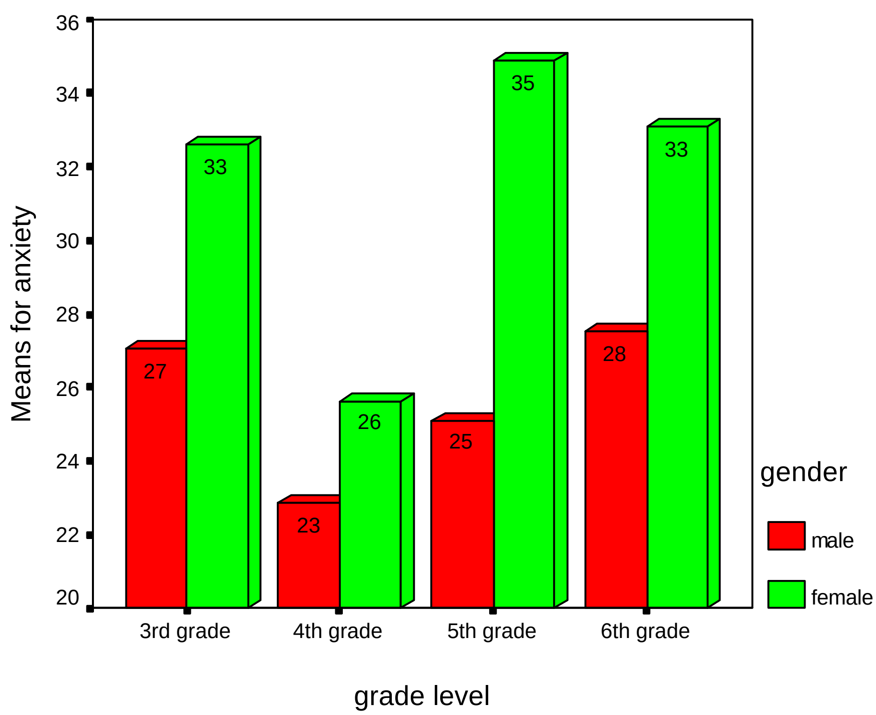


Figure 8.

Graphic depiction of mean scores for anxiety.

Motivation

The motivation domain was designed to measure perseverance when faced with challenging math problems. The study revealed motivation and perseverance with challenging math problems as statistically significant (.008), affecting all students. Data revealed that third, fourth, and sixth grade share comparable attitudes within their grade level, whereas fifth grade boys and girls share the largest variance within any grade level. Fourth graders responses showed the fewest negative attitudes in motivation. Sixth grade boys and girls both revealed negative attitudes in the motivation domain. This was in fact the highest negative domain for sixth grade boys. Graphic depictions of mean scores by gender and grade level for the motivation domain are shown in figure 9.

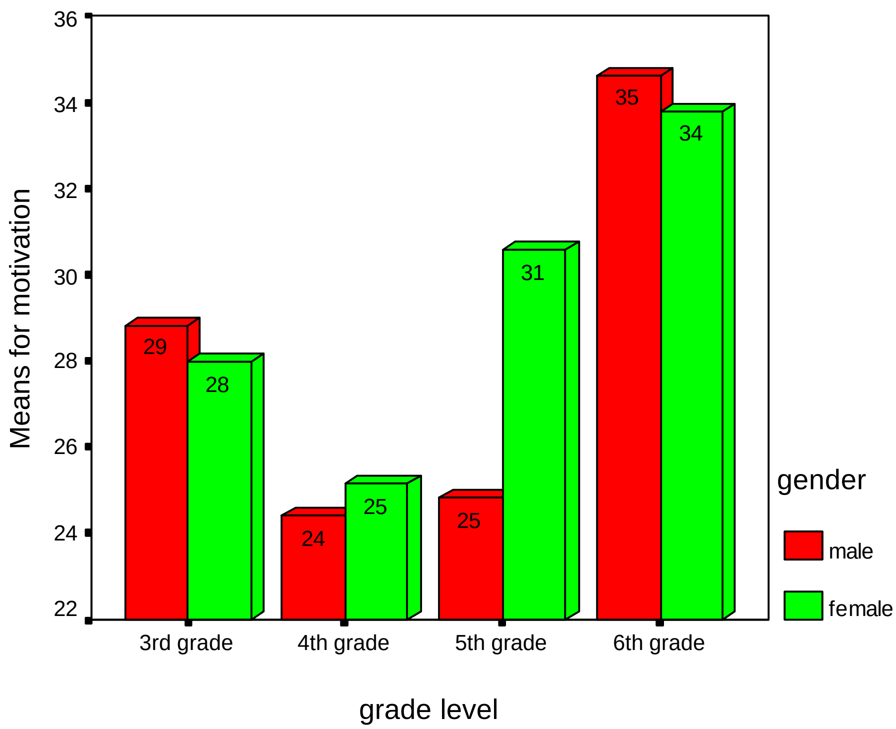


Figure 9. Graphic depiction of mean scores for motivation.

Usefulness

The usefulness domain was designed to measure student beliefs about current usefulness of mathematics and the importance to their future education. The data revealed third grade boys and girls share similar attitudes related to usefulness. Girls' responses showed more negative attitudes in this domain than the boys at their respective grade levels. Fifth grade responses revealed the fewest negative attitudes of all the domains. The sixth grade data revealed the highest negative attitudes in usefulness. The greatest discrepancy between boys and girls in usefulness was shown in fourth and sixth grade. Each had a three point mean difference. Figure 10 depicts the graphic representation of mean scores by gender and grade level in the usefulness domain.

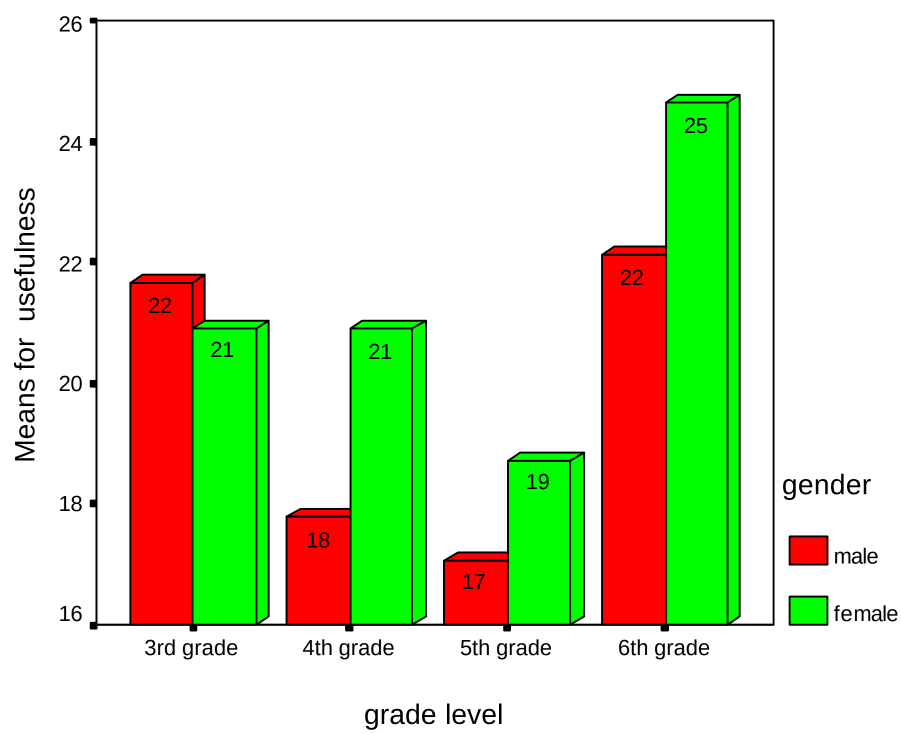


Figure 10.

Graphic representation of mean scores reported by students in the usefulness domain.

Teacher's Attitude

The teacher's attitude domain was designed to measure student perception of teacher's attitude towards themselves as successful learners of mathematics. The data revealed balanced attitudes between the third grade girls and fourth grade boys. This domain was the lowest score for fourth grade girls showing they had the most positive feelings of their teacher's attitudes towards their success. The fifth grade girls' responses showed a sharp increase in negative attitudes compared to girls in fourth grade. Data of sixth grade boys showed the most negative attitudes related to teachers' perception of them as successful learners of mathematics. The greatest discrepancy between boys and girls in teacher attitude occurred in sixth grade. Figure 11 depicts the graphic representation of mean scores reported by gender and grade level in the teacher's attitude domain.

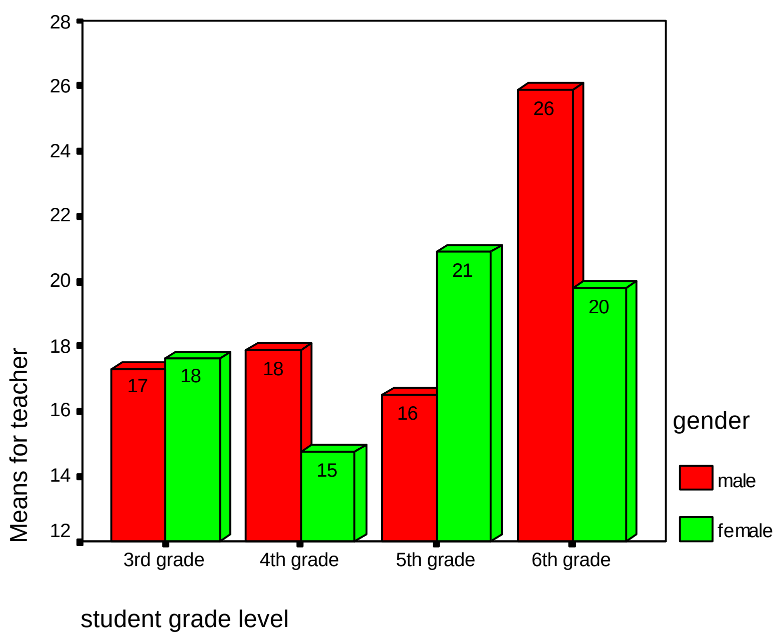


Figure 11. Graphic depiction of means scores in the teacher attitude domain.

Confidence

The confidence domain was designed to measure the confidence to learn and perform well on tasks. Data indicated student confidence in mathematics was varied between boys and girls until sixth grade. Responses of sixth grade boys and girls both revealed negative attitudes. Third, fourth and fifth grade boys' responses showed fewer negative attitudes related to confidence than girls at their grade levels. However, the data showed a significant increase in the sixth grade boys' attitudes over other boys in the study. Sixth grade was the only grade that boys' responses displayed more negative attitude than the girls. The data showed girls having similar attitudes in the confidence domain. The greatest discrepancy in confidence between boys and girls occurred in fifth grade. Figure 12 depicts the mean scores by gender and grade level on the confidence domain.

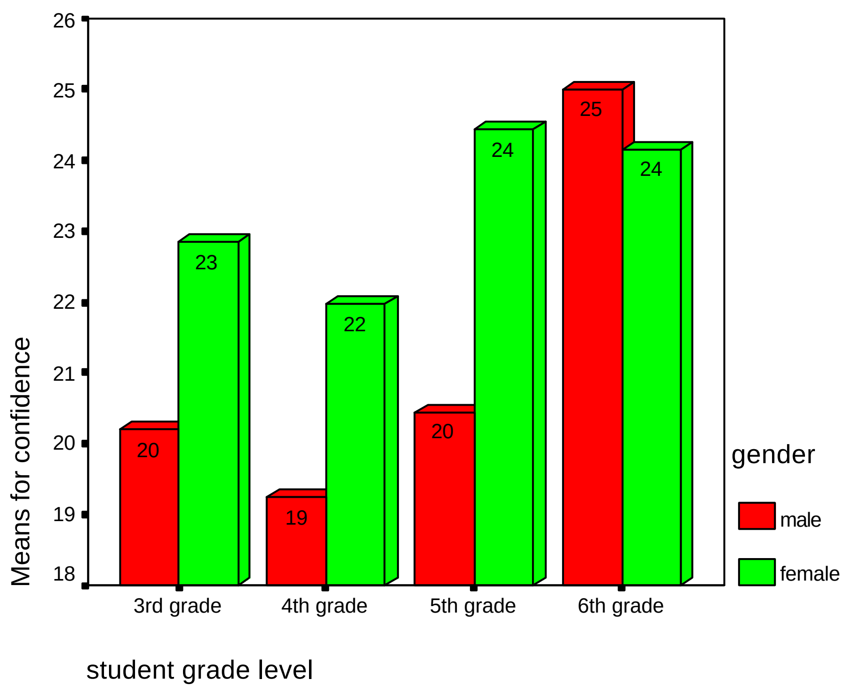


Figure 12.

Graphic representation of means scores in the confidence domain.

Domain Total

The domain totals are the results of averaging the eight domain scores by gender and grade level. Data reflects average mean scores for the domains explored in this study. Third and sixth grade boys and girls responses showed similar attitudes across the domains. The fourth grade students were also similar across the domain however, were distinguished by revealing the best overall attitudes towards math. The fifth grade boys expressed positive attitudes and the fifth grade girls' responses expressed negative attitudes. The greatest discrepancy between boys and girls in math attitude occurred in fifth grade. The sixth grade boys and girls distinguish themselves as having the most negative attitudes of all students in the study. Figure 13 depicts mean scores for math attitudes across all domains.

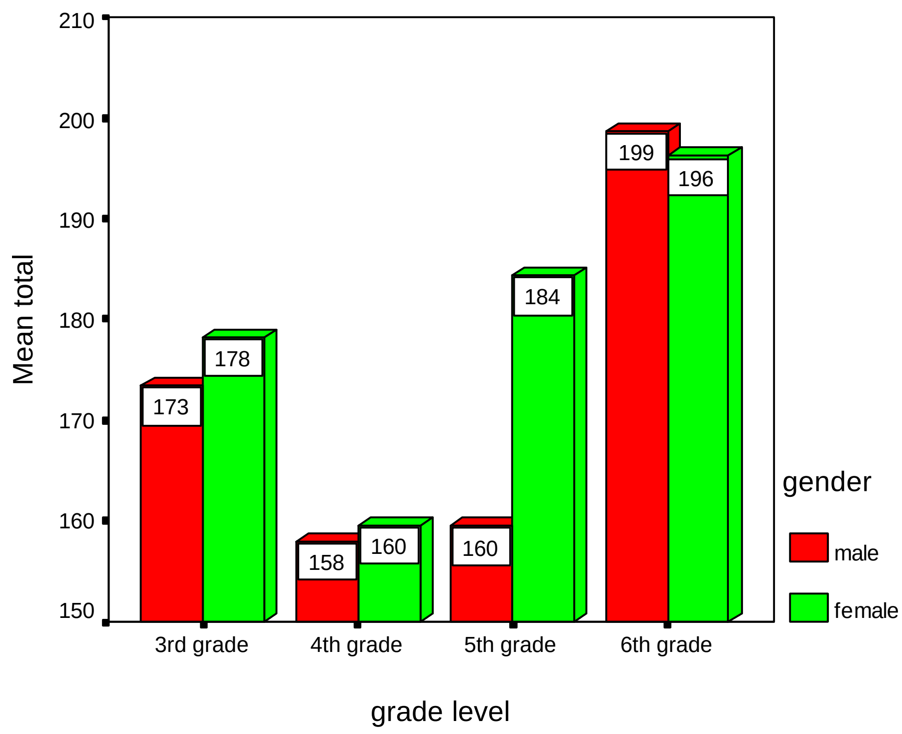


Figure 13. Summary means of attitudes for all domains

Inferential Statistics

A Multivariate Analysis of Variance (MANOVA) was selected to test for significant differences (overall effect) across domains. Once significance of the anxiety and motivation domains was determined, the multivariate analysis was used to compare grade level and gender variables simultaneously. The MANOVA test statistic was used for comparing groups is Wilks' lambda. It was transformed to an *F*-statistic yielding a probability level (p-value). The results are reported in table 24. At each grade level, girls' responses showed higher anxiety than the boys. Main effects for anxiety (.002), motivation (.008) and teacher's attitude (.042) were found. Additional domain analysis at each grade level did not support teacher attitude as a statistically significant finding. The finding (.042) was representative of a cumulative effect, meaning there was no individual significance but when accumulated yielded a significant effect. Table 24 reports the multivariate results.

Table 24

Multivariate Tests of Domain Student Responses on the Fennema-Sherman Math Attitudes Scales

Effect	Value	F	Hypothesis df	Error df	Sig.
Intercept Wilks' lambda	.071	346.478	8.000	213.000	.000
Grade Wilks' lambda	.837	1.625	24.000	618.366	.031*
Gender Wilks' lambda	.858	4.396	8.000	213.000	.000
Grade and Gender Wilks' lambda	.881	1.153	24.000	618.366	.280

Table 25

Levene's Test of Equality of Error Variances

Domains	F	df	df2	Sig.
attitude	1.602	7	220	.136
mother	1.787	7	220	.091
father	.603	7	220	.753
anxiety	1.928	7	220	.066
motivation	1.461	7	220	.183
usefulness	1.886	7	220	.073
teacher	1.621	7	220	.131
confidence	2.053	7	220	.050*

Levene's test of equality of error valances tests the null hypothesis that the error variance of the dependent variable is equal across groups. Confidence was significant at the .05 level. Anxiety was borderline significant at .06.

Table 26 details interactions among grade levels and domains. Anxiety (.002) and motivation (.05) are the two main effects identified as significant by the data. Anxiety was the most significant negative attitude revealed among all grade levels with both boys and girls. At every grade level, girls' responses indicated higher levels of anxiety than boys. Negative attitudes related to motivation are also supported in the data. Sixth grade boys' and girls' responses expressed the most negative attitudes in this domain. Fewer negative attitudes were revealed in girls' responses in the motivation domain. Responses of the sixth grade boys indicated a better attitude toward motivation than girls in sixth grade.

Anxiety (.002) and motivation (.05) are the two main effects identified as significant by the data in Table 26. Within grade, motivation (.008) and teacher's attitude (.042) emerged as significant while anxiety (.06) was a borderline result. However, within gender, anxiety emerged as significant (.002). Complete data is presented in Table 26. The Bonferroni post-hoc analysis is presented in Table 27. A level of statistical significance was revealed in motivation from fourth to sixth grade (.005) and from fifth to sixth grade (.04). Complete results of the Bonferroni post-hoc are presented in Table 27.

Table 26

Tests of Between-Subjects Effects

Source	Variable	Type III sum of squares	df	Mean square	F	Sig.
Model	attitude	301.39	7	43.056	.931	.48
	mother	204.82	7	29.260	.747	.63
	father	357.54	7	51.077	1.036	.41
	anxiety	4514.69	7	644.956	3.472	.002*
	motivation	1829.17	7	261.310	2.052	.05*
	usefulness	931.98	7	133.141	1.365	.22
	teacher	764.19	7	109.169	1.737	.10
	confidence	960.86	7	137.265	1.059	.39
Grade	attitude	127.15	3	42.38	.916	.43
	mother	54.70	3	18.22	.465	.71
	father	256.32	3	85.44	1.73	.16
	anxiety	1378.36	3	459.45	2.47	.06
	motivation	1540.67	3	513.56	4.03	.008*
	usefulness	487.94	3	162.65	1.68	.18
	teacher	523.90	3	174.63	2.78	.042*
	confidence	329.04	3	109.68	.85	.47
Gender	attitude	87.59	1	87.59	1.90	.17
	mother	13.21	1	13.21	.34	.56
	father	2.10	1	2.10	.04	.84
	anxiety	1783.27	1	1783.27	9.60	.002*

Source	Variable	Type III sum of squares	df	Mean square	F	Sig.
	motivation	55.18	1	55.18	.43	.51
	usefulness	211.39	1	211.39	2.17	.14
	teacher	52.24	1	52.24	.83	.36
	confidence	185.41	1	185.41	1.43	.23
Grade/gender	attitude	206.02	3	68.67	1.49	.22
	mother	65.22	3	21.74	.56	.65
	father	87.50	3	29.17	.55	.62
	anxiety	338.80	3	112.93	.61	.61
	motivation	108.61	3	36.20	.28	.84
	usefulness	76.37	3	25.46	.26	.85
	teacher	354.64	3	118.21	1.88	.13
	confidence	93.34	3	31.11	.24	.87
Total	attitude	10476.90	227			
	mother	8825.00	227			
	father	11206.22	227			
	anxiety	45376.58	227			
	motivation	29848.21	227			
	usefulness	22386.25	227			
	teacher	14595.00	227			
	confidence	29474.66	227			

a R Squared = .029 (Adjusted R Squared = -.002)
b R Squared = .023 (Adjusted R Squared = -.008)
c R Squared = .032 (Adjusted R Squared = .001)
d R Squared = .099 (Adjusted R Squared = .071)
e R Squared= .042 (Adjusted R Squared= .071)
f R Squared = .042 (Adjusted R Squared =.011)
g R Squared = .052 (Adjusted R Squared = .022)
h R Squared = .033 (Adjusted R Squared = .002

Table 27

Post Hoc Bonferroni

Variable	grade level	grade level	Mean Difference	SE	Sig.	95% Confidence Interval Lower bound	Upper bound
Attitude	3rd grade	4th grade	-.78	1.12	1.000	-3.77	2.21
		5th grade	-1.23	1.16	1.000	-4.33	1.87
		6th grade	-1.91	1.67	1.000	-6.34	2.53
	4th grade	3rd grade	.78	1.12	1.000	-2.21	3.77
		5th grade	-.45	1.21	1.000	-3.69	2.78
		6th grade	-1.13	1.70	1.000	-5.66	3.40
	5th grade	3rd grade	1.23	1.16	1.000	-1.87	4.33
		4th grade	.45	1.21	1.000	-2.78	3.69
		6th grade	-.68	1.73	1.000	-5.28	3.92
	6th grade	3rd grade	1.91	1.67	1.000	-2.53	6.34
		4th grade	1.13	1.70	1.000	-3.40	5.66
		5th grade	.68	1.73	1.000	-3.92	5.28
Mother	3rd grade	4th grade	.60	1.03	1.000	-2.16	3.35
		5th grade	1.02	1.07	1.000	-1.84	3.87
		6th grade	-.71	1.53	1.000	-4.79	3.37
	4th grade	3rd grade	-.60	1.03	1.000	-3.35	2.16
		5th grade	.42	1.12	1.000	-2.55	3.40
		6th grade	-1.30	1.57	1.000	-5.47	2.86

			Mean difference	SE	Sig.	95% Confidence interval	
Variable	grade level	grade level				Lower bound	Upper bound
	5th grade	3rd grade	-1.02	1.07	1.00	-3.87	1.84
		4th grade	-.42	1.12	1.00	-3.40	2.55
		6th grade	-1.72	1.59	1.00	-5.96	2.51
	6th grade	3rd grade	.71	1.53	1.00	-3.37	4.79
		4th grade	1.30	1.57	1.00	-2.86	5.47
		5th grade	1.72	1.59	1.00	-2.51	5.96
Father	3rd grade	4th grade	2.01	1.16	.51	-1.08	5.09
		5th grade	2.31	1.20	.34	-.89	5.51
		6th grade	.68	1.72	1.00	-3.90	5.26
	4th grade	3rd grade	-2.01	1.16	.51	-5.09	1.08
		5th grade	.30	1.25	1.00	-3.03	3.64
		6th grade	-1.33	1.76	1.00	-6.00	3.35
	5th grade	3rd grade	-2.31	1.20	.34	-5.51	.89
		4th grade	-.30	1.25	1.00	-3.64	3.03
		6th grade	-1.63	1.78	1.00	-6.38	3.12
	6th grade	3rd grade	-.68	1.72	1.00	-5.26	3.90
		4th grade	1.33	1.76	1.00	-3.35	6.00
		5th grade	1.63	1.78	1.00	-3.12	6.38

Variable	grade level	grade level	Mean difference	SE	Sig.	95% confidence Interval Lower bound	Upper bound
Anxiety	3rd grade	4th grade	5.85	2.25	.06	-.15	11.84
		5th grade	.12	2.33	1.00	-6.09	6.33
		6th grade	-1.76	3.34	1.00	-10.65	7.12
	4th grade	3rd grade	-5.85	2.25	.06	-11.84	.15
		5th grade	-5.72	2.43	.12	-12.20	.76
		6th grade	-7.61	3.41	.16	-16.68	1.47
	5th grade	3rd grade	-.12	2.33	1.00	-6.33	6.09
		4th grade	5.72	2.43	.12	-.76	12.20
		6th grade	-1.89	3.46	1.00	-11.11	7.33
	6th grade	3rd grade	1.76	3.34	1.00	-7.12	10.65
		4th grade	7.61	3.41	.16	-1.47	16.68
		5th grade	1.89	3.46	1.00	-7.33	11.11
Motivation	3rd grade	4th grade	3.60	1.86	.38	-1.36	8.56
		5th grade	1.89	1.93	1.00	-3.26	7.03
		6th grade	-5.98	2.76	.19	-13.34	1.38
	4th grade	3rd grade	-3.60	1.86	.33	-8.56	1.36
		5th grade	-1.72	2.01	1.00	-7.08	3.65
		6th grade	-9.58	2.82	.005*	-17.10	-2.07

			Mean difference	SE	Sig.	95% Confidence interval	
Variable	grade level	grade level				Lower bound	Upper bound
	5th grade	3rd grade	-1.89	1.93	1.00	-7.03	3.26
		4th grade	1.72	2.01	1.00	-3.65	7.08
		6th grade	-7.87	2.87	.04*	-15.50	-.23
	6th grade	3rd grade	5.98	2.76	.19	-1.38	13.34
		4th grade	9.58	2.82	.005*	2.07	17.10
		5th grade	7.87	2.87	.04*	.23	15.50
Usefulness	3rd grade	4th grade	2.17	1.63	1.00	-2.17	6.52
		5th grade	2.69	1.69	.68	-1.81	7.19
		6th grade	-2.40	2.42	1.00	-8.84	4.03
	4th grade	3rd grade	-2.17	1.63	1.00	-6.52	2.17
		5th grade	.51	1.76	1.00	-4.18	5.21
		6th grade	-4.58	2.47	.40	-11.15	2.00
	5th grade	3rd grade	-2.69	1.69	.68	-7.19	1.81
		4th grade	-.51	1.76	1.00	-5.21	4.18
		6th grade	-5.09	2.51	.26	-11.77	1.59
	6th grade	3rd grade	2.40	2.42	1.00	-4.03	8.84
		4th grade	4.58	2.47	.39	-2.00	11.15

Variable	grade level	grade level	Mean difference	SE	Sig.	95% Confidence interval Lower bound	Upper bound
		5th grade	5.09	2.51	.26	-1.59	11.77
Teacher	3rd grade	4th grade	1.05	1.31	1.00	-2.44	4.53
		5th grade	-1.09	1.36	1.00	-4.71	2.52
		6th grade	-3.70	1.94	.35	-8.87	1.47
	4th grade	3rd grade	-1.05	1.31	1.00	-4.53	2.44
		5th grade	-2.14	1.42	.7	-5.91	1.63
		6th grade	-4.75	1.98	.11	-10.03	.53
		4th grade	2.14	1.42	.79	-1.63	5.91
		6th grade	-2.61	2.01	1.00	-7.97	2.76
	6th grade	3rd grade	3.70	1.94	.35	-1.47	8.87
		4th grade	4.75	1.98	.11	-.53	10.03
		5th grade	2.61	2.01	1.00	-2.76	7.97
Confidence	3rd grade	4th grade	1.80	1.88	1.00	-3.21	6.80
		5th grade	-.94	1.95	1.00	-6.13	4.25
		6th grade	-3.01	2.79	1.00	-10.43	4.42
	4th grade	3rd grade	-1.80	1.88	1.00	-6.80	3.21
		5th grade	-2.74	2.03	1.00	-8.15	2.68
		6th grade	-4.80	2.85	.56	-12.38	2.78

Variable	Grade level	Grade level	Mean difference (I-J)	SE	Sig.	95% Confidence interval	
						Lower bound	Upper bound
	5th grade	3rd grade	.94	1.95	1.00	-4.25	6.13
		4th grade	2.74	2.03	1.00	-2.68	8.15
		6th grade	-2.07	2.89	1.00	-9.77	5.63
	6th grade	3rd grade	3.01	2.79	1.00	-4.42	10.43
		4th grade	4.80	2.85	.56	-2.78	12.38
		5th grade	2.07	2.89	1.00	-5.63	9.77

Note. * The mean difference is significant at the .05 level.

Summary

Chapter IV contained the study findings exploring the math attitudes of gifted students with a focus on gifted girls in the elementary grades. The study included 267 gifted participants in an accelerated math program for grades three through six. Gender and grade level were the independent variables and eight domains of the MAS (attitude, motivation, mother's math attitude, father's math attitude, anxiety, motivation, usefulness, teacher's math attitude, confidence, and anxiety) served as the dependent variables. Descriptive and inferential statistics were analyzed using SPSS. The data were examined to identify if any significant main effects or interactions. Incomplete or missing data in some domains warranted the elimination of those sections in the analysis. Results of the multivariate analysis of variance (MANOVA) were reported in tabular form and discussed. A pre-determined level of significance (.05) was selected and used throughout the study. The multivariate null hypothesis tested was, *"There are no differences between gifted students in grades three through six on eight domains of the Fennema-Sherman Math Attitudes Scales".* The analysis resulted in a Wilk's lambda value of 0.84 and produced a multivariate F value of 1.63. The obtained probability (p-value) was 0.03; therefore, the null hypothesis was rejected concluding, there is a significant multivariate effect.

Anxiety (.002), motivation (.008) and teacher's attitude (.042) emerged as main effects. Within gender, anxiety emerged as the driving force with an F value of 9.60. The type of anxiety was independent. The data documented grade level interactions in motivation (.008), and teacher's attitude (.042). The data did not support significance regarding teacher's attitude at the domain level. The data substantiated significant interaction in gender and anxiety (.002). The result of the multivariate analysis of variance was driven by the anxiety result. Further examination yielded anxiety significance at all grade levels with a large mean difference between boys and girls. Boys were less anxious than girls at all levels. Specific analysis looking for patterns noted borderline statistical significance in anxiety between the third and fourth grade students (.06) and statistical significance in motivation between fourth and sixth grade (.005) and fifth to sixth grade (.04). A post hoc (Bonferroni) was run to test the domain against itself. No post hoc was run to compare gender mean scores because there were only two groups.

The anxiety domain distinguished itself by reflecting significance for boys and girls at every grade level in the study. As noted, it emerged as statistically significant (.002) with a significant $F = 9.60$. Graphic depictions of domain mean scores were compared for boys and girls across all grade levels in the study. Data reflected an overall better math attitude in boys in the study. Data from third grade boys and girls showed similar attitudes between boys and girls across the domains. The most positive math attitudes occurred in fourth grade. Data revealed the most variability in attitudes between fifth grade boys and girls. Negative math attitudes escalated in fifth grade, especially for the girls. The boys and girls at fifth grade had the largest mean difference of the students in the study. Sixth grade data revealed boys and girls having the most negative math attitudes among all students in all grades in the study.

Conclusions

This study explored the math attitudes of gifted students focusing on gifted girls in the elementary grades. Three research questions framed the examination of math attitudes and differences of gifted third, fourth, fifth, and sixth grade students:

1. What are the math attitudes of third, fourth, fifth, and sixth grade gifted students on eight domains of the Fennema-Sherman Math Attitudes Scales?
2. How do gifted boys and girls in grades three through six differ in their attitudes toward math?

3. What are the most significant math attitudes of third, fourth, fifth, and sixth, grade gifted girls?

The MAS was selected as a tool to guide the specific questions of the study. The eight domains used were; attitudes towards success, mother's attitude, father's attitude, anxiety, motivation, usefulness, teacher's attitude, and confidence. The ninth domain, the male domain scale was eliminated from this study. Instrument author, Dr. Elizabeth Fennema, advised omitting the math as a male domain scale because it had not shown significant results in prior studies, and it was designed for the age of the children in this study.

Each domain was designed to measure a specific math attitude. The attitude towards success domain measured the degree to which students anticipated positive or negative consequences as a result of success in mathematics. The mother's attitude domain measured perceived attitude toward children as successful learners of mathematics. The father's attitude domain measured the perceived attitude toward children as learners of mathematics. Feelings of anxiety, dread, nervousness, and other physical symptoms related to doing mathematics were measured by the anxiety domain. The motivation domain measured perseverance when faced with challenging math problems. The usefulness domain measured students' beliefs about current usefulness of mathematics and the importance to their future education. The teacher's attitude measured the students' perception of the teacher's attitude toward them as successful learners of mathematics. Student confidence to learn and perform well on tasks was measured by the confidence domain.

The measurement instrument was straightforward and effective. Each domain used in the study contained 12 response items, resulting in 96 response items per student. Six items per domain were stated positively and positively scored and six items per domain were stated negatively and were reverse scored. The Likert-type responses for each item were; *strongly agree* (a), *agree* (b), *not sure* (c), *disagree* (d), and *strongly disagree* (f), generating a numeric score of one to five for each response. Dr. Fennema suggested this format for simplicity and avoidance of confusion. Dr. Lawrence Cross, a faculty member with Virginia Tech in the Research and Evaluation department, believed the integrity of the instrument and validity of the results would remain intact using some adjusted format changes because the content, readability and age of the students were appropriate for the changes. Each student received a domain score and a cumulative total score for all domains. A lower score indicates fewer negative attitude responses, thus conveying a more positive individual math attitude. Likewise, a higher score indicates more negative responses and a more negative math attitude.

A multivariate analysis of variance compared the boys' and girls' responses in grades three, four, five, and six in each domain. The multivariate null hypothesis tested was, *"There are no differences between gifted students in grades three through six on eight domains of the Fennema-Sherman Math Attitudes Scales"*. The analysis resulted in a Wilk's lambda value of 0.84 and produced a multivariate *F* value of 1.63. The obtained probability (p-value) was 0.03; therefore, the null hypothesis was rejected, concluding there is a significant multivariate effect. The study yielded significance in anxiety (.002) and motivation (.008). Initial analysis yielded teacher's attitude as significant (.042). However, additional investigation did not substantiate it as significant at the individual grade level.

The research questions examined in the study used the student responses on the MAS as the tool for discovery. The first research question explored the math attitudes of third, fourth, fifth, and sixth grade gifted students. The data yielded two significant findings; anxiety (.002) and motivation (.008). Student responses reflected boys have a better attitude than girls. The third and sixth grade students were in a new program and in a new school. They shared similar attitudes across all domains. The fourth grade responses were the best of any grade level in the study. The greatest discrepancy between boys and girls occurred in fifth grade. The sixth grade distinguished themselves with the most negative attitudes of all the students in the study. They had the fewest number of participants and had a change in teacher mid-year.

The second research question examined the differences in math attitudes between gifted boys and girls in grades three through six. Student responses in each of the eight domains yielded some differences between the boys and girls and among grade levels. Data comparing the boys and girls, yielded better attitudes for boys overall. In fact, responses from the fourth and fifth grade boys were the most positive in the study. In the anxiety domain, where statistical significance was supported by the data, girls' negative responses exceeded boys at all levels. Data from the motivation domain yielded the most variability in fifth grade between the boys and girls. Other large differences between boys and girls occurred in attitude towards success (sixth grade), mother's attitude (third grade), father's attitude (sixth grade), usefulness (fourth grade), teacher's attitude (fifth and sixth grade), and confidence (third, fourth, and fifth grade). Overall, fifth grade boys expressed positive attitudes and the fifth grade girls expressed negative attitudes. The greatest discrepancy between boys and girls in math attitude occurred in fifth grade.

The third research question examined the most significant math attitudes of third, fourth, fifth, and sixth grade gifted girls. Data from the study indicated that girls overall have the best math attitudes in fourth grade, followed by the third, then the fifth, and finally the sixth. Compared to boys at their respective grade levels, the fifth grade girls and boys had the greatest discrepancy. Responses from sixth grade girls revealed the most negative attitude of girls in the study.

Specific data from each grade level indicates some variability among grade levels. Data from third grade girls reveals the most positive attitudes related to attitudes for success, mother's attitude, father's attitude, and teacher's attitude. Fourth grade girls' most positive responses were in attitudes towards success, mother's attitude, father's attitude, and teacher's attitude. Fifth grade girls' most positive responses were in attitude towards success, mother's attitude, father's attitude, and usefulness. Sixth grade girls' most positive responses were in attitudes towards success and teacher's attitude.

A discussion of the results, implications for practice, and recommendations for further study are discussed Chapter V.

Chapter V

Discussion

Finding statistical significance in anxiety and motivation was only the beginning of significant discovery for me. As I reflect on the work, I am struck by the unanswered questions and topics that this study did not address. Specifically, I wonder about gifted students with dual-exceptionalities; the differences between giftedness and talents not yet realized; implications for children, parents, teachers, and school systems; and how to determine the next phase of the journey. The quantitative data is clear. However, I sense an undercurrent of qualitative data within each domain that is waiting to be explored.

One of the areas that caused concern and may need additional exploration was the sixth grade. The sixth grade students in the study experienced a very difficult year. They were placed in a temporary location, were isolated from other middle school students, were in the first year of a new program, and experienced difficulties with their math teacher who was ultimately replaced mid-year. These factors, coupled with the fact that only 22 sixth grade students participated in the study cause me to be cautious with their results compared to other students in the study.

Each domain revealed specific insight related to particular attitudes. The attitude towards success domain measured the degree to which students anticipated positive or negative consequences as a result of their success in mathematics. The data from this study expands the findings. Wilson, Stocking, and Goldstein (1993) found that math preferences may already be in place by the end of elementary school. This study confirms that by third grade, gifted boys and girls have specific attitudes related to mathematics. Data from sixth grade boys yielded the most significant negative attitudes all the children in the study. A study conducted by Miserandino (1996) investigated perceived competence and autonomy in above-average children and explored self-regulation to determine what above average children need to become oriented toward learning. Miserandino hypothesized that high ability children disengage from school if their competence or autonomy needs are unfulfilled. The data from this study supports her findings in that student responses revealed negative attitudes in several domains. Investigating responses from all girls in the study indicated they do anticipate positive consequences as a result of success in math. This finding also concurs with conceptual understandings of Bandura's social learning theory.

The Mother's attitude domain measured the students' perception of their mother's attitude toward them as learners of mathematics. Third grade boys' responses were more negative than other boys in the study. Responses from girls in the third, fourth, and fifth grade indicated more positive attitudes than boys. This trend was reversed in sixth grade, with boys showing more negative responses than girls. The data revealed that something changes for sixth grade girls. Perhaps by sixth grade, mothers were not helping as much with math at home, maybe the mothers were not as confident in their own ability, possibly stereotypical associations emerged, or conceivably it is normal adolescent behavior. Whatever the case, these findings support the work of Dickens and Cornell (1990), Parsons, Adler, & Kaczala, (1982) and Parson et al. (1982) who found that mothers' expectations of their gifted girls impact a girls' belief about her abilities. They further concluded that girls' beliefs in their own abilities are more affected by their mother's belief than their own past performance. Data from the study indicates that gifted children, especially girls in the sixth grade, need to know their mothers believe in their math ability.

The father's attitude domain measured the students' perception of their father's attitude toward them as learners of mathematics. The data reflects that fourth grade girls have the best attitude regarding their father's math attitude. In contrast, third grade boys' and sixth grade girls' responses indicate negative attitudes. Tocci and Engelhard (1991) believed that parents are the most influential group in attitude formation. Data from this study suggests parents need to be made aware of the negative attitudes that exist for third grade boys and sixth grade girls.

Anxiety emerged as the most significant finding (.002) of the study. The anxiety domain was designed to measure feelings of anxiety, dread, nervousness, and other physical symptoms related to doing mathematics. Student responses indicated anxiety at all grade levels. Appropriate levels of stress can have a positive influence on gifted children and the data from this study does not indicate whether the anxiety is functional or not. If anxiety manifests itself in physical symptoms, it would be interesting to note clinic visits or absenteeism among the children in the study. Dirkes (1983) believed that when gifted students learn to use anxiety to their advantage; they are able to integrate their uniqueness into their environment. He further reported learning these adaptation techniques affords students the ability to respond to conflict in a positive manner. This study confirms the findings of Lamb and Daniels (1993) that anxiety exists in fifth grade. In addition, their study found significant gains in anxiety between fourth and fifth grade. The data from this study suggests significant anxiety exists in third grade, improves in the fourth grade and increases in fifth and sixth grade. Moreover, twenty-two years later, the data from this study supports the findings of Wood (1988) that girls are affected more than boys. If anxiety is functional, that may be positive for gifted learners.

The motivation domain was designed to measure perseverance when faced with challenging math problems. Data established motivation (perseverance when faced with challenging problems) as the second area of statistical significance (.008) in the study. Perhaps this is related to Bandura's (1977) work which describes motivation as being inclined to perform a response due to a consequence that reinforces the behavior and determines subsequent actions. This shows children need praise for perseverance from parents and teachers.

The usefulness domain measured students' beliefs about current usefulness of mathematics in relationship to their future education. Girls' responses in fourth, fifth, and sixth grade showed more negative attitudes in this domain than the boys at their grade levels. The data revealed the highest negative attitudes in sixth grade. These findings concur with Brush (1985) that efforts are needed to promote usefulness of mathematics in classrooms across the country.

The teacher's attitude domain measured the students' perceptions of their teacher's attitude toward them as successful learners of mathematics. Data from the study indicates that the sixth grade students, especially the boys, have negative attitudes related to teacher's attitude. Perhaps this was due to unusual circumstances in sixth grade. The students did not have a math teacher endorsed or experienced in gifted education. In addition, the teacher was replaced mid-year. These circumstances may have contributed to the students' negative attitudes. The subsequent teacher was a content expert. However, she did not hold an endorsement in gifted education. The findings from the sixth grade appear to align with the Weiner (1986) study that discovered teachers with no special preparation or background in gifted education were uninterested in or even hostile toward gifted students. Likewise, the Thomas (1973) study concluded that general education classroom teachers' attitudes were frequently negative and filled with misconceptions concerning giftedness. Implications from these studies suggest biased attitudes were forcing gifted students to modify their classroom behavior, hide their real talents, and imitate the negative behavior of other children. Weiner (1986) also concluded that teachers with experience working in special programs, or conducting professional development for the gifted tended to be more enthusiastic about them as learners. Unlike the sixth grade, third, and fourth grade did not express the same negative attitudes regarding their teacher's attitude.

The confidence domain measured the confidence to learn and perform well on tasks. Data from this study may support earlier findings. Earlier studies found that even though they are successful in school, girls' confidence often remains low (Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1985; Fennema & Sherman, 1976; Meyer & Fennema, 1990). If girls believe that they are incapable of performing well in math class, they may experience a sense of helplessness in the classroom (Covington & Berry, 1976; Dweck & Repucci, 1973). This helplessness may lead to the phenomena of girls taking fewer high-level math courses.

Gifted girls seem to be particularly vulnerable to cultural stereotyping when it comes to math. Spencer and Steel (1994), and this study suggest girls are frustrated with the difficulty of math problems. Likewise, Bandura (1986) found that frustration leads to performance impaling anxiety. Self-efficacy continues to predict performance even when the effects of anxiety are controlled. If indeed, the effect of anxiety should dissipate when self-efficacy precepts are controlled (Bandura, 1986). These two studies as well as this study demonstrate that we as educators are accountable for modeling, encouraging, and tying relevance to all aspects of mathematics for gifted students, especially gifted girls in elementary school.

Gifted children often choose not to master a concept until they need it. If gifted girls, as evidenced in the study, do not see a usefulness of mathematics, they may not master the concepts as presented in the classrooms. If they wait too long, the window of opportunity may be closed. The data from this study indicates specific steps are warranted. Strides must be made while window of opportunity is still open.

Implications for practice

Practitioners, researchers, parents and others can take some specific steps to improve learning for gifted children in our schools. Thoughtful analysis of individual situations and children will provide a useful resource guide for improvement. General suggestions for educators and parents, based on the data from this study include:

1. Encourage gifted students to persist at difficult math problems.
2. Provide training for teachers, parents, and guidance counselors on the nature and needs of gifted students.
3. Provide specific training for teachers in best practices for gifted learners; differentiation, developing social skills, and effective cooperative learning group work.
4. Acknowledge the importance of female role models in mathematics and invite guest speakers to speak with students.
5. Provide math career awareness activities.
6. Examine feelings of dread, anxiety, nervousness, and other physical symptoms related to doing mathematics through proactive guidance programs.
7. Routinely offer students useful applications of mathematics instruction.

Recommendations for further study

Educators are faced with a challenging dilemma of providing appropriate differentiated instruction for all learners. The “No Child Left Behind” act includes the handicapped, those needing remediation, and the gifted. Gifted children are not traditionally acknowledged as a special population in need of specialized services. Leta Hollingworth began the no child left behind movement by focusing on gifted children in 1926. In our quest to continue on the journey of excellence, researchers interested in pursuing math attitudes of gifted students may consider one of the following avenues for further study:

1. Repeat the study in two to three years to investigate if any trends exist.
2. Study functional anxiety as it relates to gifted learners.
3. Investigate the physical manifestations of mathematical anxiety.
4. Duplicate the study with gifted girls in high school to compare results.
5. Replicate the study with non-gifted students to examine similarities and differences.
6. Conduct study of teacher attitudes towards gifted learners and math.
7. Conduct an in-depth study of fifth grade gifted girls to determine if it is a critical year for the development of life long attitudinal beliefs.

Summary

This study began as a journey toward an answer. It was full of uncertainties and questions, grandiose ideas, and unsubstantiated beliefs. It was conceived from a burning passion for learning, yet somehow through an arduous process of self-discovery was transformed into a portrait constructed from sophisticated intricacies. Some answers have been revealed, while more questions have emerged. There are suggestions, but more work needs to be done. This may present challenges to educators in schools. Thoreau once said, “Things do not change, we do”. If we are to change the course for gifted learners in our schools, we must also change. There is a magnificent world, full of opportunity, waiting for our gifted children. They are waiting for us to help them develop their talent. What are we waiting for? It is our future too.

References

Altman, R. (1983). Social-emotional development of gifted children and adolescents: a research model. *Roeper Review, 11,* 65-68.

Ames, C. (1984). Achievement goals in the classroom: Students' learning strategies and motivational processes. *Journal of Educational Psychology, 84,* 49-74.

Armstrong, J. M. (1985). A national assessment of participation and achievement in women in mathematics. In S. Chipman, L. Brush, & D. Wilson (Eds.*), Women and mathematics; Balancing the equation* (pp. 59-94). Hillsdale, NJ: Erlbaum.

Bandura, A. J. (1971). *Analysis of modeling processes.* In A. Bandura (Ed.), Psychological modeling: conflicting theories (pp. 1-62). Chicago: Aldine.

Bandura, A.J. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A.J. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1989a). Human agency in social cognitive theory. *American Psychologist, 44,* 1175-1184.

Bandura, A.J. & Walters, R. H., (1963). *Social learning and personality development.* NY: Holt, Rinehart, & Winston.

Barnard, H. (1849). *School architecture*. NY: A.S. Barnes & Co.

Bearvais, K., Mickelson, R., & Pokay, P. (1985). *Influences on sex equity in math achievement: Summary of research and recommendations.* Ann Arbor: University of Michigan, Bush Program in Child Development & Social Policy.

Bell, L. A. (1989). Something's wrong here and it's not me: Challenging the dilemmas that block girls' success. *Journal for the Education of the Gifted, 12,* 118-130.

Benbow, C. & Stanley, J. C. (1980). Sex differences in mathematical ability: Fact or artifact? *Science, 210,* 1262-1264.

Betz, N. E., & Hackett, G. (1983). The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behavior, 23,* 329-345.

Bloom, B. S. (1956). *Taxonomy of educational objectives: The classification of educational goals*. Handbook 1: Cognitive domain. New York: Longmans, Green & Co.

Borg, W. R., & Gall, M. D. (1996). *Educational research: An introduction* (6th ed.). NY: Longman.

Bowman, M. (1983). (November/December). Why we burn: Sexism exorcised. *Humanist, 43,* 28-29.

Brandon, P. R., Newton, B. J., & Hammond, O. W. (1985). *The superiority of girls over boys in mathematics achievement in Hawaii.* Paper presented at the annual meeting of the American Research Association, Chicago.

Broadbooks, W., Elmore, P., Pedersen, K., & Bleyer, D. (1981). A construct validation study of the Fennema- Sherman Mathematics Attitudes Scales. *Educational and Psychological Measurement, 41*, 551-557.

Brown, S. (1998). *Practical Feng Shui*. Great Britain. Bath Press Group.

Bruner, J. S. (1960). *The process of education.* Cambridge, MA. Harvard University Press.

Brush, L. R. (1985). *Cognitive and affective determinants of course preferences and plans, Women and mathematics: Balancing the equation.* 123-150. Hillsdale, NJ: Lawrence Erlbaum.

Burrage, S., & Bailey, H. T. (1899). *School sanitation and decoration.* NY: D.C. Heath & Co.

(pp. 556).

Byrne, B. M. (1984). The general academic self-concept nomological network: A review of construct validation research. *Review of Educational Research, 54,* 427-456.

Callahan, C. M. (1979). *The gifted and talented women.* In NSSE yearbook on the gifted and talented. Chicago: University of Chicago Press.

Callahan, C. M., & Reis, S. M. (1996). Gifted girls, remarkable women. In K. Arnold, K. D. Noble, & R. F. Subotnik (Eds.), *Remarkable women: Perspectives on female talent development.* (pp. 171-192). Cresskill, NJ: Hampton Press.

Carey, G. L. (1958). Sex differences in problem-solving performance as a function of attitude differences. *Journal of Abnormal and Social Psychology,* 56, (256-260).

Chase, T. C. (1868). *Schoolhouses and cottages for people of the south.* Washington: Government Printing Office.

Chipman, S.F., & Thomas, V. G. (1985). *Women's participation in mathematics: Outlining the problem*. In S.F. Chipman, L.R. Brush, equation (pp. 1-24). Hillsdale, NJ: Erlbaum.

Clark, B. (1988). *Growing up gifted.* 3rd edition. NY: McMillan.

Coleman, J. M., & Fults, B. A. (1983). Self-concept and the gifted child. *Roeper Review, 5,* (44).

Covington, M.V., & Berry, R. (1976). *Self-worth and school learning*. NY: Holt, Reinhart & Winston.

Cramer, J., & Oshima, T. C. (1992). Do gifted females attribute their math performance differently than other students? *Journal for the Education of the Gifted, 17,* (1), 53-73.

Dabrowski, K. (1959). *Social-educational child psychiatry.* Warsaw

Darwin, C. (1871). *The descent of man*. London: Murray.

Dauber, S. L., & Benbow, C. P. (1990). Aspects of personality and peer relations of extremely talented adolescents. *Gifted Child Quarterly, 34*, 1-15.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior.* NY: Plenum.

Dickens, M. N., & Cornell, D.G. (1990). *Parental influences on the mathematics self-concept of high achieving adolescent girls.* (Report No.20). Charlottesville, VA: University of Virginia, Appalachia Educational Laboratory. (ERIC Document Reproduction Service No. ED 318207).

Dirkes, M. A. (1983). Anxiety in the gifted: pluses and minuses. *Roeper Review, 68,* 2-7.

Dreger, R. M., & Aiken, L. R. (1957). The identification of number anxiety in a college population. *Journal of Educational Psychology, 48,* 344-351.

Dweck, C. (1986). Motivational processes affecting learning. *American Psychologist, 41,* (10), 40-48.

Dweck, C. S., & Elliot, E. S. (1983). Achievement motivation. In E.M. Hetherington, *Handbook of Child Psychology, 4,* 643-691.

Dweck, C. S., & Repucci, N D. (1973). Learned helplessness and reinforcement responsibility in children. *Journal of Personality and Social Psychology, 25,* 109-116.

Eccles, J. S. (1984). Sex differences in mathematics participation. *Advances in Motivation & Achievement, 2,* 93-137.

Eccles, J. S., Adler, T. E., Futterman, R., Goff, S. B., Kaczula, C. M., Meece, J. l., & Midgley, C. (1985). *Self-perceptions, task perceptions, socializing influences, and the decision to enroll in mathematics*. In S.F. Chipman, L. R. Brush, & D. M. Wilson (Eds.), Women and mathematics: Balancing the equation (pp. 95-122). Hillsdale, NJ: Erlbaum.

Eccles-Parsons, J.S., Meece, J. L., Adler, T. F., & Kaczula, C. M. (1982). Socialization of achievement attitudes and beliefs: Parental influences. *Child Development, 53,* 10-32.

Feingold, A. (1992). Sex differences in variability: A new look at an old controversy. *Review of Educational Research, 62,* 61-84.

Fennema, E. (1974). Mathematics learning and the sexes: A review. *Journal of Research in Mathematics Education, 5,* 126-139.

Fennema, E. (1980). *Success in math*. Paper presented at sex differentiation in schooling conference. Churchhill College, Cambridge, MA.

Fennema, E. & Peterson, P. L. (1986). Teacher-student interactions and sex-related differences in learning mathematics. *Teaching and Teacher Education,* 2(1), 55-65.

Fennema, E., Peterson P. L., Carpenter, T. P., & Lubinski, C. A. (1990). Teachers' attributions and beliefs about girls, boys, and mathematics. *Educational Studies in Mathematics*. 21(1), 55-65.

Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman Mathematics Attitudes Scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *JSAS Catalog of Selected Documents in Psychology, 6,* (31) (Ms. No. 1225).

Finn, J.D. (1971). Expectation and the educational environment. *Review of Educational Research, 42,* (3) 387-399.

Fox, L. (1977). Sex differences: Implications for program planning for the academically gifted. In J. Stanley, W. George, & C. Solano (Eds.), The Gifted and creative: A fifty-year perspective (pp. 113-138). Baltimore: Johns Hopkins University Press.

Fox, L. H. (1980). Conclusions: What do we know and where should we go? In L.H. Fox, L. Brody, & D. Tobin (Eds.), *Women and the mathematical mystique* (pp.195-208). Baltimore: Johns Hopkins University Press.

Fox, L. H. (1983). Mathematically able girls: A special challenge. *Chronicle of Academic and Artistic Precosity, 2, (*3), 1-2.

Fox, L. H., Sadker, D., & Engle, J. L. (1999). Sexism in U.S. schools: Implications for the education of gifted girls. *Gifted and Talented International, 14,* 66-79.

Forgasz, H. J., & Leder, G. C., (1996a). Mathematics and English: Stereotyped domains*? Focus on Learning Problems in Mathematics*, 18, (1, 2, & 3), 129-137.

Forgasz, H. J., Leder, G. C. & Taylor. (1996). *Mathematics and language studies: A cross-national comparison.* Paper presented at the annual meeting of the American Educational Research Association, NY.

Freeman, J. (1979). *Gifted children*. Baltimore: University Park Press.

Friedman, L. (1989). Mathematics and the gender gap: A meta-analysis of recent studies on sex differences in mathematical tasks. *Review of Educational Research, 59, (*2) 185-213.

Fulton, R. D. (1991). A conceptual model for understanding the physical attributes of learning environments: *New Directions for Adult and Continuing Education, 50,* 13-21.

Glass, G. V., & Hopkins, K. D. (1984). *Statistical methods in education and psychology*. Englewood Cliffs, NJ: Prentice-Hall

Goodlad, J. I. (1984). *A place called school*. NY: McGraw Hill.

Goud, S. (1879). *The mismeasure of man.* NY: W.W. Norton.

Groth, N. (1969). *Vocational development for gifted girls: A comparison of career needs of gifted males and females between the ages of ten and seventy years*. Paper presented at American Personnel & Guidance Association.

Hackett, G. (1985). Role of self-efficacy in the choice of math-related majors of college women and men: A path analysis. *Journal of Counseling Psychology, 32,* 47-56.

Hackett, G., & Betz, N. E. (1989). An exploration of the mathematics performance correspondence. *Journal of Research in Mathematics Education*, 20, 261-273.

Haladyna, T., Shaughnessy, J., & Shaughnessy, J. M. (1983). A causal analysis of attitude toward mathematics. *Journal for Research in Mathematics Education*, 14, 19-29.

Higham, S. J., & Navarre, J. (1984). Gifted adolescent females require differential treatment. *Journal for the Education of the Gifted, 8,* (1), 43-58.

Hilton, T. L., & Berglund, G. W. (1971). *Sex differences in mathematics achievement*. Educational Testing Service. Princeton, NJ.

Hollinger, C. L., (1985). The stability of self perceptions of instrumental and expressive traits and social self-esteem among gifted and talented female adolescents. *Gifted Child Quarterly, 28*, (3), 135-139.

Hollinger, C. L. (1991). Facilitating the career development of gifted young women*.* *Roeper Review, 13,* (3), 135-139.

Hollingworth, L. S. (1926). *Gifted children: Their nature and nurture.* NY: Macmillan.

Hollingworth, L. S. (1935). *The Nature of Human Nature*. Paper presented at staff meeting, Teachers College, Columbia University, NY.

Hollingworth, L. S. (1939). What we know about the early selection and training of leaders. *Teachers College Record, 40*, 575-592.

Hollingworth, L. S. (1940a). *Prairie years.* NY: Columbia University Press.

Hollingworth, L. S. (1942). *Children above 180 IQ, Stanford-Binet: origin and development.* Yonkers, NY

Horner, M. (1972). Achievement-related conflicts in women. In Mednick, M. and Tangri, S. (Eds.) New Perspectives on Women. *Journal of Social Issues, (28),* 157-175.

Hyde, J., Fennema, E., & Lamon, S. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin*, *107 (*2), 139-155.

Janos, P. M., Fung, H. C., & Robinson, N. M. (1985). Self-concept, self-esteem, and peer relations among gifted children who feel different. *Gifted Child Quarterly, 29*, (2), 78-81.

Jolivet, A. (1988). *Applying interface concepts to facility planning. (26),* 4. Tuscon Unified School District: Council on Educational Facility Planners.

Kagan, J. (1964). Achievement-related conflicts in women. In Mednick, M. and Tangri, S. (Eds.). New Perspectives on Women. *Journal of Social Issues, (28),* 157-175.

Kellogg, R. S. (1916). *Teacher's cottages*. IL. The National Lumber Manufacturers Association.

Kerr, B. (1985). *Smart girls, gifted women*. Columbus, OH: Psychology Press.

Kerr, B. (1994). *Smart girls two: a new psychology of girls, women and giftedness.* Dayton, OH. Psychology Press.

Lamb, J. & Daniels, R. A. (1993). Gifted girls in a rural community: math attitudes and career options. *Exceptional Children 2,* (4), 14-22.

Lantz, A. E., & Smith, G. P. (1981). Factors influencing the choice of non-required mathematics courses. *Journal of Educational Psychology, 73,* 356-362.

Lapan, S. D. (1989). Guidelines for developing and evaluating gifted programs. *Roeper Review, 11,* (3), 167-169.

Leder, G. C. (1992). Mathematics achievement and fear of success. *Journal for Research in Mathematics Education, 13,* (2), 124-135.

Leder, G. C. (1995). Learning mathematics: The importance of social context. *The New Zealand Mathematics Magazine,* 32(3), 27-40.

Lent, R. W., Lopez, F. G., & Bieschke, K. J. (1991). Mathematics self-efficacy. Sources and relation to science base career choice. *Journal of Counseling Psychology, 38,* 424-430.

Li, A. F., & Adamson, G. (1995). Motivational patterns related to gifted students: learning of mathematics, science, and English: An examination of gender differences. *Journal for the Education of the Gifted, 18,* (3), 284-297.

Ma, X., (1995). Gender differences in mathematics achievement between Canadian and Asian educational systems. *The Journal of Educational Research, 89,* (2), 118-127.

Maker, C. J. (1995). *Teaching models in education of the gifted.* US

McGuffey, C. W. (1978). *The impact of school building age on school achievement in Georgia*. CEFP Journal, 16, 6-9.

Maccoby, E., & Jacklin, C. N. (1974). *The Psychology of Sex Differences*. Stanford University Press, Stanford, CA.

Meece, J. L., Eccles, J., Futterman, R., Goff, S. B., & Kaczala, C. M. (1982). Sex differences in math achievement: Toward a model of academic choice. *Psychological Bulletin, 91,* 324-348.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990) Predictors of math anxiety and its influence on young adolescents' course enrollment and performance in mathematics. *Journal of Educational Psychology, 82,* 60-70.

Meyer, M. R., & Fennema, E. (1990). *Internal influences on gender differences in mathematics.* In E. Fennema & G. C. Leder (Eds.), Mathematics and Gender (pp. 60-95). NY: Teachers College Press.

Meyer, M. R., & Koehler, M.S. (1990). Internal influences on gender differences in mathematics. In E. Fennema & G.C. Leder (Eds.), *Mathematics and Gender* (pp. 60-95). NY: Teachers College Press.

Mills, W. T. (1915). *American school building standards*. OH. Franklin Educational Publishing CO.

Miserandino, M. (1996). Children who do well in school: Individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology*. *88,* (2), 203-214.

Mui, F. L., Yeung, A. S., Low, R., & Jin, P., (2000). Academic self-concept of talented students: Factor structure and applicability of the internal/external frame of reference model. *Journal for the Educational of the Gifted. 23,* (3), (353-367).

National Council of Teachers of Mathematics. NCTM Standards. [Online]. NCTM. Available: http://www.enc.org/reform/ [2000, October 1].

Navarre, J. (1980). Is what is good for the gander, good for the goose? Should gifted girls receive differential treatment? *Roeper Review, 2*, (3), 21-25.

Pajares, F., & Miller, D. M. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology, 86,* (2), 193-203.

Parsons, J. E., Adler, T. F., & Kaczala, C. M. (1982). Socialization of achievement attitudes and beliefs: Parental influences. *Child Development, 53,* (2), 310-321.

Pearson, K. (1924). *Life, letters, and labours of Francis Galton*: Vol.2 Cambridge: Cambridge University Press.

Piaget, J. (1952). *The origins of intelligence in children*. New York, Norton.

Piaget, J. (1981). In H. Gruber, *Darwin on man* (2^{nd} ed.) p. viii. Chicago: University of Chicago Press.

Piechowski, M. (1984). Two developmental concepts: Multi-levelness and developmental potential. *Counseling and Values, 18,* 86-93.

Piechowski, M. (1998). *Spiritual giftedness and the transpersonal dimension of experience*. Paper presented at the Wallace National Research Symposium on Talent Development. Iowa City, IA.

Pierce, J. V. (1961). *Sex differences in achievement motivation of adolescent high school students*. Chicago: University of Chicago Press.

Reis, S. M. (1987). We can't change what we don't recognize: Understanding the needs of gifted females. *Gifted Child Quarterly, 31*, (2), 83-89.

Reis, S. M. (1989). Reflections on policy affecting the education of the gifted and talented students: Past and future perspectives. *American Psychologist*, *44,* 399-408.

Reis, S. M. (1995). Talent ignored, talent diverted: The cultural context underlying giftedness in females. *Gifted Child Quarterly, 39,* (3), 162-170.

Reyes, L. H. (1984). Affective variables and mathematics education. *The Elementary School Journal, 84,* 558-581.

Richert, E. S. (1982). *National report on identification: Assessment and recommendations for comprehensive identification of gifted and talented youth*. Sewell, NJ: Educational Improvement Center-South.

Robinson, N. M., & Noble, K. D. (1991). *Social-emotional development and adjustment of gifted children*. In M.C. Wang, M.C. Reynolds, & H.J. Walberg (Eds.), *Handbook of special education, research and practice*: Vol. 4. Emerging Programs (pp.57-76). Elmsford, NY: Pergamon.

Rodenstein, J. M., & Glickauf-Hughes, C. (1977). *Career and lifestyle determinants of gifted women*. Madison: Wisconsin University.

Roeper, A. (1978). The young gifted girl: A contemporary view. *Roeper Review, 1,* (1), 6-8.

Rosenthal, T. L., & Bandura, A. L. (1978). Psychological modeling: Theory and practice. *Handbook of psychotherapy and behavior change: An empirical analysis* (pp. 621-658*).* NY: Wiley.

Rosenthal, T. l., & Zimmerman, B. J. (1978). *Social learning and cognition.* NY: Academic Press.

Rossi, A. S. (1965). Women in science: Why so few? *Science, 148*, 1196-1208.

Rotter, J. B. (1954). *Social learning and clinical psychology,* NY: Prentice Hall. Of Minnesota

Sandman, R. S. (1980). *Mathematics Attitude Inventory*. Minneapolis: Minnesota Evaluation

Center, University

Schunk, D. H. (1987). Peer models and children's behavioral changes. *Review of Educational Research, 57*, 149-174.

Schunk, D. H. & Gunn, T. P. (1985). Modeled Importance of task strategies and achievement beliefs: Effect on self-efficacy and skill development. *Journal of Early Adolescence, 5*, (2), 247-258.

Schwartz, L. L. (1980). Advocacy for the neglected gifted: Females. *Gifted Child Quarterly, 24*, (3), 113-117.

Schwarzer, R., Seipp, B., & Schwarzer, C. (1989). Mathematics performance and anxiety: A meta-analysis. In R. Schwarzer, H. M. Van Der Ploeg, & C. D. Spielberger (Eds.). *Advances in test anxiety research* (Vol. 6, pp. 105-119). Berwyn, PA.

Seeley, K. (1987). Gifted students at risk. In L. Silverman (Ed.), *Counseling the Gifted and Talented* (pp. 263-278). Denver, CO: Love.

Sells, L. W. (1973). *High school mathematics as the critical filter in the job market.* Unpublished manuscript. Available from Department of Sociology, University of California, Berkely.

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

Silverman, L. K. (1986). What happens to the gifted girl? In C. J. Maker (Ed.), *Defensible programs for the gifted* (pp. 43-89). Rockville: Aspen, CO.

Silverman, L. K. (1991). Helping gifted girls reach their potential. *Roeper Review. 13,* (3), 122-123.

Silverman, L. K. (1991). Facilitating the career development of gifted young women. *Roeper Review. 13, (*3), 135-139.

Spencer, S. J., & Steele, C. M. (1994). Under suspicion of inability: Stereotype vulnerability and women's math performance. Unpublished manuscript. SUNY Buffalo and Stanford University.

Stein, A. H., & Bailey, M. M. (1973). The socialization of achievement orientation in females. *Psychological Bulletin, 80,* 345-366.

Stein, A. H., & Smithells, J. (1969). Age and sex differences in children's sex role standards about achievement. *Developmental Psychology, 1,* 252-259.

Sternberg, R. J. (2000). Wisdom as a form of giftedness. *Gifted Child Quarterly, 44,* (4), 252-259.

Strauss, S., & Subotnik, R. R. (1991). *Gender differences in classroom participation and achievement: An experiment involving advanced placements calculus classes.* Part 1. Unpublished manuscript, Hunter College of CUNY, NY.

Terman, L. M., (1916). *The measurement of intelligence.* Boston: Houghton Mifflin.

Terman, L. M. & Associates. (1926). *Genetic studies of genius: Mental and physical traits of a thousand gifted children.* Stanford, CA: Stanford University Press.

Terman, L. M., & Oden, M. H., (1947). *The gifted child grows up.* Palo Alto: Stanford University Press.

Thomas, S. B. (1973). Neglecting the gifted causes them to hide their talents. *Gifted Child Quarterly, 17*, 193-197.

Tobias, S. (1978). *Overcoming math anxiety.* NY: Norton.

Tocci, C. M., & Engelhard, G. (1991). Achievement, parental support, and gender differences in attitudes toward mathematics. *The Journal of Educational Research, 84,* (5), 280-286.

Torrance, E. P. (1992). A national climate for creativity and invention. *Gifted Child Today, 15,* 10-14.

Triandis, H. C. (1971). *Attitude and attitude change.* New York: John Wiley & Sons.

U.S. Congress. Educational amendment of 1978. Public law 95-561, IX, A.

VanTassel-Baska, J. (1983). Profiles of precocity. *Gifted Child Quarterly, 13,* (4), 183-185.

VanTassel-Baska, J. (1998). *Excellence in educating gifted and talented learners.* Denver, CO; Love Publishing Company.

Virginia Department of Education. http://www.pen.k12.va.us/VDOE/Instruction/Gifted/

Vygotsky, L. S. (1929). The problem of the cultural development of the child, II. *Journal of Genetic Psychology,* 36, 414-434.

Waber, D. P. (1977). Sex differences in mental abilities, hemispheric lateralization, and rate of physical growth at adolescence. *Developmental Psychology, 131,* (1), 29-38.

Weiner, B. (1986). *An attributional theory of motivation and emotion*. NY: Springer-Verlag.

White, R. W. (1959). Motivation reconsidered: the concept of competence motivation. *Psychological Review, (66),* 297-333.

Willinsky, J. M. (1996). *Girls, women, and giftedness*. Unionville, NY: Royal Fireworks Press.

Wilson, J. S., Stocking, V. B., & Goldstein, D. (1993). Gender differences in course selection criteria: Academically talented students in an intensive summer program. Paper presented at the annual meeting of the American Educational Research Association. Atlanta, GA. (ERIC Document Reproduction Service No. ED 369721.

Wilson, M. (1992). *Children's academic self-perceptions: The influences of social comparison and classroom setting*. Unpublished doctoral dissertation. Department of Psychology, Iowa State University, Ames, IA.

Wood, E. F. (1988). Math anxiety and elementary teachers: What does research tell us? *The Learning of Mathematics, 8(*1), 8-13.

Zinker, J. C. (1977). *Creative process in gestalt therapy*. New York: Brunner/Mazel.

Appendix A

Student Directions

By answering these questions, I will find out how you feel about yourself and math. Each of the pages has statements and boxes with letters A, B, C, D, & F. You can mark your answers right on the sheet.

Example 1: I like math.

As you read each statement, you will know if you agree or disagree. Use the code and mark the box that best fits your opinion.

A = ***I STRONGLY AGREE***

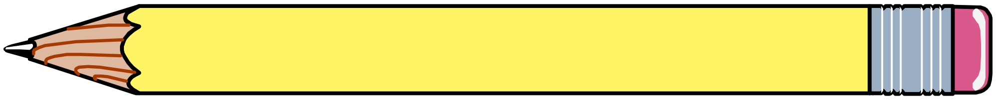
B = ***AGREE, BUT NOT AS STRONG OR "SORT OF" AGREE***

C = ***I'M NOT SURE***

D = ***I DISAGREE, "SORT OF"***

F = ***I STRONGLY DISAGREE***

TIPS:



- ✓ Mark every statement
- ✓ Work fast, but carefully
- ✓ There are no "right" or "wrong" answers
- ✓ Whenever possible, let things that have happened to you help you make your decision.

Thanks for your help,

Mrs. Martin

Appendix B

Fennema-Sherman Attitude Mathematics Scale

ATTITUDES TOWARD SUCCESS IN MATH						
1.	I like math.	*A*	*B*	*C*	*D*	*F*
2.	I'd be proud to be the outstanding math student.	*A*	*B*	*C*	*D*	*F*
3.	I am happy to get good grades in math.	*A*	*B*	*C*	*D*	*F*
4.	It would be great to win a prize in math.	*A*	*B*	*C*	*D*	*F*
5.	Being first in a math competition would make me happy.	*A*	*B*	*C*	*D*	*F*
6.	Being thought of as smart in math would be a great thing.	*A*	*B*	*C*	*D*	*F*
7.	Winning a prize in math would make me feel embarrassed.	*A*	*B*	*C*	*D*	*F*
8.	Other kids will think I'm weird if I get good grades in math	*A*	*B*	*C*	*D*	*F*
9.	If I get good grades in math, I would try to hide it.	*A*	*B*	*C*	*D*	*F*
10	If I got the highest grade in math, I'd prefer no one knew.	*A*	*B*	*C*	*D*	*F*
11	It would make kids like me less if I were a really good math student.	*A*	*B*	*C*	*D*	*F*
12	I don't like people to think I'm smart in math	*A*	*B*	*C*	*D*	*F*
MOTHER'S MATH ATTITUDE						
13	My mom thinks I am the kind of person who can do well in math.	*A*	*B*	*C*	*D*	*F*
14	My mom thinks I can be good in math.	*A*	*B*	*C*	*D*	*F*
15	My mom has always been interested in my progress in math.	*A*	*B*	*C*	*D*	*F*
16	My mom has encouraged me to do well in math.	*A*	*B*	*C*	*D*	*F*
17	My mom thinks math is one of the most important subjects to study.	*A*	*B*	*C*	*D*	*F*
18	My mom thinks I will need math for my career after I graduate from high school.	*A*	*B*	*C*	*D*	*F*
19	My mom thinks advanced math is a waste of time for me.	*A*	*B*	*C*	*D*	*F*

20	As long as I have passed, my mom doesn't care how I do in math.	*A*	*B*	*C*	*D*	*F*
21	My mom would not encourage me to plan a career in math.	*A*	*B*	*C*	*D*	*F*
22	My mom does not care if I take advanced math courses.	*A*	*B*	*C*	*D*	*F*
23	My mom thinks that just a little math is all you need to know.	*A*	*B*	*C*	*D*	*F*
24	My mom hates to do math.	*A*	*B*	*C*	*D*	*F*
FATHER'S MATH ATTITUDE						
25	My dad thinks that math is one of the most important subjects to study.	*A*	*B*	*C*	*D*	*F*
26	My dad has strongly encouraged me to do well in math.	*A*	*B*	*C*	*D*	*F*
27	My dad has always been interested in my progress in math.	*A*	*B*	*C*	*D*	*F*
28	My dad thinks I will need math for my career after I graduate.	*A*	*B*	*C*	*D*	*F*
29	My dad thinks I am the kind of person who can do well in math.	*A*	*B*	*C*	*D*	*F*
30	My dad thinks I can be good in math.	*A*	*B*	*C*	*D*	*F*
31	My dad wouldn't encourage me to plan a career that involves math.	*A*	*B*	*C*	*D*	*F*
32	My dad hates to do math.	*A*	*B*	*C*	*D*	*F*
33	As long as I pass, my dad doesn't care how well I do in math.	*A*	*B*	*C*	*D*	*F*
34	My dad thinks advanced math is a waste of time for me.	*A*	*B*	*C*	*D*	*F*
35	My dad thinks I need to know just the basics in math.	*A*	*B*	*C*	*D*	*F*
36	My dad doesn't care if I take advanced math courses.	*A*	*B*	*C*	*D*	*F*
MATH ANXIETY						
37	Math does not scare me at all.	*A*	*B*	*C*	*D*	*F*
38	It wouldn't bother me at all to take more math courses.	*A*	*B*	*C*	*D*	*F*
39	I don't usually worry about being able to solve math problems.	*A*	*B*	*C*	*D*	*F*
40	I almost never get nervous during a math test.	*A*	*B*	*C*	*D*	*F*

41	I am usually calm during math tests.	*A*	*B*	*C*	*D*	*F*
42	I am usually calm in math class.	*A*	*B*	*C*	*D*	*F*
43	Math usually makes me feel uncomfortable and nervous.	*A*	*B*	*C*	*D*	*F*
44	Math makes me feel uncomfortable, restless, irritable, and impatient.	*A*	*B*	*C*	*D*	*F*
45	I get a sick feeling when I think of trying to do math problems.	*A*	*B*	*C*	*D*	*F*
46	My mind goes blank and I am unable to think clearly when working math problems.	*A*	*B*	*C*	*D*	*F*
47	A math test would scare me.	*A*	*B*	*C*	*D*	*F*
48	Math makes me feel uneasy, confused, and nervous.	*A*	*B*	*C*	*D*	*F*
MOTIVATION						
49	I like math puzzles	*A*	*B*	*C*	*D*	*F*
50	Math is enjoyable to me	*A*	*B*	*C*	*D*	*F*
51	When a math problem comes up that I cannot solve right away, I stick with it until I find the solution.	*A*	*B*	*C*	*D*	*F*
52	Once I start working on a math puzzle, it is hard to stop.	*A*	*B*	*C*	*D*	*F*
53	When I have a question that doesn't get answered in math class, I keep thinking about it.	*A*	*B*	*C*	*D*	*F*
54	I am challenged by math problems I cannot understand right away.	*A*	*B*	*C*	*D*	*F*
55	Figuring out math problems is not something I like to do.	*A*	*B*	*C*	*D*	*F*
56	The challenge of math problems does not appeal to me.	*A*	*B*	*C*	*D*	*F*
57	Math puzzles are boring.	*A*	*B*	*C*	*D*	*F*
58	I do not understand how some people can spend so much time on math and seem to like it.	*A*	*B*	*C*	*D*	*F*
59	I would rather have someone else figure out a tough math problem than have to work it out myself.	*A*	*B*	*C*	*D*	*F*
60	I do as little work in math as possible.	*A*	*B*	*C*	*D*	*F*
USEFULNESS OF MATH						
61	I'll need math for my career.	*A*	*B*	*C*	*D*	*F*

62	I study math because I know how useful it is.	*A*	*B*	*C*	*D*	*F*
63	Knowing math will help me learn a living.	*A*	*B*	*C*	*D*	*F*
64	Math is an important and useful subject.	*A*	*B*	*C*	*D*	*F*
65	I need to master math for my future work.	*A*	*B*	*C*	*D*	*F*
66	I will use math in many ways as an adult.	*A*	*B*	*C*	*D*	*F*
67	Math is not important in my life.	*A*	*B*	*C*	*D*	*F*
68	Math will not be important in my life's work.	*A*	*B*	*C*	*D*	*F*
69	I see math as a subject that I won't use very much in daily life as an adult.	*A*	*B*	*C*	*D*	*F*
70	Taking math is a waste of time.	*A*	*B*	*C*	*D*	*F*
71	It's not important for me to do well in math as an adult.	*A*	*B*	*C*	*D*	*F*
72	I expect to have little use for math when I get out of school.	*A*	*B*	*C*	*D*	*F*
TEACHER'S MATH ATTITUDE						
73	My teachers have encouraged me to study more math.	*A*	*B*	*C*	*D*	*F*
74	My teachers think I am the kind of person who could do well in math.	*A*	*B*	*C*	*D*	*F*
75	Math teachers have made me feel that I have the ability to do a lot of math.	*A*	*B*	*C*	*D*	*F*
76	My math teachers would encourage me to do all of the math I can.	*A*	*B*	*C*	*D*	*F*
77	My math teachers have been interested in my progress in math.	*A*	*B*	*C*	*D*	*F*
78	I would like to talk to my math teacher about careers that use math.	*A*	*B*	*C*	*D*	*F*
79	When it comes to anything serious, I have felt ignored when I try to talk to the math teacher.	*A*	*B*	*C*	*D*	*F*
80	I have found it hard to win the respect of math teachers.	*A*	*B*	*C*	*D*	*F*
81	My teachers think advanced math is a waste of time for me.	*A*	*B*	*C*	*D*	*F*
82	Getting a math teacher to take me seriously is usually a problem.	*A*	*B*	*C*	*D*	*F*
83	My teachers would think I was kidding if I told them I was interested in a career in math.	*A*	*B*	*C*	*D*	*F*

84	I have had a hard time getting teachers to talk seriously about math.	*A*	*B*	*C*	*D*	*F*
CONFIDENCE IN LEARNING MATH						
85	I feel confident trying math.	*A*	*B*	*C*	*D*	*F*
86	I am sure that I could do advanced work in math.	*A*	*B*	*C*	*D*	*F*
87	I am sure that I can learn math.	*A*	*B*	*C*	*D*	*F*
88	I think I could handle more difficult math.	*A*	*B*	*C*	*D*	*F*
89	I can get good grades in math.	*A*	*B*	*C*	*D*	*F*
90	I have a lot of self-confidence when it comes to math.	*A*	*B*	*C*	*D*	*F*
91	I am no good at math.	*A*	*B*	*C*	*D*	*F*
92	I do not think I could do advanced math.	*A*	*B*	*C*	*D*	*F*
93	I am not the type to do well in math	*A*	*B*	*C*	*D*	*F*
94	For some reason, even though I study, math is really hard for me.	*A*	*B*	*C*	*D*	*F*
95	I do fine in most subjects, but when it comes to math I really mess up.	*A*	*B*	*C*	*D*	*F*
96	Math is my worst subject.	*A*	*B*	*C*	*D*	*F*

Thank you for your help.

GRADE (circle one) 3 4 5 6 **Boy or Girl** (circle one)

Appendix C

Key to Fennema-Sherman Math Attitudes Scales

A = Attitude toward math
MA = Mother's math attitude
FA = Father's math attitude
X = Anxiety toward math
MT = Motivation toward math
U = Usefulness of math
TA = Teacher's math attitude
C = Confidence in math

(+) = Question reflects positive attitude
(-) = Question reflects negative attitude

Question #	Category	Attitude		Question #	Category	Attitude		Question #	Category	Attitude
1	A	+		25	MA	+		46	FA	-
2	A	+		26	MA	+		47	FA	-
3	A	+		27	MA	+		48	FA	-
4	A	+		28	MA	+		49	X	+
5	A	+		29	MA	+		50	X	+
6	A	+		30	MA	+		51	X	+
7	A	-		31	MA	-		52	X	+
8	A	-		32	MA	-		53	X	+
9	A	-		33	MA	-		54	X	+
10	A	-		34	MA	-		55	X	-
11	A	-		35	MA	-		56	X	-
12	A	-		36	MA	-		57	X	-
				37	FA	+		58	X	-
				38	FA	+		59	X	-
				39	FA	+		60	X	-
				40	FA	+		61	MV	+
				41	FA	+		62	MV	+
				42	FA	+		63	MV	+
				43	FA	-		64	MV	+
				44	FA	-		65	MV	+
				45	FA	-		66	MV	+

Question #	Category	Attitude		Question #	Category	Attitude
67	MV	-		85	TA	+
S	MV	-		86	TA	+
69	MV	-		87	TA	+
70	MV	-		88	TA	+
71	MV	-		89	TA	+
72	MV	-		90	TA	+
73	U	+		91	TA	-
74	U	+		92	TA	-
75	U	+		93	TA	-
76	U	+		94	TA	-
77	U	+		95	TA	-
78	U	+		96	TA	-
79	U	-		97	C	+
80	U	-		98	C	+
81	U	-		99	C	+
82	U	-		100	C	+
83	U	-		101	C	+
84	U	-		102	C	+
				103	C	-
				104	C	-
				105	C	-
				106	C	-
				107	C	-
				108	C	-

Scoring Directions

Each *positive* item receives a score based on points.

A= 5 B= 4 C= 3 D= 2 F= 1

The scoring for each *negative* item should be reversed.

A= 1 B= 2 C= 3 D= 4 F= 5

Add the scores for each group to get a total for that attitude

Appendix D

[School Letterhead]

April, 2002

Dear Students and Parents,

What do you think about math? What influences your attitude? I'd like to investigate the math attitudes of our students through the use of the Fennema-Sherman Math Attitudes Scales as part of my dissertation for Virginia Tech. The instrument has 96 statements that the students will rate on a scale from Strongly Agree to Strongly Disagree. It should take under 30 minutes to complete and will be administered in one setting. I'm investigating the attitudes that gifted girls have in math and am looking for similarities and/or differences among the grade levels. Questionnaires will be numbered, and the key kept by me so no one will have access to the individual responses of the children. Confidentiality of student identity and responses will be protected. There are no immediate benefits to you or the students.

I would like you to talk it over and sign the slip below if you give your consent (parent) and are willing to participate (student) in the study. If you choose to opt out, that's fine. Students will be given an alternative math assignment to complete in the media center. ***Please return slips to me by April 30th.***

Thank you for your help. I'm looking forward to completing the study and sharing our results when it's all finished!

Sincerely,

Rose Martin
Principal

PARTICIPATION SLIP

○ Yes, I agree to participate in the math attitude study ______________________________
Student Signature

○ I give my permission for my child to participate in the study ________________________
Parent Signature

○ *No thank you* ______________________________ ______________________________
Student *Parent*

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Institutional Review Board

Dr. David M. Moore
IRB (Human Subjects) Chair
Assistant Vice Provost for Research Compliance
CVM Phase II - Duckpond Dr., Blacksburg, VA 24061-0442
Office: 540/231-4991; FAX: 540/231-6033
e-mail: moored@vt.edu

MEMORANDUM

TO: Travis Twiford Educational Leadership & Policy St. 0302
Rosalie Martin ELPS 0302

FROM: David M. Moore

DATE: April 24, 2002

SUBJECT: **Expedited Approval –** "Math Attitudes of Gifted Students: A focus on Gifted Girls in the Elementary Grades" – IRB #02-249

This memo is regarding the above-mentioned protocol. The proposed research is eligible for expedited review according to the specifications authorized by 45 CFR 46.110 and 21 CFR 56.110. As Chair of the Virginia Tech Institutional Review Board, I have granted approval to the study for a period of 12 months, effective April 23, 2002.

Approval of your research by the IRB provides the appropriate review as required by federal and state laws regarding human subject research. It is your responsibility to report to the IRB any adverse reactions that can be attributed to this study.

To continue the project past the 12 month approval period, a continuing review application must be submitted (30) days prior to the anniversary of the original approval date and a summary of the project to date must be provided. My office will send you a reminder of this (60) days prior to the anniversary date.

cc:File

Hampton City Schools Administrative Center
303 Butler Farm Road
Suite 108/110
Hampton, Virginia 23666

Psychological Services, Research, and Evaluation

AMERICA'S FIRST
IN FREE EDUCATION

April 25, 2002

Mrs. Rose White
Mary Peake Center
Hampton City Schools
Hampton Virginia

Dear Mrs. White:

This is to confirm that the Research Committee of the Hampton City Schools has approved your request for research for your dissertation on attitudes toward mathematics among girls at our gifted centers.

We expect that participation will be voluntary and anonymous on the part of your respondents and that Hampton City Schools will not be identified in the paper.

Best wishes for a rapid completion.

Sincerely,

Dwaine R. Harrell, Ph.D.
Coordinator, Psychological Services, Research and Evaluation
Research Committee Chair

Better . . . Because We Care

Appendix F

Vita

15131 Yarmouth Court
Carrollton, Virginia 23314

(757) 238-8121 (H)
(757) 727-2160 (w)
rmartin@sbo.hampton.k12.va.us

Rosalie M. Martin

Personal Comment

Opportunity- I relish the opportunity to meet critical challenges with innovative and creative solutions.

2002-Present Central Office

Hampton City Schools
Hampton, Virginia

Director of Gifted Education K-12

- Administer the Gifted Education program K-12
- Design, implement, and continue to evaluate curriculum
- Control and monitor budget
- Design ongoing professional development for schools
- Evaluation of school personnel
- Communicate program to community
- Provide guidance and support to schools in the development, implementation, and improvement of the instructional program commensurate with SOLs and SOQs
- Efficient compliance with state/division deadlines, standards, and policies

Experience

2000-2002 The Mary Peake Center Hampton City Schools
Hampton, Virginia

Principal

- Opened new magnet school for gifted students grades 3-5
- Administer the total school program
- Design, implement, and continue to evaluate curriculum
- Collaborate with staff to plan and implement flexible school schedules
- Develop and communicate school program to community
- Control and monitor school budget
- Conduct ongoing professional development for school staff
- Manage the supervision and evaluation of all school personnel
- Develop and conduct building evacuation and emergency plan drills
- Provide guidance and support to teachers in the development, implementation, and improvement of the instructional program
- Distribute weekly staff memo
- Efficient compliance with division deadlines, standards, and policies
- Selected as Principal of the Year 2001

1997- Yorktown Middle School *Yorktown, Virginia*

Interim Principal/Assistant Principal

C

- Facilitated special education Child Study meetings and maintained timelines
- Monitored academic/cross curricular activities
- Planned and organized orientation and cultural activities
- scipline, and best practices
- Published article on Instructional Practices

1994 1997 Grafton Bethel / Seaford Elementary

Assistant Principal

-
- Developed building evacuation and safety plans
-
- Prepared five year curriculum review for accreditation

1996 *Grafton, Virginia*

Summer School Principal

-
- Interviewed and hired all staff
- Developed school protocol
-

1985- *York County Schools* *Grafton, Virginia*

Teacher

- Grades four through six

- *All Saints Interparochial* *Wickliffe, Ohio*

Teacher

- Grades five through eight

Education

- **(2002)** ***Ed.D. in Educational Leadership and Policy Studies***
  Virginia Polytechnic Institute and State University Blacksburg, Virginia
- **(1994)** ***MA in Educational Administration and Supervision***
  Old Dominion University Hampton, Virginia
- **(1982)** ***BA in Education***
  University of Findlay Findlay, Ohio

Professional Affiliations	ASCD (Association for Supervision and Curriculum Development)
	VASCD (Virginia Association for Supervision and Curriculum Development)
	AASA (American Association of School Superintendents)
	NAESP (National Association of Elementary School Principals)
	VAESP (Virginia Association of Elementary School Principals)
	AERA (American Educational Research Association)
	NAGC (National Association of Gifted Children)
	VAGC (Virginia Association of Gifted Children)