GENDER ISSUES IN THE MATHEMATICS CLASSROOM:

STUDENT PERCEPTIONS AND PARENTAL BELIEFS

by

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ABSTRACT

The abundance of literature on gender equity and mathematics is evident. As a result, the field of education has developed theories and processes in order to combat gender bias. The benefits are obvious as more females are enrolled in higher level mathematics. Despite the progress, females choosing to enter rigorous math courses and pursue mathematical and scientific intensive careers remain relatively unchanged.

In recent years, the motivational aspects of parental influence and self-efficacy have been examined in an attempt to discover their influence on academic motivation. Utilizing Expectancy Value theory, an exploration of this area was undertaken in an attempt to explain parental influence and personal perceptions on engagement in the mathematics classroom.

Grounded theory will be the process in which data will be analyzed. Through a continual comparative analysis, emerging themes can be examined and altered in order to appropriately reflect the data. As the process progresses, theories will emerge that are grounded in the data.

The goal of this study was to understand how students' self efficacy, parents' beliefs and the interactions among these dynamics, effect female students' thoughts regarding their mathematical capabilities and the pursuit of higher mathematics. The results were consistent with current theories regarding self-efficacy and student motivation. Schools and educators need to provide opportunities for students to experience success in the mathematics classroom to develop and increase self-efficacy.

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CHAPTER I

GENERAL NATURE AND PURPOSE OF THE STUDY

Introduction

We live in a mathematical world. Mathematics surrounds individuals in education, employment, and daily activities. One aspect of a person's success is contingent upon understanding mathematics and having the ability to utilize it. Individuals' mathematical abilities also influence their career choices. Persons who do not have the skills to do mathematics will not have opportunities that others do (Adams, 1998). Adequate preparation is necessary if a career in mathematics is desired; and more and more careers are mathematics intensive (Maple & Stage, 1991). The *Principles and Standards for School Mathematics* state:

> In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed. NCTM challenges the assumption that mathematics is only for the select few. On the contrary, everyone needs to understand mathematics. All students should have the opportunity and the support necessary to learn significant mathematics with depth and understanding. There is no conflict between equity and excellence. (National Council of Teachers of Mathematics [NCTM], 2000, p. 4)

Persons must have a strong background in mathematics with a firm grasp of concepts in order to prepare them for life. This position was reiterated by civil rights leader Robert Moses (2001) who stated, "In today's world, economic access and full citizenship depend crucially on math and science literacy. I believe that the absence of math literacy in urban and rural communities throughout this country is an issue as urgent as the lack of Black voters in Mississippi was in 1961" (p. 5). In essence, mathematics has been recognized as a critical filter and gateway to higher education and better jobs

(Schoenfeld, 2002). If educators are to equip students with the skills needed to rise to their potential, educators must provide multiple opportunities that engage students in the field of mathematics.

Equity in education is a mantra that has been raised for decades in the United States. Brown vs. Board of Education (1954) established that “separate educational facilities are inherently unequal." This required major changes in education in order for all students to receive an equal education, regardless of race or color. The Title IX Education Amendments of 1972 were passed in order to eliminate discrimination based on sex. As a society, America has striven to better the educational system and experiences of all students. However, inequities based on gender are still observed in education.

As a result, the American Association of University Women, (AAUW) commissioned a study conducted by Greenberg-Lake: the Analysis Group to explore gender bias in America’s schools. *Shortchanging Girls, Shortchanging America* (AAUW, 1991) was the first national survey to associate the abrupt drop in self-esteem experienced by pre-adolescent and adolescent girls with their classroom learning. This study was quickly followed by a pioneering analysis that specifically delved into gender inequities in education (1992). This study was revolutionary and thus began the query into gender equity issues in American classrooms. Since the initiation of this scope of study, a large body of work has been established in an attempt to explore this phenomenon. In particular, a plethora of research related to gender issues in the mathematics classroom has been generated. This research has produced many findings

on how to address the equity issue and encourage females to have greater success in mathematics.

Upon publication of the groundbreaking studies commissioned by the AAUW, other studies began to burgeon in the field of gender and mathematics. Initially, studies utilized a deficit model, in which those who didn't perform as well as others were compared to those who did well (Becker, 2003). This position was derived from and standardized on the basis of men's interpretations of research data drawn predominantly or exclusively from studies of males (Brown & Gilligan, 1992). As a result, "when women [young adolescents] do not conform to the standards of psychological expectation, the conclusion has generally been that something is wrong with women" (Gilligan, 1982, p. 81).

However, researcher views have changed dramatically in recent years. Through additional research, studies found that differences in mathematical performance are attributed to the socialization and learning processes of females and not their innate inability (Becker, 2003; Fennema, Carpenter, & Lamon, 1991). This was a pivotal point in the study of mathematics because it allowed females to be considered as mathematically abled as males. Math provides an opportunity for both sexes to excel.

Female students have moved forward in the field of mathematics. In 1981, 4819 females earned a degree in mathematics from degree-granting institutions; this increased to 5787 in 2002 (National Center for Education Statistics [NCES], 2003a, 2003b). Females made up 55.5 percent of the total Advanced Placement (AP) examinees in the United States during the academic year 1998-1999 (Texas Education Agency [TEA], 2001). In Texas, female high school participants taking AP examinations have increased

4.6 percent between 1995 and 1999 (TEA, 2001). However, specific subgroups consistently surpass their peers. In fourth grade, males and females showed no measurable increase in the previously obtained scores. Yet males outperformed females in mathematics in 2003 in the fourth, eighth, and twelfth grades (National Center for Education Statistics [NCES], 2002; TIMSS, 2003). With all the changes that have occurred, interventions that have taken place, and the increased knowledge about gender equity, males outperforming females on standardized mathematics tests continues to occur. Further investigation is needed to determine the cause of this phenomenon.

In spite of the individual variances between students as well as gender differences, it is desirous for all students to excel in mathematics. The call for equity and excellence in mathematics comes from the numerous vantages (Smith, 2001). Females have been subjected to the deficit model (Becker, 2003) in an attempt to explain their alternate ways of knowing. The deficit model is one that looks at females as lacking or having a deficit since they are not as successful as males. Additionally, some research has found that differences between males and females occur. When the significant differences appear, it is in the secondary grades and favored males (Wilson & Zhang, 1998). Additionally, genetic disposition has been utilized as an explanation of gender differences (Leahey & Guang, 2001). However, research on the opposite end of the paradigm indicates that while one's genetic framework may influence mathematical achievement, it does not necessarily predispose one to a specific level of achievement (Gallagher, 1998). A psychobiosocial model that employs a biological and socialization complex interaction, in which the aspects cannot be separated from each other, maintains that the factors, psychological, biological, and social interact simultaneously to create

gender differences (Halpern, 1997). Most research has a common thread and supports the conclusion that all children have the ability to learn mathematics when given quality mathematics opportunities (NCTM, 2000).

Determining attitudes and their affect on a person's behavior is a complex concept. Social Cognitive Theory provides an avenue to explore this realm (Bandura, 1986). Bandura (1993) described that mechanism through which feelings, thoughts, motivation, and behavior are influenced as self-efficacy. Self-efficacy involves feelings of self-confidence and the belief in one's ability to be successful at the given task (Bandura, 1986). Students who have high self-efficacy in mathematics may choose to take higher level mathematics courses and more actively engage the content as opposed to those who have a low-self-efficacy (Bandura, 1986; Secada 1992).

Research has also considered student-teacher interactions as an influencing factor on females' choice in pursuing higher mathematics. Educator programs have enhanced curricula to ensure students are aware of the need for gender awareness (Kelly, 2002). Research has reinforced the understanding that high-quality teachers are integral to children's intellectual development and achievement (U.S. Department of Education, National Center for Education Statistics, 1999). Gender biases in the classroom have been established, realized, and continue to occur. It is essential to continue to study teachers' thoughts and actions about gender, as the teacher is the one who aids students as they learn. Teacher use of strategies communicates their beliefs about gender, and multiple-gendered messages are transmitted to students through the many curricular and organizational decisions teachers make throughout a school day (Garrahy, 2001).

The American Association of University Women (1992) completed research that revealed a declining interest in mathematics among girls as they advance through elementary and middle school. However, as state requirements have become more rigorous, more females are taking higher level mathematics courses. Nonetheless, it is interesting to note that, when it becomes elective to take higher level mathematics courses, the majority of females decline to pursue mathematics. As a result, females are not entering fields of study that require a substantial amount of math (NCES, 2002).

These factors illuminate potential variables that can engage females in mathematics and encourage their pursuit of higher math education courses. However, by focusing on the concept of self-efficacy and parental beliefs, perhaps some light can be shed on why early adolescent females experience a lowering of their mathematical self-efficacy. An understanding of the interplay may aid in evolving mathematics education to further include females and encourage them to continue pursuing mathematics at higher levels.

Statement of the Problem

The problems to be examined in this study are the reasons behind the lowering of females' mathematical self-efficacy during their early adolescent years. Previous research has indicated that there has been a decline in the mathematics and science performance of students in the United States (NCES, 2002).

The most recent Trends in International Mathematics and Science Study (TIMSS, formerly known as the Third International Mathematics and Science Study) found that boys outperformed girls in fourth and eighth grades. Research has established

inequalities in educational experiences between males and females (American Association of University Women, 1992; Bevan, 2001; Fennema, 1990; Hanna, 2003; Leder, Forgasz, & Solar, 1996; Oatti and Lee, 1995; Sadker & Sadker, 1986, 1994). Differences in mathematical performance are sometimes attributed to the socialization and learning processes of females and not an innate inability (Becker, 2003). The problems to be examined in this study are the reasons behind the lowering of females' mathematical self-efficacy during the early adolescent years.

Purpose of Study

The purpose of this study is to examine how female students' perceptions of their ability in mathematics affect their success in the content area and interest in taking future mathematics courses. The parents' view of female students' mathematical abilities will be compared to their view of male classmates' mathematical abilities. This study will also explore how parental beliefs regarding female mathematical ability affect the female students. This information is critical as the interplay between these factors is complex. Finally, this study will attempt to provide insights into the attitudinal factors which effect females' math perspectives. Results of the study can assist in creating an understanding of the phenomena being explored.

Research Questions

The grounded theory framework is being utilized so that common concepts can be identified and developed. In doing so, an understanding of the phenomena can be ascertained in order to encourage female students to remain in mathematics courses and

to examine possible attitudinal factors that affect their mathematical perspective. This study will be guided by the primary question, "Why is it that during the early adolescent years a lowering of mathematical self-efficacy occurs in females?" The specific questions addressed during this study are as follows:

1. What are individual female perceptions of their math capabilities?
2. How do the participants perceptions of females' capabilities in mathematics compare to their perceptions of male capabilities in mathematics?
3. What is the relationship between the individual's attitude and her mathematical performance and beliefs regarding current and more rigorous mathematical courses ahead in her academic career?
4. What are parental beliefs regarding their daughters' ability, success, and future success in mathematics?
5. What are parental beliefs regarding their daughters' performance in mathematics?
6. What beliefs do parents have regarding their daughters' mathematical capabilities and how do these beliefs relate to their daughters' study of higher mathematics?

These issues will need to be clearly scrutinized prior to conclusions being drawn as to the best approach that will encourage female students to remain in mathematics and have positive experiences.

Significance of the Study

Previous research has discussed teacher actions and student self-efficacy. Additionally, research has been completed on individual aspect of parental expectations

and the effect they have on female mathematics students. This research is being completed from a feminist perspective, one that emphasizes male and female differences, as vital in learning mathematics. By exploring the issues from this aspect, the deficit model is no longer valid. The feminist perspective recognizes differences in ways of knowing and learning for males and females. It acknowledges a difference in learning and supports an awareness of these differences in order to allow students to be treated equitably.

This study provides a view of mathematics from multiple perspectives. Parental beliefs and the individual's self-efficacy will be explored. This study was developed to explore why early adolescent females experience a lowering of mathematical self-efficacy and to add to the understanding of this issue.

Definition of Key Terms

The following terms were defined by the researcher in order to provide a clear and concise understanding as utilized in this study. In the current literature base, definitions of these words vary. An operational definition is required in order to contextualize the construct. By defining the construct in terms of observable variables, an understanding of meaning and consistent communication can occur between various researchers who are studying the same construct (Northcutt & McCoy, 2004).

Adolescent - One who is in the period of life from puberty to maturity terminating legally at the age of majority. For this study, this will range from 11 to 18.

Early Adolescent - The period of life at the beginning of adolescence. For this study, this will be the ages of 11 to 13 years old.

Equity – A leveling of the playing field for all students. Equity is accomplished in a threefold manner as: equal opportunity to learn, equal educational treatment, and equal educational outcomes.

Expectancy Value Theory – The premise that people are motivated to engage in an activity to an extent that they expect to succeed is examined in light of the value they place on the success of that activity (Eccles et al., 1983; Wigfield, 1994; Wigfield & Eccles, 2000).

Feminist Perspective – The position that recognizes gender is socially constructed and accepts that differences are not biologically determined. Gender differences may be attributed to acknowledge and support, rather than deny or change.

Gender - The non-physiological components of sex that are culturally regarded as appropriate to males and females. The behavior, cultural, or psychological traits typically associated with one sex.

Gender Bias – A perception influenced by gender.

General Mental Ability – Information processing skills that reflect individuals' ability to adapt and learn from the environment as time passes.

Inherent Factors – Factors such as general mental ability and personality that are supported by current research to be genetically derived and stable.

Outlier – An individual whose scores are farthest from the minimum passing score.

Self-Efficacy - The judgment of confidence that students apply to their academic performance in specific academic activities (Bandura, 1997).

TAKS – An acronym for the Texas Assessment of Knowledge and Skills. This is an assessment given yearly by the state of Texas to determine if students reach objectives established for the specific grade level.

Assumptions of the Study

The research basis of this study was established on well-developed and theoretically sound perspectives concerning mathematical perceptions and self-efficacy. It was assumed that participant responses would be directly measurable as the review of literature suggests. The assumption was made that participants would be forthright and honest in their responses. Through the utilization of triangulation of data, responses will be verified as accurate. Triangulation of data allows for information to be viewed in a variety of different ways providing support of theories grounded in the data. Triangulation of data enhances findings by providing insight into emerging themes. Additionally, it was expected that students would be open and willingly participate in the data collection. Furthermore, the researcher posited that adults involved in the study would have a vested interest in providing information and would readily participate in the study.

Limitations of the Study

The study is designed to examine how students' self-efficacy and parents' beliefs effect female students' perceptions regarding mathematical capabilities and the pursuit of higher mathematics. This research is being conducted in a single school in a city with the population of approximately 200,000 located in the West Texas Region. The school,

with its diverse student population, is one of the largest elementary school in the city. The data was collected through interviews, observations, archival documents, and surveys. The analysis sought to understand how a female student's individual perception of her mathematical abilities as well as those of her parents.

All participants are volunteers and must give their consent to take part in the study. If the desired participant is unwilling to participate, another student who meets the required criteria must be obtained. Similarly, if a participant chooses to withdraw midway through the study, another participant must be found. This is crucial as the population in each study quadrant is two and similarities as well as differences are being examined between study participants. It is very important to make every effort to maintain participant follow-through in order to keep attrition to a minimum.

Confidentiality is critical in obtaining participants for the study. This also encourages full disclosure as participants do not have to be concerned with others, such as teachers or parents, being informed of their statements. Confidentiality is outlined in the consent form (See Appendix D). Likewise, during initial interviews with participants this will be reiterated.

Interviews will be employed to garner information. Interviews allow people to express their feelings as well as provide an opportunity for understanding the phenomena. Through interviews, the researcher can delve into the "how" and "why" of participants' reactions. However, the fundamental weakness with interviews is that there is the possibility for not obtaining full and accurate disclosure. The possibility of participants stating what they feel the interviewer wants to hear as opposed to the reality is a concern (Short, 1991). Additional weaknesses follow that same vein. Will parents be honest in

their responses and willing to put themselves under the research microscope? Will their responses accurately reflect their actions? These concerns are very real as interviews will provide a large source of information for the study. The importance of accurate information being provided in the interview process cannot be overstated. High-quality interviews allow participants to be at ease and speak freely regarding their ideas. Through developing rapport and the trust of students, the researcher is able to conduct quality interviews. Rapport and trust were developed through frequent conversations and constant presence of the researcher. These interviews "produce rich data filled with words that reveal the respondents' perspectives. Transcripts are filled with details and examples" (Bogdan & Biklin, 1998, p. 97).

Researcher bias is also a possible limitation as this can cause erroneous coding or unjustified conclusions. To minimize this possibility, observations of students and teachers in the classroom will be employed. Additionally, triangulation of the data will allow for an analysis that compares statements regarding the subject to behavior and previous experiences (Dooley, 2001). Through the use of these various methodological tools, a more holistic representation of the person and their responses can be attained.

Another limitation of this study is the volume of data that will be generated. Short (1991) maintains that realistic consideration must be given regarding the collection of data. As a result, the population studied will be small, consisting of two females from each quadrant. Students were placed in one of four quadrants with the demarcation being the minimum passing score on the 2004 mathematics and reading Texas Assessment of Knowledge and Skills (TAKS). The four quadrants were: High Mathematics-High

Reading, High Mathematics-Low Reading, Low Mathematics-High Reading, and Low Mathematics-Low Reading.

The sample population had to be feasible in order to systematically examine results (Miles & Huberman, 1994). However, this design of the study allows for transferability to females who meet the established criteria. The established criteria will be placement in the appropriate quadrant based on individual results on the Texas Assessment of Knowledge and Skills [TAKS]. The results from this study will augment previous research and provide an understanding of how parents and individual student's perception affect mathematical performance as well as a student's beliefs regarding her current and future mathematical endeavors.

Summary

There is an abundance of literature on gender equity and mathematics. As a result, the field of education has developed theories and processes in order to combat the bias. The benefits are numerous as more females are enrolled in higher level mathematics. Despite the progress, the number of females choosing to enter rigorous math courses and pursue mathematical careers remains relatively unchanged. The goal of this study is to add to the understanding of why a lowering of mathematical self-efficacy occurs in females during the early adolescent years.

Chapter II

REVIEW OF RESEARCH AND RELATED LITERATURE

Introduction

Throughout the past two decades the examination of females, equity, and mathematics has been prolific. This examination created a critical lens in which researchers, educators, administrators, and parents have been able to examine how females are best served in the mathematics classroom. The focus of the lens was initially established with two watershed reports published by the American Association of University Women (AAUW). Shortchanging Girls, Shortchanging America (1991) investigated the influence of gender on career goals, academic interests, and self-confidence. Students who were interviewed, ages 9 to 15, cut across the spectrum of race and socio-economic status. The results were dramatic and disconcerting. This study concluded that females experienced a significant loss of self-efficacy in mathematics and this affected them academically. The second study, How Schools Shortchange Girls (1992), brought the critical lens into sharper focus as it delineated the different academic realities experienced by females and males. This report exposed the discrepancy in public schools regarding the treatment of the two genders. In essence, males and females were systematically treated differently in the United States educational system.

Gender and Mathematics

During this time that the National Council of Teachers of Mathematics (NCTM) determined that mathematics education must be improved in the United States (National

Council of Teachers of Mathematics, 1989). The organization began to formulate guidelines and principles in order to provide the highest quality mathematics instruction possible for students. Remaining true to this goal, the NCTM published *The Principles and Standards for School Mathematics* (2000). This document established the need for excellence in the mathematics classroom. "The Standards" outline six principles for school mathematics that are broad umbrellas concentrating on specific needs in the mathematics classroom. One of the six resounding themes is equity.

> Educational equity is a core element of this vision. All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study-and support to learn-mathematics. Equity does not mean that every student should receive identical instruction; instead it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students. (NCTM, 2000, p. 11)

The decisions made by educators have profound consequences for all students and society as well. With this understanding, the conceptual framework was established in creating a mathematically literate society. Since the introduction of the findings commissioned by the AAUW in 1991 and 1992, great strides have been taken to improve the experiences in mathematics for females. More and more females are enrolled in mathematics (Reese, Miller, Mazzeo, & Dossey, 1997). Yet, in spite of advances made, females often still self select out of mathematics (Reese, Miller, Mazzeo, & Dossey, 1997). Additionally, research reveals that as females progress through their education, their self perceptions, especially in mathematics, decline (Chipman, 2005; Moses, Howe, & Niesz, 1999). The attitude decline and the long term influence of this phenomenon on females have been confirmed in several subsequent studies.

In order to explore the subject matter more thoroughly, a comprehensive examination of gender issues in the mathematics classroom must be explored. Through a review of literature, gender issues in the mathematics classroom are documented. Furthermore, literature regarding the role of female students and parental beliefs was reviewed in order to lay the groundwork for this study. The literature review delineated each aspects influence and made apparent the need for exploration of interaction between these constructs.

Previous research has indicated that there has been a decline in the mathematics performance of students in the United States (NCES, 2002). The most recent Trends in International Mathematics and Science Study (TIMSS, formerly known as the Third International Mathematics and Science Study) found that for fourth-grade boys and girls there has not been a measurable change in the average mathematics achievement while eighth-grade students, male and female, showed improvement (TIMMS, 2003). However, this study found that boys outperformed girls in fourth and eighth grades. This is a change from results of the 1995 study where there were no measurable differences in the performance of males and females in fourth grade (TIMMS, 2003).

While students enter school with the same aptitude, some believe a phenomenon allows for males to outscore females in the field of mathematics (Sadker, Sadker, & Klein, 1991). Research conducted on many fronts has established inequalities in educational experiences between males and females (American Association of University Women, 1992; Bevan, 2001; Fennema, 1990; Hanna, 2003; Leder, Forgasz, & Solar, 1996; Oatti and Lee, 1995; Sadker & Sadker, 1994). Differences in mathematical performance are sometimes attributed to the socialization and learning processes of

females and not an innate inability (Becker, 2003). To determine what affects an early adolescent females' perspective on mathematics, one must look at the holistic experience to determine pertinent factors. The individual's belief in her own ability to succeed in current and future mathematics undertakings, parental beliefs, and the interplay of these factors are important to explore. This information will be integral in determining how to assist girls reach their fullest potential in the field of mathematics.

Historical Perspectives

The research that has occurred in gender equity and mathematics has informed views and modified positions of educators and researchers in their exploration of gender and issues that arise in the mathematics classroom. These works shed light upon the inequity for females that occurs in the classroom. As a result, the research resulting in a modification in the classroom cycle began. The changes were necessitated as studies continued to document the lack of achievement of female students (Secada, 1992; Croom, 1997).

It was critical to encourage and improve the involvement of females in mathematics as that subject matter has been recognized as a critical filter, a gatekeeper, to higher education and better jobs (Atanda, 1999; Sells, 1978; Stone, 1998). While gender differences in mathematics have been decreasing, there continues to be a disparity in course selection and career selection in collegiate pursuits (AAUW, 1998). Additionally, females' perceptions of their abilities in mathematics continue to wane as they mature (AAUW, 1991; 1992). Student self-efficacy was explored in relation to mathematics course taking. According to the AAUW,

There is a circular relationship between enjoyment of these subjects and self-efficacy. Students who like math possess significantly greater self-efficacy; students with higher self-efficacy like math and more. Theses students like themselves more, feel better about their schoolwork and grades, consider themselves more important, and feel better about their family relationships (AAUW, 1991).

Traditional Approach

The traditional view of females and mathematics is one that is less than complimentary. The original position maintained by theorists, and the public in general, was that females were unable to perform as well as males in the mathematics classroom. Originally it was thought that they did not have the mental faculties to withstand the rigors of such a difficult and complex subject. However, it soon became a matter of females being seen with a deficit. The position held by many educators was that females were somehow lacking and had to be 'fixed' to be more like males who have the desired characteristic of doing well in mathematics (Becker, 2003). This position was supported by the belief that mathematical ability was innate and that most females did not have that ability. Society continues to purport such stereotypic roles today (Orenstein, 1994). Television, radio, even toys send messages that sometimes reinforce traditional roles.

Gender Issues in the Classroom

Stereotypic ideas regarding females mathematical abilities, although diminishing, are still present in the classroom (Matthews, Binkley, Crisp, & Gregg, 1998). Girls have the ability to succeed, but often are not expected to succeed (Reis, 1998). Females are often sent the message that they don't have to succeed, just try. This is a very interesting aspect and indicates that ability is emphasized for males while effort is emphasized for females. The difference is subtle but powerful. With the emphasis being on ability, this

is considered a controllable, low effort, aspect of life. One exerts his ability, applies it, and can succeed. It is controlled by the person. However, on the other end of the paradigm is effort. Effort is uncontrollable and requires a high amount of energy to sustain. Effort implies an uncontrollability as it is not a skill, as opposed to ability. Effort also takes an incredible amount of energy to sustain. When messages are transmitted to females that they are unable to meet the same expectations as males, their value of self and capabilities is lessened resulting in a lowering of their mathematical self-efficacy.

Research conducted has established inequalities in educational experiences between males and females (Oatti and Lee, 1995; American Association of University Women, 1992). Despite this, most teachers insist they teach from a gender-free position. Their instruction is based on personal beliefs and prior experiences; hence, their treatment varies based on student gender. In a subject traditionally seen as male dominated, mathematics, teachers overestimated male students' abilities and viewed them positively (Garrahy, 2001). As a result, females have less opportunity in mathematics to engage the content, answer questions, and interact with the teacher.

Situated cognition theories suggest moving beyond thinking about the curriculum and pedagogies. Educators must contemplate how learning "can change students' identities by changing their ability to participate in the world" (Brickhouse, 2001, p. 288). These types of classrooms would allow the teacher to attend to students' needs in a very precise and deliberate manner. Issues of interest, although sometimes similar, will be different and approaches to the subject will also vary. By having gender-sensitive

classrooms, one approach will not be diminished or seen as less valuable. This is an important aspect as boys and girls approach problem solving in different ways. Research has shown some females felt mentally intimidated by males (Durost, 1996). Particularly, females expressed concern about being rejected by their peers or as being seen as undesirable (Reis, 2002). Additionally, this is a precarious position for the gifted females in the classroom. They face additional struggles as they attempt to navigate through school, peers, and giftedness.

Changes in Approach

As ideas involving gender and mathematics evolved, a positivist approach was utilized. This approach observed overt behavior students engage in at the observed time. Overt behaviors such as, student-teacher interactions or avoidance behaviors, became the object that was being studied. The focus was on measuring the behavior, and studying a specific group. The purpose of this type of examination was to derive a description for the studied group as a whole in regards to the observable behavior. Additionally, relationships could be examined or the findings used to predict outcomes for similar groups. This position is particularly beneficial when comparing males and females in the mathematics classroom.

From a positivist perspective, data that is extremely descriptive can be obtained regarding gender issues and mathematics. Nonetheless, it is important to realize that data must be examined from multiple perspectives in order to understand it in a holistic manner. The feminist perspective, used in this study, acknowledges differences in the way of knowing and learning for male and females. It is important to note that this

perspective does not tout itself as a better position, but merely different. That is not to say the feminist perspective values one gender above the other or that one is viewed as superior to the other. It merely acknowledges that we learn differently and educators need to be aware of that situation and attend to it so students will be treated fairly. Viewing mathematics and gender issues from a feminist perspective, acknowledges: differences in learning styles, engagement approaches, knowledge acquisition and communication techniques.

The feminist views males and females as equal and values both perspectives. However, data and observations decidedly have a different slant (Campbell & Greenburg, 1993). Mathematics, historically, has been seen from a masculine perspective. An example of this is the deficit model approach previously mentioned. Females, because they did not perform as well as males in mathematics were seen as lacking in skills and needed to be 'fixed'. Feminism does away with this perspective and provides an opportunity to observe the content from a female's perspective. The feminist perspective is necessary to balance the mathematics classroom since despite advancements in mathematics, certain types of mathematics still favor males (Fennema & Carpenter, 1998; Forgasz & Leder, 1996).

Current Research

Secada, Fennema & Adajian (1995) report that the most current research regarding gender equity is in the domain of cognitive psychology. By linking gender issues, mathematics, and cognitive psychology, a deeper understanding of the complex issue can be developed. This is vital as it brings other areas of expertise to a subject that

continues to need examination. Additionally, by using various perspectives to view the issue of gender and mathematics, a more holistic view of gender issues can be obtained.

Parental Beliefs

Children have numerous influences in their lives. Peers, family, and society all play roles in shaping a child's self perception. Parents play a significant role in the lives of their children. Messages are directly and indirectly transmitted to children regarding all aspects of their lives. What a child deems important, as well as their interests, and pursuits, are shaped through parental input.

Likewise, the valuing or devaluing of academic skills is conveyed to the child. Hattie (1992) suggests that judgments adolescents make about their individual competence in academic endeavors are based upon more than just task performance. Parental influence affects adolescent belief systems regarding their academic ability (Eccles, Jacobs, & Harold, 1990). The concept of parental influence on children is not new. Schools have known the importance of parental support and districts have encouraged parents to become involved in their student's education. This aspect has been identified in research as having a decisive role in student self determination of educational success and achievement (Valenzuela & Dornbush, 1994).

It is suggested that academic achievement and student views of their academic selves are formed by parental beliefs (Jacobs & Eccles, 1992). It is clear that parents influence attitudes and course taking, and this is extremely important in the realm of mathematics. Mathematics is often labeled a gatekeeper (Adams, 1998). With this being the case, students need encouragement in advancing their mathematical pursuits.

Parental support and involvement is an important aspect of this process. Parental participation and beliefs have been recognized as a significant influencing factor in students' achievement and educational advances (McNeal, 1999). A student's academic self-efficacy is directly influenced by their parents. Parents transmit their beliefs and values regarding academic pursuits and individual capabilities to their children.

If the values associated with mathematics have been an affirmation for the child, both in his abilities and value of the content, the child will have a more positive outlook regarding the subject matter and the pursuit thereof. Conversely, if beliefs transmitted by parents are negative, this has a direct affect on the child. The child may not feel she can be successful nor consider herself able to pursuit more rigorous mathematical courses. The importance of this was supported by the work of Stevenson, Schiller, and Schneider (1994) who found that individual students' previous experiences and perceptions of mathematical experiences affect their later opportunities for taking advanced mathematical courses.

It is posited that an individual's self perception evolves from many different entities and each one can be considered an individual factor affecting self perception. Eagley and Chaiken (1993) suggest the perceptions of self and of others be melded into an overall evaluative response. This allows for a more accurate reflection of what is actually occurring. Students do not consider their parents' beliefs and views in isolation. Rather, they engage them, evaluate the position, and then modify their beliefs about themselves based upon the parental information in conjunction with their experiences. This is a continual process throughout childhood and adolescence as the young person determines their capabilities and identity.

Adolescents who experience success in mathematics, and receive positive affirmation regarding their capabilities and continuation in the pursuit of mathematics, usually continue their work in this domain. Adolescents who receive messages that they do not have capabilities in mathematics frequently display disengagement and usually self select not to continue to take mathematics courses as soon as possible. The perception of ability along with actual achievements predict adolescents' plans for the pursuit of additional mathematics courses as well as mathematics-related careers (Watt & Bornholt, 1994).

Social Cognitive Theory

Social Cognitive Theory is multi-faceted and complex in the understanding of human behavior. It assumes that people shape their environment as opposed to merely reacting to it. Social Cognitive Theory explains human behavior as "a model of triadic reciprocity in which behavior, cognitive and other personal factors and environmental events all operate as interacting determinant of each other"(Bandura, 1986, p. 18). It is important to note that the 'triadic reciprocity' is the interaction between environment, inner personal controls, and behavior, and is fundamental to Social Cognitive Theory. The triadic forces are equal and mutually dependent; however they do not respond equally (Maddux, 1995). This approach has been regularly utilized in explaining human behavior in the field of education.

Self-Efficacy

Self-efficacy is one aspect of the Social Cognitive Theory and is important to understand the theory. Self-efficacy is dynamic and being continually redefined based on personal experiences and perceptions. It is important to understand that self-efficacy and self-esteem, although often used interchangeably, are different. Self-efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments (Bandura, 1997). Beliefs affect the values placed on the action required to complete the task. Additionally, expectations regarding what is required to produce the outcome are held by the person. Positive expectations serve to encourage the behavior to produce the desired outcome. In education, "continuing motivation to learn is facilitated through the satisfaction of expectancies in the current learning episode" (Driscoll, 2000).

Negative expectations serve to discourage undertaking the behavior. This allows for a disengagement to occur. The more often a person experiences disengagement, the less likely they are to continue to participate in the behavior. The student may change her goals in regards to the task. The student may, instead of striving for the 'A' in the class, decide that due to negative outcomes merely passing the class with a 'C' will be satisfactory.

Self-efficacy is an extremely powerful motivator for individuals. It can either encourage a student to continue in the steps to gain mastery or discourage a student from attempting to master the skill. When beliefs regarding personal efficacy are firmly established, they are difficult to change and become self-perpetuating. People who have a strong sense of self-efficacy often set higher goals and display perseverance in difficult

situations (Maddux, 1995). Conversely, if students, "estimate their chance of actually bringing behavior into line with the standard to be poor, their response will be to stop trying and to withdraw from the situation" (Geen, 1989).

Self-efficacy is a complex, dynamic force which can propel individuals as they experience difficult experiences to continue and persevere. It can also negatively influence persons from continuing to engage in an activity or even to attempt another that is related to the first. Self-efficacy is extremely useful in the initial stages of skill development as it allows for continued practice until the skill reaches the level of automation (Bandura, 1997). For individuals to continue to engage in a skill, it is imperative that self-efficacy buoy them through the initial stages of learning in order to continue to engage in the activity.

Self-Efficacy in Mathematics

In order to better understand self-efficacy in mathematics, it needs to be understood that the development of self-efficacy is complex and multi-dimensional. Self-efficacy is innate, but shaped by experiences and perceptions of individuals in relation to their ability to successfully complete tasks. Self-efficacy affects students' engagement in content areas as well as choice of classes (Bandura, Barbaranelli, Caprara, & Pastorelli, 2003). It controls the amount of effort put forth as well as the anxiety experienced by the student. "Students who believe they are capable of performing academic tasks use more cognitive and metacognitive strategies, and, regardless of previous achievement or ability, work harder, persist longer, and persevere in the face of adversity" (Pajares, 2002, p. 117).

Students' abilities and previous mathematical experiences help shape the students' mathematical self-perceptions (Pajares & Kranzler, 1995). Likewise, these are strong predictors of future performance. This perception of self, one's self-efficacy, either will encourage a student in the field of mathematics or enhance the disengagement process. One effect of positive self–efficacy is encouragement of students to engage in the content area. Students aren't necessarily better problem solvers or smarter, but they see themselves as successful and more willing to work harder and not give up when the problems become more difficult.

One of the most fulfilling aspects of education is the acquisition of a new skill. It is exciting and rewarding for the student. If a student experiences this type of learning, self-efficacy is enhanced. Students feel less apprehensive about mathematics and are more willing to engage the content. The student believes in her capabilities and is more confident in the classroom activities. This, in turn, can lead to increased satisfaction with themselves and the content.

Self-efficacy is exhibited in different manners by males and females. In elementary school, males and females self report roughly equal confidence in mathematics, but by early adolescence boys begin to rate themselves as above their female peers in abilities (Wigfield, Eccles, & Pintrich, 1996). Research has provided a variety of reasons for this evolving difference, nonetheless, an examination of the role of self perceptions and parental beliefs is necessary to consider the beliefs construct.

Females who are gifted are especially vulnerable in this area during the early adolescent years; gifted girls experience a drop in opinion of themselves and their academic performance. What has been found are that society's attitudes changes toward

the gifted female (Kerr, 1994). Society values the intelligence of female until she comes of age. At that point, societal norms and dogma shift the focus from intellectual pursuits to those of 'regular' girls. Emphasis is placed on physical attributes as well as social pursuits. In attempt to fit in, the gifted girl, hides the giftedness and becomes one of the crowd. The tightrope between giftedness and adolescence is precarious. Students must be made to feel valued and encouraged in their unique abilities.

Expectancy Value Theory

Expectancy Value Theory utilizes a motivational construct to explain choices made, performance, and the desire to continue a particular behavior. An individuals' decision to engage in an activity is based upon their belief in how well they will accomplish the task and to the extent that they value it (Eccles et al., 1983; Wigfield, 1994; Wigfield & Eccles, 2000). Researchers have examined various aspects of the framework in order to obtain a better understanding of the influence it exerts on this theoretical framework. One aspect, of particular importance in this study, is the relationship between the variables expectancy and value placed on the given task. DeBacker and Nelson (1999) utilized a modified Expectancy-Value Theory model in their work, shown in Figure 2.1, when studying content-specific situations. The modified expectancy value model is used to focus on aspects that are important in this study. Utilizing this model, an examination of individual perceptions, beliefs in their abilities, the value the individual places on engaging the content, and perceived options regarding future mathematics courses can begin.

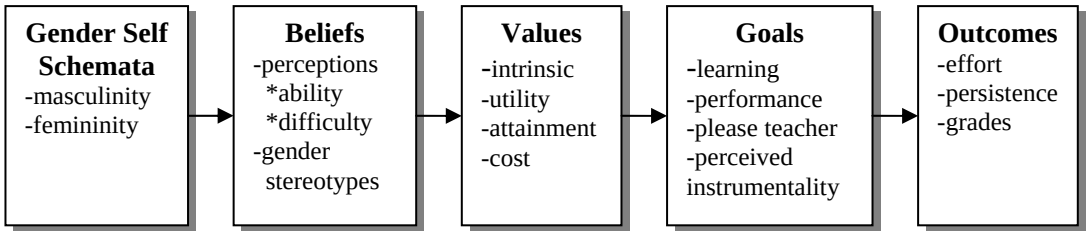


Figure 2.1. Expectancy-Value Model

Eccles et al. (1983) initially developed the model in the realm of mathematics achievement. Although the expectancy value model of achievement motivation has been expanded upon and is much more complex, the modified version focuses on the values explored in this study. The study will look at the belief construct and its effect on value. Eccles et al. (1983) determined four aspects of valuing academic behavior. The values are: intrinsic, utility, cost, and attainment. Intrinsic value is the commonly held definition of personal enjoyment for completing an activity. The activity is valued for itself and not seen as a means to an end. Utility value is an assessment of the skills and their usefulness in the future. Cost is considered the value placed on the effort needed to learn the activity. If the activity is deemed important enough for the individual to invest time and effort, the cost value is higher. The final aspect to be discussed is attainment. Attainment value weighs the importance of mastering the concepts. In terms of mathematics, attainment value is high when a student possesses strong desires to master concepts and do well in the course. Instrumentality refers to the perception that the performance will determine the outcome.

As seen in the model, beliefs have a direct bearing on values. Students' beliefs will determine if they will actively engage the content and if it will be valued. The model also displays that beliefs ensconce personal perceptions of ability and gender stereotypes.

Parents have a direct influence in the area of beliefs. Utilizing this model will allow for an examination of the valuing of mathematics based on individual perceptions as well as the influence of parental beliefs in this population of students. The issue is complex and by examining the individual constructs of parental beliefs and self-efficacy, and how they are interconnected, a more thorough understanding can be obtained.

Summary

There are many entities that exert influence on students of today. Peers, teachers, and society all have some bearing on students' academic pursuits. However, parental input has been found to be vitally important in the forming of an adolescent's belief system regarding academics. This input affects personal perceptions and is especially critical in the field of mathematics. The input from parents has a direct bearing on the student's self-efficacy. This, in turn, has an effect that can be either positive or negative on the student. Either it propels the student on to study mathematics and continue to pursuit the subject matter, even when times get tough, or it acts as a negating factor and discourages the student from continuing in the endeavor.

The influences of parental beliefs on the self perceptions of their daughters are important to examine as they have a significant impact on students' desires to continue their study of mathematics. If student beliefs reflect those of their parents, students' perceptions will be directly influenced. It is imperative that a study delve into this aspect as it can provide information that can shape scholastic interactions with parents and students. Opportunities to engage parents in order to change negative attitudes regarding

females and their mathematical abilities is necessary so that a more positive and equitable stance is established.

CHAPTER III

METHODOLOGY

Introduction

Equity issues have been at the forefront of education for the last two decades and a large body of information is available concerning gender issues in mathematics. As a result of the information, researchers have altered their approach to studying gender issues and mathematics. No longer are deficit models, implicating females as needing to make characteristic changes to become more similar to males, the commonly held belief. Rather, positivist and feminist models are now employed and gender is viewed as a socially constructed meaning. Differences in mathematical performance are attributed to the socialization and learning processes of females and not an innate inability (Becker, 2003).

Despite all the interest and decades of studies, certain subgroups of students outperformed other groups in 2000. When one looks at higher education the differences offer an even more stark contrast. In careers where high levels of math and science are required, females lag dramatically behind. In students receiving Bachelors degrees in Engineering, females only make up 19 percent of that population while in computer technologies females account for 27.7 percent of the graduating workforce (National Center for Education Statistics, Integrated Postsecondary Education Data System [IPEDS], 2002).

With all the changes that have occurred, the interventions that have taken place, this continues to be the situation. This qualitative study is designed to explore the logical questions posed as a result of this perplexing information.

Research Questions

This study was guided by the primary question, "Why is it that during the early adolescent years a lowering of mathematical self-efficacy occurs in females?" Webster's Dictionary (2002) defines adolescence as "the state or process of growing up; the period of life from puberty to maturity terminating legally at the age of majority." For this study, the adolescent years will be operationally defined as the ages 13 to 18. The early adolescent years were will be defined as the age of 11 to 13. The specific questions addressed during this study are as follows:

1. What are individual female perceptions of their math capabilities?
2. How do the participants perceptions of females' capabilities in mathematics compare to their perceptions of male capabilities in mathematics?
3. What is the relationship between the individual's attitude and her mathematical performance and beliefs regarding current and more rigorous mathematical courses ahead in her academic career?
4. What are parental beliefs regarding their daughters' ability, success, and future success in mathematics?
5. How do parental beliefs affect the daughter's performance in mathematics?

6 What beliefs do parents have regarding their daughters' mathematical capabilities and how do these beliefs relate to their daughters' study of higher mathematics?

Rationale

A qualitative approach to research is being utilized to determine the potential explanations of female beliefs regarding their abilities and output in mathematics. Additionally a qualitative methodology is being implemented to acquire an abundance of data and hence a greater depth of understanding from the study (Berg, 2004). Berg continues by stating, “Qualitative procedures provide a means of accessing unquantifiable facts about the actual people researchers observe and talk to or people represented by their personal traces… As a result, qualitative techniques allow researchers to share in the understanding and perceptions of others and to explore how people structure and give meaning to their daily lives” (p. 7). This approach to gathering data allows for the researcher to obtain a holistic view of the subjects. In order to delve into the reasoning behind females’ attitudinal nuances towards mathematics and attempt to address the “why” and “how” of the research questions, a qualitative approach is required.

Grounded Theory

For this study, grounded theory will be used to glean the needed information. Grounded theory is utilized when the researcher, through continual comparative analysis and re-analysis, determines common concepts and premises (Glaser, 1978; Glaser & Strauss, 1967). The information is then projected to a broader, more general level

(Glesne, 1999). The data and resulting categories are established, reexamined, and altered until a satisfactory congruence between theory and data is obtained (Lancy, 1993). As the process progresses, the theory itself emerges as a result of examining the data. Glaser and Strauss (1967) maintain, "Theory should emerge…it should never just be put together," (p. 41) rather it is grounded in the data.

The theory that emerges must be viewed contextually. Cremin (1988) maintains that the researcher must be extremely sensitive to the importance of the context as this will assist in grounding the theory as well as explaining the occurring phenomena. Additionally, a key aspect of grounded theory is attending to the process of researching so learning can occur (Cole & Knowles, 2000). Thus, the research is responsive to the data and continually reflects, analyzes, and adjusts. It is this process that generates knowledge. As a result, the information obtained is an accurate representation of the unique phenomena occurring in that setting.

Grounded theory lends itself to a more thorough development of theory in this situation. The theory is developed from a body of data and fits the data uniquely. Grounded theory allows the researcher to use a comparative inquiry in the gathering of research. This allows a comprehensive look at individual cases occurring in a consistent environment. Cases that manifest different outcomes can be explored and a determination of how the variables interact as a unit to produce the specific outcomes can be investigated for causal factors (Strauss, 1987; Strauss & Corbin, 1990).

Eight students will be involved in the study and interviews, observations, and archival documents will be utilized. Creswell (1994) explains that grounded theory is the approach to be utilized when a theory that is grounded in the data is to be developed and

the data involves interviews with different people in the realm of study. It is necessary to interview several individuals to ascertain if their unique characteristics contribute to their successes or difficulties in the mathematics classroom or if, perhaps, there is a larger phenomenological reason.

Participants

Eight, sixth grade student participants were seen on a regular basis for five weeks. During this time weekly observations and interviews were conducted. Additionally, parents of these students were interviewed, although interactions with these participants will not occur as frequently as with the students. All participants were selected through purposeful sampling. Purposeful sampling allows the choosing of particular subjects to be selected "because they are believed to facilitate the expansion of the developing theory (Bogdan & Biklen, 1998). This remains consistent with the position maintained by researchers Miles and Huberman (1984) who report that data sources locations are vital. They must be convenient in order to facilitate involvement and data gathering (Bogdan & Biklen, 1998). Additionally, having the ability to interact with participants on a weekly basis will allow for a more thorough investigation and timely completion of the study. The time allotted for a study is an approximation and natural occurrences, such as illness or teacher trainings, will invariably occur (Glesne, 1999). However, being on the investigation site weekly provided the opportunity for additional observations and data gathering. This situation allowed for a better acquisition of data and a more thorough understanding of the participants and the setting (Glesne, 1999).

In order to select participants who can contribute and shape the study, the researcher must find individuals who best reflect the desired criteria (Denzin & Lincoln, 2000). Females who are in the sixth grade and 11 to 13 years old had the potential to be in this study. The age range, 11 to 13 was determined to be the needed participant ages based upon research in the area of gender issues and mathematics. Studies found that females experience a drop in self-esteem by pre-adolescence and adolescent girls who have had inequitable educational experiences in mathematics (AAUW, 1991; AAUW, 1992; Bevan, 2001; Fennema, 1990; Hanna, 2003; Leder, Forgasz, & Solar, 1996; Oatti and Lee, 1995; Sadker & Sadker, 1986, 1994; Secada, 1992).

To explore these phenomena in early adolescents, it was determined for this study participants would constitute females ages of 11 to 13. Upon identification of potential study participants, archival records were utilized to determine female students who fell into the desired realm of the four quadrants. The qualifying and placement tool was the 2004 Texas Assessment of Knowledge and Skills (TAKS).

Instrumentation

Archival Data

Archival records were utilized in this study. The 2004 TAKS results are official documentary records (Berg, 2004) and "provide both historical and contextual dimensions to your observations and interviews" (Glesne, 1999, p. 59). The previous TAKS scores will place the students in the appropriate quadrant. For this study, the interest was in sixth-grade testing which includes mathematics and reading. The 2004

sixth-grade TAKS alpha reliability was: 0.886 for reading and 0.902 for math (Texas Education Agency [TEA], 2004, Appendix 16).

The archival information provides an understanding of responses and may assist in identifying themes that may be developed during the study (Cole & Knowles, 2000). The information provides the methodology for qualifying students in the quadrant placements. Also, it is one leg in the triangulation of data regarding student participants and will aid in reducing the possibility of missing data (Berg, 2004).

Fennema-Sherman Mathematics Attitudes Scales

The Fennema-Sherman Mathematics Attitudes Scales were developed in 1976 and will be utilized in this study. The nine subscales are domain specific and measure various attitudes towards learning mathematics. The subscales are: Attitudes Toward Success in Mathematics, Confidence in Mathematics, Effectance Motivation in Mathematics, Father Scale, Mathematics Anxiety, Mathematics as a Male Domain, Mother Scale, Teacher Scale, and Usefulness of Mathematics. These scales were developed through a grant from the National Science Foundation and have been widely utilized as a measure of mathematics attitudes since the late 1970s (Forgasz, Leder, & Gardner, 1999; Thompson & et al., 1993).

The Fennema-Sherman Mathematics Attitudes Scales have become one of the most popular instruments used in research over the last three decades (Tapia & Marsh, 2004). The instrument is nearly 30 years old and has 108 items, on the various scales to measure nuances in attitudes. There has been ensuing research that questioned whether the scales actually measure what they state and have suggested that a smaller number of

factors be identified (Melancon, Thompson, and Becnel, 1994; Mulhern and Rae, 1998). However, studies followed determining validity and reliability and although a perfect fit was not found, validity through a factor structure analysis was determined to be "reasonable and is especially noteworthy" due to limited sample size and the number of variables (Thompson, Melancon, & Becnel, 1993). Despite this weakness, the Fennema-Sherman Mathematics Attitudes Scales remains one of the most prevalent tools to measure mathematical attitudes. Utilizing the results of the scales provide opportunities to explore the attitudes of student participants. This is critical as attitudes affect the learning and pursuit of mathematics (Fennema & Sherman, 1976). The scales allow for an examination of attitudes and behaviors regarding mathematics and how student participants perceive these attitudes.

Data Sources and Collection Methods

Data Sources

Archival Data. The TAKS is a standardized test given yearly beginning in third grade in the state of Texas. The test is utilized to determine if the student has obtained the knowledge in the tested subject area for that grade. The knowledge level is established through the Texas Essential Knowledge and Skills (TEKS) for each grade level. There are multiple aspects to the test. For this study, the interest was in sixth-grade testing which includes mathematics and reading. The 2004 sixth-grade TAKS alpha reliability was: 0.886 for reading and 0.902 for math (Texas Education Agency [TEA], 2004, Appendix 16).

Students were placed in one of four quadrants (Figure 3.1) with the demarcation being the minimum passing score on the 2004 mathematics and reading TAKS. The four quadrants were: High Mathematics-High Reading, High Mathematics-Low Reading, Low Mathematics-High Reading, and Low Mathematics-Low Reading. This study focused on mathematics. However, by utilizing reading scores as an additional categorization, a more holistic view of the individual was obtained. Additionally, the study focused on outliers, individuals whose scores are the farthest from the minimum passing score, on each test. By obtaining the outliers in each quadrant differences will be enhanced and there will be a greater opportunity to make inferences regarding the decline in participants' mathematical self-efficacy.

Individual scores were obtained for students. Initially, the researcher looked at outliers in each quadrant to determine possible participants. In the high mathematics-low reading quadrant, the researcher determined which students had the highest math scores to make initial selection of participants. The reading scores of the initial group were then examined, and the two students with the lowest reading scores were retained. Thus, the researcher obtained the two students with the highest mathematics scores and lowest reading scores for this quadrant. This process was utilized for placing students in the other three quadrants. Figure 3.1 displays the four different quadrants and the placement of the desired participants.

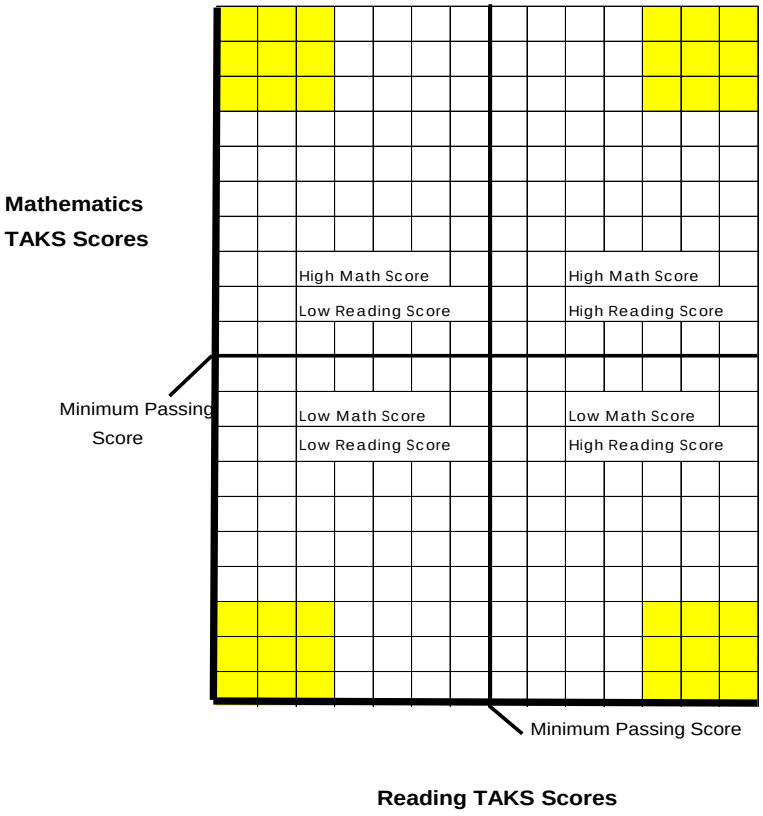


Figure 3.1. Participants in 6th Grade Gender Issues in the Mathematics Classroom Study
South Plains Elementary Spring 2005

Due to the volume of data that will be generated and the depth of information required in this study, a limitation of two students in each quadrant was necessary. Thus, eight students were involved in this study. It is important to note, that a large population to draw from was desired as this provides a greater opportunity to obtain students who fit the desired criteria.

Despite the fact that the differences between the quadrant groups are what were studied, many similarities must also be taken into account so that conclusions can be drawn. The students involved in this study were all female, ages 11 to 13, and in sixth grade at South Plains Elementary School in Lubbock, Texas. The students had the same

math instructors although they may not be receiving instruction at the same time. Finally, the participants took the Texas Assessment of Knowledge and Skills test the previous year and determination of quadrant assignment was based on those results.

Due to the significance of other factors that mold a student's mathematical experiences, additional similarities were not required. In fact, this study explored other factors and provided insights as to the attitudinal factors which affect females' math perspectives. Students' academic self concept was a significant mitigating factor in this study. A recent study reported that between fifth and sixth grade, girls' intrinsic math motivation dropped more sharply while intrinsic motivation in language arts and social studies either remained constant or increased (Harter & Jackson, 1992). The females' mathematical self-efficacy was explored deeply. Additionally, students had varied parental support and the amount of this input needs to be addressed as well.

Focus Groups. The study utilized focus groups at the midpoint and conclusion of the study. Focus groups are defined as "a research technique that collects data through group interaction on a topic" (Hesse-Biber & Leavy, 2004). Focus groups consisted of all student participants in this study and discussed themes that had been observed during interviews and observations. Students were given the opportunity to discuss their thoughts and ideas about mathematics and perceptions of others during this time to stimulate an in-depth exploration of the topic. Focus groups are extremely useful for gleaning more information because participants usually feel more comfortable talking when they are involved in a group discussion and, due to the stimulation generated by the feelings of others in the group, participants' become more talkative (Greenbaum, 1988).

Focus groups allow for a story to unfold, a theory to develop, and explanations to emerge that help to develop an organized representation of the data (Goebert, 2002).

Interviews. Interviews were utilized to glean information from students and parents. Due to the nature of interviewing, questions will be semi-structured and, based on participant responses, open for follow-up questions. The initial framework of questioning will be based on research questions and the role of the interviewee in the study.

Parental interviews will focus on beliefs regarding their daughters' ability and success in mathematics. One area of interest is how parental beliefs affect the daughter. This will be explored in relation to the student perceptions of parental beliefs. The study also sought to determine if student perception matches the parent reported stance. The Parent Questions are included in Appendix A.

Student participant questioning focused on perceptions of their capabilities. Additionally, questioning focused on how the students' perceptions affect their performance in mathematics. Finally, the affect of parental views on female performance in and the pursuit of mathematics were explored. Questions involved an exploration of the attitudes expressed in the Fennema-Sherman Mathematics Attitudes Scales. The majority of interview time was spent with the student participants and focused on their perceptions and how parental beliefs affect these perceptions.

Observations. Observations of natural settings (Berg, 2004) are a regularly used methodology in qualitative research. Observations provide insights of the settings and

actions taking place in the study. Best and Kahn (1998) define observations as usually consisting of "detailed notation of behaviors, events and the contexts surrounding the events and behaviors" (p. 253). The researcher must be cognizant of situational constraints as observing in the classroom presents unique conditions (Bogdan & Biklen, 1992). "The observer must know just what to look for. He or she must be able to distinguish between the significant and insignificant aspects of the situation" (Best & Kahn, 1998, p. 293). The observer must not only be aware of behaviors and contexts, but also be alert for non-occurrences (Best & Kahn, 1998). Non-occurrences are things that should have transpired but did not. Observations provide an important contribution to descriptive research, thus allowing for examination of interpretations and emerging themes.

Auto-Ethnographies. Auto-Ethnographies offer an opportunity to explore and understand the complex ideas held by an individual. They provide insight into the reasoning and beliefs of a person. Glesne (1999) defines auto-ethnography as a "kind of writing that inquires into the self as part of a sociocultural context" (p. 181).

This methodology lends itself to a qualitative study. It focuses on experiences and allows individuals to explain unique perspectives of their situation. Auto-ethnographies are extremely valuable as they assist in developing theoretical ideas regarding the human experience and, in this case, educational experiences (Short, 1991). The utilization of this tool will allow students to respond in a private manner, yet inform the emerging themes. Auto-ethnographies provide an instrument to explore concepts as well provide support for student responses and behaviors.

Collection Methods

A variety of data collection methods were utilized in this study in order to verify findings, strengthen posits, and develop more thorough understandings (Denzin & Lincoln, 2000). These methods include: interviews, observations, focus groups, auto-ethnographies, archival data, and the Fennema-Sherman Mathematics Attitudes Scales. By utilizing multiple methods, a triangulation of the data is obtained. The triangulation of data strengthens emerging themes and examines developing understandings as they are verified from multiple sources (Berg, 2004).

Archival data was utilized to determine which students were included in the study. Results from the 2004 Texas Assessment of Knowledge and Skills results were utilized in this initial step of data collection which allowed for a concise placement of students into the appropriate quadrant. Additionally, based on their scores, students were eliminated from the study. Two females from each quadrant participated in the study. The Fennema-Sherman Mathematics Attitudes Scales were administered to determine the individual's attitude toward mathematics. This information will further delineate the participants' position regarding mathematics, self-efficacy, and various attitudinal perceptions.

Observations of students were another form of data analysis. Eisner (1998) states, "Making sense of schools and classrooms is enhanced by paying attention to the variety of phenomena that emerge on their own and by setting up the conditions that elicit information that is unlikely to emerge directly. It also profits from looking for information in unexpected places. In general, the richest vein of information is struck through direct observation of school and classroom life" (p. 199). This was the position

maintained by the researcher during the observation process. To understand the rich underpinnings of what affects the participants' mathematical self-efficacy required thorough and in-depth observations.

Interviews were also utilized to glean information. Interviews allow people to express their feelings (Eisner, 1998). They allow for the understanding of phenomena. Through interviews, the researcher delved into the "how" and "why" of participants reactions. Semi-structured interviews were utilized in this study. According to Freebody (2003), "Semi-structured interviews aim to have something of the best of both worlds by establishing a core of issues to be covered, but at the same time leaving the sequence and the relevances of the interviewee free to vary, around and out from that core."

Utilizing adolescents in this study provided a unique opportunity to observe young people contextually. "The context is the world as realized through interaction and the most immediate frame of reference for mutually engaged actors. The context may be thought of as a situation and time bounded arena for human activity. It is a unit of culture" (Graue & Walsh, 1998). In order to begin to understand the complexity of the research, this context must be attended to. One aspect of this understanding is considering social positions held by children in order to more fully understand their world, their context (Graue & Walsh, 1998). In order to develop the ability to accurately access the adolescent participant's world, one must establish rapport with them. Holmes (1998) purports that in order to gain a child's trust and gain access to desired data, the researcher must establish a role that exerts no authority over the children and establishes a trusting relationship that is modeled after the friendship bond. This bond will be established through contact with the students prior to the inception of this study. Upon introduction

of the study to students, the relationship began. Additionally, by carefully maintaining confidentiality, respect for the student participants was modeled encouraging student participation.

Through continual interactions this allowed for students to be viewed over time and rapport was developed. Students became more responsive and trusting of the researcher. Confidentiality was maintained throughout the study and this strengthened the relationship between participants and researcher. Students' responses were determined to be consistent and supported by observations. Additional time spent observing and talking with participants allowed the researcher to obtain a more holistic view of the students. Additionally, this provided an opportunity to observe consistency in behavior and responses.

The inherent weakness of interviews, as stated previously, is whether those being interviewed will be honest. Additionally, will they accurately reflect their true stance as opposed to saying what the interviewer wants to hear? There is a concern that "falsehood may be substituted for meaning and narrative truth" (Short, 1991, p. 141). However, by being in the field and observing participants, the researcher was able to support statements through the triangulation of data. In order to obtain an accurate representation of the individuals participating in this study, a variety of data collection methods was utilized. Examining multiple sources of information through triangulation of data allows for a comparative analysis of perceptions regarding a subject or behavior (Dooley, 2001). Thus, a more accurate representation of the person and their responses can be obtained.

Another concern with this process is the sheer volume of data. The depth of the study required a substantial amount of data to explore the research questions. Due to the

depth of information necessary for this study, a limitation of student participants is required. A researcher must be able to know when enough data have been gathered to complete the study. Additionally, "practical considerations of space and imagined audience eventually determine the quantity of data" (Short, 1991). Ultimately, data were gathered until the research questions were adequately and fully addressed.

Triangulation of Data

Triangulation of data occurs when a researcher utilizes various data gathering methods as a way of supporting data validity. Information obtained during the research should be accurate, comprehensive, and reflect what occurs in the setting under study (Bogdan & Biklen, 1992). By utilizing a variety of data gathering methodologies, a continual analysis of findings can occur. Berg (2004) states triangulation is a means of "refining, broadening, and strengthening conceptual linkages" (p. 6). Through the use of multiple approaches to the data, the researcher can obtain verification of the findings. Furthermore, "triangulation in order to increase confidence in research findings may also involve the incorporation of multiple kinds of data sources" (Glesne, 1999). Triangulation of data is utilized to strengthen this study and obtain increased certainty in the findings.

Timeframe and Chronological Sequence

The research was conducted during April and May 2005 for five weeks. Observations began after the TAKS test administration in order to obtain a more accurate representation of student attitudes and behavior. By initiating observations after the state

testing, students were no longer under pressure to perform on the test and the researcher could obtain data not skewed by testing stresses. Observations were the initial step as this allowed for students and the mathematics teachers to become comfortable with the researcher. These observations began during the first week of data collection and continued throughout the study. In order to view the students in their various mathematical classes, the researcher was present throughout the majority of the school day. During the five week study, the researcher made classroom observations on 20 different days.

The setting for student observations was their mathematics classroom in order to ascertain behavior and responses in that context. The observations provided further support for emerging theories as well as offering one realm of the data triangulation. Observations focused on student behaviors, student-teacher interactions, student responses, both verbal and nonverbal, and student interactions with peers.

During the initial week of the study, the Fennema-Sherman Mathematics Attitude Scales were administered. The nine subscales are domain specific and measure various attitudes towards learning mathematics. Student participants were given questionnaires regarding their feelings about mathematics. The data was collected and scored at the initiation of the study. For this study, the focus was on participants' perceptions of parental views and these students' beliefs regarding their ability in mathematics.

During the initial week students also completed a mathematical auto-ethnography. This was a free-write opportunity and students were informed that this was an opportunity to discuss their mathematical journey and express their feelings regarding mathematics. Students were then given 40 to 60 minutes to complete their entry.

Students completing their writing in varying amount of time. There were three students who asked to be allowed to write their entry at home. This was allowed as the researcher did not want to have the students missing their academic classes. Also, this allowed for contemplation, privacy, and a more thorough writing to occur. Auto-ethnographies are shown in Appendix C.

The eight student participants were interviewed weekly at varying times. Students were not in mathematics class simultaneously so interviews and observations ranged throughout the day. Student weekly interviews were 30 minutes in length in order to explore responses to the questionnaires and their feelings about mathematics. The interview days varied throughout the week in order to obtain a more complete view of the environment. Interviews were conducted in a private office to ensure confidentiality and allow students to feel most at ease while they were responding to the questions. Student interviews will be based upon responses to the questionnaires, and will be semi-structured as the researcher must be responsive to interviewee replies. A copy of the student interview questions are included Appendix A.

At the midpoint and conclusion of the study, a focus group was formed in order to gain further information and ensure that the researcher was defining the findings in an accurate context. Focus groups provided another means for collecting data, allowed for observations of student interactions, and provided participants an opportunity to discuss specific experiences and attitudes (Berg, 2004). The student participants will meet together to discuss emerging themes and ideas. This opportunity allows for them to engage each other in conversation regarding the topic, piggy back off of each other's ideas, and provide a sense of community during the study. Utilizing this methodology

along with individual interviews will provide a greater understanding of the phenomena being examined.

Interviews of participants' parents occurred two times and lasted 30 minutes. The interviews took place during the third and fifth weeks of the study. During these interviews, an exploration of parental beliefs regarding their child's ability in mathematics was conducted. This will provide a framework which will be the basis of an exploration of parental beliefs regarding their daughter's mathematical abilities and perception of parental beliefs.

Location

The primary data collection site utilized for this study is South Plains Elementary, in Lubbock, Texas. A pseudonym for the school is being utilized to ensure confidentiality. The school is one of the largest elementary schools in the city where the study was conducted. This allows for a larger population to draw from that will allow a meeting of the conditions for this study. All female participants were in sixth grade and met the operational definition of early adolescent.

There was variation in class, ethnicity, and mathematics achievement. However, the study is looking at commonalities among the set of females in each quadrant that makes them successful or not. To ensure that parents were in the most conducive setting for the interview, all interviews were in their homes at a time that was convenient for them unless they requested a different location. When that occurred, arrangements were made to conduct the parental interviews at South Plains Elementary or on the telephone.

Data Analysis

Simultaneously analyzing the data as they are being collected facilitates focusing and honing the study (Glesne, 1999). By analyzing data, the researcher attempts to make sense of the voluminous information. Patterns are explored and the data are interpreted (Strauss & Corbin, 1990). Themes which emerge as a result of coding, examining, recoding, and re-examining signal a trend or significant feature grounded in the data. Bogdan and Biklin (1998) state, "Ideas and understandings will come to you on a regular basis as you go about your research…. Do not put off 'thinking' because all the evidence is not in. Think with what data you have" (p. 170). Noted authorities encourage this practice as it allows the researcher to engage the ideas, grapple with them, and redefine the study. By engaging in the cyclic and spiraling process, the researcher is able to understand the nuances of the study. Additionally, the data are managed in the process, not at the culmination of the observations.

After the collection of data is complete, the first step of analysis is reduction. The information must be made accessible and manageable in order to establish themes and patterns (Berg, 2004). Data reduction is manifested through coding of the data. "As you read through your data, certain words, phrases, patterns of behavior, subjects' ways of thinking, and events repeat and stand out" (Bogdan & Biklin, 1998, p. 171). They become the basis of the coding process (Lancy, 1993).

Open coding is utilized to, as the title indicates, generate a wide berth of opportunity to explore the data. Broad themes are initiated and data are loosely grouped under the overarching themes and should be studies in great detail (Berg 2004). Data are explored in an unrestricted manner. They are looked at in great detail and may be

redefined and reorganized. Once the data have been thoroughly dissected under open coding, it is time to move on to the axial coding. Axial coding takes place after open coding is complete and great detail is paid to coding around one category (Strauss & Corbin, 1990). Each individual category is delineated based on participant responses and responses are examined under this specific context. The data are then placed in sub-categories under the specific theme. This highly developed coding frame allows for each theme to be scrutinized developing an understanding of the data.

Student performance on the 2004 Texas Assessment of Knowledge and Skills (TAKS) test was utilized to determine quadrant placement for each girl. These data will be maintained as they explain student orientation in the study. Data display consists of organizing the information in such a way that permits drawing of conclusions (Miles & Huberman, 1994). The displaying of information assists in identifying components of the study and, like coding, is dynamic and changing (Glesne, 1999).

Analytic induction of data was initiated immediately following the coding process. It should, "combine analysis of data after the coding process with analysis of data while integrating theory" (Berg, 2004). This allows for a more thorough presentation of and exploration of data. Theory is redefined during the process, melded by new facts that arise for the data, but also inaccurate ideas can be eliminated as the theory evolves.

The analysis then leads to the conclusion and verification of the theory. Grounded theory will support the conclusions as it is developed from the data itself (Berg, 2004). Additionally, the data display allows for the information to be easily

viewable and attainable. The displays allow researchers to view their knowledge regarding the data as well as tendencies that might have gone unnoticed (Glesne, 1999).

Data Management Plan

The researcher followed the protocol of gaining permission for the study from the Institutional Review Board at Texas Tech University. Authorization from the school district and the school administrator were also obtained prior to study initiation.

Gathering of data began during the spring semester of the 2004-2005 academic school year. Observations were conducted at this time and students became familiar with the researcher. This assisted in allaying anxiety concerning interviews. Data was gathered during April and May 2005 and then analyzed.

Several potential problems could arise and, if dealt with preemptively, could be minimized. Because this study dealt with early adolescent students, parental support and agreement was required. The Texas Tech University Institutional Review Board approval letter is included in Appendix E. By meeting with the parents prior to the inception of the study, the researcher was able to explain how their child was chosen to participate in the study, address parental concerns, explain what was involved in the study, and describe possible benefits gleaned from the data collected.

The researcher conducted will have a “meet and greet” session prior to the initiation of the study. Students were provided with an invitation for themselves and their parents to meet the researcher at the school library, obtain information regarding the study, and obtain parental consent. The meeting was informal, discussed the study, and made parents and students feel comfortable about their participation in it. The researcher

also explained the need for parents to participate and their specific obligations. Informing the family of the specific expectations and needs beforehand allowed all parties to be aware of the process and make an informed decision about participation. Through clearly outlining the purpose, procedures, and timeline of the study to all those involved, ownership was encouraged and participants developed a vested interest in the study.

Engaging female students who would actively participate in the study, gaining their trust, and sparking their interest to become involved in the research was most important. During time in the classroom the researcher developed a rapport with the students. Being honest with these students and explaining the purpose of the study and what will occur with the findings diminished their reluctance to participate. Prior to beginning the work, the researcher developed a list of students that fit into each of the quadrants to be examined. Thus, if a particular student declined to participate, another student could be chosen from the categorical list and delay in the study would be minimal.

The amount of data generated in qualitative research is vast. It is quite easy to become bogged down in capacious amounts of information. If a clearly defined, concise method of gathering and maintaining data is not established, the researcher can become inundated and analysis will be hindered. Interviews were initially recorded in order to ensure all information was obtained from the participants. Weekly, the information was transcribed and stored in a word processing program. This also occurred with observation notes taken during this study. Besides the obvious benefits of maintaining the data and keeping it organized, additional benefits arose as a result of using the

computer. Utilizing the computer necessitated data organization and afforded the opportunity for continual reflection. "The concreteness and specificity necessary for computer use require researchers to be clear and explicit about their decisions… Computer use can therefore help to demystify qualitative analysis and contribute to its accountability" (Glesne, 1999).

Validity and Transferability

Validity and transferability have been construed as being difficult, to obtain in qualitative research. Despite years of work in qualitative studies, validity remains a central question in this field of work (Eisner & Peshkin, 1990). However, by creating a triangulation of data, support for findings can be established. It is understood that triangulation denotes multiple sources of data being utilized to obtain a fuller understanding of the studied phenomena (Bogdan & Biklin, 1998). This approach is an effective justification of the findings as they are corroborated by various resources. Additionally, the approach of providing diverse methodological strategies allows for the strengths of one method to compensate for the imperfections of another (Denzin, 1970). Eisner (1998) coins the term "structural corroboration" as a gathering of evidence that authenticates the derived conclusion.

To support the findings of this study, triangulation of the data was implemented from a variety of sources. Student interviews were the primary data-gathering tool. However, parents were being interviewed in an effort to obtain a more thorough description of the student. Additionally, classroom observations and archival documents

were employed to gain further depth of understanding and clarity. Structural corroboration was established with the utilization of the varied resources of information.

Qualitative researchers look to the specific first, to understand the particular phenomena explored, then to apply the findings on the larger scale (Glesne, 1999). Often when researchers infer the findings involving a specific set of subjects in a particular setting, this can speak to a larger set of people who have the similar characteristics, thus attaining transferability (Bogdan & Biklin, 1998). Researchers conduct studies to gain information and, after analysis, disseminate the data obtained. "Once a possible solution is identified, it remains worthless until it has been presented to others who can use the findings" (Berg, 2004). Thus, researchers need to impart their findings to others as a transmission of outcomes and implications. In this study, sixth-grade females were studied in the mathematics classroom. Many of them fit into the established quadrants and, thus, the findings were useful in understanding and predicting future mathematical behavior and transferability was achieved. Interactions in the mathematics classroom varied by individuals. However, by exploring math subgroups that maintain similar characteristics, patterns will emerge. These broad and sweeping patterns will allow transferability to occur.

Reliability is an alignment between what researchers' document as data and what actually occurs in the setting under investigation (Bogdan & Biklin, 1998). For this study reliability was established through several venues. Participants' feedback was incorporated into the study. Following the collection of data from interviews, copies of the findings and conclusions were provided to participants. This allowed them to

determine if their standpoint has been accurately reflected, and helped in establishing new interpretations of the data (Bogdan & Biklin, 1998; Glesne, 1999).

Summary

The use of a qualitative approach in this research was most conducive to obtaining the desired information. Through this process, an understanding of how students' self-efficacy and parental beliefs affect the female students' perceptions regarding mathematical capabilities and the pursuit of higher mathematics was obtained. Although each of these aspects has been studied previously, additional research was needed on their combinatorial effect and on ways they interact. By examining the individual constructs and how they are perceived by student participants, similarities and differences among students in the four different quadrants will be examined.

By utilizing grounded theory in this study, a continual comparative analysis was employed in order to define evolving concepts. Through the use of previous test scores, scale responses, interviews, and observations, the needed data was gathered and continually reassessed resulting in a correspondence between the theory and data. Additionally, the importance of the contextual aspect of this study was attended to as it assisted in grounding the theory and explaining observed behaviors.

Establishing a framework that provides females with an opportunity to receive positive experiences in mathematics is critical. The research process yielded data that suggests an understanding that this phenomenon allows for a lowering of mathematical self-efficacy during early adolescent years. Nonetheless, this was only the beginning and

must be developed further to expand this area of study. Other studies must be conducted to further expand the field of gender issues and mathematics.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The research on gender issues and mathematics is copious. This area of study has generated vast amounts of studies in an attempt to develop an understanding of gender differences in the learning and acquisition of mathematics. It is important to determine the reasoning behind female responses in mathematics and examine areas that are problematic within the mathematical system (Boaler, 1997). This study was designed to examine female perceptions of their mathematical ability and how these perceptions affect their success in mathematics. An exploration of parental beliefs affect on their daughters' perceptions of their mathematical abilities was also examined. The findings provided a lens in which to view the phenomena that was being explored.

The data for this study was gathered and analyzed from a qualitative perspective. Data was gathered through multiple methods to gain insight into female student perceptions of their mathematical abilities. Analysis tools utilized were: the Fennema-Sherman Mathematics Attitudes Scales, classroom observations, student interviews, parental interviews, focus groups, and archival records. The data was examined by quadrant placement as well as an overall analysis of emerging themes.

Prior to beginning the study, identified students met with the researcher so the purpose of the study could be explained and determine initial student interest in participation. During this time, the various data gathering methods were explained in order for students to be aware of the processes involved and have an understanding of the

procedure. Additionally, an on campus meeting was arranged for the parents and students to meet with the researcher and obtain information regarding the study. At that time, consent forms for the students who were present were obtained. For the parents who did not attend the meeting, a phone call was placed to their home introducing the researcher and explaining the purpose and procedures of the study. All parents responded favorably to their daughter participating in the study. The researcher informed parents that students would be bringing the consent form home the following day. Parents were informed if they wanted their daughters to participate in the study, they would need to sign the consent form and return it to school as soon as possible. The following day students were provided the consent form which they promptly returned.

Restatement of the Research Questions

This study was guided by the primary question, "Why is it that during the early adolescent years a lowering of mathematical academic self-efficacy occurs in females?" The specific questions addressed during this study are as follows:

1. What are individual female perceptions of their math capabilities?
2. How do the participants perceptions of females' capabilities in mathematics compare to their perceptions of male capabilities in mathematics?
3. What is the relationship between the individual's attitude and her mathematical performance and beliefs regarding current and more rigorous mathematical courses ahead in her academic career?
4. What are parental beliefs regarding their daughters' ability, success, and future success in mathematics?
5. How do parental beliefs affect the daughter's performance in mathematics?

6. What beliefs do parents have regarding their daughters' mathematical capabilities and how do these beliefs relate to their daughters' study of higher mathematics?

Data Collection

The data collection took place over a five week period. In order to obtain a clearer picture of classroom activities, student interactions and perceptions, the study began after the 2005 TAKS test. The researcher felt this would provide the opportunity to observe more authentic interactions within the classroom. This would allow for student interviews to be completed without the pressure from preparing to take the state mandated test looming over the student. Additionally, by completing the classroom observations after the mandated testing, it was felt that the observations would be of more genuine classroom behavior as opposed to primarily review and preparation for the state test.

In order to view the students in their various mathematical classes, the researcher was present throughout the majority of the campus school day. During the five week study, the researcher made classroom observations on 20 different days spending the instruction time in the mathematics classrooms. This also afforded the researcher three days to observe the students in their other classes as well. The researcher observed each participant in both mathematics classes as well as Science/Social Studies and Reading classes.

District and School Setting

Student participants were all students at the same elementary school in West Texas. The school is one of the largest elementary schools in the city of approximately 200,000 residents. Through the Academic Excellence Indicator System (AEIS), 2003-2004 District Profile, the school district reports serving a total student population of 28,491. School district student population is ethnically diverse with: 45.4% Hispanic, 38.1% White, 14.8% African American, .3% Native American, and 1.5% Asian/Pacific Islander. This also closely reflects the state population. AEIS reports the state ethnic delineation as: 43.8% Hispanic, 38.7% White, 14.3% African American, .3% Native American, and 2.9% Asian/Pacific Islander (Texas Education Agency, 2005).

The school where this study took place has a diverse population, and based on parental responses, individuals were categorized ethnically. According to parental responses, student population is: 60.6% Hispanic, 23.1% White, 15.6% African American, .1% Native American, and .6% Asian/Pacific Islander. 76.6% of the school population is deemed Economically Disadvantaged (Texas Education Agency, Academic Excellence Indicator, 2003-2004 Campus Performance, 2005).

Classroom Setting

All students participate in two math courses, taught by Ms. Smith and Ms. Jones. Pseudonyms were utilized for the teachers of the participants. The classes are meant to augment each other with Ms. Smith teaching primarily the district curriculum and Ms. Jones teaching problem solving and supplementing what is being covered in Ms. Smith's class. Each class is forty-five minutes long. Students, depending on their schedule,

attended one math class with one to two classes between the following math class. It varied as to which class the students would attend first.

During the five week observation period, students overwhelmingly spent time completing individual work with minimal partner or cooperative group work being completed. In Ms. Jones' class, students worked individually 100% of the time. In Ms. Smith's class, student spent most of the time completing work independently; however, approximately 20% of the observed days were spent in pair work. During this study, there was never cooperative group work observed in either classroom.

Ms. Jones' Classroom. Ms. Jones' room provided a more traditional approach to mathematics. The desks were arranged by pairs but remained in a linear fashion. The teacher would pass out the work for the day and then dismiss students who needed to proceed to special education or resource classes for assistance with the work for the day. Ms. Jones would then stand at the front of the room and complete all instructions from there. She worked examples of the problems on the overhead projector, usually the first two or three on the sheet, and then inquired if students had questions. She would answer any questions while at the overhead and then let students work individually on homework. During the entire observation period, all assignments and work in class were paper and pencil assignments. This was the process that was followed during *every* observation. On average, students would have twenty to thirty homework problems to complete nightly. The teacher said, "I'm turning you loose," as a signal for students to begin working on their own.

She would then alternate walking around to provide assistance and sitting at the computer and working. The majority of the time, students would need to approach her with a specific problem in order to gain assistance. If a student approached Ms. Jones with a question, she attempted to explain it to them about two times. If the student still failed to understand the problem, Ms. Jones would complete the work for them on their worksheet. She would tell the student, "Just follow that example; I worked it for you." Students were not provided support as they grappled with difficult concepts. Instead, if they did not grasp the concept immediately, the answer was given to them and the problem was worked for them. In this manner, student interaction was kept to a minimum amongst each other and with teacher.

When work was completed it was put away and students were either told to AR (Accelerated Reader) read or given free time. The work was not checked nor graded prior to the following day. With this arrangement, the classroom was very quiet for about half the class period as students work on their assignment. However, the classroom then became loud as students were "done" and allowed free time. The classroom was no longer conducive for students who still needed to work. Dialogue among the students did not revolve around mathematics. A diagram of the classroom layout is displayed in Figure 4.1.

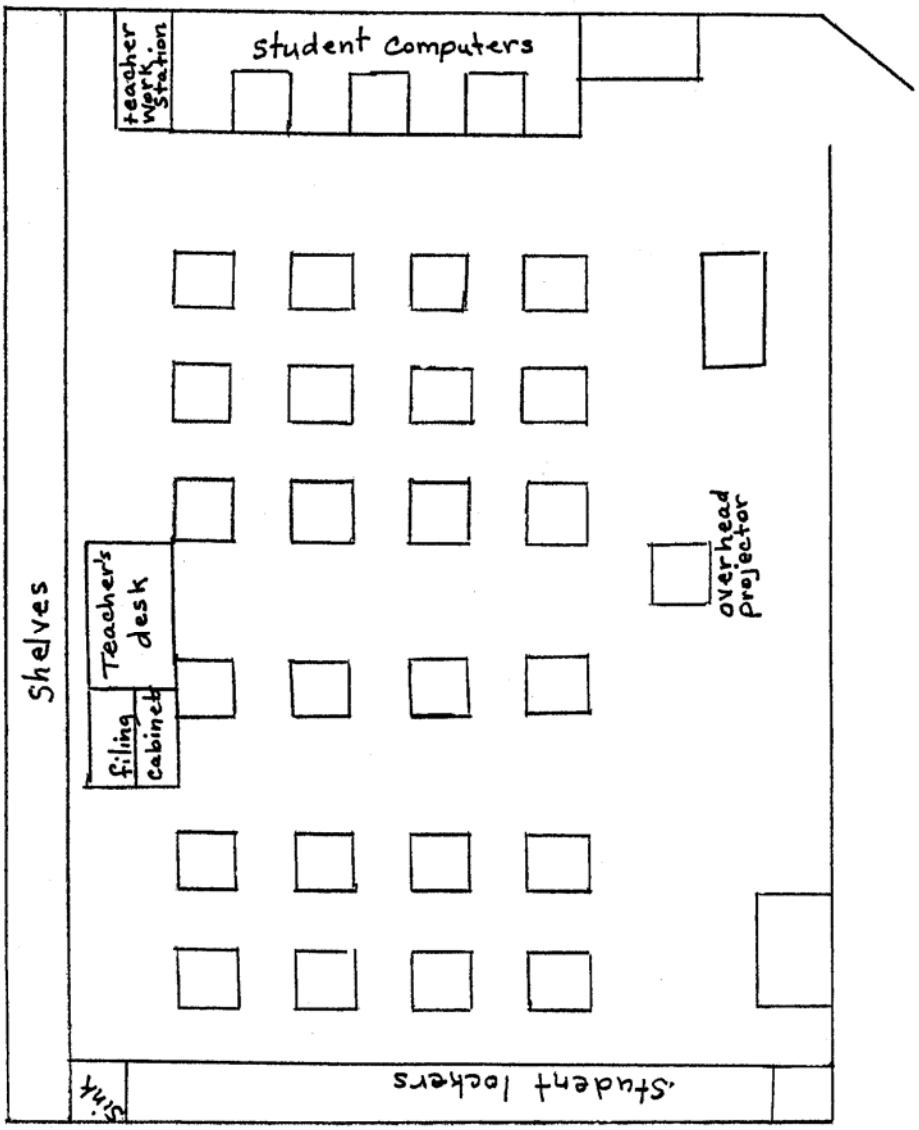


Figure 4.1
Mrs. Jones' Sixth Grade Mathematics Classroom Layout

Ms. Smith's Classroom. Ms. Smith's classroom also resembled a more traditional classroom. The desks were paired but remained in rows. A diagram of the classroom displays the classroom layout in Figure 4.2. Students worked individually approximately 80% of the time, with the remaining 20% being student pairs working together. During individual work, the classroom remained quiet with Ms. Smith giving instruction on how to complete the assignment. Ms. Smith stood at the front of the class and showed students the steps to complete the assignment on the overhead. She would work the initial problems to demonstrate the process utilized to successfully solving the problems. Ms. Smith would then ask if students had any questions and would answer them at that time. Ms. Smith then immediately began walking around the room and working with individuals to determine their understanding of the assignment that was to be completed. During the observations, Ms. Smith sent special education students for additional outside assistance on four different instances; all other times, she worked with students within the classroom to ensure their understanding of the concept.

Ms. Smith had students using various mathematical tools, compasses and protractors, about 20% of the time that students had individual work. As she explained to the students, "You are using these tools to become familiar with them and practice skills you need for seventh grade." The students also did limited paired work in this classroom. Students used unifix cubes and fraction bars in working to comprehend decimals. The students always did paper and pencil assignments, but the assignments were supported with manipulatives during 20% of the classroom experiences. During the time students worked on assignments, Ms. Smith constantly circulated the room observing students while they worked. She would ask questions of all students, regardless of their

capabilities, to ensure they understood the concept and provided assistance as needed. Her approach was proactive and focused on the student understanding the concept. When a student experienced difficulty, she would question them regarding the procedure to solve the problem and provide directions and support to complete the process. Her assistance was scaffolding in order for the student to complete the assigned task.

Student interactions with the teacher were a regular occurrence. Interactions among students were minimal except when they were completing paired work. During paired work, interactions revolved around the assignment, and depending on the pairing, often mirrored individual work. When students were comfortable with each other, they worked together and assisted each other throughout the assignment. However, when students were uncomfortable with the pairing, students did what was required together, but then reverted to working individually. This situation happened frequently. During observations in the classroom, students worked continuously on their assignments. Assignments were about 15-20 problems in length. In order to not disturb those who had not yet finished, as students finished their work they engaged in activities at their desk such as AR reading or other work.

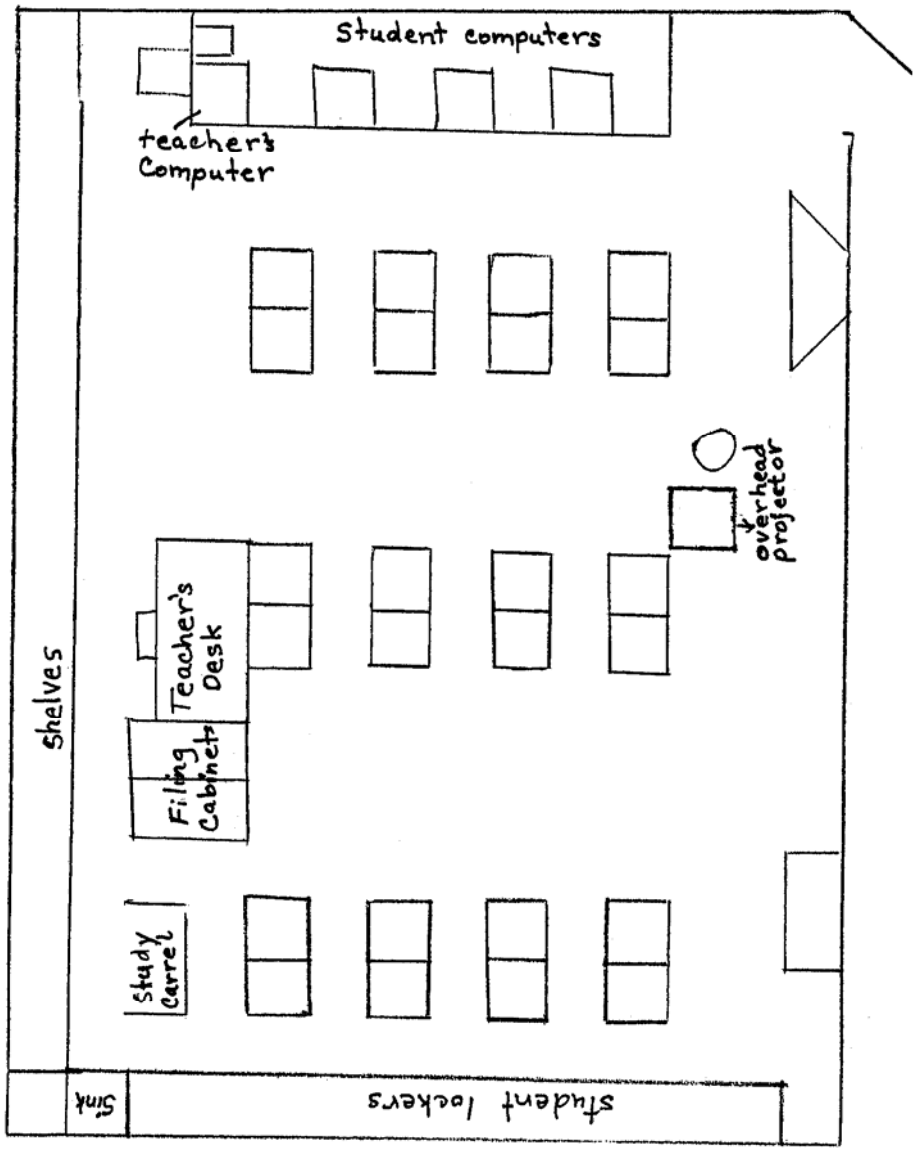


Figure 4.2
Mrs. Smith's Sixth Grade Mathematics Classroom Layout

Quadrant Placement of Students

Individual student scores on the 2004 Texas Assessment of Knowledge and Skills, TAKS, were obtained and the researcher verified which students met the qualifications to be in the study. All participants were in regular education courses and had taken the 2004 TAKS test. In the High Mathematics-Low Reading quadrant, the researcher determined which students had the highest math scores to make initial selections. The reading scores were then examined, and the two students with the lowest reading scores were retained. Thus, the researcher obtained the two students with the highest mathematics score and lowest reading score combination to fit into that quadrant. This same process was utilized for determining participants for the remaining three quadrants. Upon obtaining the names of students who met the criteria for the study, parental consent forms were provided to them and returned to the researcher in order to begin the study. Pseudonyms were assigned for all student participants to conceal their identity and allow for students to speak freely.

The student scores on the 2004 Math and Reading TAKS test, their pseudonyms, and placement in the appropriate quadrants are displayed in Table 4.1.

Table 4.1

Student Identification, Quadrant Placement and 2004 TAKS Scores

Quadrant	Participant Number	Student Pseudonym	Math Score	Reading Score
High Mathematics-High Reading	1	Alice Holt	2336	2709
High Mathematics-High Reading	2	Jennifer Aguirre	2639	2709
High Mathematics-Low Reading	3	Kendra Brown	2233	2062
High Mathematics-Low Reading	4	Shana Moore	2132	2100
Low Mathematics-High Reading	5	Debbie Fuentes	1992	2178
Low Mathematics-High Reading	6	Candy Smith	1881	2108
Low Mathematics-Low Reading	7	Vivian Moreno	1900	1910
Low Mathematics-Low Reading	8	Valerie Sandoval	1992	1997

*2100 is minimum score for passing for Mathematics and Reading

Student Participants

The students who participated met all the qualifications to be involved in the study. Females ranged from 11 to 13 years of age and fit the appropriate quadrants. One student met the minimum passing score on the reading test in the High Mathematics-Low Reading quadrant. Her score did not fall below the 2100 minimum passing score, but was exactly 2100. It was determined that she would be the student to take part in the

study as she best fit the criteria for that quadrant. Although her score did not fall below the minimum passing score on the TAKS reading test, it was determined she remained the best subject for that particular quadrant. Other than the additional quadrant member, no other student reflected the qualification for the High Mathematics-Low Reading quadrant.

The females who participated in this study also reflected the diversity of the campus. The girls, when asked to describe themselves, classified their race as: two White, four Hispanic, and one African American. The final student had an Anglo surname but self reported her ethnicity as Hispanic. When questioned regarding this, she stated she has a White mother and Hispanic father. She classified herself as Hispanic stating, "Mexican blood is stronger than White blood. At least that is what my Mom says."

High Mathematics-High Reading Quadrant Students. Alice is a twelve year-old, Anglo girl who resides with both of her parents. She is one of four daughters and is the second oldest. She reported that she likes her sisters although "they are sometimes quite a handful." Alice stated she has a normal family life and is kept busy with school, church, and playing the cello. Alice reported that she is very involved with her church. She explains, "I like to do things with my youth group. In the summer we often go to church camp. I really like when we do things like that."

Alice is one who excels in school and enjoys academics. Alice continued by stating her favorite class is Math, although she did specify it is the class with Ms. Smith as the teacher, and her least favorite is Social Studies. She is quiet and shy, both in

school and at home. She is not involved in sports but enjoys music, specifically playing the cello. She describes herself as a "thinker" and stated, "I like to spend time in my room alone just thinking about things. I like to think a lot. I just think deep thoughts." When asked to elaborate, Alice contemplated her response for an extended period of time. She replied,

> You know, things need to be figured out. Problems need to be figured out. I think about things that happened at school and how I can make them better. I think about something hard I had to do at school, and how I can make it easier next time. I think about problems in the world and how to try to make them better. I think about a lot of stuff!

Alice emphatically stated she loves music. She is very involved in playing the cello and practices every day. Alice stated she spends a lot of time listening to music on her CD player. Alice added that she loves classical music and continued by saying, "I don't listen to the junk on the radio. You know, the rap and stuff. I like to listen to classical. Classical music, it somehow expands your mind."

Jennifer is a lively and gregarious 12 year-old Hispanic who lives with her mother and stepfather. She stated that she has only had a stepfather for about four years, but that he had been around since she was a small child. Her parents divorced when she was very young, and she sees her biological father, but not as often as she would like to. Jennifer is an only child and around adults much of the time.

Jennifer feels that school is very important. She stated that she really likes school but that sometimes it is boring. She reported that school comes relatively easy for her, but sometimes she has to study when it comes time for tests. Her favorite class is Mathematics and her least favorite is Science. Jennifer is an outgoing person who will readily make friends. When describing herself, she stated she is smart, funny, athletic,

and a person who sticks up for her friends. Jennifer feels that she has many friends, and that she is a good friend as well.

This student is involved in numerous extracurricular activities. She is very athletic and participates in many sports. She recently completed her basketball season, and is now actively involved in softball. She is the starting pitcher and very proud of her accomplishments. Jennifer stated that when she is finished with the school day, she goes home and does her homework because when her mother gets home, they go to the various practices. Jennifer described her life as very busy but fun.

High Mathematics-Low Reading Quadrant Students. Kendra is a 12 year old Anglo student who chooses her friends carefully. She is cautious with people until she gets to know them. Kendra stated, "I am careful with people because I don't want them to know nothin' about me until I really know that they are my friend." She is friendly once she trusts you, but displayed a suspicious nature. Kendra is a leader among her group of friends and realizes this fact. She states, "I can get my friends to do what I want. If I want us to play something or to do something, I just tell 'em what I want to do and we do it."

Kendra stated she is an only child. However, the information the researcher had received indicated that she had five siblings in the home. When questioned regarding that, she stated, "Well, I have foster brothers and sisters that have been adopted, so they aren't *really* my brothers and sisters. We have a foster kid right now that my Mom is trying to adopt. She should be adopted pretty soon and we are going to change her name." Kendra is the second oldest of five children and is the oldest daughter in the

home. Kendra stated both parents reside in the home and, “Everything is just like anybody else’s home ‘cept we have foster kids. It’s no big deal, just the same as everyone else.”

Kendra reported that school is “okay”. She continued by saying that it is boring and not any fun most of the time. She stated her favorite class is Mathematics and her least favorite is Reading. She continued by saying, “I like math because it comes easy for me. I dunno why, it just does. Reading is another story. I don’t like it because it is boring and they try to trick you.” Kendra stated that the best thing about school is being able to be with her friends. She added that she isn’t involved in any type of sports activities. In her free time, she likes to play basketball with neighborhood friends, talk on the phone, or watch television. Her favorite thing to do after school is to just “hang out” with friends.

Shana is an African American who is quiet and has an infectious smile. Shana is a quiet, intent young lady who has very clear plans for her future. She is very polite and often speaks softly when asked a question. Shana describes herself as “A funny person who has lots of friends. I am popular with the kids I go to school with, but not too popular, you know? ” Shana is the oldest child in the home, with a younger sister and brother. She resides with her mother who is a single parent and often works 12 hour shifts. Shana feels a great responsibility to help her mother. She states, “I have to do well in school. I have to be good. My mom needs me to be good to help her. She works hard and being good is the way I can help.”

Shana is a well behaved student in school. She is well liked by both peers and teachers. She is a hard worker and strives to excel in school. Shana states her favorite

subject is Math and least favorite is Reading. When asked why, her response was, "Math is easy to me; I can do it with a little work. Reading is another thing. I try and try, but it is just so hard. I don't really know why it is, but it is." Shana indicated that she works as hard as she can in reading, but that she feels that sometimes it is no use.

Shana is not involved in any organized extracurricular activities. She stated that she likes to play basketball when her friends come over, but that is about all the sports she does. She loves to talk on the phone and hang out with friends.

Low Mathematics-High Reading Quadrant Students. Debbie is a Hispanic female who is reserved but friendly. She is the older of two daughters and lives with her mother, father, an aunt, and her cousin. Debbie is bilingual and utilizes her skills many times as she often interprets for her mother. She is quiet and feels it is important to be respectful. She is pensive and thinks carefully before responding to questions. When describing herself, Debbie states, "I'm a nice person and a good friend. I am kind of shy, but really like to laugh. I have a lot of friends and we laugh a lot when we are together. I don't like a lot of attention because it is embarrassing, so I am kind of quiet."

Debbie has a strong desire to do well in school, and stated that she likes school. Her favorite subject is Reading and her least favorite is Science. She enjoys school, but doesn't like a lot of homework. Debbie states,

> I do okay in school and I try really hard. I try to be smart, but I'm not in everything [at school]. You know, I listen in class and I work hard, but things like math and science aren't easy to learn. I guess I am not one of those people who get those things really easy. Some kids in class make it look easy; they get it.

Debbie is not involved in any organized extracurricular activities. She will play with her friends from the neighborhood, and they play basketball, tag, or whatever game they think up. Debbie's priority is helping her family. She takes care of her cousin often because her aunt is at work and her mom is working around the house. She also spends a lot of time playing with her younger sister.

Candy is 12 years old and considers herself Hispanic. Her mother is Anglo and her father is Hispanic. When describing herself, Candy says, "I am musical. I love music! Someday I am going to be a singer. I like to have fun and hang out with my friends. I am loud and sometime act a little crazy. My friends sometimes think I am hyper." Candy is a young lady with many friends and a lot of dreams for the future.

Candy acted embarrassed when asked to describe her family. She said she has never really known her father. He was never around and she doesn't often talk to him. She and her mother were living with her parents and a few weeks ago, her mother abandoned her. She continues to reside with her maternal grandparents and is content with that situation. She stated, "I am glad my mom is gone. She was really mean to me. I hope she never comes back." Candy said that since she was left with her grandparents, her grandmother returned to work to take care of them. Her grandfather is disabled and does odd jobs to earn money. She stated that since her mother has left, there hasn't been yelling in the home and she considers it full of love.

Candy describes herself as an average student. She considers herself a "whiz" at reading and good at math. Her favorite subject is Reading and least favorite is Math. When describing her feelings about school, Candy states,

> You know I like it. I mean, I know I am supposed to like it. I know I am supposed to do well to do something with my life. It is just okay. I like reading

> and that is important because I am going to be a singer when I grow up. I have got to be able to read the words to the songs and stuff. But the other things, I don't know if I am really going to use them. I mean, I know I will need math. But just basic stuff, you know, like adding and subtracting to pay bills. That other stuff is really kind of worthless.

Candy is not involved in any extracurricular activities other than playing with neighborhood friends. She said she doesn't really do much except play with friends, watch television, and hang out with her grandparents.

Low Mathematics-Low Reading Quadrant Students. Vivian is a Hispanic 13 year-old girl who is friendly and easygoing. When describing herself she uses the words "nice," "friendly," and "pretty cool." She stated that she has many friends and that they like to play together or just sit around and talk. Vivian is a child who wants to please the adults in her life. She supported this statement by saying, "I really can't let my parents down. They want me to finish high school and get some college, so I have to keep trying to do well." She resides with both parents and two siblings. She is the middle child and has an older brother and younger sister.

Vivian stated that school is okay and her favorite subject is Language Arts because she gets to write, but the worst class is Math. Vivian's disposition changed when the discussion turns to performance in school. She became quiet and looked down while discussing the subject. Vivian stated that school is very hard. Vivian described academics, herself and feeling out of place. She stated,

> You know, no matter how hard you work, it doesn't matter. I try and try and I never do well. I mean, I make okay grades and all, but on the stupid test, you know the one we take about this time every year, I really stink! I hate it because I try so hard and get frustrated. I guess I am kind of stupid.

Vivian reported she does not have any extracurricular athletic activities. She stated her family is very involved in church and attends activities many times during the week. Vivian states that she enjoys that aspect of her life and looks forward to spending time with her church friends. She continued by saying that she hangs out with friends in her neighborhood, but they primarily sit around and talk about things that interest them. The subject varies from school gossip, to boys, to what happened in school, to whatever sparks their interest at that time.

Valerie is a 12 year old Hispanic young lady who puts on the appearance of being a strong, tough girl. Describing herself she stated, "I am one of the cool kids, no one messes with me. I'm one of the homies. I am pretty tough and no one messes with me." When pressed for more of a description of herself, she added that she is a kid that gets along with people as long as she knows them. She continued by saying she is a good person and keeps to herself and her friends. Valerie has one sister and is the daughter of a single mother. She hasn't had contact with her father in about two years. Valerie has had a somewhat transient life, moving from school to school and various residences. She is very guarded in behavior and is initially distrusting of people.

School is a subject that Valerie does not readily discuss. She stated she likes school, but the teachers are sometimes mean and hassle her. She also stated she will not do homework because if she can not get it done in school, she is not going to get it done. Valerie added, "School was fun, but it gets less fun as you go up in grades. All the fun is taken out and it is just work. School would be really bad if it wasn't for my friends." Regarding her performance, she reported that she is an average student, but doesn't want

to put effort into her classes. She feels that, if she wanted to, she could excel in academics.

Valerie does not participate in organized extracurricular activities. She stated that her mom works late, and she has to help around the house. Her mom is not able to take her anywhere, so she just hangs out in her neighborhood. She visits with neighborhood friends, watches television, and listens to music in her free time.

Analysis

Data was collected through use of the Fennema-Sherman Mathematics Attitudes Scales, student interviews, focus groups, classroom observations, archival data, and parental interviews. The NVivo qualitative data analysis program was utilized and permitted the researcher to code and examine the data. This allowed for themes to emerge and a constant comparison to be utilized in the exploration of the data. Numerous themes emerged throughout the study and will be explored in relation to the research questions.

Fennema-Sherman Mathematics Attitudes Scale Results

Data Collection, Descriptions, and Analysis. The Fennema-Sherman Mathematics Attitudes Scales consists of 12 Likert-type items to measure each of the nine domain constructs. The constructs measure pertinent attitudes related to mathematics learning. The scales (See Appendix A) were used at the initiation of the study to determine attitudes and perceptions. The descriptives for each specific quadrant will be examined as well as an overall synthesis of the data.

Each scale is comprised of six positive and six negative statements that relate to the particular scale. The score is based on the response that indicates a positive effect on the learning of mathematics. The higher the scale score, the more positive the individual's attitude (Fennema & Sherman, 1976).

The Mathematics as a Male Domain scale is scored differently than as outlined previously. The less one stereotypes mathematics, the higher the score will be. Fennema and Sherman designed the scale under the assumption that the less a female stereotyped mathematics as a male domain, the more likely she was to study and learn mathematics (Fennema & Sherman, 1976).

The scales were distributed to all the participating students on the second day of the study. This occurred before individual interviews began in order for student answers to reflect their beliefs without consideration of the interview questions and focus of the study. Each of the selected students were given the nine subscales one at a time; as they completed one subscale, a new one was provided. The researcher read each statement to the students to ensure that they understood it. The scales were then gathered and results were clustered in the appropriate quadrant for analysis, calculations of descriptive statistics, and examination of nuances. Each scale is provided with individual quadrant item scores reported. The individual scores for each measurement scale, standard deviation, and range per question is are included in Appendix B. Additionally, means are provided per question, student, quadrant, and scale. These are also included in Appendix B. For the purpose of this study, each scale is examined through a comparison of quadrants.

Mathematics as a Male Domain Scale. In Figure 4.1, the quadrant scores on this scale are displayed, and all quadrant means can be examined. Individual scores are displayed in Appendix B. The High Mathematics-High Reading quadrant scored the highest possible score on each question with the individual mean being 5.0 for each of these students. Therefore, the responses indicated they strongly did not stereotype mathematics as a male domain. Their individual means were above the overall mean of 4.17.

Kendra, like Jennifer and Alice, received the highest possible score on every question. With her mean score being 5.0, she was above the scale mean as well. Shana's scale mean of 4.33 was above the collective mean of 4.17. Her individual statement scores were above the composite average except on statement 6 and 7. She had the lowest possible score on the question pertaining to a female being a genius in mathematics. This was explored during individual interviews and Shana explains that she really wasn't sure if a girl could be a math genius. She stated, "It seems that all the really smart people in mathematics, the people who use math a lot, are men." Her response mirrored that of her mother which is documented in the parent interview subsection. The mindset of her parent definitely impacted Shana.

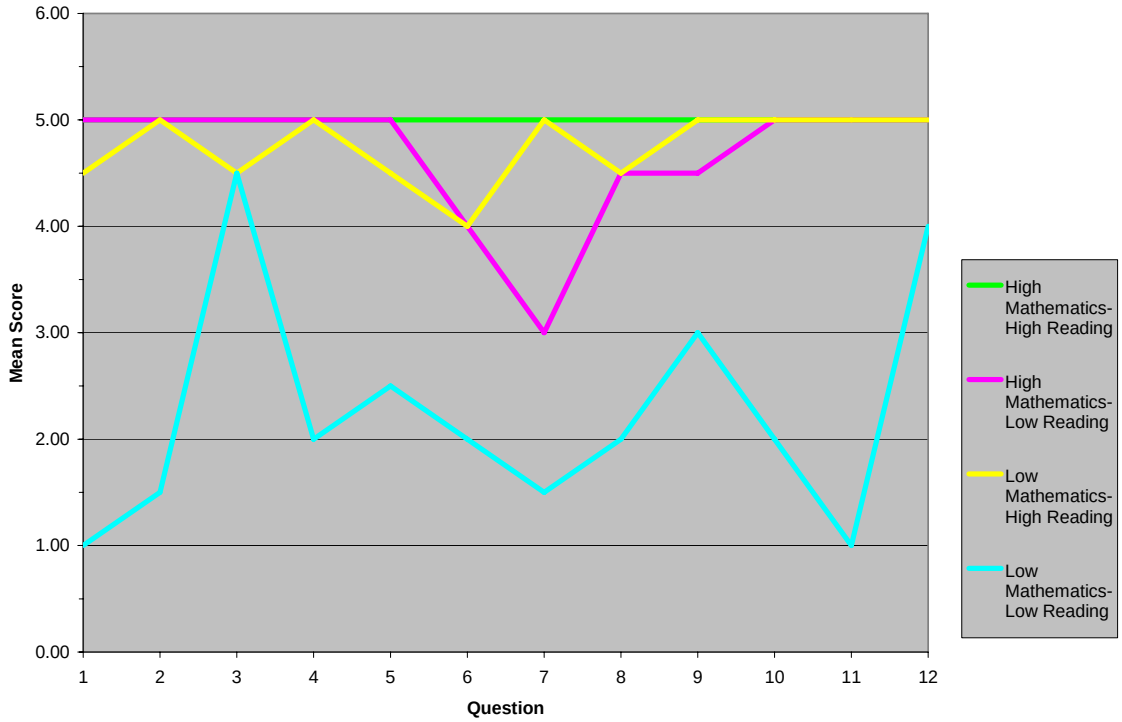
In the Low Mathematics-High Reading quadrant, Debbie and Candy obtained a scale mean of 4.5 and 5.0 respectively. This was above the scale mean of 4.17. All individual item scores were above the mean for Candy. Diana scored at or above the question mean on all statements except 3, 5, and 6.

In the Low Mathematics-Low Reading quadrant, both participants scored well below the scale mean. Victoria scored a 2.08, while Valerie scored 2.50 as their scale

mean which was substantially below the overall scale mean of 4.17. Question 3 stated: "I would trust a woman just as much as I would trust a man to figure out important calculations." This is the only statement that obtained a response that was higher than the item mean for one quadrant participant. With the exception of Valerie's score on question 3, all responses were below the individual item mean.

The Mathematics as a Male Domain scale was designed slightly different than the other scales associated with Fennema and Sherman. On this scale, the higher score indicates the less one stereotypes mathematics as a male domain. The High Mathematics-High Reading quadrant had the highest mean, 5.0, with the Low Mathematics-Low Reading quadrant having the lowest mean of 2.29. The scale mean was 4.17. The lowest mean was not unexpected, but was examined during the interviews of the students in this quadrant.

Figure 4.3



Mathematics as a Male Domain Scale Data

Attitude Toward Success in Mathematics Scale. The scale measured the student's desire to be viewed as successful in the field of mathematics. It measured the value associated with public acknowledgement of success in the mathematics classroom.

Figure 4.4 displays quadrant means for this scale. The overall mean for the scale is 4.29, while the High Mathematics-High Reading participants means varied with one scoring above and the other below the overall mean. Jennifer's mean score was 4.67 while Alice's was 3.83. Alice scored the lowest on statement 1 out of all study participants. On that statement, her score of 2.0 was well below the item mean of 4.5. This was explored during the interview process. There were many differences between

Jennifer's and Alice's responses on this scale. Jennifer scored the highest score possible on every item except the one discussing people's perception of one who gets A's in math. Alice on the other hand, had scores that varied from a high score of 5, the highest possible, to a low score of 2, the second lowest score possible.

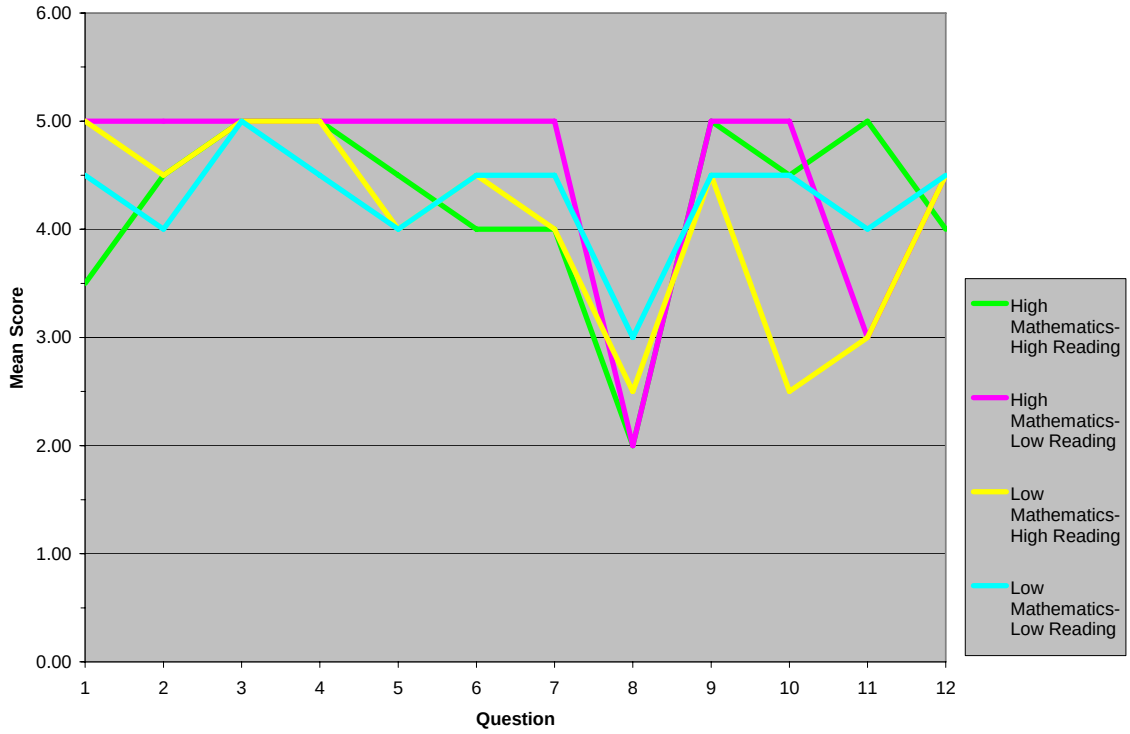
In the High Mathematics-Low Reading quadrant, both students' scale mean is above the overall scale mean of 4.29. Kendra's scale mean was 4.58 and Shana's was 4.50. Both girls' scores drop below the item mean for questions 8 and 11.

In the Low Mathematics-High Reading quadrant, the data varied. Debbie's mean of 3.92 was below, and Candy's mean of 4.67 was above the scale mean. This was an interesting phenomenon as Debbie had been more proactive in mastering her mathematics skills. This finding was unusual and perplexing to the researcher. The Low Mathematics-Low Reading quadrant also exhibited variation in the recorded scores. Vivian had a scale mean of 4.17, which was below the scale mean of 4.29 while Valerie's scale mean score of 4.42, just above the scale mean.

Of interest in the findings was the High Mathematics-High Reading mean being below the scale mean. The remaining High Mathematics quadrant is well above the scale mean and is the highest of all quadrants. The mean of the remaining two quadrants, both Low Mathematics, were equal to or lower than the scale mean. Upon discussion with the High Mathematics-High Reading quadrant students, responses supported the scale data. The girls in this quadrant reported that they were already considered the 'brain' of the class; they have experienced their fair share of teasing and pestering for getting good grades. Jennifer makes this point by stating, "Being the smart one isn't all

it's cracked up to be. Sure you feel good about getting good grades, but then your friends start giving you a hard time. It's like you just can't win; almost like they're jealous."

Figure 4.4

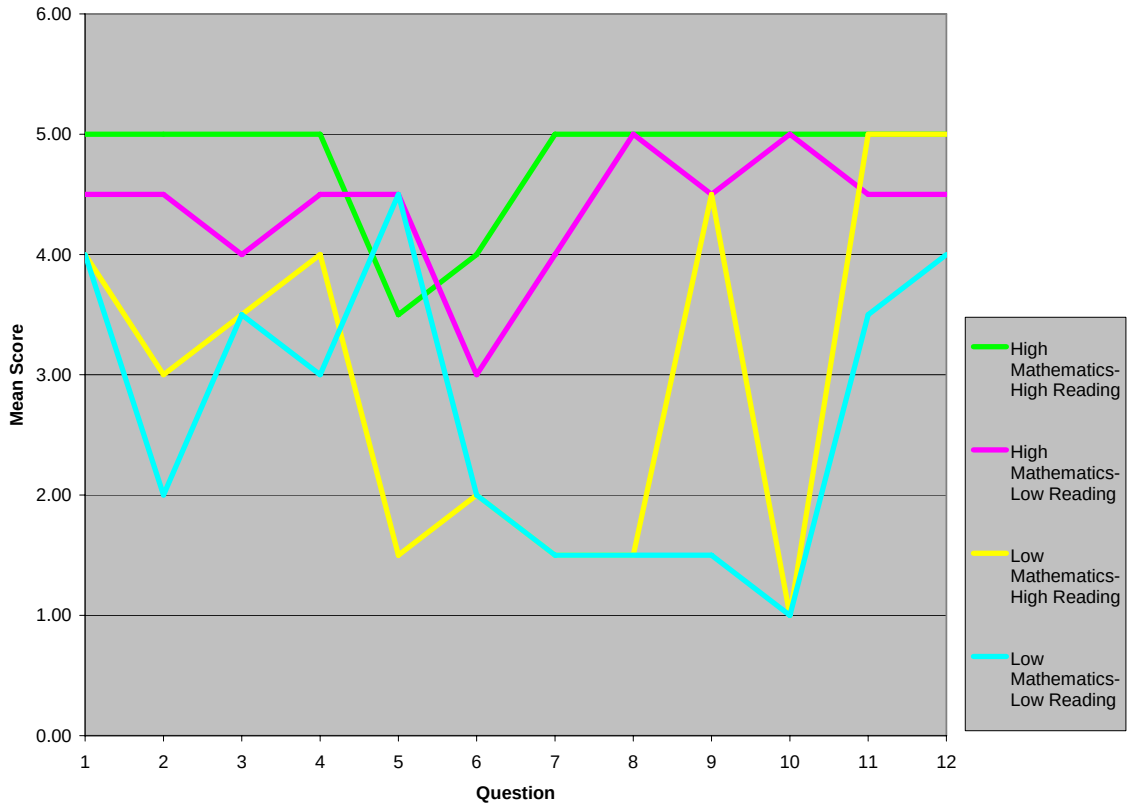


Attitude Toward Success in Mathematics Scale Data

Effectance Motivation in Mathematics Scale. The mean of all quadrants are displayed in Figure 4.5. The scale means of both High Mathematics-High Reading quadrant members were well above the scale mean of 3.72. Jennifer's mean was 4.58 while Alice's was 5.0. Both students scored above the item mean except for question 5 where Jennifer's response was 1.5 below the item mean.

The High Mathematics-Low Reading mean of 4.38 remained above the scale mean of 3.72. Both Low quadrant means were below the scale mean being 3.04 and 2.67. It is interesting to note that as one moves from High Mathematics quadrants to Low Mathematics quadrants, each mean decreases and ends with the Low Mathematics-Low Reading quadrant mean of 2.67 being well the scale mean of 3.72.

Figure 4.5



Effectance Motivation in Mathematics Scale Data

Usefulness of Mathematics Scale. This scale looks at the value students place on mathematics. Questions probe beliefs about using mathematics in their adult life as well

as feeling about current mathematical experiences. The results compiled from this scale are in Appendix B. Overall, results varied greatly from quadrant to quadrant.

Results, depicted in Figure 4.6, were as expected for the High Mathematics-High Reading Quadrant, and the High Mathematics-Low Reading. In these quadrants, the only response that varied in consistency was Shana's response to question 12. However, due to the continuity among the other statements on the scale and interview responses provided by Shana, the researcher believed the student either misunderstood the question or marked it incorrectly.

The results for the Low Mathematics-High Reading quadrant were interesting to the researcher. With the emphasis on mathematics in today's school, specifically in this school with two mathematics courses, seeing mathematics as useful (question 2) would seem a logical conclusion. What was of interest was the score on statement 4, "Mathematics is a worthwhile and necessary subject." Both students selected 'undecided' as their response. This reason was examined in more depth through personal interviews. Through discussions with Debbie and Candy it was clear they were adopting a 'wait and see' attitude. They wanted to determine their ability to succeed, or not, before the skill was deemed valuable to them. This behavior was explained through Expectancy Value Theory and remains consistent with the theory.

Social Cognitive Theory (Bandura, 1989) maintains that the belief individuals have regarding certain successful behaviors is shaped by their experiences and ability to perform that behavior. In this case, the behavior was engaging in mathematics. Debbie and Candy needed to experience success in order to deem the activity meaningful. This was supported by statements made by both students during individual interviews.

However, this stance was epitomized in Candy‘s statement, “I don’t know if math is worth it. When you work at it and you still get bad grades it kind of makes you want to give up. Maybe I don’t have the stuff that makes you good at math.”

The responses of participants in the Low Mathematics-Low Reading caused individual and quadrant means to be substantially lower than the other quadrants. Although not particularly unusual, the vacillation within the quadrant peaked the researcher’s attention. Results were consistent per statement, but varied on response to the type of statement. On the questions that pertained to the future, such as question 3, “Knowing mathematics will help earn a living,” the participants scored high. However, on questions dealing with math being worthwhile and relevant, scores were at the extreme end of the spectrum. This was addressed during student interviews in an attempt to explain the variance.

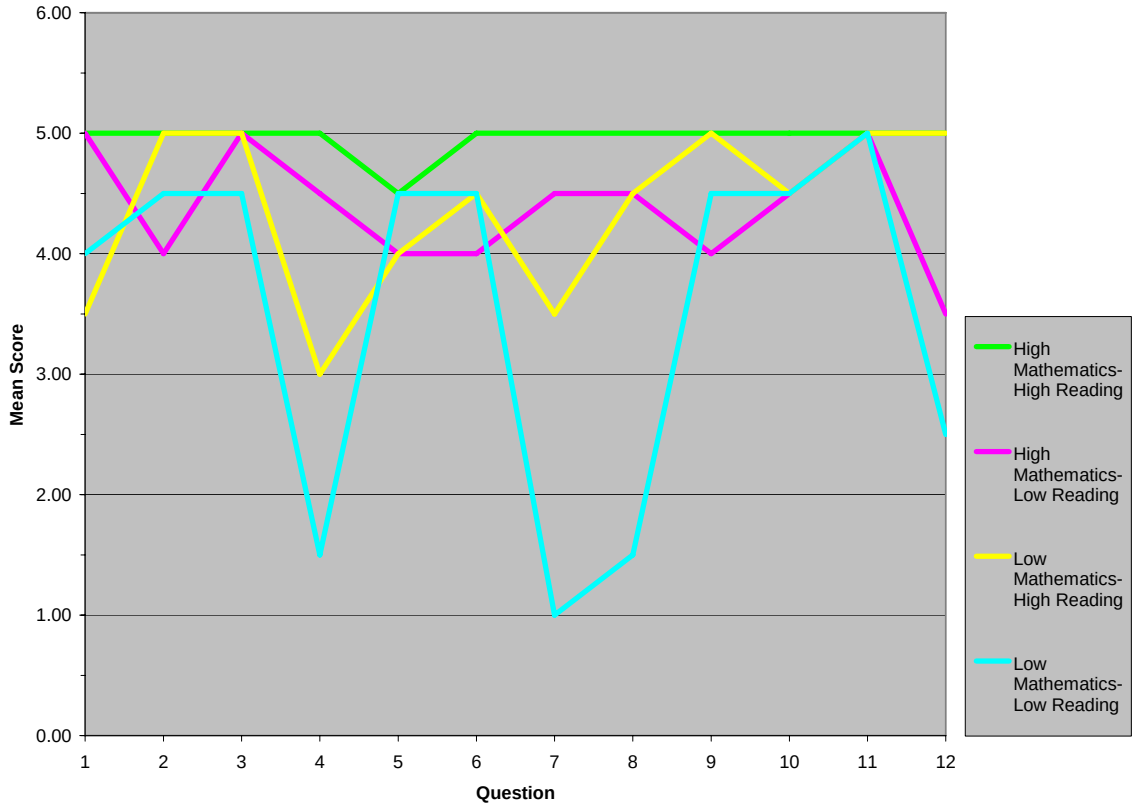
Students are frequently told by teachers that mathematics is important. Messages, directly and indirectly, tie success in mathematics with securing a well paying job. Thus, questions pertaining to the future benefits of mathematics earned high scores. This was expected. However, responses were very low, on questions 4, 7, and 8. These questions pertained to: math being a worthwhile subject, relevancy of mathematics to the student’s life, and mathematics not being important in the student’s future career.

These responses, which were supported by interview data from the students and parents, were consistent with Expectancy Value Theory (Wigfield & Eccles, 2000). The theory states people engage in activities to the extent that they are successful and value the activity. They must expect to succeed otherwise they will choose not to engage in the task. This explains the responses of the girls in this quadrant. Neither student had been

experiencing success; they struggled with homework, grades, district tests, as well the state mandated testing. There responses displayed their non-valuing of mathematics as they have not deemed it worthwhile due to their difficulties. These experiences, parental beliefs and student perceptions of their inabilities predispose the girls to excluding themselves from pursing advanced mathematical courses.

Both students, while being interviewed informed the researcher of plans to no longer take mathematics when graduation requirements are met. When asked about plans for taking math classes in the future, Vivian quickly responded, "Oh I don't think so. I will probably stop when I don't have to take anymore; probably after Algebra or something like that. I don't want to take more, it's too hard. Besides I'm not really good at it, am I?" Valerie responded in a similar way and informed the researcher that she wants to finish math soon because it is frustrating for her and makes her feel like a failure. This was evidenced from a poignant statement she made on the last day of the study. She had just found out the she had not passed the mathematics test. She stated to the researcher, "I give up. I tried this year, and it was just like the year before. I can't pass the stupid test. I hate this." She then began to cry out of frustration and disappointment. The failure did cause her to see herself as not being mathematically-abled.

Figure 4.6



Usefulness of Mathematics Scale Data

Confidence in Learning Mathematics Scale. The scale responses were consistent with expectations and are displayed in Figure 4.7. The High Mathematics-High Reading quadrant far surpassed the means on individual items as well as the scale mean. The High Mathematics-Low Reading quadrant also provided results that were consistent with expectations. Means were 4.83 and 4.79, respectively.

Findings among participants varied in the Low Mathematics-High Reading quadrant. Candy's mean of 2.75 varied significantly from that of Debbie's 4.42. After interviews, observations, and data analysis, the researcher developed an understanding of the phenomena. Figure B.3 in Appendix B displays the quadrant responses on this scale,

and Debbie scored higher on almost every statement. Thus, the researcher attempted to gain insight regarding the variance among the girls through the various research tools utilized in this study.

The Fennema-Sherman Scales was the data collection tool that brought in the initial volume of data. Observations and interviews were initiated, but those tools take time to gather information. Upon obtaining the completed scales, data analysis immediately began. When this variation was determined, the researcher paid particular attention to the phenomena. It was explored with the quadrant members through observations, student, parent, and focus group interviews, and archival data. Therefore, an understanding of the phenomena was developed.

Speaking with the girls provided very different aspects to the quadrant. Debbie had been taking very deliberate steps to improve in mathematics. For her, it was more than wishful thinking. She had, with help, developed a plan to improve in mathematics and was following through. This was clearly evidenced during classroom observations, interviews with Debbie, and interviews with her parents as well. Candy also stated she has a desire to improve in mathematics. However, despite her statements to want to advance her mathematical skills, she had no direction or plan to do so. Classroom behaviors, such as avoidance of work and disengagement did not aid in Candy's mathematical improvement.

Parental support varied greatly as well. Both sets of parents expressed a desire for their daughters to do well in mathematics. They also wanted to aid in the process, but approaches were very different. Mr. Fuentes, Debbie's father, was constantly working with Debbie in order to ensure her understanding of the mathematics homework. He was

diligent and had a certain doggedness to his interactions with Debbie. When she didn't have homework, Mr. Fuentes created his own problems, or if they are at the store, will pose problems to her. He also has sought assistance from Mrs. Smith, the mathematics teacher, in order to ensure his understanding of the desired mathematical processes. Mrs. Fuentes, although not to the extent of Mr. Fuentes, would help Debbie by practicing multiplication and division facts. Math and Debbie's desire for success had truly become a family affair.

During interviews, Mr. Smith stated he didn't know how to help Candy. He stated that he had gone to the school and asked the teacher to show him how to work the problems, but he still didn't understand the process so he gave up. When asked to describe how the family helped Candy with her homework, Mrs. Smith responded,

> We ask her if she has any homework. If she does, she will sit at the dining room table and do it while I cook dinner or do laundry. If she has a specific problem, we will show her how we did it when we were in school. The problem is, math isn't done that way anymore so she usually gets it wrong.

Looking at archival data, the 2004 TAKS scores, Debbie did not pass mathematics; however, she did score higher than Candy. During personal interviews, Debbie stated this was a driving force for herself personally. She wanted to pass the test this year. Debbie stated,

> I was really sad that I didn't pass the [math] test last year. That wasn't going to happen this year. I worked hard so I could pass. I feel really good about it too. I really think I did it Ms. Ortiz, I really think I did! I feel better about myself too. The hard work, works. I can tell I am better at math and don't get all scared in math class anymore.

Candy did not ever talk about her previous testing disappointments. In order to investigate this theme, the researcher did ask her about how not passing the 2004 TAKS math test, made her feel. She indicated she was disappointed, sad, and a little angry, but

did not elaborate. The researcher pressed to determine if it was a motivational factor for Candy as it was for Debbie. However, Candy's response was, "You know, I felt bad about not passing it, but this year is different. I am going to pass it." When asked why she felt she would pass it, Candy informed the researcher that she had worked hard. When the researcher inquired into what she actually had done to prepare for the test, she became indignant. Candy replied, "Uh, you know. I worked here at school and stuff. I take homework home and did it. You know." When asked if Candy ever did extra work to practice her skills, her reply was, "Why? We do enough of the stuff in school."

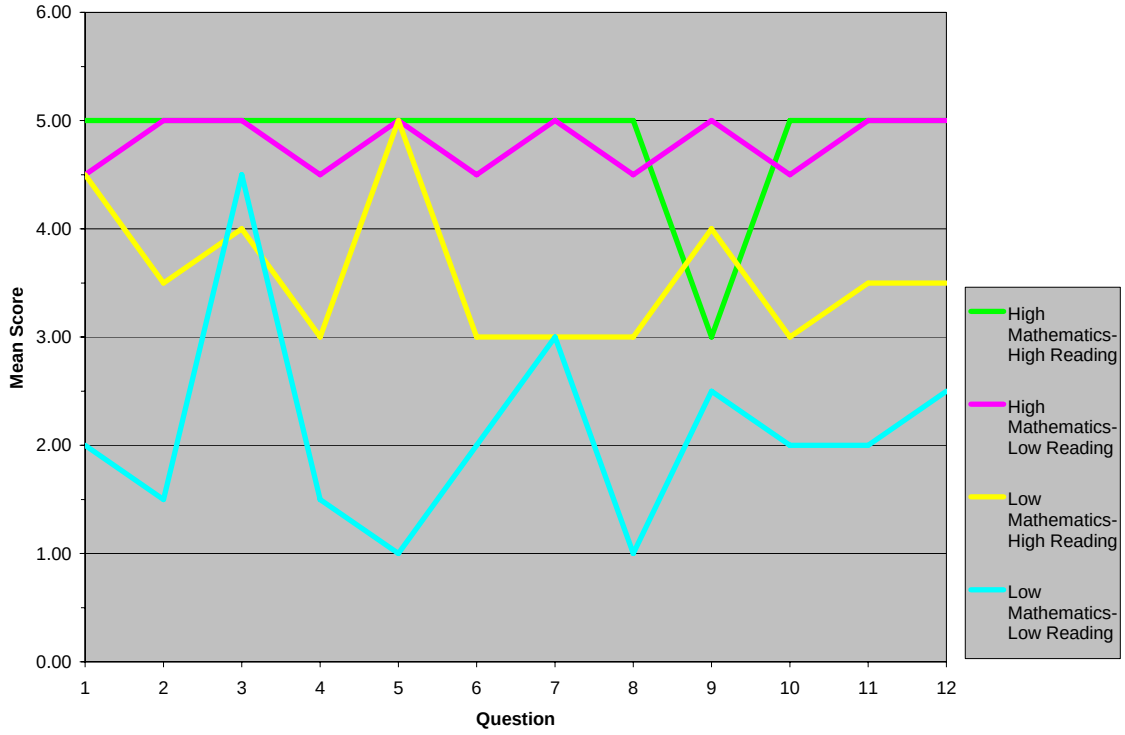
Observations also illuminated the differences between the two girls. Candy actively engaged in behavior that was not conducive to learning. She did many things to avoid working on her math. She would comb her hair, write notes, and talk with friends among other things. When given the opportunity in Ms. Jones' class to work or talk with friends, she invariably put her work away without it being done.

Debbie strived to complete her work in class. The researcher observed several times where students were given the opportunity to put their work away, finish it later, and instead visited with classmates. Debbie, would continue to focus on her work, and seemed to have the ability to ignore her surroundings and concentrate on the task at hand. Occasionally a friend would pull up a chair to talk with her, but after a brief conversation Debbie would excuse herself and return to her work.

The students in the Low Mathematics-Low Reading quadrant each had a mean lower than the scale mean of 3.83. Vivian's mean of 1.5, and Valerie's 2.75, were substantially below the scale mean. Results were mixed on individual items, with Valerie scoring higher than the item mean on: 3, 7, and 4. On this scale, the pattern of quadrant

means decreasing as one crosses from the highest quadrants down to the lowest remains consistent and are supported by the findings of this study.

Figure 4.7



Confidence in Learning Mathematics Scale Data

Mathematics Anxiety Scale. Findings on the scale reflect the overarching pattern from previous scales. The High Mathematics quadrants have the highest scores with the Low Mathematics-Low Reading quadrant having the lowest scores. Figure 4.8 displays the quadrant means for each item on the scale. In the High Mathematics-High Reading quadrant, an unexpected response was obtained on statement 4 from one participant. Alice indicated a negative response towards tests in math class. Alice explained her

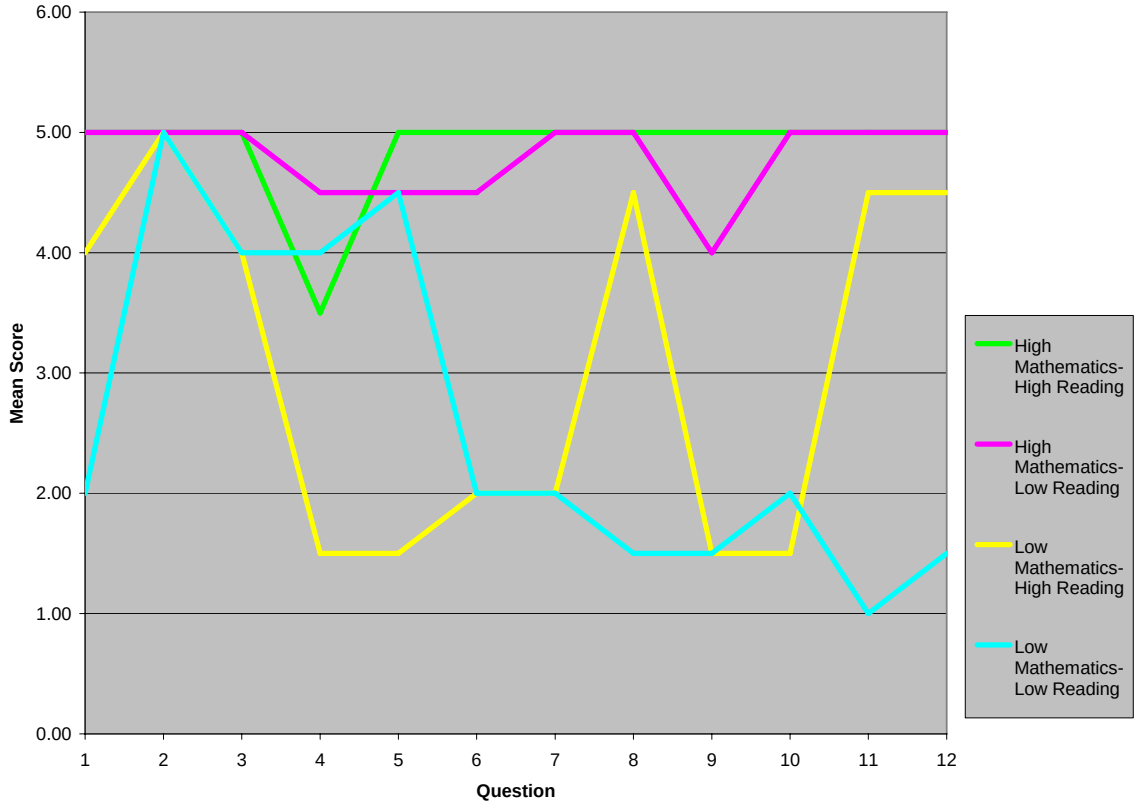
response as she always becomes nervous while testing. She stated she is always prepared and it is just a nervous feeling that overtakes her. She dismissed it as a personality trait since it occurs throughout all subjects and not just mathematics. Results were as expected with the exception on that response.

The Low Mathematics-High Reading quadrant results were as anticipated with most scores being at or below the item mean. Debbie's scale mean of 3.25 and Candy's scale mean of 2.83 were lower than the overall scale mean of 3.82. Feelings of anxiety were confirmed by certain scale items and results were supported by observations and student interviews.

The Low Mathematics-Low Reading quadrant displayed the lowest means of all quadrants. Vivian's scale mean was 2.08 while Valerie's was 2.33 with the overall scale mean being 3.82. As expected the individual item scores were below item means except for question 5. During individual interviews, this item was discussed and Vivian stated she had scored the item incorrectly as she does become nervous during testing. Valerie maintained her response was correct and accurate. The researcher never had an opportunity to observe the students during a mathematics test; therefore no data could be gathered on the accuracy of this statement.

Results remain consistent when examining the quadrant means as depicted in Figure 4.8. The quadrant means decrease while moving across the High Mathematics quadrants to the Low Mathematics quadrants.

Figure 4.8



Mathematics Anxiety Scale Data

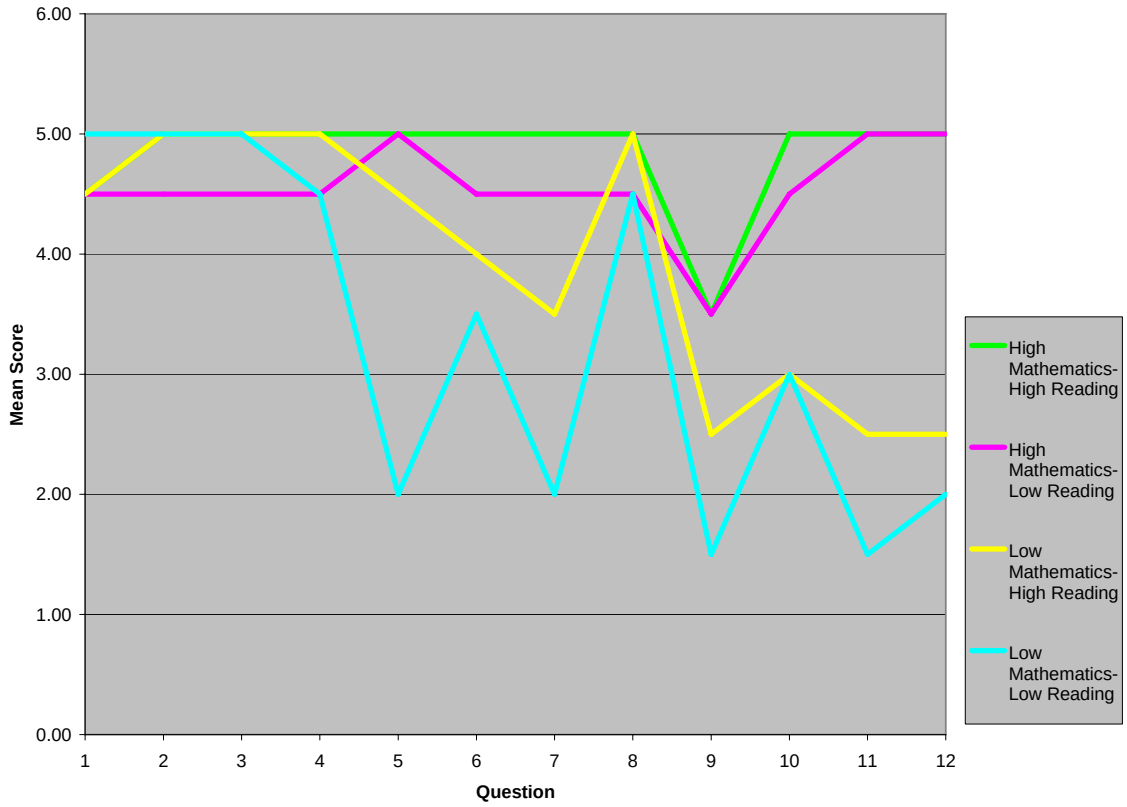
Father Scale. This scale evaluated student perception of their father's attitude towards their learning of mathematics. For the two students who came from single parent homes, they each had a significant male figure in their lives. They completed this scale based on their interactions with the significant male. For Valerie the significant male in her life is her uncle since they, until recently, lived with him. For Shana, the significant male is her maternal grandfather.

Results for the High Mathematics-High Reading and High Mathematics-Low Reading quadrants were consistent with other data obtained during this study. The means

were 4.83 and 4.54, respectively, and were both higher than the scale mean of 4.16. The Low Mathematics-High Reading quadrant exhibited results that were anticipated. Debbie's mean, 4.25, was higher than Candy's mean, 3.58, and higher than the scale mean of 4.16. The Low Mathematics –Low Reading quadrant maintained the lowest individuals' means as well as the lowest quadrant mean. Vivian had a mean of 3.25 while Valerie had a mean of 3.33, both well below the scale mean of 4.16. Results were as anticipated and can be seen in Figure 4.9.

Quadrant means continue to follow the developed pattern of High quadrants having the highest means and steadily decreasing until reaching the lowest mean from the Low Mathematics-Low Reading quadrant. It was interesting to the researcher that the Father mean was higher than the Mother mean. During interviews with the students, most indicated their father was the parent who took an interest in their mathematical pursuits. The interview findings support the scale data.

Figure 4.9



Father Scale Data

Mother Scale. This scale evaluated student perception of their mother's attitude toward the student learning mathematics. There were interesting results that emerged in this quadrant. Although the High Mathematics-High Reading quadrant's mean was above the scale mean, it was not the highest. In fact, it was second lowest at 4.08. Jennifer's mean was 3.83, and Alice's was 4.33 with the scale mean being 3.79.

On question 5, which states, "My mother thinks that mathematics is one of the most important subjects I have studied," both students recorded a '2', which was the lowest scoring received on this question.

This was intriguing and the researcher, during private interviews, discussed this with each of these girls. Jennifer, who also scored her mother very low on questions 3, 10, and 12, answered questions in a very matter of fact manner on this subject. She stated that her mother has never been interested in her mathematical abilities. Jennifer elaborated,

> Don't get me wrong, she wants me to do well and knows that I can. She encourages me about that, but other than the regular Mom speech, you know, 'Do well in your classes. I know you can do it. You need to take a lot of math and science to prepare you for college, blah, blah, blah.' But she doesn't like math. My stepfather is the one who helps me with math. If I go to her, she tells me to go to him. As long as I bring home good grades, she doesn't care if I am interested in it or not. I don't think she thinks learning math to learn math is important either. I mean, she knows, and tells me, that you have to learn it to get through school, to pass on to the next grade, maybe for your job. But she doesn't think it is important to like it because it's fun or because you just enjoy it. To me, that is most important of all.

Jennifer's responses made her choices on the scale very clear. She undoubtedly believes that her mother is not interested in her math career except for Jennifer receiving good grades and maintaining her excellent grade point average.

Alice's responses were above or near the mean on every item except this one. When I explored her reasoning behind her response, she stated that her mother really pushes her to excel in the language and reading as well as in her musical pursuits: Her mother is not interested in math and science as much as her other courses. Her explanation justified her answer selection. The individual responses to the scale questions can be examined in Figure B.7 in Appendix B.

The High Mathematics-Low Reading quadrant and the Low Mathematics-High Reading quadrant had the highest mean. They both had a mean of 4.25 compared to the

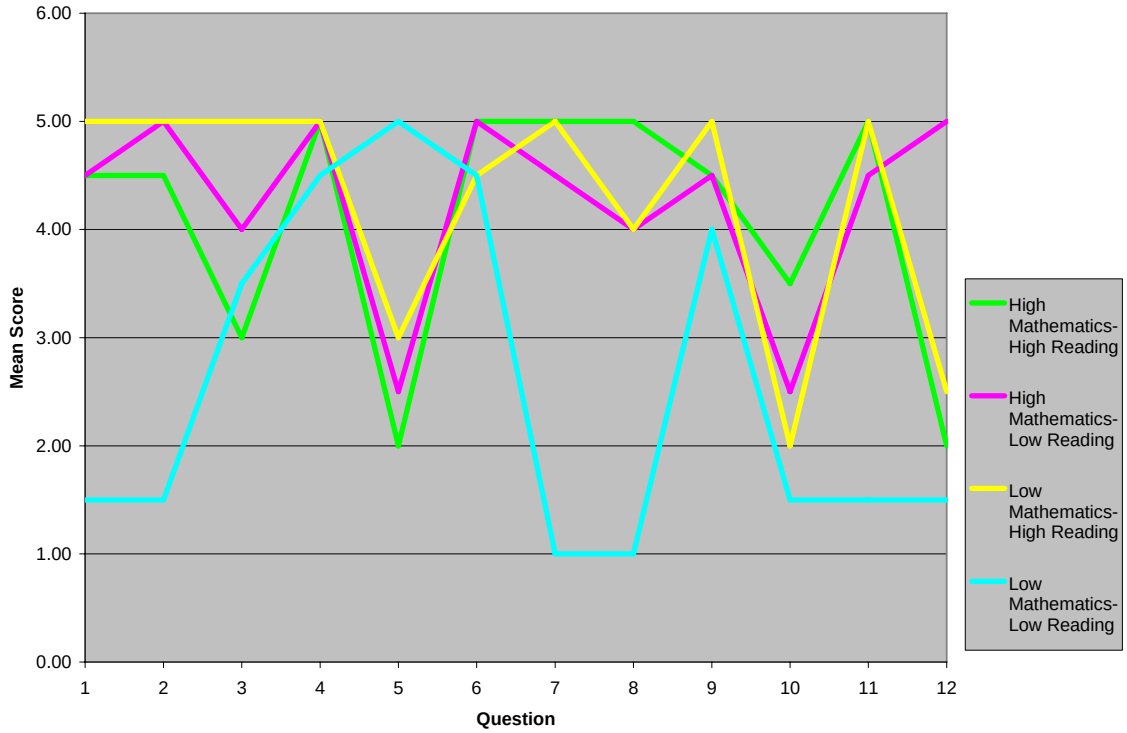
scale mean of 3.79. Overall, the results were as anticipated with the exception being one individual's very high scoring of her parent.

In the Low Mathematics-High Reading quadrant, Candy scored her grandmother with a significant amount of 5's, the highest score possible. When asked about this Candy replied, Oh I did that because, other than her telling me she hated math, she is always telling me to do my best and that it is important. She tells me that even though she didn't like it and that she didn't do good in it, I need to. "

The Low Mathematics-Low Reading quadrant responses remain comparatively low. Vivian's mean of 2.17 and Valerie's of 3.0 were again below the scale mean of 3.79. This remains consistent with the data. An interesting aspect of this scale is that on question 5, where the High Mathematics-High Reading quadrant scored their mothers the lowest, this quadrant scored their mothers the highest.

The quadrant and scale means are displayed in Figure 4.10. As previously discussed, the High Mathematics-Low Reading and the Low Mathematics-High Reading quadrant had the highest scale mean on this item. This was the only time that the High Mathematics-High Reading quadrant did not have the highest mean. The Low Mathematics-Low Reading quadrant has the lowest mean on this scale.

Figure 4.10



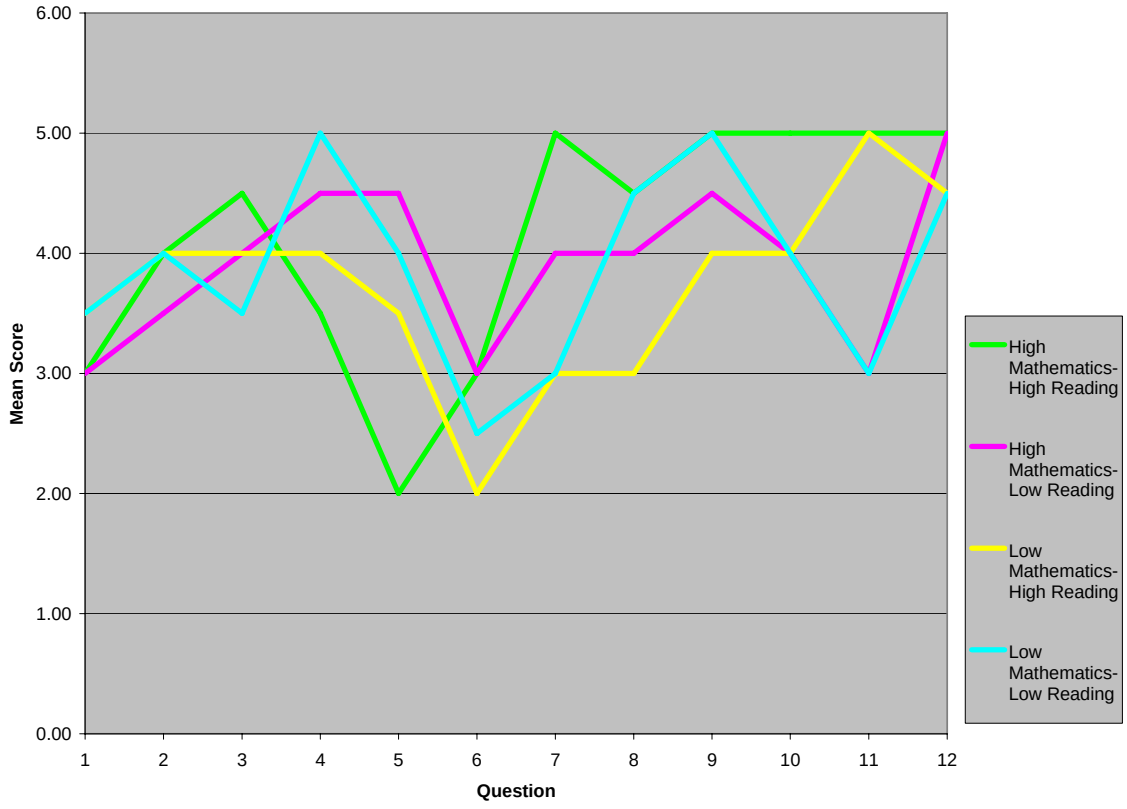
Mother Scale Data

Teacher Scale. This scale was completed at the beginning of the study and was not sufficiently addressed by the researcher. The students have two math teachers and the researcher did not specify which math teacher to consider when completing the scale. As a result, the descriptives are reported, but specific conclusions could not be drawn.

Figure 4.11 displays the quadrant means on the individual items on this scale. The High Mathematics-High Reading quadrant had the highest mean of 4.13 with the scale mean being 3.91. The mean decreases across the quadrants with a slight deviation from the developed pattern. On this scale, the students in the Low Mathematics-High

Reading quadrant had the lowest mean with it being 3.71. This was below the scale mean of 3.91.

Figure 4.11

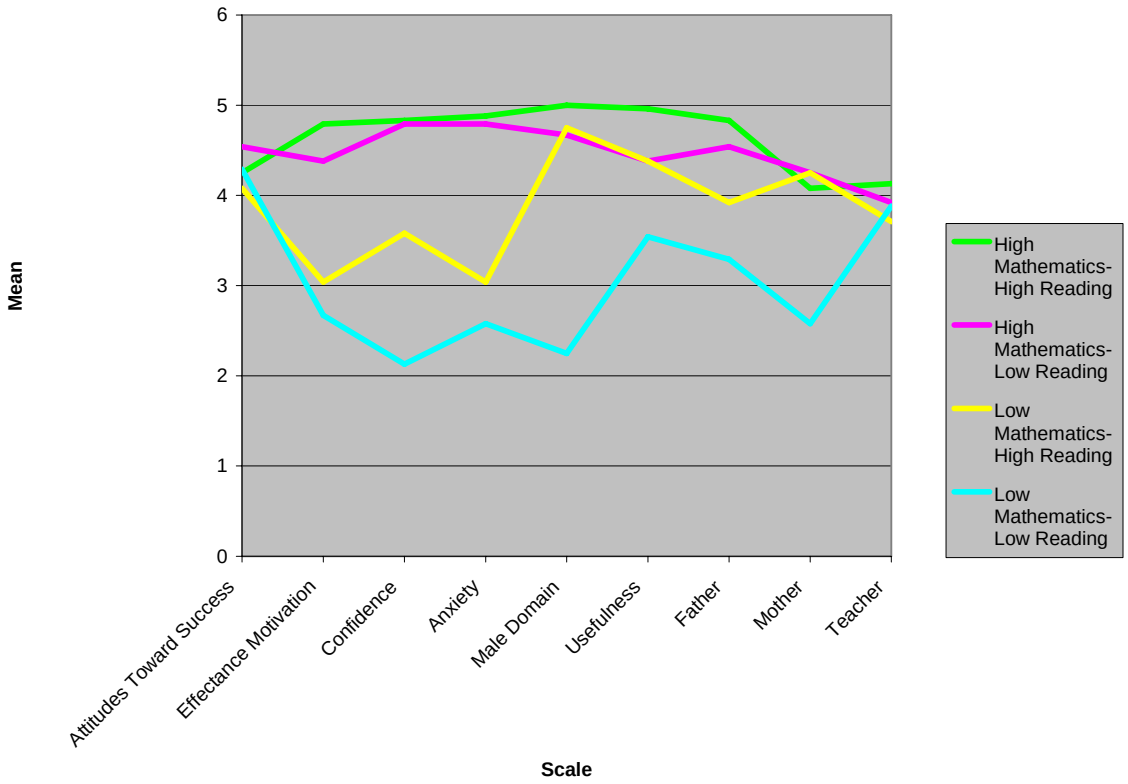


Teacher Scale Data

Analysis and Summary of Survey Data. The survey data provided a wealth of information, for the researcher to begin answering the questions guiding this study. The results allowed for an examination of trends and areas to examine during interviews and observations. Figure 4.12 displays quadrant means across all Fennema-Sherman Mathematics Attitudes Scales. The figure reveals that, except for the Attitudes Toward Success scale, the Low Mathematics-Low Reading quadrant consistently had the lowest

mean on every scale. On that same scale, the High Mathematics-High Reading quadrant mean did not surpass the scale mean. This is the only scale where that occurs. The High Mathematics-Low Reading quadrant means surpasses the scale mean in every instance. This information provides the backdrop for the examination of the data and provides a vital aspect to the triangulation of data.

Figure 4.12



Fennema-Sherman Mathematics Attitudes Scales Data Summary

The scale data provided the underpinnings of the exploration into the participants' perceptions of their mathematical capabilities. Most differences were examined between

the various quadrants. However, there were interesting differences that occurred in the Low Mathematics-High Reading quadrant as well.

The first research question answered was, "What are individual female perceptions of their math capabilities?

The High-Mathematics-Low Reading quadrant, expressed very positive perceptions of their mathematical abilities. Their quadrant mean on all scales surpassed the scale mean. These students exhibited many of the traits seen in the High Mathematics-High Reading quadrant.

Overall, the Low Mathematics-Low Reading quadrant had the least amount of confidence and belief in their skills. It was interesting to note that on the Usefulness of Mathematics scale, responses were on both ends of the scale. When answering questions about the importance of mathematics for the future (question 1) and knowing mathematics will help earn a living (question 2), the students in this quadrant scored at the high range of the scale. However, when it came to statements reflecting the current and practicality of studying mathematics, they scored at the bottom of the scale. Question 4, pertaining to math being a worthwhile subject, and question 7, pertaining to math having no relevancy to their life, reflected that the students believed these statements very strongly.

What was disturbing to the researcher is that while students in this quadrant, had very strong beliefs that mathematics would help then earn a living (mean = 4.5), they reported on question 8, "Mathematics will not be important to me in my life's work," a mean score of 1.5. They may believe that mathematics is the door to better careers and opportunities, but they do not see it happening for them.

In the High Mathematics-High Reading quadrant, the girls scored their mothers belief that math is one of the most important subjects, the lowest of all the participants. On this same scale and same statement, the Low Mathematics-Low Reading quadrant girls gave their mother the highest score possible.

The High Mathematics-High Reading quadrant scored below the scale mean on The Attitudes Toward Success in Mathematics scale. This was explored during interviews and the findings were intriguing. The participants are extremely smart and are at the top of their class academically. During observations, these girls are called on by the teacher to answer questions, help others, and assist the teacher with activities. Peers, although not cruel, teased them about being smart and top in the class. During interviews these observations were verified, especially for Alice. To exacerbate the situation, Alice is extremely shy and reserved. She does not like attention drawn to her, and so in light of the observations, and interviews, the results on this scale are supported.

The findings involving the Low Mathematics-High Reading quadrant were consistent with literature and current research. Nonetheless, in this study an interesting finding developed and was noticed on the Confidence in Learning Mathematics scale. The findings were later supported with interviews of parents, students, focus groups, and archival data. Debbie's score on the Confidence scale was significantly higher than Candy's, with over a 1.5 difference on their individual means. From the various data sources, the researcher gathered information which supported the stance that Debbie was experiencing more success in the field of mathematics. It is important to note that the experiences extended beyond the classroom. As a result, her confidence was higher as reported on this scale.

An interesting point to bring to bear occurred at the conclusion of this study. It did not impact this study, but provided additional support to the findings regarding the girls in the quadrant. On the last day that the researcher was present at the school, the 2005 TAKS scores were provided to the students. The score not only determined if the student is meeting the minimum state standards, but summer school attendance and, at certain grade levels, retention is based upon these results. Debbie passed the mathematics portion of test and Candy did not.

Debbie made a point of coming to talk to the researcher and celebrate her success. She cited her hard work, support of mathematics teacher, Mrs. Smith, and help from her parents. As she succinctly stated,

> You know I did it! I knew I could! I believed in myself and never gave up. Oh it was hard work, a lot of it, but it paid off. Oh my goodness, I passed! I will have to keep working hard to keep this up, but I can. I will! I need to talk with Mrs. Smith to see what I have to work on over the summer to be ready for next year.

As we continued to talk about her success, she exhibited some traits attributed to the High Mathematics-High Reading quadrant. She was: determined, self assured, aware of specific skills needed, as well as processes to attack problems. Additionally, she exhibited a trait exclusive to the High Mathematics-High Reading quadrant. She was aware of her weaknesses and what she needed to work on to improve her mathematical skills. Candy on the other hand exhibited a fatalistic attitude. She was disappointed but her response was, “You know I am just not good at math. I guess it runs in the family.” When the researcher asked her how she could improve in order to raise her score for next year, her response was a shrug of her shoulders.

The scales provided a strong aspect of the triangulation of data. Armed with this information, observations and interviews were conducted to explore anomalies, substantiate responses, and clarify information.

Auto-Ethnographies

During the initial week of the study, students completed an auto-ethnography. Students explained their mathematical experiences through school and their feelings toward mathematics. Students' ideas varied based on personal experiences; however, students in the High Mathematics quadrants had more positive experiences than students in the Low Mathematics quadrants.

The auto-ethnographies provided verification of interview responses and classroom observations. The High Mathematics quadrants expressed enjoyment in mathematics overall. These students did have mixed experiences throughout their academic career; nonetheless, overall the experiences were positive. The four students also discussed positive feelings regarding mathematics and see utilizing math in their futures.

The auto-ethnographies of the Low Mathematics quadrants students were also mixed when discussing their previous school experiences with mathematics. However, they did reflect more of a negative view of mathematics. In the Low Mathematics quadrant students spoke of their dislike of mathematics and desire not pursue higher mathematics course taking. The information received from the auto-ethnographies supported information provided during personal interviews and classroom observations. The auto-ethnographies are included in Appendix C.

Interview Data

Data Collection Process. The students were interviewed throughout the five weeks that the researcher was present on campus. One interview was conducted on the first and last week of the study, while two interviews were completed each of the remaining three weeks. The student had individual interviews which normally lasted approximately 30 minutes. Each student participated in seven to eight interviews in a private conference room or office on the school campus. All participants had seven interviews except for Jennifer. She had eight interviews, as she had insights she wanted to discuss and explore.

All interviews were held on the school campus during school hours. Due to campus needs, interviews were not always held in the same room; however, various offices were used and privacy was always maintained. Students were pulled and interviewed during their non-academic activities so as not to interfere with their academic progress. Students were informed that the interviews were being taped and consented to the process. Likewise, parents had been informed that taping of interview conversations would occur and consented to the process. Parental consent forms had been obtained prior to the inception of the study (see Appendix E). Participants were reminded at the beginning of every interview that the information was confidential and agreed to the interview and it being recorded. After each interview, the data was transcribed as the initial step of analysis. This data provided one aspect of the triangulation of data necessary when research is conducted.

The initial interview was one to allow the students to become familiar with the process, feel at ease with the researcher, and become comfortable with being recorded.

Students were informed they had the opportunity to stop the interview, if at any time they felt uncomfortable or objected to the questions. Following the interviews, recordings were transcribed for analysis. Questions were asked in a semi-standardized format. Additional questions were asked for further exploration of responses and clarification. These questions followed the nature of the interview and additional ideas were explored. A copy of the student questions are included in Appendix A.

Data Analysis Process. The examination of the individual interviews was the initial step of data analysis. Interview responses were grouped and examined by assigned quadrants and then through an overall analysis. The transcripts were scrutinized in order to examine continuities and variation among the four quadrants and overall as well.

After the data was transcribed, an examination of occurring themes took place. The researcher looked for language that reflected student perceptions regarding their mathematical self-efficacy and their capabilities. Some of the focus words were effort/ability, enjoyment, usefulness, frustration, skills, and performance. When these words, or derivatives of them, were found, they were noted. Data that provided insight into the specific research questions was also examined. Additionally, student responses were used to develop an understanding of the data in relation to the other modes of data collection that were utilized. Through the interviews, examples of the themes and supporting data were obtained. The themes were examined with two different domains in mind. The study focused on the student perceptions and how parental beliefs affect the students. Both of these realms will be addressed throughout this chapter.

Interviews with Student Participants

High Mathematics-High Reading. When interviewing the girls in this quadrant, they had very clear ideas regarding the questions that were posed to them. Both gave their responses significant thought prior to explaining their position. Also, both were intent on getting their ideas across and ensuring the researcher fully understood their position on the subject.

During the interviews, three clear themes evolved. They were: ability/skills, self esteem/success, and parental beliefs. Success and self-esteem were merged because during the interviews, these concepts were discussed in connection with each other by the students. Overall, this quadrant viewed the themes in a positive manner.

The first theme explored was ability/skills. Jennifer and Alice were able to discuss their skills and abilities in very specific terms.

Both Jennifer and Alice stated they enjoyed the challenge of math. Jennifer made this clear when she said,

> I like math. It makes you think. You know what it's like when you get one of those problems that is so hard? You can't let it beat you. You sit and figure it out and then you feel great. You know that you have the needed strategies to figure out tough problems and they work. It gives you confidence in yourself.

Alice commented, "Math is fun. You get a problem; it may be difficult, but you stick with it and work it out. You have to know how to do things in order to be successful. It makes you feel good; knowing that you did all that work and the problem is right."

Both girls discussed how analysis and the process of breaking down a problem into manageable steps as two of the things that helps them be successful in mathematics. Jennifer credits her success in mathematics to her ability. Jennifer reported,

Ever since I was a little kid, I worked on math. I remember being about three years old and being taught multiplication. It wasn't hard multiplication, it was like 2 times 3, but my dad worked with me to understand it. One of the things that I learned from him was to draw a picture of the problem. In other words, when he showed me 2 times 3, he drew three circles in two groups. Or sometimes he would use something like, Cheerios or little toys to show me the problem. You know, you have three toys and you give one away, stuff like that. I'll tell you something, I still do that on my paper if I am having a hard time with a problem. I will draw it out to help me understand it.

Jennifer also gave examples of her mathematical abilities and how she uses them outside of school. Jennifer is very passionate about music. She plays the cello, and makes the association between music and mathematics. She specifically states this hobby helped her learn about fractions.

> Thanks to playing the cello, I got a really good grasp of fractions. In music there are all kinds of notes, half, quarter, sixteenth, and in every measure they must add up to the music time. I learned to add fractions really fast! The best thing is I enjoyed it. I enjoyed playing the cello and I enjoyed counting the fractions.

Jennifer went on to explain that she had learned how many math concepts work outside of school and this had allowed her to hone her mathematical skills. By doing so, she had become aware of how to solve complex problems. She maintained, "Doing things that you wouldn't think are math-y, but really are, helps you figure out how math works." To prove her point she gave the example of working with her father on the car. "Now you wouldn't think that had anything to do with math, but it does," she stated, "You have to use wrenches that are fractions, and metric tools; you really have to be good. And, you have to do the stuff in your head, no pencil and paper there!"

Jennifer and Alice gave numerous examples of using their mathematical abilities outside of school and the skills becoming stronger. Both Alice and Jennifer expressed a cognitive awareness of their mathematical skills, their importance, and the skills being

utilized in complex ways. Jennifer specifically made the connection that this application allowed her to view complex, multi-step problems in a manageable way.

Both girls gave specific examples of their fathers pointing out math concepts and skills as they were being used. When asked to explain how this made them feel, Alice responded, "Really good. To be doing something and then realize, wow, I used math for that, it's really cool. It makes me think math is fun and easy, what I do at school should be a piece of cake."

The theme of success/self esteem emerged as a natural progression of these conversations. Jennifer and Alice had been made aware of mathematics in the world around them, and that it was not just a school subject. They had been successful with mathematics, both in and outside of school. When speaking of success, both girls provided examples of personal success. Alice, however, lowered her voice and spent a large amount of the discussion looking at the table. This was a change for her as she had normally kept eye contact with the researcher. When asked to explain why her demeanor changed, she explains, "I know I am good at math, and it makes me feel good about me. But, other kids give me a hard time about being smart. I like being smart, but I wish that everyone didn't have to know about it." This response directly supported her responses on the attitude scale as well as avoidance behavior that was observed in the classroom. In class, Alice would finish her work, but then remained looking busy so not to draw attention.

Alice and Jennifer gave examples of success, high scores on papers and tests, passing the TAKS test yearly, and "getting it" the first time the teacher explains a problem. Jennifer gave an example the researcher observed. On a day that the teacher

was absent she left a series of complex algebra problems for the students to complete. The type and amount of work was meant to keep the students busy and quiet for the class period. However, Jennifer completed the work prior to the end of class. When she was done, she looked at the researcher and made eye contact. She then smiled, raised her paper towards the researcher and mouthed the words, "I finished." Regarding this situation Jennifer stated, "Now that was success. The work was very hard, but I stuck with it and got it done. I made a good grade too! I love that feeling. It makes you proud to be you!"

Jessica and Alice stated numerous times that they felt good about themselves because of their success in the mathematics classroom. They felt smart and successful. Their success increased their self-efficacy and provided the fortitude to persist through difficult tasks. Alice and Jessica reported that they felt sorry for students who experience difficulties in mathematics. When asked how it would make them feel if they experienced difficulties Alice responded, "Not good. I don't think you can feel good about school or yourself for that matter, when you can't get math. It makes you feel dumb I think. I know it would make me feel that way. I wouldn't feel good about myself at all." Jessica reported similar feelings. She stated, "Gosh. I mean, I can't imagine that. I love math. If I didn't have that, I would hate it. It would really make me feel bad."

The final theme discussed was the student perceptions of parental beliefs. The students had very clear ideas about who did and didn't like math in their home and it was related to gender. Both students stated their father was more supportive of mathematics endeavors and took more of an interest in the student's mathematical abilities. The stories the children related to the researcher all involved their fathers, never the mother.

Jennifer stated, “My mom hates math. In fact, as I long as I get good grades, she doesn’t even talk to me about it. If I have a math problem, she will send me to my stepfather for help.” As she continued to explain, Jennifer stopped talking and had a look of shock on her face. The look actually startled the researcher. Jennifer stated, “Oh my gosh, I get it now. This is what you are looking at. My mom hates math and doesn’t help me because of that. So I go to my stepfather. This is how it all starts. This is how come people think boys are better at math than girls.” In her own terms, Jennifer discussed the math avoidance she sees in her mother and the subtle message that sends to her as a female. In the researcher’s eyes, it was an epiphany for Jennifer.

Alice, when discussing this subject, became more animated than usual. She was normally a quiet, shy, polite young lady. However, as we talked about this subject, she sat on the edge of her seat, used her hands to demonstrate as she talked, and her voice was louder than her normal tone. Initially, Alice displayed her normal disposition as she began discussing her mother’s lack of interest in her mathematical pursuits. She stated that her mother prefers reading and writing, so she doesn’t really pay attention to Alice’s mathematics. It should be noted that during the parent interview, the same sentiment was expressed to me by Alice’s mother. During her interview, Mrs. Holt stated, “Math is really his thing,” as she pointed to her husband.

When discussing future mathematical coursework, Alice became more assertive in making her position known. As she explained her thoughts, Alice moved to the edge of her chair and leaned towards the researcher. She motioned with her hands and spoke more loudly. She responded, “Of course I am going to take additional math courses.

You know, my mom doesn't really say anything about it, but my dad, he thinks I can." When the researcher commented on this being a positive aspect, Alice retorted,

> Yeah well he thinks I am 'special'. He thinks I have the gift of math. But you know what? He is one of those people that think boys are better than girls at math. I get so mad sometimes, because he says stuff about that. And what is worse is that if I ever do have trouble in math he will say it is because I am a girl. That's not right."

Despite the issues that Jennifer and Alice had to grapple with, both state they have intentions of continuing to take mathematics courses throughout high school and into college. Overall, they both stated they felt supported in mathematics and their parents want them to continue to take as much mathematics as possible. Alice discussed the importance of knowing math to get a good job. Jennifer talked about the need for math as society is becoming more advanced. Both students realize the significance of mathematics in their current and future life.

High Mathematics-Low Reading. The females in this quadrant reflected many of the qualities seen in the High Mathematics-High Reading participants. Although not expressed to the extent of the females in the High Mathematics-High Reading quadrant, these students had a keen awareness of their abilities and were also conscious of the skills they utilized. The primary difference between the two quadrants occurred in the area of self-esteem.

Shana and Kendra were able to discuss the things that made them successful in mathematics. When pressed, Kendra talked about her ability to multiply and divide numbers without using pencil and paper. She stated that this skill was important because, "When you are working on a big problem, a really hard one, that has a bunch of steps,

you have to be able to do some of the stuff, the steps, in your head fast." The researcher asked her to explain the reasoning behind her statement. She continued, "You have to be able to do them and get them out of your brain so you can focus on the hard stuff. If you are using your brain to do a simple multiplication problem, like 8 times 7, you can't get to the rest of the problem." Kendra put the thoughts of many mathematics teachers into words. Simply put, free up the mind for harder, more complex mathematics processes.

Shana also gave examples of mathematical abilities and how she used them outside of school. She gave the example of cooking. There are times that Shana began preparing the dinner meal because her mother had not returned home from work. She discussed using math skills to double a recipe in order to have enough to feed everyone. She reminded the researcher that you have to be able to add or subtract fractions to complete this type of task. Likewise, both girls speak of the value of possessing good mathematical skills.

The self-esteem/success theme is an area were the two High Mathematics quadrants varied. Although the girls in this quadrant have experienced success in mathematics, the feelings associated with experiencing difficulties in reading occasionally crept into the mathematical realm.

When discussing their success in mathematics both students cite grades, test scores, and the passing of the TAKS test. Kendra discussed how she felt good about herself and it gave her the confidence to keep trying. She stated, "It makes me feel good when I find out I passed a test and did really good on it. That shows that I am smart and I know my math." Shana expressed similar feelings but then added, "But it's not like that in reading. Reading is so hard. It bugs me sometimes, it make me feel kind of dumb."

When asked if that ever occurred in the math classroom she indicated no. Shana than added, "Well sometimes, when I am having trouble with a problem in math, I worry that I am going to get like I am in reading. You know, kind of having a hard time. I don't want that."

During parent interviews the mothers indicated that they expect their daughters to continue to excel in mathematics and continue taking mathematics courses. Mrs. Moore talked about the importance of mathematics in the medical field, and during the student interview, her daughter mentioned the same concept.

"You know I want to be a vet when I grow up," Shana stated, "I need to be really good at math because of working with medicines and stuff." Kendra spoke of mathematics as a tool to get the kind of job one wants. During the conversations with these students, it was amazing to the researcher how many times the words of the parents came out of the girls' mouths. The importance and desire to do well in mathematics and continue to take courses was very evident in this quadrant.

Low Mathematics-High Reading. Candy and Debbie responded differently when the researcher explored the questions with them individually. Initial responses altered when the researcher probed for deeper understanding. Candy was a child who displayed two faces during this study. When she was with other students she was sure of herself, talked of her sufficient mathematical capabilities, and how she had no problems whatsoever in her mathematics classes. However, during private interviews she allowed her true feelings to emerge.

Debbie, although a bit insecure, had a great deal more confidence in her mathematical capabilities. She described herself as a hard worker when it came to mathematics. She also stated she was getting help so she can get even better at math. Her self-esteem in mathematics was much higher than Candy's.

One of the biggest differences between the two girls in this quadrant was in their approach to addressing their previous problems with mathematics. Both students did not pass the mathematics section of the 2004 TAKS test. However, what they each did with that information was vastly different.

According to Candy, and verified through her grandparents, when she failed the test, Candy went to summer school. When asked what else she had done to improve her chances of passing the test this year, she had very broad answers. As the researcher pressed her for specifics, she stated she does her homework, studied at home, and paid attention in class. The actions Candy mentions are very generic and are the behaviors that anyone who wants to do well in a class should do. When questioned about the possibility of taking action, such as practicing basic math skills, to improve her abilities, Candy's response was, "Mmm, I don't think that will help. You have what it takes to do well in math or you don't."

However, Debbie's actions were very specific. Debbie reported that when she found out that she had failed the test last year she was very upset. She stated she felt dumb and angry. However, when she talked with her parents about it, they decided they would take specific actions in order to help Debbie succeed. They worked on problems over the summer and practiced basic skills. As a result, Debbie returned to school having experienced success in mathematics consistently throughout the summer and,

consequently, had a greater belief in her abilities. Debbie stated that throughout the year, she and her parents had continued to work on her math skills. She had done extra work, practiced mathematics facts, and got help from her parents when she experienced difficulty with homework.

The difference has resulted in Debbie developing strategies that help her solve problems, being aware of her skills and areas she needs to improve in, and developing a belief in herself and her abilities. Candy's belief of innate ability indicated that she accepts her poor mathematical performance as inevitable, and nothing can be done to improve it.

The beliefs of self improvement, held by Debbie, or innate ability, held by Candy, directly effect their belief in the opportunity for success and their self –esteem. Debbie talked about knowing that she could work problems even if they were initially difficult. She also addressed the idea that she could be successful as she had determined to improve her abilities. Candy believed mathematics skills were innate abilities. She stated she needs to try her best but there is really no way to make dramatic improvements.

The parents mirrored the diverse concepts represented by each child, and the students were keenly aware of them. Candy's grandparents felt that males are better at mathematics than females, and Candy reiterated that statement. Additionally, Candy stated her grandparents expect her to give her best effort and to try her best in mathematics. However, when Candy was asked about her plans for taking mathematics courses beyond the minimum requirements for graduation, she stated, "Oh I don't know. What is the point really?" As she explained her reasoning, phrases such as "boys do better at math" and "I don't know if I can do it" were heard.

Despite Mr. Fuentes expressing doubt about her pursuing higher mathematics courses, Debbie had left that door ajar. She stated that she wasn't sure and will just have to wait and see. She concluded by saying, "I know I should, but, I may need help to do well. If I get that help, I know I can make it. Look at what I did this year with a little help."

Low Mathematics-Low Reading. The interviews with these students were extremely productive. They provided insight as to the perceptions and reasoning behind the behavior, or lack thereof, in the mathematics classroom. The students were initially reluctant to share their views, but soon began expressing their thoughts when they realized that confidentiality was going to be maintained.

These students expressed very little belief in their abilities. Vivian especially is one who did not think she had the skills to compete and succeed in mathematics. She discussed her sincere attempts but that they end in her receiving poor grades or failing a test. She stated, "I try, I really do. I listen in class, but then when I get home, it is like I am looking at something I haven't seen before." She spoke of math as something she has to do and must put up with because she doesn't have a choice. Vivian spoke of her attempts and failures and expressed frustration and said she often "would like to just take everything, all the math, all the work, and shove it off my desk."

Valerie's response, although expressed in a different way, indicated the same disenchantment. When asked about her abilities in mathematics, Valerie stated that she was okay. As the researcher attempted to open this discussion up and talk about her feelings, her body language changed. She crossed her arms and slouched down in her

chair. When asked by the researcher if something was wrong, she leaned forward and replied, “Look, I really don’t care. It doesn’t matter if I care, it won’t change nothin’. I suck at math. I don’t want to talk about it anymore.” She then sat back crossed her arms again and turned away from the researcher. She made it clear, verbally and physically, that the conversation was over. The researcher began discussing the upcoming graduation in order to move away from the subject that made Valerie so defensive. She responded and began to talk with the researcher. However, whenever the subject of mathematics was broached, Valerie again physically withdrew and responded that she did not want to talk about it.

The self-esteem and lack of success went hand in hand for this quadrant. Both students lacked mathematical self-esteem because of experiencing only small success in math. This was evidenced through statements made in interviews, responses to the survey, and observations. Both girls engaged in math avoidance tactics. Valerie would often write notes during class. This is normal behavior for adolescent students, but Valerie would write long, time-consuming notes to her friends. She would then get up to get a drink of water or sharpen her pencil and passed the note to her friend. There was nothing subtle about her behavior; she did not want to engage in mathematics.

Vivian spoke of her inadequacies in mathematics and how it made her feel poorly about herself. She spoke of her frustration and feelings of inadequacies many times throughout the study. She exhibited nervous habits, such as biting her nails or chewing on her hair, often as soon as she sat down in math class. Self-esteem in mathematics was critically short for Vivian and Valerie.

Vivian and Valerie were aware of their parents' expectations, or lack of, when it came to continuing to take math classes when they are no longer mandatory. Vivian had already made the decision to discontinue math taking as soon as possible. Valerie spoke of her capabilities in very poor terms. These students and their parents do not hold great expectations for their child in the field of mathematics. The parents expressed the belief that mathematics is an innate ability and that males have a predisposition to perform better than females in mathematics. The ideas have been passed from parent to child as during interviews with the individual students, these ideas were expressed.

Summary of Student Participant Interview Data. Student interviews were one aspect of gathering data in this study. The students participated in seven to eight individual interviews. They were carried out throughout the five week study and were held on the school campus.

Several themes were explored during interviews with distinct responses from the various quadrants. The themes were self-esteem/success, abilities, and parent beliefs. Student responses were most often grouped by quadrant. The High Mathematics-High Reading quadrant participants had many similarities with each other as did the other quadrants. Personal experiences for the participants varied from positive to discouraging.

One of the clear findings through the interviews was that parent beliefs are clearly transmitted to the child. The ideas were conveyed, whether directly through conversation or indirectly through innuendos, to the student who comprehended the ideas of the parents. Additionally, students incorporated them into their mindset and responded according to those expectations.

A difference among the quadrants that emerged was that students in the High Mathematics quadrants had an awareness of their skills and what they utilized in mathematics. Additionally, they were aware of their weaknesses in order to build that skill. With the exception of Debbie, the Low Mathematics quadrants spoke of their abilities in broad general terms, such as being able to add or subtract, but did not express an awareness of skills needed to excel in their current mathematics course or specific weaknesses they themselves had. The gathered data supported findings obtained from the Fennema-Sherman Scales, classroom observations, focus groups, and parental interviews. The student interview provided a significant amount of information which added to the depth of this study and provided a vital aspect to the triangulation of data.

Focus Group Interviews

Focus groups were seen twice during the study. The initial focus group was held midway through the study, during the third week, to allow for discussion of emerging themes. Additionally, it provided an opportunity for the student to interact and exchange ideas as the researcher observed the dynamics and recorded the conversation. The researcher audio and videotaped the focus group in order to scrutinize body language, observe nonverbal cues, and investigate the verbal interchange. The audiotape was transcribed and then evaluated for themes.

This focus group allowed the girls to come together and discuss ideas that had developed throughout the interviewing and classroom observation processes. The first focus group was conducted over a 45-minute class period. Students were brought together during their first period, a non-academic class, for the focus group. The time

was selected to comply with the principal's request to attempt to avoid interference with their academic courses. The focus group was held in the school cafeteria during the first period of the day. Thus, the group was not disturbed as the cafeteria was not in use at this time for any school function. It had already been cleaned after the breakfast meal so there were not any adults in proximity of the group as well. The researcher explained the guidelines for participating. Since the researcher wanted this focus group to be more casual and consist of a dialogue between the girls, there were two guidelines. The girls were informed that the guidelines were: all conversation was to involve mathematics, and only one person talking at a time so that everyone had a chance and all can be heard. The girls agreed to these guidelines. The focus groups were designed to be conversational and informal in order for participants to discuss their feelings. As a result, conversation varied from directly discussing mathematics to other subjects that indirectly affected mathematics. The researcher allowed for the conversation to wander to topics not directly involving mathematics to explore themes that evolved during individual interviews. The students were again reminded that confidentiality and anonymity would be guaranteed. After the data was gathered and transcribed, it was examined to find themes that emerged.

Mid-Study Interview. The first focus group occurred during the third week of the study. All student participants were present and participated. The girls were excited about being together and getting a chance to talk. All the participants knew each other and the rapport was relaxed and enthusiastic. As the researcher explained the purpose of all the girls being together and the focus group, the girls began talking amongst

themselves. The researcher reminded the students of the guidelines and they quieted so the focus group could begin.

Four themes emerged from the focus group. They were: public perception, relationships among peers, learning styles, and parental support. The concepts were discussed in overarching terms, with specifics being brought to light by individual students.

Jennifer was the initial person who broached the subject of stereotypes, in particular, the idea that males are better than females at math. When the researcher posed this as a question inquiring if males are in fact better at math than females, the response was a loud "No!" The students were offended by this idea and displayed it physically as well as verbally. When the question was being posed, many girls shook their heads in a negative response or verbally said, "No!" Three girls rolled their eyes, and one young lady put her hands on her hips and said, "I can't believe you actually said that!"

That response came from one of the most reserved girls in the study. The researcher reminded the group that the statement was not the researcher's personal belief, but that it was a restatement Jennifer's observation. Alice immediately jumped into the conversation and responded,

> You know, that is so dumb. Sure some boys are good at math, just like some girls are good at math. Some boys are bad at math just like some girls are bad at math. That idea is just ridiculous. I can't believe how many people still believe that. It is a lot of people, and its people who should know better too!

Kendra added, "You know what is dumb too? People pretend that they don't think that, but then they act like it is true." Candy added, "Yeah, people like teachers, your friends, or your parents."

The girls then began talking in pairs or trios about specific instances where they had experienced an encounter with someone of the purported mindset. In listening to them talk to each other, everyone had had a negative experience with a person who held the belief that males were better at mathematics than females. However, the situations that were most offensive to the students, involved parents. Alice spoke with indignation about her father's beliefs that boys are better, to some extent, than girls at mathematics. She stated, "I do all sorts of math things on my own, figuring things out, but does he take that into account. No! He just thinks I am different; that I got the math bug or something like that." During her statement she postured and had large arm movements. She was very expressive on this topic, and for her, that much animation was rare. It was obvious, that she felt strongly about this topic. Alice brought up examples of things she had done that exhibit her mathematical abilities, but maintained it was not as valued by her father. The other girls nodded their head as Alice spoke and appeared to support her position.

After the initial reaction, the researcher noticed Vivian and Valerie hadn't added to the topic. They nodded their head in affirmation, but had not been making statements contrary to the idea that males outperform females in mathematics. When asked what she thought, very timidly Vivian asked if perhaps that concept could be correct. Jennifer, Alice, and Kendra all began speaking at once to explain why that idea was not correct. Vivian nodded her head in affirmation of what was being said, and quickly exchanged glances with Valerie. Neither of them addressed the group on this subject openly. The conversation continued with participants giving examples of their encounters with people who held the given belief.

Shana, who had been relatively quiet up to this time stated, “Yeah, but when you look out in the real world, guys are in more of the math type jobs. Like architects, doctors, and the teachers that teach the hard math are guys. Is that why everyone thinks boys are better at math than girls?”

The question posed by Shana caused everyone to pause and consider the statement. It was totally quiet as the girls contemplated the idea. At this point, the researcher suggested the students think about it and we would discuss it during the next focus group.

The next theme brought up was the different styles of learning. Alice stated,

> Math classes are hard sometimes for girls because we like to talk things out. Boys just work the problems and don’t care. We don’t get to work together very often; sometimes in Mrs. Smith’s room. I know it helps me to understand better and also helps those who don’t understand it too. Boys just learn differently, they aren’t smarter. People think they are smarter because they fit into the classroom better. Teachers like you to work by yourself and boys do that really well.

Jennifer added, “For me, working together helps both partners understand better. We need to not compete against each other so much and work together.” Debbie added that it was easier to ask your partner when you don’t understand, than the teacher in front of the whole class. She stated asking the teacher is intimidating. Shana also supported the line of thinking by adding, “Partners just make sense. You have more brains thinkin’ on the same problem.”

The next theme introduced involved gender relationships. During individual interviews, several girls introduced the idea that females can’t be smarter than the males otherwise the males won’t like you. The researcher introduced the theory to the focus group. Valerie immediately chimed in, “Mm, mm! That is true. You need to not let boys know how smart you are or, you know, you can’t get a boyfriend.” Vivian, Candy,

and Kendra all were nodding their head in a positive affirmation of Valerie's statement. Shana had her hand over mouth and was giggling with embarrassment. The researcher asked her why she was laughing and she replied, "Because it is true. I don't like boys, not yet, but I know it's true, girls do it now." The students then began talking with each other again naming specific students in their classes who act in this manner. Jennifer stated, "You can be a little bit smarter than the boys, but not a lot. They don't like it when you are a lot smarter than them."

The researcher asked the group why this concept was so important. Alice immediately jumped in and added, "Yeah, if a boy really likes you he shouldn't care if you are smarter than he is, right? I am not interested in boys now, but when I am he better not act like that!"

The group was silent for a moment, and then the response to Alice's statement grew rapidly. Candy added, "Yeah me too, I'm not acting like that." Numerous other students chimed in likewise. The researcher observed a surge in the girls' confidence as every student responded that they would not act dumber than boys for the sake of a relationship. Earlier during the conversation, the students named several female peers who acted dumber than the boys in order to impress the young men. The researcher decided to question if any of the participants have ever acted in such a manner. An emphatic "No!" was received. All the participants were adamant that they did not nor had they ever, acted in such a manner. The researcher asked again, and the girls remained firm in their response. However, the researcher wondered if some of the students actually participated in this behavior in a subtle manner, and either did not

realize it, or if they perhaps did not want to admit it since the group determined it is adverse behavior. This is a behavior that was noted during classroom observations.

The final theme revolved around parental beliefs. The group explored two aspects of belief: the parents' perceptions of the student's abilities and the affect of those beliefs on performance in the current mathematics classroom as well as the pursuit of higher mathematics. On this subject a very clear division among the participants was observed. The students who had positive experiences and positive parental input were eager to discuss this topic. This subject took some time to develop into a discussion, as the students who felt their parents did not view their mathematical abilities in a positive manner were hesitant to talk. To aid in fostering a dialogue on the subject, the researcher explained that this was an opportunity for individuals to discuss their situations with others who may have similar circumstances. It was an opportunity for support and explorations of ideas. The participants then began to share their experiences.

The data primarily varied among the High Mathematics quadrants and the Low Mathematics quadrants. The split in responses was very clear and Candy as well as Kendra mentioned the division in their responses. The High Mathematics quadrant had much more positive discussions. Alice, Jennifer, Kendra, and Shana all discussed how their parents praise them for their abilities in math. Kendra stated, "My mom and dad are always telling me how good I am in math. It makes me feel good. I remember that and I know I can do the work when it is hard." Shana expressed a similar point of view, "Me too. My mom tells me I can do the hard math problems. She tells me I have to be good at math if I want to be a veterinarian so I have to keep working. She knows too, because

she is a nurse." The girls in the High Math quadrants had many stories to share that expressed positive parental perceptions of their capabilities.

Conversely, the four girls in the Low Math quadrants did not have evidence of positive parental perceptions. Initially, the girls all indicated that their parents' perceptions were positive. However, when they heard examples from the High Math quadrant girls, they became quiet and did not volunteer their own positive perception examples. The girls in the Low Math quadrants would make eye contact with others in their quadrants, but then avoided eye contact with the other students. The body language also became closed as they crossed their arms across their body, and two girls turned partially away from the group. The researcher then asked if the students had other experiences regarding their parents' that, perhaps, weren't as positive in mathematics. Students were quiet and the researcher waited for a response. Timidly, Debbie offered her insight, regarding her father. "My father keeps encouraging me. He won't let me get down when I don't understand. Sometimes he gets on to me, but it's his way of trying to get me to do better, to feel better about math."

Vivian stated, "My mom makes me feel better too. She tells me just to do my best. She says that math was hard for her and that I am just like her." After pausing, Vivian adds in a quiet voice, "She said that not everyone is as good at math as others." The group was quiet as they contemplated what had been said. Several girls avoided eye contact with each other and the researcher as well. After a few minutes Debbie addressed Vivian directly. She stated, "I don't think that it is 'cause we are like somebody. We are, like, ourselves, and that just means we have to try harder and work harder. The hard work will pay off. You have to practice, and learn, then somehow, you get it." Vivian

shrugged her shoulders and flatly stated, “I don’t think I can.” After this exchange, the group became very still and considered what had been said. They began fidgeting and stretching, as they became uncomfortable with the silence.

Jennifer stood up and moved to the middle of the circle. She smiled broadly and said to everyone, “C’mon, we are girls and we are just as smart as boys, right? Right?” The girls caught her enthusiasm and raising their fists in the air yelled, “Yeah!” The researcher had to temper the excitement as we were in school and classes were being conducted. The researcher reminded them that classes were being taught so voices needed to be kept lower. Jennifer turned and mouthed “Sorry” to the researcher. The researcher closed the focus group by asking if anyone wanted to say anything else. The girls either shook their head no or stated “No”. The researcher closed the focus group by reminding the students to think about the topics we discussed and informing them that we would discuss them in the personal interviews or during the final focus group. The students were then dismissed to return to their classroom.

As they were leaving, Diana approached the researcher and stated, “Thank you for talking with us. I am going to keep telling myself that I am just as smart as the boys. Sometimes you know something, but you need to hear it again. I know I can do this!” She hugged the researcher and then hurried off to her class. Diana’s response gave the researcher much to think about. It made the researcher curious if this had been a “good” year for her in mathematics. Perhaps involvement in the study validated her as a mathematician. Not simply because she was included, but because she was able to discuss her concerns with peers in a safe environment and receive affirmation from them as well.

The focus group was an interesting dynamic as it vacillated from a very vocal "girl power" support group to an opportunity to consider statements made by peers and reflect on personal beliefs. A risk-free environment was established and the girls felt comfortable sharing personal perspectives. This was evidenced by the conversations and personal reflection that took place among the participants. As the students were leaving the cafeteria and returning to the classroom, the researcher overheard participants discussing what was presented in the focus group. It appeared to get them thinking about some of the complexities surrounding gender and mathematics.

End of Study Interview. The final focus group was conducted during the final week of the study as the final data gathering and to bring closure to the study for the student participants. Due to scheduling conflicts with the sixth grade obligations, the focus group was held during an academic period and was, therefore, a shorter meeting time. This was approved by the principal as students had numerous activities scheduled throughout the week. The focus group met for 20 minutes in a cramped, musty bookroom. The original room that was to be used for the meeting was being used by a school district occupational therapist and students, and all other conference rooms and offices were in use or otherwise unavailable. As a result, the researcher was directed to the bookroom to hold the meeting. It was not conducive to any type of meeting; however, it was unknown when a meeting room would be available and nothing was open for several days. Therefore, the researcher decided to make the best of the situation and conduct the focus group in the given room. Due to the setting, it was not possible to

videotape the session. The camera could not be placed in a position were all girls could be seen, so an audio tape was the data collection method utilized during the focus group.

Although the bookroom was small, the girls were able to sit on the floor in an oval shape. The researcher sat in a chair but was part of the oval. The participants grumbled about being in the bookroom and it being a cramped space. The researcher ignored the comments, and after the initial few minutes of establishing personal space, settling in, and getting comfortable, the students appeared ready to begin the discussion. They stopped the conversation and waited for the researcher to provide instructions. The researcher reminded the students of the participation rules that were outlined from the previous focus group. The students indicated that they understood and agreed to abide by the two rules. The researcher informed the girls that this was the final opportunity to meet and discuss their ideas as this was the final meeting of the study. Many of the girls expressed disappointment with the study being concluded, and a few asked if the researcher would still be around and come to visit them. Debbie invited the researcher to the sixth grade graduation and Jennifer, Alice, Shana, and Vivian all began encouraging the researcher to come to the graduation. The researcher felt honored by the invitation because it was unsolicited and genuine. However, to remain focused on the study and to complete the group meeting, the researcher informed the students that we would discuss the graduation at a later time. The researcher explained that the focus group needed to discuss the final ideas and conclude prior to discussing graduation. The students seemed to agree and quieted down to begin the study.

From the previous focus group, the students were left contemplating the notion of people believing that males are better than females in mathematics. It was a difficult and

complex question and the students were given time to ponder. Valerie offered an immediate, “People believe that ‘cause they’re stupid.” Girls laughed at the statement and the researcher chose not to respond to the statement. Several students offered ideas involving ignorance. Candy stated, “Because they don’t know better.” Kendra suggested that maybe the individuals that believed this notion didn’t know a smart girl.

Vivian stated, “I think that people get something in their head and it just sticks. You know what I mean? It might not be true, but they think it is. Maybe to them it is true.”

Shana added, “What she said is true. Like my grandpa. He says that girls aren’t as good at math as boys. But he sees me and knows I can do it, but he doesn’t believe it. He just thinks that I am weird. Girls are not supposed to do well in math.”

After Shana finished her thought, group members turned to each other and nodded while whispering to each other. This response seemed to satisfy the group because no one else added different thoughts.

The researcher asked if someone in the group had a different idea about why some people think that boys are better than girls at math. No one responded so the researcher asked someone to summarize what the group had agreed was reasoning behind this concept.

Alice immediately spoke up. She responded,

> Well, I think people have different reasons to think that. Maybe they don’t know a smart girl; maybe they just think less of girls. We hear in the news and everything that girls are just as smart as boys and all, but what it comes down to is people still don’t believe it. They stereotype girls. And the bad part is that even when you prove them wrong, they don’t think their idea is wrong; they just think you are weird. You are different. It is like you can’t win. You are still a girl, and girls aren’t supposed to be good at math.

Alice's insight was extremely mature and seemed to cut to the heart of the situation. The other group members said things like "She's right" and "Yeah". Others nodded their head in affirmation. Everyone gave some type of verbal or physical indication of agreement with the statement.

It was coming to the end of the meeting time and the researcher wanted to provide closure to the study. The researcher asked the students to state some of the ideas that they had developed during our time together. Students started responding randomly such as "girls are just as good as boys at math," "we need to work at math to get better at it," "our parents want us to do well," and "we all learn differently."

The researcher thanked the students for participating in the study and dismissed the students to return to their class. All the participants came to the researcher to say "goodbye" or "thanks" individually before returning to their class. Jennifer, Alice, Debbie, Shana, and Vivian all gave the researcher hugs and reminded the researcher to come back and visit them.

Analysis and Summary of Focus Group Interviews. The focus group meeting allowed students to discuss math and gender issues as a whole, allowing for development of ideas and further investigation into emerging themes. The group was empowering for the girls, as they realized their struggles and insecurities were not unique. The group was especially beneficial to the girls in the lower quadrants as they saw even the "smart" girls had concerns regarding mathematics.

The ideas that were developed dealt with commonly held misconceptions about females and mathematics, different learning styles, and parent beliefs about their daughter's capabilities. Additionally, students discussed the pressure to balance academics and being smart with not appearing to be "too smart" in the company of their male peers.

All the student participants supported the existence of the final theme. It was something that all agreed existed and were aware of as well. The pressure of trying to do their best in academics, yet not appear to be "smart" was discussed at length. Perhaps by bringing it to the forefront, it can be addressed and not merely swept under the carpet.

Students participated equally in the focus groups. The researcher was cognizant of individual participation and participation was fairly equal among participants. However, during conversations about specific subjects, as mentioned previously, specific students did speak more frequently than others. It was interest to note that this occurred when discussing males outperforming females in mathematics. The students in the Low Mathematics-Low Reading quadrant were not participating as much in the conversation contrary to this thought. During private interviews, the students in the Low Mathematics-Low Reading quadrant indicated the belief in male superiority in mathematics. This contradicted the position expressed during focus groups, and may be the reason they did not participate as frequently in that aspect of the discussion.

A similar reaction was observed in the Low Mathematics quadrants when discussing positive parental perceptions. After initially stating their parents provided positive support, they declined to provide evidence upon hearing other participants' examples. The Low Mathematics students offered examples of how their parents support

their efforts and provided data regarding their view of parental perceptions. Overall, students participated in the focus group equally. It must be noted, however, that when a subject that was uncomfortable was discussed, the Low Mathematics participants were more reluctant to add their voice to the subject matter.

Finally, the focus groups had an unanticipated effect on the students. The girls in this study developed camaraderie. Although they all knew each other, many were merely acquaintances. However, the involvement in this study made them aware that everyone had struggles, even the smart girls. Additionally, it allowed the students to see each other as having the same struggles and experiences. It pleased the researcher to see the girls leaving the meeting talking about the ideas expressed during the focus group. The group walking down the hall consisted of unique individuals who found many similarities with each other in their navigation of the mathematics classroom.

Interviews with Parents of Student Participants

Data Collection Process. Interviews with parents of the student participants occurred during the third and fifth week of the study. One set of parents requested to meet at the school to complete the interviews. Interviews for six of the remaining parents were completed in their home. One parent requested a telephone interview as she desired to protect the identity of a foster child in the home. With each parent set, the researcher conducted two interviews that were approximately 20 minutes long. There were two families who, because of their obligations elsewhere, asked for the interview to be compressed into one interview. They were willing for the interview to be twice as long if

they could get the interviewing done in one appointment. In order to accommodate them, the researcher interviewed the two families in one appointment per family.

Parents were informed that the interviews were being taped and consented to the process. Consent forms had been obtained prior to the inception of the study. Parents were reminded, at the beginning of every interview, the information was confidential and agreed to the interview and it being recorded. After each interview, the data was transcribed following the same procedures utilized when the students were interviewed. The data provided another aspect in the triangulation of data.

Six of the student participants reside with two parents or guardians in the household. The remaining two, live in single parent households with the mother as the head of the household. For the interviews with the two parent households, the researcher requested that both parents or guardians be present and participate in the interviews. This occurred with four of the two parent households. Only the mother was interviewed in the two remaining households. In the two situations where only one parent was present for the interview, it was the mother who participated in the interview process. Following the interviews, the recordings were transcribed for analysis. Pseudonyms were used to allow for anonymity and confidentiality.

Questions were asked in a semi-standardized format. Additional questions were asked for further exploration of responses and clarification. These questions followed the nature of the interview and additional ideas were explored. A copy of the parent questions are included in Appendix A.

Data Analysis Process. The examination of the parent interviews was the final step of data analysis. Interview responses were grouped and examined by the assigned quadrants and then an overall composite analysis was examined. After the data was transcribed, the information was scrutinized to determine the themes that had emerged. The researcher looked for language that reflected parental perceptions regarding the mathematical capabilities, success, and future success of their daughter. Data that provided insight into the specific research questions was also examined. Through the interviews, examples of the themes and supporting data were obtained.

High Mathematics-High Reading. Alice's and Jennifer's parents were eager to participate in the study. Each parent actively participated and was interested in the overall findings from the interviews and observations. Jennifer's parents were interviewed in their home while Alice's parents were interviewed in a private conference room at the elementary school. Both sets of parents have some level of collegiate education and are white collar workers.

Jennifer's mother greeted the researcher with a friendly smile and eager handshake. She escorted the researcher into the formal living room of her immaculate home. Mrs. Andrews was eager to participate in the study, and sat on the edge of the sofa leaning forward talking with the researcher. Shortly after this, Mr. Andrews came home from work. As he walked in, his wife reminded him of the appointment, and he introduced himself to the researcher. He excused himself for a minute, and returned a few minutes later ready to begin the interview. The parents had welcomed the researcher

into their home without reservations and both were poised on the edge of their seats ready to begin the interview.

Jennifer's parents described her as gentle, compassionate, and intelligent. The mother talked a great deal about how kindhearted Jennifer is. She talked about how her daughter is always concerned about other people and is a champion of the underdog. It was apparent that this characteristic was important to mother and she was pleased to see it exhibited in Jennifer. Her stepfather talked about Jennifer being witty and smart. He focused on her ability to do well in academics and her determination to excel in school. The parents often added to each other's statements and had many complementary things to say about Jennifer. It was interesting to note that the mother focused on the people skills and emotional aspects of her daughter, while the stepfather primarily focused on Jennifer's intelligence and analytical skills.

Alice's parents arrived promptly for the interview at the school. The interview was conducted in a small private office off the main school office. It was compact but not uncomfortable. There was a small fan blowing to cool room, so a quiet hum was constant throughout the interview. We sat at a table with Mrs. Holt and the researcher on the corner facing each other. Mr. Holt sat further away from the researcher on the other side of his wife. Mrs. Holt was very friendly and open to the researcher as she carried on pleasantries prior to the beginning of the interview. Mr. Holt had a different demeanor. His behavior displayed a slight hesitation to engage in conversation. When he sat down, he leaned back in his chair and crossed his arms over his chest. The researcher observed him watching her intently as Mrs. Holt conversed. The researcher reminded the parents of the purpose of the study and reiterated that the findings were an attempt to begin to

answer questions regarding early adolescent female actions in the mathematics classroom. Mrs. Holt asked if the researcher thought it was the parents' fault that some girls don't do well in mathematics. The researcher responded that it was a complex issue and many factors influence females mathematical performance. This study is merely one piece of the puzzle. After this statement, Mr. Holt nodded his head and his demeanor changed. He uncrossed his arms, sat upward, and began to show an interest in the interview.

Alice's parents described her as quiet and extremely responsible. Her mother talked about Alice's passion for music. They also referred to Alice as extremely smart, very thoughtful and reflective. When asked what one word would be used to describe Alice, they both agreed on analytical. They gave numerous examples of how throughout her life, she has had the desire to figure out how things work.

The first theme that emerged and was very predominant revolved around the abilities exhibited by the females in this quadrant. The parents of both girls spoke about several specific qualities exhibited by their child which aid in their success in mathematics.

Numerous times during the interview Mr. and Mrs. Holt said that Alice is different than the rest of their children. When asked to elaborate the mother responded, "She is much more thoughtful. She likes to figure things out. Since she was little, she would take things apart to see how they work." Alice's father continued, "In fourth grade she wrote a report and did a PowerPoint presentation on how to change a piston on an engine. She is always trying to analyze things. I really think she has an analytical mind and it helps her, especially in mathematics." The parents continued to give examples of

how she took toys apart, worked on car engines, and rigged her television so that by pulling a string she could change channels without getting off her bed.

A similar idea was mentioned by Jennifer's mother and stepfather. Her stepfather stated,

> Jennifer is one who wants to figure things out for herself. She looks at problems or situations, and decides the best way to approach it; and that goes for homework and socially as well. For example, in math when she has homework and I'll ask if she needs any help, she will tell me, 'No. Let me do this by myself.' She studies the problem and works it until she has it right and is satisfied with the results. If she needs help, she watches what you do, absorbs it, and then accomplishes the task for herself.

Both sets of parents spoke of this trait, analysis, in a positive manner. They found it desirable and expressed pleasure to have their daughters exhibit an interest and desire to analyze and solve problems. Both Alice's and Jennifer's parents spent a great deal of time discussing their child's ability to analyze as well as the numerous benefits of this skill. Jennifer's mother, Mrs. Andrews, spoke of how this skill can be transferred and applied to any situation. She stated,

> Jen is always wanting to learn things for herself. She really wants to figure things out. You know what I mean? Like when our computer was broken and someone came over to fix it, she was right there looking over his shoulder, watching everything he was doing. Afterwards, Jen was talking about learning to do that so she could take care of fixing our computer. Since then, she has been looking on the internet and trying to find out more about computers. It's like a fire has been lit under her. A challenge and figuring things out for herself does that to her.

Jennifer's stepfather added,

> I am amazed when I watch Jennifer. She is so bound and determined not to be beaten, by anything. If she has a really hard problem, she works and works and solves the problem. If there is a problem that she needs help with, I help her. But my help consists of talking her through the solving of the problem. She then is off and running on her own. She doesn't want help. She wants to figure things out on her own, to work the problems on her own.

It was interesting to the researcher that in Jennifer's situation, the stepfather spoke about her abilities academically while her mother spoke of her social abilities. When pressed, the mother would talk about Jennifer's academics, but was much more comfortable talking about her social skills. Alice's parents shared the discussion equally with the father taking the lead in answering most questions. The mother would then support his statement with additional elaboration or specific examples. They agreed on almost every topic. As one of Alice's parents would be talking, the other parent would nod his or her head in affirmation.

The parents spoke of other abilities which help their daughters succeed in math. They discussed mastery of basic skills such as multiplication and division, enjoyment of the subject, perseverance, and assertiveness. The parents were cognizant that it is a multitude of skills that aid in a student being successful in mathematics and indirectly addressed this fact as they spoke of the numerous skills their daughters' possessed.

Regarding perseverance, Alice's father said, "This ability will only be beneficial to her in the future. Math is only going to get harder and she has to have the drive to stick with it. Alice definitely does."

Mrs. Holt added, "She is one that we will not have to worry about. She will excel at whatever she puts her mind to because she has that ability. She loves math because it challenges her and allows her to exercise her mind. The harder the work the better as far as she is concerned."

The next theme that emerged was success and expectations. These two concepts were merged into one theme since parents tied these two values together during interviews. The parents held high expectations for their daughters' performance in

mathematics as well as placing great value on attaining the most math skills possible. Both sets of parents stated their daughter can and will succeed at all levels of mathematics. That expectation of success was very clear after talking with Mr. Holt. He stated," She [Alice] will most definitely do well in mathematics. I don't know how far she'll go, maybe Calculus, but she will do well. She has the skills to succeed. I mean, Calculus is hard, but Alice has what is takes to do well." Her mother added,

> She can do anything she sets her mind to. I think, that at least in part, we have something to do with that. We expect a lot out of her. Not in a bad way, I mean, we have very clear and high expectations for her, for all our girls. She knows we expect her best and she gives it. Establishing clear expectations is very important. As an educator, I must set high expectations for my students, and so much more for my own children.

This stance was reiterated when during an interview with Jennifer's parents. I specifically addressed the concept of expectations to the mother because she had spoken about Jennifer socially but not academically. Her mother replied,

> Oh we expect great things from her. She always performs well in school. In fact, she got her first "B" this year in Science and it crushed her. I think she will continue to do well because we stress the importance of school to her. She knows, because we talk about it a lot, that in today's world you can't do well without a good education. Especially math and science, those are two subjects you have to really do well in. I would be surprised if she *didn't* do well; she has always succeeded in math and science.

When each set of parents were speaking of their expectations for their daughters, they were emphatic and wanted to make it clear to the researcher that they, and their child, understood the importance of establishing clear expectations for their child. During the conversation with Jennifer's mom, she moved closer to the researcher and leaned forward. She reached out and touched the researcher's arm to make her point. This was the only time she made physical contact with the researcher. Alice's parents,

although less animated, were no less passionate in relating their position to the researcher.

The next theme that developed was the value placed on mathematics. Jennifer's mother spoke repeatedly about how in her job within an architecture firm, math is critical when reading plans, bidding on jobs, and overall tasks. Her stepfather spoke about how mathematics is important in his position with an engineering company. Both parents gave examples of how they discuss the value of mathematics with their daughter. They talked about the importance of having as many mathematical skills as possible. Additionally her stepfather spoke in depth about math being an asset to a person. Mr. Andrews stated,

> Jennifer knows how important mathematics is. She hears us all the time talking about, or even conducting business. We talk about how important math is. You asked earlier about the value of mathematics, well, it is extremely valuable. Not just for paying bills or balancing your check book, but it's [math] all around us. When you look at buildings, math is involved, when you design a bridge, medicine, driving, math is everywhere.

Alice's father talked about how he utilizes math in his position at a local community college. Her mother, who is a professor of music, explained how math is in music. She spoke of the connection between mathematics and music as well as how Einstein was an accomplished musician. Mrs. Holt gave examples of other mathematicians who were musically inclined as well. She states,

> As I said before, Alice knows how important math is. She knows that you need to have a good education to get a good job and be successful in life. Nowadays, if you want to be competitive, you need a strong math background, and really science as well. If you want a well paying job, you need more than basic math. Our society has become so technological and advanced; you need to take more intense math and science classes.

When the question was posed about differences between males and females in mathematical ability, the reactions were mixed. Jennifer's parents used words such a "ridiculous" and "preposterous". They expressed indignation as we discussed Dr. Summers', President of Harvard University, statement from earlier this year. Mrs. Andrews, Jennifer's mother, states, "Girls are just as smart as boys at mathematics and science. I think we need to make sure they know that, they need to really know it is okay to be as smart as boys. Boys don't have an at-birth advantage."

This was the topic that divided the position held by Alice's parents. Her father spoke first strongly defending Dr. Summers. He stated,

> I think he was unfairly vilified for saying something we all know. Boys have something inherently that helps them do better in math. . I don't think it is all innate. There is the nature versus nurture debate, but boys do better and take more math. Now, I know that you probably don't agree with me, but I know I have seen it repeatedly; surely you have as well.

His wife, however, did not agree with him. Up until this time, while he spoke she nodded her head in agreement and then provided additional statements supporting his position. However, when he stated his position, she immediately stopped nodding and stared at the table in front of her. During his statements, she never made eye contact with the researcher or her husband. When he finished stating his position, she shrugged her shoulder as she replied, "Well, I don't necessarily agree with that. I think that the difference is that boys and girls learn differently. We need to make sure that teachers reach all the students and not lose them along the way. When kids aren't enjoying it or aren't being successful, we lose them."

High Mathematics-Low Reading. The researcher obtained mixed participation from Kendra and Shana parents. Kendra's mother, Mrs. Brown, agreed only to a telephone interview as to protect the identity of a foster child in the home. Additionally, only the mother was interviewed. She stated her husband did not want to be interviewed because he worked all the time. Shana came from a single parent home, hence only her mother was interviewed. The interviews took place in her home.

The researcher met Mrs. Moore at her apartment for the interview. The apartment was a small and well kept with many photos of the children. As we sat in the living room, it became obvious that Mrs. Moore had just woken up. She had worked a 12 hour shift the night before and had only gotten a few hours of sleep before the interview. Mrs. Moore was very polite, but reserved with the researcher. As we talked prior to the interview, Mrs. Moore became more relaxed and apologized for being groggy when the researcher had arrived at the home. We discussed the purpose of the study and how the researcher's interest in the study developed. Mrs. Moore sat next to the researcher on a small sofa in the living room and the interview was conducted at that time.

When I interviewed both parents, the reaction was very different than the High Mathematics-High Reading parents. The parental initial responses were cautious and almost suspicious of the researcher. It appeared that the parents wanted to make sure to say the 'right" thing, what the researcher wanted to hear, but weren't sure what that was. Kendra's mother asked several times, "Now what are you looking for exactly?" During the initial discussion, Shana's mother was careful to answer and exhibited cautiousness. She would think for a long time in order to form her answer, and then watch the researcher closely for a reaction to her statements.

In order to alleviate the concern exhibited by the parents, before beginning the formal interview, I attempted to build a stronger rapport with each mother. Shana's mother and the researcher talked about Mrs. Moore's family, her job, and the difficulty of being a single parent. This allowed her to see the researcher in a more genuine manner as opposed to merely one gathering data. After our discussions of the broad subjects, the researcher observed a relaxation in her body language. She smiled more often, laughed, became animated as she responded, and openly answered questions. She moved in closer proximity to the researcher and kept eye contact during her responses. There was a visible change in her physical and verbal responses after the initial interaction.

In order to assuage the reservations held by Kendra's mother, the researcher discussed the nature of the study and it was explained that there was not a predetermined outcome. The researcher explained how the study was developed and of a personal interest in the subject. The researcher felt that uncertainty was still heard in the mother's voice and posed a question regarding her hesitation. The mother responded that she was concerned that parents were going to be blamed for the child's inabilities to do well in school. The researcher explained that what was being examined is why early adolescent girls experience a drop in their mathematical self-efficacy. This study was a piece of work in an attempt to understand this complex matter. The researcher added that there were no preconceived ideas regarding the conclusion; it was a matter of finding a piece to the complex puzzle. The researcher spoke specifically about previously being a math teacher and general observations of female students in the classroom from past years. When the researcher began discussing observations in broad statements, Kendra's mother began to sound more at ease. She replied, "Okay, I get it now. This will be really good

information that can help all girls, won't it?" The researcher affirmed this statement and reminded the parent that anonymity is guaranteed for all persons involved in the study. Mrs. Brown then stated she was ready for the interview to begin.

Mrs. Moore, Shana's mother, described Shana as "quiet" and "the typical oldest child". She elaborated by saying that Shana is very serious and responsible. Mrs. Moore talked fondly of her child and admitted concern over Shana's quietness. She expressed concern that her daughter will not be able to assert herself as she matures. Regarding school, Mrs. Moore stated that Shana does well in school but struggles with reading. Overall, she states that Shana is a good child who works hard, helps her mother, and is a loving child.

Kendra's mother described her daughter as "a good child" and "kind". Mrs. Brown stated that Kendra has a rebellious streak and it sometimes showed itself. She added that Kendra is "just a regular sixth grader." She concluded with the remark that she thought Kendra was smart, but sometimes just had "blocks" and didn't do well on tests.

The first theme discussed was abilities of their daughters. Both parents stated that they felt that their daughter had the ability to do well in mathematics. As Kendra's mother stated, "Well, I think she has the ability to do well in math. Look at her grades, they are great in math. Look at her [TAKS] test scores, she always passes." Shana's mother made a similar statement. She said, "Shana has always done well in math. She likes it and works hard to do good work. Her grades show she has the ability." She then compared her math and reading abilities. Mrs. Moore questioned,

> Do you know why she doesn't do as well in reading? I thought girls were supposed to be good at reading and writing and boys good at math? She tries but

> has a hard time with reading and it frustrates her. It's funny, I always tell her to do well and try hard, but I am kind of surprised that she does so well in math. Isn't that more of a boy thing?

Before the researcher could respond she continued, "I think boys and girls have the same ability to do math, but something happens that gets more of the boys attention; you know, something in school that makes boys respond better to math." This line of thought was interesting to the researcher as it was explored as a possible aspect of this investigation. When the researcher asked her to elaborate, she stated,

> You know I have two girls and Shana is the oldest. As they move up in school, they just don't seem to like math as much as when they were little. I have also noticed that with my little sister too. She used to do so good, and now, oh girl, my mom has her hands full. She just don't care. I don't want that to happen to my girls. They's just as smart as boys, but they just lose interest. It has to be something going on at the school because nothing's changed here!

Mrs. Brown expressed her belief that Kendra has the ability to do math and will continue to do well. When asked if males have more math ability than females, she chuckled and said "No! When the president from Harvard said that, that was ridiculous! Both are just as capable."

The second theme that emerged was the value/importance theme. Both children's parents talked about the value of mathematics and the importance of having a good grasp of mathematical concepts. Mrs. Moore, a nurse, talked about how she uses math at work daily. "I use math all the time at work," she states, "You have to have that skill. And it is a big deal. If I make a mistake, it could mean someone dies! I think that, especially when Shana is an adult, math will be a critical skill."

Kendra's mother spoke of the importance of good math skills as well. "Kendra can be anything she wants to be, but you have to be good in math. It doesn't matter what

you do, you need to be able to do math." When the researcher asked how Mrs. Brown sees her daughter using math as an adult she responded, "You use math all the time. Not only at home when balancing the checkbook or paying bills, but in your job. Who knows what Kendra will grow up to be?"

The next theme that surfaced was success/expectations. Throughout the interviews, both parents talked of high expectations for their children. The parents in this quadrant also tied expectations with success. Mrs. Brown also tied success with her daughter's previous experiences in mathematics. She stated, "Kendra has always been good in math. I think she always will because she seems to have a knack for it. She's a girl who does well in math." The researcher was intrigued by the final statement and questioned if there were girls who don't do well in mathematics. Kendra's mom replied, "Well sure there are. Not everyone is a math whiz; but it is based on individual differences and preferences, not if you are a boy or a girl."

Mrs. Moore stated that Shana wants to enter the medical field and will need to know a lot of math. She continued by stating, "Obviously, I expect her to do well. She has to get a good job and support herself. Math will help her do this. She has been saying she wants to be a vet or a doctor or something like that, now that is a lot of math." When asked about Shana's ability to continue with harder math, her mother replied,

> Now, I didn't do what I was supposing to and stopped talking math in high school. It was really hard for me to become a nurse. I had to study really, really hard. I talk with Shana about that, she knows. She sees what it was like for me, what it is like for me. Shana is determined to make a good life for herself and she will. She will keep taking math so she won't have to struggle like I have. And it is different for Shana, because I didn't like math and wasn't good at it. Shana is good at math; she always passes her tests and makes the work seem easy. I think math will stay easy for her. I don't think that it will for a lot of other girls though.

When the researcher asked her to elaborate, Shana's mother stated, "I know girls are just as smart as boys, but it seems that they lose interest in the subject. Once that happens, you don't have as many girls taking math classes."

An interesting response from each child's parents occurred when the mother was asked to describe what they thought a mathematician looked like. Shana's mother stated, "Well when I think of a person using math, I think of someone like me…a nurse, a woman, a Black woman. But if you mean a person who *really* uses math, like a doctor or engineer, I think of a man, a tall White man." She chuckled, shook her head and reiterated, "Yeah, a White man." Kendra's mother was hesitant to answer the question. She stated, "A mathematician is anyone, we all use math everyday whether we realize it or not." When the researcher posed the question again and asked her to describe the physical attributes of such a person she thought for a few minutes before she responded. She replied, "Well I think of a man who is tall and has thick glasses." She then quickly qualified her response by saying, "Really, we all do math and we are, I guess, I guess I could say we all look like people who do mathematics."

Low Mathematics-High Reading. The parents in this quadrant were the most diverse set in the study. Both parents/guardians were present for the interview. Candy resides with her maternal grandparents. Debbie's parents are a very traditional Hispanic family, with her mother being a Mexican national. The males were definitely the head of the household in this quadrant and took the initiative in discussing the topic with the researcher.

The interview with Mr. and Mrs. Smith, Candy's maternal grandparents, was conducted in their home. The home is a small, older home in an established neighborhood. The living room was bright and the furniture was slightly worn. When the researcher sat down on the sofa, Mrs. Smith offered refreshments as the day was extremely warm. The researcher thanked her but declined the offer. Mrs. Smith called her husband, who was in the back of house, to come to the living room for the interview. Mr. Smith entered the room, introduced himself, and sat in the massive recliner. The recliner faced the television so direct eye contact was only obtained when he would turn and face the researcher. Mrs. Smith sat next to the researcher for the interview. However, once the interview began, Mr. Smith turned and usually faced the researcher.

Candy resides with her grandparents, Mr. and Mrs. Smith. They are in the process of attempting to gain legal custody of her as Candy's mother had abandoned the child with the grandparents. As a result, the grandparents' lifestyle has changed with the maternal grandmother returning to work full time in order to make ends meet since Mr. Smith is disabled. According to the grandparents, Candy's mother had been in and out of the household, but Candy has resided with them most of her life. When describing her granddaughter, Mrs. Smith stated, "Oh she likes to be the center of the attention. She is always in the middle of things. She is a good girl and tries hard in school." Mr. Smith added, "Candy is kind of lazy. She needs to apply herself in school. She is too interested in having fun."

Debbie's family lives in a small home in a neighborhood full of children. The home, although full of people, was not cramped. As we sat in the living room to discuss the interview, Mr. and Mrs. Fuentes appeared anxious. As the researcher reminded the

family of the purpose of the study, Mr. Fuentes nodded and stated he remembered what we had talked about during the initial meeting at the elementary school. He reminded his wife, in Spanish, the purpose of the study and she also nodded her head in approval. They were ready participants.

Debbie's family is a very traditional Hispanic family. Debbie's parents were friendly and extremely polite. Mr. Fuentes is bilingual and converses well in both languages. Mrs. Fuentes speaks some English but converses in Spanish. Mr. Fuentes took the initiative to answer the questions. Mrs. Fuentes would occasionally interject her thoughts, but left the bulk of the discussion to her husband. When describing Debbie, Mr. Fuentes used words such as "kind", "helpful", and "loving." When he described her academically he stated, "She is a smart girl. She is just a little shy and doesn't always ask questions when she needs to. She tries really hard."

The initial theme examined in this quadrant was ability. Both parents talked about the children's ability to complete the current mathematic load. However, the parents put the emphasis on effort as well as ability. Mr. and Mrs. Smith as well as the Fuentes feel their children have the ability to adequately address the current level of mathematics. Mr. Fuentes stated, "Debbie is a smart young lady, and she works really hard. She wants to do well and I think she can. She works to do well in mathematics." He leaned forward and added, "She is smart and tries and tries; she just needs some help to do better." The researcher probed deeper by rephrasing his statement and inquiring if his statements reflect on effort or ability. Mr. Fuentes responded, "I guess I am talking about effort, because she does put a lot of effort. But she also has the ability. When you talk to her about the problem she is working on, she isn't lost; she knows what she is

doing." Mr. Fuentes concluded, "Yeah, she has the ability. She is a smart kid." The researcher asked Mr. Fuentes if there are other things he observes to let him know she has the ability. He paused and contemplated the question then responded,

> I don't know. I guess that it [math] comes easier for her than for us. I went to school, but all that she has to do to for her homework is, you know, more than we ever had to do. If she can do all that, she has the ability. We do whatever we can to help her. We will try to figure out problems together. It helps me too. I have gone up to the school and visited with the teachers to make sure we know how to help her. We practice here at home, in the car, wherever we can come with math work for her. I know she can do it and pass the tests. I know she can be good at math because she is smart and works hard at school and here at home.

Mr. Fuentes could not list specific skills beyond addition, subtraction, multiplication, and division, that Debbie needs to master in order to do well in mathematics. He stated he knows they need to do other things, but was not really sure what those things are.

Mr. Smith stated several times, "She [Candy] has the ability to pass the classes and tests, but she has to apply herself. She doesn't do that. She doesn't want to do that. That takes too much work." The researcher asked Mr. Smith if he noticed anything in particular that affirms Candy's ability in math. He contemplated the question but could not list any specific skills. He simply stated, "She has the ability if she applies herself. She just needs to do whatever it is that they have to do to work those problems they get."

Mrs. Smith's position was subtly different. "Candy can do it, I think. What I am glad about is that she at least puts the effort into the work. I think she tries but it is hard math. That new math, we can't help her with." The researcher noticed that Mr. Smith addressed ability and Mrs. Smith discussed effort. The researcher then inquired into Candy's abilities to accomplish the needed mathematical tasks specifically with Mrs. Smith. She was hesitant to answer and looked at her husband for several seconds before

responding. Reluctantly she stated, “I don’t think Candy really has the ability to do the math she has to do. She has a hard time with simple multiplication problems. She never learned them, and even though we try to go over multiplication problems with her, it doesn’t stick.” I asked her how they go over multiplication problems and Mrs. Smith stated they have flashcards to review. “But,” she adds, “Candy still doesn’t get them. It’s not that she doesn’t care, she doesn’t have what it takes.” While she is making this statement, Mrs. Smith tapped the temple of her head. The researcher then asked Mr. Smith what his thoughts were on the subject and he responded, “I am not sure. I think girls in general have a harder time with math. Boys find math easier.”

The next theme observed was success/expectations. All parents/guardians indicated they expect their daughter to do well and try hard in math class. However, the way the parents in this quadrant viewed success was very different than in the previous two quadrants. Parents viewed success as the effort put forth by the student. Although it was not stated in direct words, it was apparent expectations were for lower grades as the students progress through mathematics in higher grades. The expectation was also tied to effort. It was expected that they try, but expectations on grades were dramatically different.

The researcher posed a question regarding the parental expectations of future math classes for their daughter. Mr. Fuentes replied, “Oh I expect her to keep taking math. But it is going to get harder. She just needs to try, to give 100% and I will be happy.” He added as an afterthought, “In high school math is very hard, I don’t know if she can bring home A’s and B’s. I will be glad if she tries her best, works hard, and passes her classes. She needs math to get a good job.”

Similar ideas were expressed by the Smith grandparents. Mrs. Smith thinks that Candy is working at her capacity currently. She stated that she believes grades will eventually start dropping as the math classes become harder. Mrs. Smith said, "Candy needs to do the best that she can, she has to pass her classes, but c'mon, Geometry and Algebra are going to be tough for her. I am just asking for her to try and do her best." Mr. Smith also reiterated this stance when he discussed her lack of abilities. "With her struggling now, it is going to get bad in high school unless she turns things around." He added that he doesn't see her going past Algebra. He felt that when she has met graduation requirements she will stop taking math. The researcher asked about his position on her stopping mathematics courses after requirements are met. He shrugged his shoulder and replied, "If that is what she wants. I went up to Algebra and did okay. I don't know if she needs anything more than that." Mrs. Smith shook her head in affirmation of his statement. It was interesting to observe that, although they agree about Candy probably not pursuing higher mathematics, the reasoning was different. Mrs. Smith focused on her belief that Candy doesn't have the capability while Mr. Smith focused on mathematics beyond Algebra being unnecessary.

The importance/value theme was examined next in this quadrant. Both sets of parents valued math, but the difference from previous quadrants was the type of math that was valued. Mr. and Mrs. Smith agreed that math was an important skill and is necessary for everyday life, but to the degree that it is needed and the type of math was limited. Mrs. Smith stated that math is needed for everyday life and gave examples such as paying bills and balancing the checkbook. Mr. Smith added by saying if you are going to make something you need to know measurement and when cooking you need to know

fractions. The researcher then inquired if other types of math such as proportions, geometry, and trigonometry, might be utilized in everyday life. Mr. Smith answered, "Not really, just basic math is needed to get along in life." Mrs. Smith added to his statement, "Math is important, you need to be able to balance your check book, pay your bills, you know, everyday things. Candy wants to be a singer when she grows up. If she does make it, she needs to know if anyone is cheating her when it comes to her money."

The researcher was curious as to the position held by parents in this quadrant regarding males being more mathematically-abled than females. Mr. Smith had previously stated that boys find math easier. The researcher revisited this point and asked him to elaborate on his statement. He replied, "Well if you look around, there are more men doctors, engineers, builders, business leaders. This just proves that men are better at math because if women were, wouldn't we have equal numbers of men and women in these jobs?" Mrs. Smith added,

> Really, if you ask just about any woman, they will tell you that they really don't like math and it was hard when they were in school. I know that is true for me, the ladies I work with, even Candy. Now I don't know about her friends, but I think Candy is an average sixth grade girl, so it is probably true for them too.

Mr. Fuentes had a different perspective. He maintains that boys and girls are born with the same ability, but as math becomes harder, girls drop out. When pressed to explain why this occurs, he contemplated the issue before responding. Mr. Fuentes concluded it was because girls, as they mature, have other things on their minds and they can't really focus on math. The researcher again explored what might preclude girls from continuing in mathematics. He responded, in a hushed tone, that many girls begin to focus on things that make them popular and don't want to be set apart as being smart. The researcher probed with an additional question regarding what females focus on to be

popular. Mr. Fuentes became very uncomfortable and squirmed in his seat as he formed his response. He looked at his wife, then to the researcher, and then back to his wife. Mr. Fuentes finally answered the question after a prolonged silence. He again lowered his voice and reminded the researcher that girls at that age are interested in boys and dating. When asked at what age does that become an issue for a girl, he responded by stating that girls around 12 or 13 begin to "really" notice boys. But what he described is what happens in high school.

Both sets of parents justified females not being mathematically competitive with males. However, this position was firmly held by the parents as they described what they thought a mathematician would look like. Mr. and Mrs. Smith as well as Mr. Fuentes described a mathematician as an Anglo man. They varied on other details such as height, age, dress, and whether he was balding, but all agreed on the gender and race.

Low Mathematics-Low Reading. The parents interviewed in this quadrant were both mothers. Valerie lives with her mother, Mrs. Sandoval, who is the head of a single parent household. Vivian's resides with both her parents, Mr. and Mrs. Moreno. The researcher was informed by Mrs. Moreno, that Mr. Moreno was not going to participate in the research since "a study about girls and math really wasn't that important." Mrs. Moreno was apologetic and embarrassed when she informed the researcher of her husband's position. The researcher eased the awkwardness, by informing Ms. Moreno that it was not mandatory for both parents to be present. The researcher would conduct the interview with the mother and that would be sufficient.

When the researcher interviewed Mrs. Moreno, she was visibly nervous. She continuously played with her hair at the beginning of the interview, a habit her daughter also exhibits when feeling stress. She apologized for her husband not being willing to participate and attempted to explain is "Well, you know men." Prior to the beginning of the interview, the researcher spoke with Mrs. Moreno about her family, job, and interests to build rapport and ease her anxiety. It worked as Mrs. Moreno stopped playing with her hair, sat back and became more comfortable in her demeanor, and conversed with the researcher.

Mrs. Moreno described her daughter as "loving", "bright", and "caring". She stated her daughter sometimes struggles in school but that Vivian does fairly well. Mrs. Moreno added that her daughter is well liked and has many friends. Vivian is helpful around the house, but sometimes is a little difficult to manage.

Valerie's family recently moved into their current residence. The home is in a lower socioeconomic neighborhood, and is older and shows signs of aging. The living room was dark as they have no wiring for ceiling lights and the only light came from the television. The room was sparsely furnished but clean. The researcher was lead to the kitchen table for the interview. Mrs. Sandoval was cooking dinner and told her younger daughter to keep an eye on the meal while we talked. She had recently gotten home from work and was visibly tired. However, she was friendly and open to the interview. She contemplated her responses and appeared to give responses that genuinely reflected her beliefs.

Mrs. Sandoval stated that her daughter Valerie is a good kid who does okay in school. She elaborated by adding that Valerie is smart enough, but this year decided she

wasn't going to do her work and focus on other things. Mrs. Sandoval informed the researcher that she has really had to keep on eye on Valerie as she would rather go hang out with neighborhood kids who are "trouble" than read or do her homework. She concluded by saying, "Valerie is really a sweet girl but she has major attitude now."

Ability was the theme initially explored with the parents in the quadrant. Both mothers equated ability with effort as well as indicating it was an innate trait. Mrs. Moreno stated that math had always been difficult for her daughter and that she learned a long time ago that as long as Vivian is giving her best, Mrs. Moreno needs to be satisfied. She added, "Not everyone can get an A in the [math] class. I make sure she does her homework, remind her to pay attention to the teacher, and that she is trying in school. What more can I ask of her?"

Mrs. Sandoval expressed a similar concept. She stated, "I know that Valerie has the ability. I have seen it. I know she tries her best. I expect her best." When asked what was meant by 'her best', Mrs. Sandoval responded,

> Her best effort. She must try. That has been the hardest thing this year; it is like she has given up trying. Her grades are down, she doesn't read, she would rather just hang out with her friends. She simply won't even try to do her best. I'm not asking for straight A's, just the best she can do. I am certainly not seeing that.

When asked what specifically they see regarding their daughters' abilities that help them in mathematics, neither parent could provide examples. Each parent spoke in broad terms about general math skills. For example, Mrs. Moreno stated her daughter would need to be able to add and subtract, multiply and divide, to do well in mathematics. Mrs. Sandoval stated that she needs to know the steps to follow to solve a problem. When asked to elaborate she stated, "Oh I don't know. You know they have to do things a certain way, and she needs to know that specific way."

Mrs. Sandoval and Mrs. Moreno spoke of the frustration their daughters feel with their lack of mathematical ability. Mrs. Moreno declared,

> Vivian gets so frustrated and angry sometimes. She will just refuse to do the work and put her head down on the table. Now this just doesn't happen, it's after she has tried to work on her homework for a long time, maybe an hour, and can't get anything done. My husband will try to help or her older brother, but when she doesn't get it, she becomes frustrated. I don't blame her either. I have looked at the math, it is not easy! I probably would do the same thing if I were her.

Mrs. Sandoval talked about Valerie sitting at the table and just staring at her work without being able to complete the task. She added,

> It isn't that she is watching TV or listening to the radio, she just sits there staring at the worksheet. When I ask her what is wrong, she just looks at me and does this. (Mrs. Sandoval shrugs her shoulders.) I look at her work and nothing is done. I ask her what she did in school and she says, 'Worked on this." But she can't tell me what to do to help her. She doesn't know how to start the problem or what to do. I don't either, so I can't help her. So she ends up putting it away and waiting until she gets to school to get help on it. Sometimes, I think she is ready to cry because of it.

Both parents spoke of the success and expectations in terms of effort. Mrs. Moreno and Mrs. Sandoval related success in terms of their child putting for the best effort. Mrs. Sandoval set the expectation of not earning "A's" as being acceptable. She stated that not everyone can get A's in math class. When the researcher inquired as to how she feels about her daughter's math grades, she sighed and responded, "I want her to do the best she can. I think she tries, although she could try harder. But, I really think she does the best she can. So, if she brings home a B, it is okay. Right now, if she brings home a C, I kind of get on to her to do better." The final statement intrigued the researcher, so I asked for Mrs. Sandoval to elaborate. She stated, "The math right now is easy. Not easy, but easier than high school. She can't get C's now because then what

will she get in tenth or eleventh grade math? That would be really bad. No, there can be no C's right now."

Mrs. Moreno also elaborated on her definition of success in mathematics being her daughter's best effort. She stated,

> My daughter does as well as can be expected. She does her best. If her best is a 'B', I am happy with it; if her best is a "C", I am happy with it. Of course I wish she could do better, but it's not her fault, I am terrible at math! All I ask is for Vivian to do her best. You asked me what I consider success in math class is; I think is it doing your best and not giving up. Math is not fun; it's hard, and confusing.

With these explanations, the researcher wanted to explore each mother's belief regarding the amount of math their daughter would enroll in as a way to explore expectations. Mrs. Moreno smiled as she responded, "Oh, she will get out as soon as she can I think. She doesn't like it. How much math do they have to have to graduate? Whatever it is that is when she will stop. And that is okay with me, just so long as she keeps trying until then."

Mrs. Sandoval made similar comments to the researcher. She stated,

> Valerie will not stay in math for too long I don't think. No, she won't because she hasn't done good in it. I am not sure why she doesn't do good, but she doesn't. Anyway, why would she want to stay in a class she doesn't have to when it isn't fun? I didn't, I got out as soon as I could. I would hope she stays in, but no, she won't. Math, real math, really isn't for girls anyways.

From conversations with parents in this quadrant it was clear that the expectations and ideas regarding success were very different. It was also very interesting that both parents foresee their daughters removing themselves from mathematics, and resigned themselves to the situation. Parents seemed at a loss on how to alter this assumed occurrence. Even though each mother expressed reservations about the girls dropping out of math, they accepted it as inevitable and justifiable. It was disheartening for the

researcher to hear the parents express these ideas. It was equally difficult to not offer thoughts or suggestions on how to keep the girls in math classes or to assist them in being more successful in mathematics.

Each mother related her daughter's experiences to those of her own. It became an opportunity for Mrs. Moreno to discuss her feelings of inadequacy in mathematics. She stated, "I can't blame Vivian because I was the same way. She is just like me. I didn't do good in math. I don't think girls do as good as boys do." The researcher believes that this stance is firm within the household as the father deemed the study unimportant. His position is affirmed through his statement regarding not desiring to participate in the study.

A similar idea was raised by Mrs. Sandoval. She stated, "I tried to do good in school, but in about 10^{th} grade I stopped taking math. It wasn't fun, I felt stupid. I hope that doesn't happen to Valerie, but I think it might. She doesn't like math anymore. She says she feels dumb in class."

It was interesting that both parents see mathematics as a necessary tool for adult life. However, the importance was placed on basic skills needed to run a household. Both parents discussed the importance of being able to pay bills and going to the store. However, neither parent elaborated on the value of mathematics beyond basic skills. The researcher asked Mrs. Moreno about the need for additional mathematical skills in her daughter's adult life. Mrs. Moreno declared, "If Vivian was going to be a doctor or something like that she would need a lot of math. I don't think she will need it when she is grown up. She wants to be a cosmetologist like me."

Mrs. Moreno and Mrs. Sandoval both expressed the idea that there are innate differences between males and females which predispositions males to excel at mathematics. Mrs. Moreno said that boys were born to do better in math than girls. When asked what she based this statement on, she replied, "My family. My son does well in math and Vivian doesn't. I didn't. Most of the girls or women I know didn't either." Mrs. Sandoval also spoke from her personal experiences and related them to her daughter. She stated, "Boys are born with something that makes them good at math. When I was young, it was boys who like math and did well, not the girls. It is still the same now."

Themes from Parental Interviews. There were three themes that emerged throughout all quadrants during the parental interviews. The responses varied, but were tied to these basic themes. The themes were: ability, success/expectations, and value. Each of these themes are discussed in the paragraphs that follow. An additional area of interest was the perception of mathematical ability differences between genders.

The first theme to emerge was abilities. All parents stated their children had the ability to pass basic mathematics courses. However, parents' view of mathematical ability varied across the quadrants. Ability in the High Mathematics-High Reading quadrants was seen as specific traits and skills that were utilized by the students, while in the Low Mathematics-Low Reading quadrant ability was equated with effort. The parents of students in the High Mathematics quadrants spoke specifically of the abilities and skills each child exhibited, such as working with fractions and being able to solve problems mentally.

The concept of ability, as the researcher moved across the quadrants, starting with High Mathematics quadrants, evolved from specific higher order skills, to basic skills, to effort put forth by the child. Parental responses ranged from strong and passionate to resigned and accepting. The parents of students in the Low Mathematics quadrants repeatedly stated that effort was most important as they did not expect their child to succeed in higher mathematics. In the Low Mathematics-Low Reading quadrant, parental responses expressed resignation to the fact that their child would not take higher mathematics courses. These parents informed the researcher that there was no point in taking further mathematical courses as their child's probability of success is unlikely. The parents of students in the Low Mathematics-Low Reading quadrant expressed resignation to the future achievement of her children. Mrs. Moreno implied that she needs to be satisfied with effort of her child when this topic was discussed. After explaining that effort was what she expected because high grades were unattainable, she stated, "What more can I ask of her?" Likewise, when discussing the same theme, Mrs. Sandoval expressed similar ideas. When discussing Vivian's performance in mathematics class, Mrs. Sandoval stated, "I'm not asking for straight A's, just the best she can do." She continued by stating that a 'C' grade is acceptable as long as her daughter is trying.

The second theme to emerge was success/expectations. These also varied greatly across the quadrants. In the High Mathematics-High Reading quadrant, expectations were high for students and this was communicated to them by their parents. The expectations were supported by success the students had experienced in class. The students in the High Mathematics quadrants spoke of their success in mathematics as well as how it made

them feel. Due to their success, they felt that they would be able to succeed in higher mathematics courses. Likewise, the students in the High Mathematics quadrants stated they intended to continue in their mathematical pursuits. However, the theme changed meaning as it crossed the different quadrants. Expectations were lower in other quadrants and success was again seen through the lens of effort. Success and expectations were put forth as a mandate from all parents. Yet again, what was deemed success varied among the quadrants. Success in the High Mathematics quadrants meant comprehending, performing, and mastering mathematics. In the lower quadrants, success was again tied to effort. As long as the child put forth their best effort, they were considered successful by their parents. Expectations were in tandem with success. Expectations ranged from clear, stated, and understood as performing satisfactorily in mathematics classes for the High Mathematics quadrants to merely passing the class in the Low Mathematics quadrants. Parents of students in the Low Mathematics quadrants did not see their child as having the ability to succeed. The exception to this case was Diana in the Low Mathematics-High Reading quadrant. Mr. Fuentes was unsure as to his daughter's mathematical abilities. He expects Diana to put forth effort, but would not be surprised if her grades are low. Additionally, Mr. Fuentes stated that he did not think Diana would take advanced mathematics. Despite his reservations, he was actively assisting his daughter perform at her optimal level through interventions in the home. Mr. Fuentes was also in contact with the mathematics teacher on a regular basis in order to understand the required mathematical skills and processes Diana needed. Mr. Fuentes spoke with the teacher regarding the needed skills and how he and his wife could help Diana gain these skills. It needs to be stressed that it was not that the parents in the Low Mathematics

quadrants did not care or that they did not want their daughter to succeed. Rather, they interconnected innate ability with math success and gender. Additionally, mothers closely tied their past personal difficulties and experiences in mathematics with those of their daughters, inadvertently lowering expectations for their daughters.

The final theme to emerge was the value of mathematics. All parents stated they valued math and math skills, and wanted their daughters to do well in mathematics. However, what was valued once again varied across the quadrants. The parents of students in the High Mathematics quadrants valued advanced skills and taking as many mathematics courses as possible. Students in the High Mathematics quadrants and their parents discussed the importance of continuing to take mathematics courses. Additionally, the students spoke of taking mathematics through high school and in college. Due to their success in mathematics, the students in the High Mathematics quadrants believe they will continue to succeed in mathematics.

In the Low Mathematics quadrants the value was placed on basic skills: addition, subtraction, multiplication, and division, for both Low Mathematics quadrants. This was quite clear when Mrs. Moreno replied, “If Vivian was going to be a doctor or something like that she would need a lot of math. I don’t think she will need it when she is grown up. She wants to be a cosmetologist like me.”

Parents of students in the Low Mathematics quadrants did not see the necessity or, in some cases, the value of higher level mathematics. The idea of valuing advanced mathematics courses was developed in the High Mathematics quadrants. Parents of students in the High Mathematics quadrants discussed the importance of advanced mathematics and continuing to pursue mathematics. They tied this action with better

careers and more secure futures for their children. They spoke very clearly about the need to continue in mathematics classes for as long as possible.

An additional theme emerged in the Low Mathematics quadrants. The parents of students in these quadrants clearly established their belief in innate ability of male students to effectively engage in mathematics. Mrs. Sandoval stated, "Math, real math, really isn't for girls anyways." In the High Mathematics quadrants there were different responses to this theme.

Summary of Parental Interview Data. The parent interviews were as diverse as the student themselves. They took place on the telephone, at the elementary school where student participants attended, and in the homes of the families. The homes varied greatly from well furnished, neat, middle class homes to sparsely furnished, lower socioeconomic homes.

Parental responses varied greatly as well. Some parents were eager to participate while some were reluctant and suspicious, and one parent refused to participate and he deemed the study unimportant. Much was learned from the conversations with parents, and it provided another aspect for triangulation of the data. The information received was then used as a tool to examine student responses and observations that occurred in the classroom. The diverse personal interpretation of a concept is not unusual; however, it must be noted when there is consistency in the interpretation. Such consistency occurred in the themes which evolved in the analysis of the data. The data gathered from the parents answered three of the research questions. Data was used to determine if the parental beliefs regarding their daughters' capabilities reflected in their daughter's

beliefs. The information provided by the parent was utilized to determine if the daughter's beliefs accurately reflected the parental stance. This information is explored in the student interview subsection.

A research question asked, "What are parental beliefs regarding their daughter's ability, success and future success in mathematics?" This question was answered in great detail during this study.

Very clear lines were drawn on the three themes that emerged. Ability was divided between those that were classified as High Mathematics and Low Mathematics quadrants. Parents in the High Mathematics-High Reading quadrant could give examples of specific skills their daughter had that helped them excel in mathematics. The idea of ability was equated with skills and strategies utilized by the girls in this quadrant. When the parents spoke of their abilities, it was in a very positive manner, and with assurance that their child has the skills needed to continue to succeed in mathematics.

Parents of the students who fell in the Low Mathematics quadrants viewed ability in a very different manner. The parents in the Low Mathematics-High Reading quadrant talked about ability as skills utilized by the daughter, but only in broad, general terms. The parents mentioned things such as, addition and subtraction, but really could not speak to more advanced skills the child might employ. They were unable to name skills specific to sixth grade, such as: manipulating improper fractions, utilizing proportions, or complex multi-step problem solving skills.

The parents in the Low Mathematics-Low Reading quadrant associated ability with effort. In fact, they used the two interchangeably when discussing the theme. With the emphasis being on effort, the subtle message being transmitted is that attempting to do

the math is sufficient. This is not to say that they do not care if there daughters do well; in fact, the parents made it clear that they want their daughters to bring home good grades. As long as the daughter puts forth effort, even if mathematics grades are not as high as desired, the effort is considered sufficient. Her ability was exhibited in her effort to complete the math tasks. Additionally, there is the anticipation that as the girls become older and engage in more challenging mathematics, grades will drop. This is expected and already an accepted occurrence. There was the feeling of inevitability expressed by parents when discussing the idea of future mathematics, grades lowering, and eventual discontinuation of mathematics course taking.

Likewise there were very clear distinctions between quadrants in the expressed ideas regarding success and expectations. As previously mentioned, in the Low Mathematics quadrants expectations were that mathematics course taking would end when high school graduation requirements are met. Success was tied to effort. The impression received by the researcher was that since high grades would be unattainable, parents will be happy with the student continuing to attempt the coursework. It appeared to be a vicious cycle with expectations for high grades lowering as subject matter becomes harder. Parents did not express contentment but rather resignation at the fact that this will occur; it is merely a matter of time. Additionally, post educational goals are not as high as possible since the student will not have strong mathematical skills. Parents expressed this idea very clearly when discussing the future career they see for their child. The parent communicated lower expectations indirectly when she commented that if her daughter was, “going to be a doctor or something like that she would need a lot of math.

I don't think she will need it when she is grown up." The parents are sending subtle messages with lowered expectations to their daughters.

The parents in the High Mathematics quadrants were diametrically opposed to the Low quadrants in expectations and their view of success. Parents in the High Mathematics quadrants spoke of success and expectations in conjunction. Success was seen as continuing to have high grades, but also an ability to apply the skills. The expectation was that the student would continue to enroll in mathematics courses and excel at them. This position was declared much more strongly by the High Mathematics-High Reading parents. They were extremely confident of this occurring and talked about it as a given future occurrence. These parents also talked about mathematics being enjoyable and challenging. They clearly associated positive experiences with mathematics and expressed this to the researcher. Parents in this quadrant also placed a heavy emphasis on the ability to analyze. Both sets of parents talked about their daughter's ability to excel at analysis and enjoy the challenge. Enjoyment and satisfaction were very evident and directly connected to math class. Parents used these ideas frequently when describing their daughter's mathematical experiences.

Parents of students in the High Mathematics-Low Reading quadrant also held high expectations and anticipated success for their daughter. However, they did not express the detail of mathematical skills possessed by their daughter as the other High Mathematics quadrant did. These parents held high expectations, encouraged their daughters in mathematics, and expect success. Success was seen as good grades and the expectation was to continue to take mathematics courses. Enjoyment and satisfaction

were not discussed by these parents. If it was associated with mathematics, neither parent mentioned the idea. This is the realm where the High Mathematics quadrants varied.

The value/importance theme also was clearly divided between the High Mathematics and Low Mathematics quadrants. The High quadrants placed great importance on mathematical skills and valued the continued progress through courses. Parents saw the necessity of continuing to participate in mathematics as a key to succeed in the future job market. The mathematical skills that were exhibited by the students were openly valued and praised by the parents.

While most parents spoke about general skills such as multiplication and division, the parents in High-Mathematics-High-Reading quadrant discussed very specific skills. The skills mentioned are regarded as higher order thinking skills and require a deeper processing of knowledge on the part of the student. These parents expressed satisfaction with their daughters' tenacity to work through difficult problems without becoming discouraged. There discussion was passionate, sincere, and exuded a sense of urgency. The remaining High quadrant also discussed specific skills although not to the extent or with the fervency of the High Mathematics-High Reading parents. The High Mathematics quadrant parents had very clear and high expectations for their children. They also stated that they had made the expectations clear to their children and the students expected these things for themselves as well. Finally, the High Math parents closely tied future success in the job market with excellence in the mathematics classroom.

While the Low Mathematics quadrant parents valued and placed importance on mathematics, it was approached from a different perspective. Basic skills were valued;

adding as well as subtracting were mentioned numerous times. However, advanced mathematics was not seen in the future of any of these girls by their parents. A resignation to the fact that the girls would cease to take mathematics at the earliest possible time was expressed. Likewise, an acceptance of this inevitability was expressed. Wistfully, parents talked about daughters taking higher math, but when it came to reality, their belief of reality was minimal math skills. In the discussions, it became clear that the mindset was that nothing could be done to alter this outcome; students either had the ability to excel in mathematics or not. Additionally, the inability to perform well in mathematics was inherent as the mother had similar experiences. Unfortunately, parents in these quadrants viewed their daughters as not having the ability, and acquiesced to this belief.

A final aspect to examine is the belief that males have the natural ability to perform better than females in the field of mathematics. Responses received were mixed from the High Mathematics-High Reading and the Low Mathematics-High Reading quadrants. In the High Mathematics-High Reading quadrant one parent strongly maintained that males have an innate ability to outperform females in mathematics. However, to explain his daughter's success he described it as an anomaly. She was "unique" and "different" and this allowed her to excel in mathematics. All other parents in this quadrant maintained a notion of equal ability among the genders. The Low Mathematics-High Reading quadrant also provided a mixed response to the ability question. Mr. Fuentes felt that both females and males are equally able to compete in mathematics. His wife never expressed an opinion on this matter, so the researcher decided to view her silence as agreement with the husband's statement. He did state that,

however, that females change their focus in the adolescence thus not performing as well as males. The other family in this quadrant clearly believed that males have a greater ability to compete in mathematics and the position was held by both parents.

The parents in the remaining two quadrants, High Mathematics-Low Reading, and Low Mathematics-Low Reading expressed beliefs similar to other parents in the same quadrant. However, each quadrant was in direct contradiction of the other. The High Mathematics-Low Reading quadrant felt that both genders are equally able. One parent did mention the idea of loss of interest in mathematics on the part of females. In the final quadrant, Low Mathematics-Low Reading, both parents clearly believed that males were more inclined to participate and outperform females in the field of mathematics. The variety of answers underscores the notion that the concept of innate ability remains firmly ensconced with individuals, and these mindsets directly affect the female students' perceptions regarding their abilities, natural aptitude, and potential success in mathematics.

Participant Observation Data

Data Collection and Analysis Process. Observations were completed during a five week continuous span of time. The eight students were spread across five different homeroom classes, so observations occurred throughout the day. There were no more than two participants in one class at a time thus allowing for a more thorough observation of individual participants. The researcher would alternate observations between the two math classes. Additionally, three days were spent observing the students in other classrooms to further develop an understanding of their behavior.

Due to the classroom setup, the researcher had to sit at the front of the classroom facing the class while making observations. At first, the researcher felt conspicuous, but soon the students and teacher got used to the observer in the classroom. The researcher was provided a small desk in the corner of the room where all students could be observed. The position proved to be most beneficial because it was vantage point where facial expressions could be seen, conversations could be observed, and reactions to the teacher were noted.

The researcher took field notes of the observations directly into a laptop computer. This allowed for more expedient note taking and NVivo was utilized to analyze the data and determine the evolving themes.

Findings.

High Mathematics-High Reading.

Observing Alice and Jennifer in math class was like watching a machine work. They knew what they were supposed to do and approached their work systematically. Alice and Jennifer, once given the assignment, were all business; they did not visit or dally in anyway. There was intensity on their faces; they were going to get that work done and not be stopped by a problem.

The researcher watched each participant closely to observe their individual problem solving process. Both of these students systematically dismantled the problem to determine how to solve the problem. They would underline parts of the problem, cross things out, circle items, and this type of activity. After surveying the problem for a few

seconds to ensure their procedures were followed, they would then proceed with the actual problem solving. Alice and Jennifer had a very clear process to attack problems.

Jennifer, when she was thinking about the problem would put her pencil to her mouth and press it against her lips. When she determined what she was going to do next, she would bounce the pencil off her lip and begin working again. Alice never exhibited any idiosyncrasies while completing her math work. She was extremely methodical.

There were two interesting behaviors noted numerous times that were exhibited by both Jennifer and Alice. Most work was done individually at the students' seat in the mathematics classrooms. When offered an opportunity to work with a partner, both students elected to work alone. If the teacher requested them to work with someone, as happened with Jennifer, she was gracious and helped the other student catch up. Alice was never put in this position. However, it is important to note that when this did occur, three times during observations, a student was put with Jennifer so she could get them caught up to where the class was working.

Another interesting behavior noted was that when either girl had a question regarding a problem, they would initially follow classroom protocol. They raised their hand and waited for the teacher to come and respond. However, if the teacher did not respond within a self-determined reasonable amount of time, the student would assert herself and go to the teacher. Alice had a question on a problem and she raised her hand. Ms. Jones was at her computer and did not see Alice with her hand up. Alice waited about 30 seconds then took the initiative to take her problem to the teacher. She went to Ms. Jones with her worksheet, asked for clarification, then returned to her desk. This behavior was exhibited by both Alice and Jennifer on a regular basis. This behavior was

exclusive to the High Mathematics-High Reading quadrant and was never observed with any other quadrant.

High Mathematics-Low Reading. Like the High Mathematics-High Reading quadrant participants, Shana and Kendra also approached their homework and assignments with a clear purpose and process to solve the problem. Although it was not observed in the same fashion, they too approached their work in a systematic manner.

Shana utilized a manner similar to the one exhibited by the High Mathematics-High Reading quadrant participants. She underlined parts of the problem, circled other aspects, and crossed out still yet other parts of the written problem. Her problem solving behavior mirrored Alice and Jennifer. The researcher did not observe Kendra dissecting problems in a manner similar to students previously mentioned. The researcher observed her apparently doing some of the steps and work in her head. This was verified when she stated, "I don't like to do all the stuff, underlining, crossing out stuff and all. I do a lot of that in my head and will only do it when I am confused and need to eliminate some information or when the teacher is watching me."

When given a choice, Shana sometimes elected to work alone, although not always. When she did work with a partner, she became more social and although attempting to get her work done, would visit with her partner as well. Kendra always elected to work with a partner when a choice was given. Depending on who the partner was would determine Kendra's response. If it was a friend, she became very social and mathematics became secondary. The friends would push their work to the side and visit only pulling the work back when the teacher came around. However, if Kendra was

partnered with a boy or a girl who wasn't a close friend, she would focus on her work. If her partner asked for assistance, Kendra would offer it, but otherwise conversation was minimal.

If questions arose for these students, Kendra would raise her hand and wait for the teacher to come to her and answer the question. The researcher never saw Shana ask a question publicly in class. She would either wait until the end of class and catch the teacher privately, or would just put her work away. When I inquired about this behavior her response was "I'm shy." She added that she didn't want the attention of other students drawn to her because that would be embarrassing.

Low Mathematics-High Reading. In both of the Low Mathematics quadrants, math avoidance tactics were actively noted by everyone except Debbie. She would work problems systematically and find the answer. However, she was much slower at doing this than the High Mathematics quadrant students. Additionally, she would ask the teacher if she was following proper procedure to ensure that she was correct.

Candy did not approach her work in any consistent manner. Sometimes she would underline information, but other times she would just begin to work the problem. It seemed to depend on her mood. If she was frustrated or tired, she started to work the problem without a systematic approach. Additionally, she would work problems out of order, and would often skip several problems. Mrs. Jones noticed this habit and spoke with Candy about working all the problems. As Mrs. Jones walked away Candy rolled her eyes and simply shook her head.

The primary source of math avoidance observed in this quadrant was disengagement. This was primarily exhibited by Candy. Numerous times Candy engaged in behavior that removed her attention from the teacher and instruction to something else. One of her most frequently used modes of disengagement was brushing her hair. The class would be told to put everything away so instruction could begin and she would start brushing her hair. The teacher would be working problems on the overhead as examples of the work that they were to complete. Candy would be staring off into space while she was brushing her hair. She would then miss 10 minutes of instruction. Other disengaging behavior observed were: writing notes, cleaning out papers from her binder, getting up to get a drink or wash her hands, or sharpening her pencil after purposefully breaking the lead. Debbie occasionally used avoidance measures, but it only occurred when she was frustrated and could not understand the work even after she asked the teacher for help. This occurrence was only observed once in the entire five weeks.

Low Mathematics-Low Reading. During observations of students in this quadrant, the researcher noticed disconcerting behavior from Victoria. Immediately upon entering the room she would exhibit nervous behavior. She would sit down and begin twirling her hair around her finger. When the actual mathematical work began, she would put her hair in her mouth and start chewing on it, or she would chew her nails. What is interesting to note is that the researcher observed her in other classes as well. In those classes, unless she was put on the spot, she did not exhibit the nervous behaviors seen upon her entering the mathematics classroom.

This quadrant frequently and blatantly was involved in math avoidance activities. Valerie would write notes to friends while Vivian would draw pictures. Disengagement occurred during every observation for both students. The length of time varied, but inevitably it would occur.

When assignments were given, many times looks of unfamiliarity would cross Vivian's face. It was as if she had never seen this type of work before, yet the teacher had just provided instruction on how to complete it. Valerie would look unsure and, almost every day, asked her neighbor for assistance.

Summary of Participant Observation Data. The students in this study approached their mathematics classes and the work involved in them in very different ways. However, similarities can be found over the High Mathematics Quadrants and the Low Mathematics Quadrants. The similarities varied in the amount of activity that was seen in each quadrant.

In the High Mathematics quadrants, all the students approached their work in a systematic fashion. Jennifer and Alice exhibited an intensity towards their work and were driven to complete it. Shana, Kendra, Jennifer and Alice all displayed a systematic approach to solving problems, although to the degree that they followed through varied. Nonetheless, a very clear process was observed.

Jennifer and Alice were the only study participants who chose to work alone. All others preferred to work with peers. When asked about the choice to work alone, Alice replied, "It is sometimes easier not to, because when they [the teacher] have me work

with someone, it is usually to get them caught up. It doesn't help me, just slows me down."

Math avoidance behaviors were exhibited throughout the Low Mathematics quadrants, although the amount and type varied. Additionally nervous habits such as chewing on nails were also observed. In the Low Mathematics quadrants disengagement from the content area was a frequent occurrence.

Summary of Data Presentation and Analysis

The study generated a plethora of data for the researcher to explore. The data involved: classroom observations, student interviews, parental interviews, focus groups, auto-ethnographies, and survey data. Although copious, it allowed for an accurate and rich understanding of the participants and their behavior in the mathematics classroom.

This qualitative study was guided by the primary question "Why is it that during the early adolescent years a lowering of mathematical self-efficacy occurs in females?" The gathered data were utilized to examine the beliefs and behaviors of early adolescent females in relation to this underlying question. A grounded theory approach was utilized to have the theory arise from the data itself (Bogdan & Biklen, 1992).

The study was initiated by utilizing the Fennema-Sherman Mathematics Attitudes Scales to determine attitudes of female students towards mathematics. The scales assessed various attitudes from considering mathematics a male domain to confidence in learning mathematics. This information provided the foundation on which to examine attitudes, beliefs, and behaviors of students and their parents.

The different types of data supported each other and provided a lens which was used to examine the emerging ideas. The various aspects of data collection: archival data, auto-ethnographies, focus groups, student interviews, survey data, parental interviews and classroom observations enriched and allowed a deeper exploration of theories. The data supported each other and provided areas for future research. Examination of data through multiple lenses allowed for conclusions to be drawn concerning gender issues in the mathematics classroom.

The information, although unique to each quadrant, could be divided loosely into the High Mathematics quadrants and the Low Mathematics quadrants. Also, students often reflected the beliefs stated by their parents. The students' beliefs varied from their parents' beliefs on the innate ability of mathematics being tied to gender in the High Mathematics-High Reading quadrant.

Overall, the students in the High Mathematics quadrants viewed mathematics in a more positive manner and expressed positive feelings towards their abilities in mathematics. The students in the High Mathematics quadrants saw themselves as having the skills and abilities to succeed in mathematics and persevere when it became more difficult. Additionally, these students saw themselves as continuing to take mathematics in high school and college. Students in the High Mathematics quadrants could speak of their skills in a specific manner and knew their mathematical strengths and weaknesses. These students were confident in their abilities and cognizant of strategies that needed to be utilized to succeed in their mathematics classes. Observations in the classrooms supported statements made by these students.

The researcher viewed a multiplicity of strategies being used. These strategies included perseverance, confidence, and a positive attitude towards mathematics. Auto-ethnographies and focus group interviews further supported data gathered during observations and interviews.

The parents of students in the High Mathematics quadrants likewise viewed their child's capabilities in a positive manner. The parents reported specific strategies used by the child and held high expectations for their child. Parents expected for their daughter to continue in higher mathematics and succeed in those classes. The only variance occurred when one parent reported his belief in the notion that math is an innate ability that is dominant in males. His daughter strongly disagreed with him and was greatly disturbed by this idea.

In the Low Mathematics quadrants, students reported more negative feelings toward their mathematical abilities and mathematics courses. They reported a lack of ability, and all but one student, expressed resignation to lower performance in mathematics. The students in the Low Mathematics quadrants were not able to speak of specific skills other than addition, subtraction, multiplication, and division. They were not able to discuss their weaknesses or areas in which they need to improve. These students also attributed an innate mathematical ability to male students. The students in the Low Mathematics quadrants reported that they do not intend to take higher level mathematics and many stated they will discontinue taking mathematics when it is no longer required. Likewise, these students did not see using mathematics in their future careers. Mathematics was viewed as a drudgery that had to be tolerated. The students in the Low Mathematics-Low Reading quadrant reported the most negative feelings and

spoke of their frustration in mathematics. It was in this quadrant that students were the most verbal regarding their resignation to the notion that they did not have the ability to succeed in mathematics.

The parents of students in the Low Mathematics quadrants equated success in mathematics courses with exerted effort. The parents expressed an acceptance of lower grades and felt that as long as the child tried, this was sufficient. They also expressed an expectation that their student would take the minimal amount of mathematics and accepted this as a fact that cannot be changed. Parents of students in the Low Mathematics quadrants implied that mathematical abilities favored boys as opposed to girls. The students in the Low Mathematics quadrants reflected many of the same ideas expressed by their parents.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

Gender issues remain a topic of interest and continuing controversy despite decades of research. Studies are conducted and knowledge is generated, yet a satisfactory resolution to concerns has not yet been attained. During a speech in January 2005 Lawrence Summers, president of Harvard, brought the issue to the forefront with his suggestion that 'innate abilities' might be one reason that women were not equally represented in the mathematical field. Dr. Summers was castigated by some and praised by others for his statement. He did, in fact, demonstrate that this issue remains important and pertinent in the fields of education and social psychology. Many contributing factors must be considered when gender issues are discussed. An area that needs to be explored is the socializing processes of pre-adolescent females which affect their attitudes towards mathematics (Kaiser-Messmer, 1993).

This purpose of this study was to examine how parental beliefs and student perceptions affect the individual in the classroom. The study examined how pre-adolescent female students' perceptions of their abilities in mathematics affect their success in current and interest in taking future mathematical courses. The utilization of grounded theory allowed for themes to be developed and examined through a continual comparative analysis. Thus, the data and information gathered is an accurate reflection of the field study. The data gathered displayed the relationship of parental beliefs and students belief regarding their capabilities and the pursuit of higher mathematics.

Additionally, this exploration revealed the relationship between the individual's attitude and her mathematical performance and beliefs regarding current and more rigorous mathematical courses ahead in her academic career. This information can be useful in providing experiences that encourage females to continue in the field of mathematics as opposed to self-selecting out of the content area. The data collected allowed for an opportunity to examine and develop an understanding of the lowering of mathematical self-efficacy phenomenon that occurs in early adolescent females. This is only one aspect of a complex issue. The research questions and findings are summarized below.

Question 1: What are individual female perceptions of their math capabilities?

Individual perceptions are as unique as the individual herself. However, there were distinct differences in beliefs of individual's mathematical abilities based quadrant populations.

Students in the High Mathematics quadrants were cognizant of their capabilities and were able to give specific examples of their capabilities. They were proud of their accomplishments and had accurate assessments of their abilities. These students displayed an awareness of the skills that are needed to excel in math. They spoke of specific skills and processes and their application. Likewise, these students were also aware of skills that they were lacking or needed to improve. This was very different from the other two remaining quadrants. This valuable position allows one to address weaknesses and specifically improve in those areas.

The students in the Low Mathematics quadrant were also aware of their skills. However, they spoke of skills in broad terms. They could not talk about the skills they

needed to excel in mathematics. Additionally, they expressed concern over the skills they did not have. The students in the Low Mathematics-Low Reading and one participant in the Low Mathematics-High Reading quadrants also expressed the idea that someone either had the 'math ability' or they didn't. It was innate and there wasn't anything a person could do to learn those skills.

Question 2: How do the participants perceptions of females' capabilities in mathematics compare to their perceptions of male capabilities in mathematics?

During individual interviews, the majority of participants brought up the idea of "boys being better than girls at mathematics". In initial interviews all student participants disagreed with this statement. However, the data received from the Fennema-Sherman Mathematics Attitudes Scales, classroom observations, and statements by some participants in the classroom indicated that not everyone was being forthright. The researcher decided this idea would be broached during focus groups. During the focus group this subject was brought up to discuss as an entity. The girls who disagreed with this concept were very vocal and expressed contempt with the idea and spoke of personal instances where they had been confronted with "boys are better at mathematics than girls". A few students did pose the question, that in spite of all posturing, maybe this was truly the case. The focus group incident became the catalyst for additional discussions during personal interviews.

Girls in the High Mathematics quadrants believed their skills and abilities were, at the very least, as good as their male peers. They felt confident in their abilities and gave numerous examples of their capabilities and how they are used in mathematics. They also made it very clear that males are not better than females in mathematics.

The students in the Low Mathematics quadrants, initially and in the focus group stated that boys were not better at mathematics. However, after the initial focus group, private interviews were held. At this time, and thereafter in other interviews, students in these quadrants admitted their belief in the ancient concept of male superiority in mathematics. They were reluctant to admit their position at first because of concern over social stigma. However, in private, they expressed either a resignation to this thought or a concession that it was true.

Question 3: What is the relationship between the individual's attitude and her mathematical performance and beliefs regarding current and more rigorous mathematical courses ahead in her academic career?

Student attitudes had a direct bearing on their current performance in mathematics and their plans for taking additional mathematics courses. The students in the High Mathematics quadrants held high expectations for themselves. These females knew they would master the mathematics of sixth grade and saw the importance of future mathematics course taking. They tied the need for strong mathematical skills to our technological society and the ability to secure gainful employment.

The students in the Low Mathematics-Low Reading quadrant did not hold their abilities in high regard. In fact, they knew they were lacking skills and so when they performed poorly, they were resigned to the outcome. The attitude most often expressed was frustration. The students were aware of their shortcomings and felt there was nothing they could do to change the situation. Since they viewed abilities as innate, studying or other interventions were seen as making only minimal and temporary improvement.

On this question, the Low Reading-High Mathematics participants varied in their responses. One student had the same outlook as the students in the Low Mathematics-Low Reading quadrant; however the other student varied significantly in her response. This student was determined to succeed. She, with her parents, developed a plan to improve her abilities. The student did additional work on her own, improved her mathematical skills, and worked with her parents on other skills. Her parents were actively involved in the improvement process. The Theory of Learned Helplessness did not apply to this student. She expressed the idea of being on the cusp of determining if mathematics is worthwhile. She had exerted the effort and will determine if it was worth it. In my discussions with this child, success in mathematics is equated with passing the sixth grade mathematics TAKS test.

Question 4: What are parental beliefs regarding their daughter's ability, success, and future success in mathematics?

Like their daughters, parents' ideas were unique to each individual. However, the patterns of beliefs did cut across the High and Low Mathematics quadrants. Parents of students in the High Mathematics quadrants had a keen understanding of their daughters' skills and abilities. High expectations were held for each child with success in mathematics an expectation. These parents equate success with good grades; those being A's (preferably) or B's. Additionally, the parents of students in these quadrants also expected their daughters to continue in mathematics beyond the required courses.

The parents of students in the Low Mathematics quadrants expressed different ideas regarding success. They, naturally, expect success from their daughters. However, success in these cases was associated with effort. Parents expressed the idea of putting

forth the best effort as success. With this idea comes the understanding that grades will be lower. The idea was communicated to the researcher directly from the parents. The girls in the Low Mathematics quadrants also expressed the ideas put forth by their parents.

None of the parents involved in this study spoke of learning mathematics for enjoyment. Parents of students in the High Mathematics quadrants saw mathematics as a doorway toward reaching future goals while those in the Low Mathematics quadrants viewed mathematics as an unpleasant task to be dealt with that would be shrugged off as soon as possible.

Question 5: How do parental beliefs affect the daughter's performance in mathematics?

Parental beliefs have an influence on their daughter's perceptions of what is expected and acceptable in mathematics. All student participants were aware of the ideas their parents held regarding mathematics in general. Students were aware of the expectations or non-expectations their parents held. However, some were not aware of specific parental beliefs.

The students in the High Mathematics-High Reading quadrant were clearly aware of what is expected of them. They talked about plans for their future, personal expectations as well as expectations held by of their parents. The students never expressed a feeling of pressure to meet these expectations, what they did express was determination. There was drive and determination in their voices as they discussed their mathematical future. The participants in the High Mathematics-Low Reading quadrant echoed the high hopes for success in future mathematics courses.

Students in the Low Mathematics quadrants were also aware of parent expectations. The majority of students in these quadrants, at the very least, expressed the idea of self selecting out of math courses as soon as the requirements for graduation were met. This concept was discussed by all of the parents. The parents expressed uncertainty regarding future mathematics course taking as they did not feel it was necessary for their daughter's future career or that their daughter did not have the capabilities to perform in those classes. The ideas were expressed with resignation. These themes were mirrored in the students' responses. One student was still in the process of determining if mathematics would be a worthwhile investment of her time and energy. She had developed a plan to improve herself, and was implementing it. The plan involved improving her skills through a myriad of tasks. Her parents supported her and participated in the practicing of the skills.

Students were aware of parents' beliefs and struggled with those that did not match their beliefs. The student in the Low Mathematics quadrant who was trying to improve her skills discussed this dissonance while knowing her father didn't think that girls could perform as well as boys in mathematics. It was interesting to note, however, that despite her father's uncertainty in her capabilities to complete advanced mathematics courses, he was actively supporting her attempt to master the current mathematics content.

Students in the High Mathematics-High Reading quadrant struggled with parental beliefs the most. One student was particularly offended by her father's belief that boys are better than girls at math and attempted to change his position by her actions. However, she sees her acts as pointless but still struggles to prove him wrong. The other

student in this quadrant grappled with her mother's lack of interest in mathematics. This student also perceived her mother as having a lack of interest in her daughter's mathematical performance in school. Both students felt frustration and a sense of powerlessness to alter their parents' beliefs.

Question 6: What beliefs do parents have regarding their daughters' mathematical capabilities and how do these beliefs relate to their daughters' study of higher mathematics?

Students were aware of the parental beliefs regarding their mathematical abilities and ideas regarding future course taking. When students discussed their thoughts, they almost always expressed ideas mirroring those of the parents. Both students in the High Mathematics-High Reading quadrant did not feel that that their mothers saw mathematics as very important, and this concerned them.

Students had high expectations when their parents held high expectations. Conversely, when parents considered their daughter's mathematical capabilities or future course taking in mathematics to be limited, invariably the daughters felt likewise. This is not to say that a students' mathematical future is based on parental beliefs; however those beliefs play a large role in shaping the child's mathematical self image.

Implications and Recommendations

When examining aspects that affect a lowering of mathematical self-efficacy in early adolescent females, the issues are complex. All student participants are taking basic mathematics courses, but are all "successful?"' What is success? If success is passing the mathematics course, then yes, the participants are successful. If success is

advancement to the following grade with peers, then yes, the students in this study are successful. If success is all of the above and passing the state mandated TAKS test in mathematics, then only half of the participants will be successful. These guideposts are the standard measuring sticks for a student's academic success in mathematics. What is not measured, but is just as critical to students advancing in mathematics, is their perceptions of self. Their mathematical self-efficacy has a direct influence on the pursuit of mathematics. Their successes and failures in mathematics will shape their desire to continue to engage in mathematics (Bandura, 1989; Bandura & et al., 1996)

The study provides insights into this phenomena and evidence supporting the importance of improving female students' mathematics self-efficacy. The females in this study clearly met most of the accepted standards of mathematical success: all receiving passing grades and advancing to the next grade at the appropriate time. However, the contrast between the High Mathematics and Low Mathematics quadrants in mathematics self-efficacy is very evident. What was very interesting and epitomized the crux of this study occurred in the Low Mathematics-High Reading quadrant. The two students were taking very different approaches to mathematics; one apparently choosing to disengage as she accepts her situation as unchangeable, the other taking means to improve her mathematical abilities thereby improving her self-efficacy.

The findings of this study provided support for studies that had been conducted previously. Chipman (2005) found that as some females progress through their education, their self perceptions in mathematics decline. This was found to be true in for the students in the Low Mathematics quadrants. Students in this study were still early in their academic careers, yet clear ideas had been developed regarding their self-

perceptions. The students in the Low Mathematics quadrants had many more negative feelings regarding themselves and mathematics as opposed to the students in the High Mathematics quadrants. The findings exhibit the importance of possessing a strong self-efficacy in mathematics in order to continue in mathematics. The information can provide valuable insights for parents and schools in order to encourage females to continue taking mathematics courses.

Through this study it also became clear that parent influence student beliefs. The students' beliefs overwhelmingly mirrored those of their parents. There were some variances in regards to gender being an innate male ability in the High Mathematics-High Reading quadrant, but otherwise, student and parent beliefs were very much in tandem. (McNeal, 1999) reported that parental beliefs have been recognized as a significant influencing factor in students' achievement and educational advances. This held true in this study. This provides support for a strong program which builds a cooperative network between parent and school. Schools need to provide opportunities for parents to engage in mathematical content and see it as a positive construct in which females can succeed.

Social Cognitive Theory explains that people shape their environment instead of simply reacting to it (Bandura, 1986). Bandura (1997) defines self-efficacy as an individual's belief in their capabilities to successfully implement the needed actions required to produce desired outcomes. The beliefs regarding success and the value placed on the task at hand also encompass self-efficacy. If an individual expects success and values the task, in this case mathematics, the person will continue to engage in the content. Additionally, the individual will display the fortitude necessary to persist when

the task becomes difficult. The findings of this study were consistent with Bandura's and support Social Cognitive and Expectancy Value Theory. Students who lacked the confidence in their mathematical skills frequently disengaged during classes and spoke of discontinuing in mathematical course taking as soon as possible. Conversely, positive expectations served to encourage the behavior to produce the desired outcome as well as providing self-efficacy in the individual's mathematical capabilities.

Bandura (1996, 1997) posited that self-efficacy affects engagement in the content areas, choice of classes, and is extremely useful in the initial stages of skill development as it allows for continued practice until the skill reaches the level of mastery. This was strongly supported through this study. The participants who were in the High Mathematics quadrants had a much higher self-efficacy and continually displayed more engagement than those in the Low Mathematics quadrants. Additionally the High Mathematics quadrants students reported a desire to continue into advanced mathematics. These students also described themselves as sticking with a problem or difficult mathematics task until it is successfully completed. They exuded confidence in their abilities and an assurance of success.

Students in the Low Mathematics quadrants did not reflect a high level of self-efficacy. They reported a lacking in mathematical capabilities as well as a desire to discontinue taking mathematics courses as soon as possible. The students in the Low Mathematics quadrants, with one exception, regularly displayed disengagement during mathematics classes. Students in the Low Mathematics quadrants displayed a resignation to their mediocre performance in mathematics and did not see any type of intervention as making a permanent improvement in their abilities. The only student in the Low

Mathematics quadrants who reflected a possible exception to this outlook was involved in obtaining assistance with her mathematical skills from her parents. The parents had worked closely with the mathematics teacher in order to address specific deficiencies in their daughter's mathematical skills. As a result, the child was obtaining reinforcement and practice of skills at home to augment the learning of mathematics at school. The findings throughout the study support Expectancy Value and Social Cognitive Theory as currently established.

As a result of the findings in this study, the following recommendations are suggested.

Recommendation #1. Encourage changes in parental attitudes regarding females, their abilities, and mathematics to reflect a more positive and equitable stance.

This recommendation may be the most difficult to implement. It is a concept that is multi-faceted and extremely complex. However, if approached from different angles, it can be accomplished. Notwithstanding, it will require a significant commitment on the part of school administrators and mathematics teachers to accomplish Recommendation #1. If they do not support and believe in the process, changing parent attitudes will not be successful.

There must be an active approach to getting parents involved in the school, especially the mathematics classroom. During parental interviews, all the parents of the Low Mathematics quadrant students discussed their inability to help their daughter with homework. The Low Mathematics-Low Reading quadrant parents exhibited resignation and felt nothing could be done to alleviate their situation. The Low Mathematics-High Reading quadrant parents reported going to the school to talk with the mathematics

teachers in an attempt to help their daughters. One experienced success and the other did not. When the parent did not succeed, he simply gave up.

Schools providing Family Math Nights, or other experiences of this nature help to bring families in to experience mathematics in a non-threatening, low-risk environment (Hall & Acri, 1995; Szemcsak & West, 1996). Family Math Night or a Math Circus would allow for an evening event where students and their families could play math games, engage mathematics teachers, and learn more about mathematical concepts.

The benefits are numerous and reaped by parents and school. Schools need parents to become more involved in their child's education. This type of event is fun and allows everyone to see mathematics outside the classroom. Math is experienced as a family event and benefits for parents are plentiful. With the situation being low stress and fun, math is not seen as an uncomfortable subject. This also allows the teacher to build rapport with parents and become more approachable (Adams, 2000). These type of activities need to be conducted on a regular basis so that rapport can be built between home and school.

Perhaps the most problematic aspect is expanding parent's concepts regarding mathematics and gender. Throughout the study it was evidenced that parental beliefs were transmitted to the child. Whether it was explicit or implicit, the beliefs were absorbed by the students. Some students disagreed with expressed parental beliefs and struggled with attempting to change the minds of their parents'. However, these girls had extensive success in mathematics and a foundation on which to base their arguments. The students who did not experience success in the mathematics classroom and had parents indicating that females have limited abilities in mathematics, exhibited a

resignation to having to struggle in mathematics. Based on research gathered during this study, changing the attitudes of parents is essential to changing the ideas female students develop regarding mathematics.

Recommendation #2. Make female students more aware of the skills and strategies good math students utilize.

The females in the High Mathematics quadrants were clearly aware of the skills and strategies good students utilized in the mathematics classroom. They spoke of specific skills and problem solving strategies. Just as importantly, they were aware of areas that needed improvement. The students in the Low Mathematics quadrants were not aware of specific skills they needed to improve upon in their mathematics courses. The students spoke of mathematics skills in general terms, such as addition, subtraction, multiplication and division. Likewise, they could not address specific weaknesses. Although those students were aware they lacked skills, their attitude expressed a general, "I just don't do well in math class."

Research in the field of reading and language arts has found that an awareness of reading skills and processes utilized by good readers helps those who struggle be aware of ways to perform and improve their own skills (Nelson, 1994). This is true for mathematics. Female students need to be aware of the required skills needed and think about mathematics analytically. This lack of skills limits a student's ability to move from concrete experiences to higher levels of thinking and application (Barton, Freeman, Lewis, & Thompson, 2001). Students need to be made aware of practices utilized in effectively solving problems and navigating the world of mathematics.

An awareness of these skills empowers students to see themselves as capable. This empowerment improves their self-efficacy and places females in control of their mathematical careers. "Self knowledge is a domain with many pathways"(Anderson, 1995). Mathematics is the gatekeeper for many realms of study; most high level careers and professions require four years of high school math (Kerr, 1997). Making female students aware of skills and strategies utilized to succeed in mathematics allows them more choices. This knowledge allows female students to choose their path of education, specifically, in selecting mathematics courses. They are not automatically eliminated from career options because of lack of skills in mathematics.

Recommendation #3. Modify learning situations in the classrooms.

This recommendation sounds simplistic, but would greatly enhance the learning experiences and successes of female students. Gardner's Theory of Multiple Intelligences has been accepted and utilized in developing classroom environments and teacher practices in order to engage those who might otherwise be disenfranchised (Gardner, 1983, 1999). Changes have been made in all content areas to reflect the individual learning styles of students. However, the mathematics classes observed in this study continue to have a more traditional approach to instruction. By teaching mathematics with a variety of approaches and utilizing multiple intelligences, all students become more aware of their different intelligence strengths and utilize their skills to attain conceptual understanding (Willis & Johnson, 2001). This, in turn, supports the development of female students' own thinking skills and results in increased self-efficacy.

By attending to the various learning styles of female students, a variety of teaching methodologies need to be utilized. This variety allows for students to engage the content in a variety of ways. Thus, allowing an opportunity for interacting with the content in a way that is comfortable for them and encourages success (Roth, 1996; Shakeshaft, 1995). Hands-on activities have been shown to significantly increase students learning in mathematics (Eggleton, 2001; NCTM, 2000).

During this study all student participants discussed their desire to have cooperative group work. Student participants suggested this allows for everyone to better understand the subject. Numerous students explained that cooperative group work allowed for a better understanding of the content. Cooperative learning groups are useful when meeting the needs of the less competitive mathematics students (Peltz, 1990). Cooperative groups have been found to improve student attitudes towards math and facilitate learning (Chang & Mao, 1999).

By providing a methodological variety of instructional strategies, teachers are better able to meet the needs of their students. All students will benefit, but this will especially aid female students who are not the traditional analytical math student. The inclusion of a variety of learning situations can encourage female students who have not been successful in mathematics to participate in this content area and improve their self-efficacy.

Recommendation #4. Provide female students with many experiences involving success in mathematics.

It was evidenced in this study that female students who experience success in mathematics are more willing to engage the content. Those who have not experienced success in mathematics do not consider themselves to have adequate mathematical abilities and frequently decrease the number of mathematical courses they take. Clearly female students must experience success in mathematics to improve their self-efficacy. Opportunities for success can be provided female students by utilizing an approach to learning mathematics that addresses the multiple intelligences of students (Campbell, 1997; Fasko, 2001).

Mathematics is often taught in a regimented, single-thought process, solitary manner. This approach disenfranchises female students who do not learn in such a manner. All female students in the study discussed the desire and necessity of working together towards the goal of mastering a concept. Opportunities of utilizing students strengths, allows them to be successful and encourages the student to strive for mastering of the assigned mathematics goal.

Early adolescent female students who are undecided in determining their value of mathematics need to be encouraged to do so. This will allow them to value mathematics and, quite possibly, continue to take higher level courses. By providing positive experiences in daily mathematics activities, students may gain increased self-efficacy. The increased self-efficacy can improve these students' probability of passing the mathematics portion of the TAKS test.

Suggestions for Future Research

This study provides an opportunity on which future areas of research can be initiated. A longitudinal study following female students and continuing to examine their attitudes, parents' attitudes, and course-taking patterns would provide additional insights. Additionally, a study could be developed to determine if student perceptions remain consistent and what, if any, are the patterns in course taking among the different quadrants.

This study also brings to light the issue of teacher practices and attitudes. In this study all participants were enrolled in two mathematics classes and observations occurred in both classrooms. Although this study did not include an examination of teacher practices and attitudes, invariably the teachers were observed. The teaching practices and interactions varied greatly between the two educators. The students also described very diverse experiences and opportunities for engaging the content. Female students' feelings and affect towards math also varied. Future studies could provide additional opportunities to examine the affect of teachers' pedagogical practices on students' mathematical experiences.

Another area to examine in future research is the influence of peers. During observations in the classroom, the researcher observed how peers exerted influence over each other. It would be of value to conduct a study of peer responses and influences among students in various quadrants.

An examination of the influence of focus groups would beneficial as well. The utilization of focus groups during this study provided valuable information. However, this study did not explore the benefits of utilizing focus groups as a tool to improve self-

efficacy. Therefore, an examination of the usefulness of focus groups as well as the effectiveness in various content areas would provide insight into potential benefits. This information could be utilized in determining ways to assist students to succeed in the content areas.

A study of boys and girls in all quadrants would allow an examination of rival hypotheses regarding this phenomenon. Having a larger number of students in each of the quadrants would allow for students to have similarities, except for gender, and provide additional data for a replicated study.

Conclusions

The recommendations based on this study are extremely important. These findings add to the understanding of gender issues in the mathematics classroom. As educators, one may not be able to change the belief system of a parent. No matter what interventions and opportunities are provided, many parents will always believe that males are better in mathematics than females. Many parents will also believe that mathematics is an innate ability. Additionally, many female students may not value mathematics or realize its importance in their future lives.

Two students who epitomize this statement are Debbie and Candy. Both students were on the cusp of determining their personal valuing of mathematics and had very different experiences. Both would consider themselves successful in mathematics if they passed the 2005 mathematics portion of the TAKS test. Candy did not pass the TAKS test and exhibited an acceptance of the idea that she does not have the ability to succeed

in mathematics. She also inferred there was nothing she could do to improve in mathematics. In her opinion, mathematics is an innate ability. Candy stated,

> Math is not easy for me. You know some people just have it. They just get math so easy. It is a natural thing for them, kind of like a special talent. I try and it never works out for me. It doesn't matter how hard I work, it doesn't make a difference. It is sort of like, what's the point? It is really frustrating you know, I don't have it and I never will.

Conversely, Debbie passed the mathematics portion of the TAKS test. Passing this test validated her mathematical skills. It also gave her confidence and encouragement in her mathematical abilities. Debbie's perception towards mathematics was very positive. She stated,

> It worked, all the hard work paid off! I didn't know if it would. I mean, look at me; I didn't think I was good at math, but I am. I am! If I can do it, other girls can too. They need to learn what it is to be good in math. If they feel how it feels, how it makes you feel good about yourself, they will want to do well too. By practicing and not giving up I made it. I now know I am a smart kid!

However, if parents and teachers can provide early adolescent female students with opportunities to be successful in mathematics, these students' beliefs in themselves change. With this transformation of self-belief and self-efficacy, students are more likely to continue in their pursuit of mathematics, enjoy it, and provide themselves with numerous career opportunities.

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APPENDIX A

INSTRUMENTS

Attitude Towards Success in Mathematics Scale (AS)

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. I would be proud to be the outstanding student in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. I would be happy to get top grades in mathematics.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. It would be really great to win a prize in mathematics.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. Being first in a mathematics competition would make me pleased.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. Winning a prize in mathematics would make me feel unpleasantly conspicuous.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. People who think I was some kind of a grind if I got A's in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. If I got the highest grade in math I would prefer no one knew.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. I don't like people to think I am smart in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Confidence in Learning Mathematics Scale (C)

1. **Generally, I have felt secure about attempting mathematics.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

2. **I am sure I could do advanced work in mathematics.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

3. **I am sure that I can learn mathematics.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

4. **I think I could handle more difficult mathematics.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

5. **I can get good grades in mathematics.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

6. **I have a lot self-confidence when it comes to math.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

7. **I’m no good in math.**

○	○	○	○	○
Strongly agree	agree	undecided	disagree	strongly disagree

8. I don’t think I could do advanced mathematics.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. I’m not the type to do well in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. For some reason even though I study, math seems unusually hard for me.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. Most subjects I can handle o.k., but I have a knack for flubbing up math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. Math has been my worst subject.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Effectance Motivation in Mathematics Scale (E)

1. **I like math puzzles.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **Mathematics is enjoyable and stimulating to me.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **When a math problem arises that I can't immediately solve, I stick with it until I have the solution.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **Once I start trying to work on a math puzzle, I find it hard to stop.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **When a question is left unanswered in math class, I continue to think about it afterward.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **I am challenged by math problems I can't understand immediately.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. **Figuring out mathematical problems does not appeal to me.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. The challenge of math problems does not appeal to me.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. Math puzzles are boring.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. I don't understand how some people can spend so much time on math and seem to enjoy it.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. I would rather have someone give me the solution to a difficult math problem than to have to work it out for myself.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. I do as little work in math as possible.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Father Scale (F)

1. **My father thinks that mathematics is one of the most important subjects I have studied.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **My father has strongly encouraged me to de well in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **My father has always been interested in my progress in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **My father thinks that I will need mathematics for what I want to do after I graduate from high school.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **My father thinks I'm the kind of person who could do well in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **My father thinks I could be good in math.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. My father wouldn't encourage me to plan a career which involves math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. My father hates to do math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. As long as I have passed, my father hasn't cared how I have done in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. My father thinks advanced math is a waste of time for me.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. My father thinks I need to know just a minimum amount of math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. My father has shown no interest in whether or not I take more math courses.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Mathematics Anxiety Scale (A)

1. **Math doesn't scare me at all.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **It wouldn't bother me at all to take more math courses.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **I almost never have gotten shook up during a math test.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **I usually have been at ease during math tests.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **I usually have been at ease in math classes.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. **Mathematics usually makes me feel uncomfortable and nervous.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. Mathematics makes me feel uncomfortable, restless, irritable, and impatient.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. A math test would scare me.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. Mathematics makes me feel uneasy and confused.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Mathematics as a Male Domain (MD)

1. **Females are as good as males in geometry.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **Studying mathematics is just as appropriate for women as for men.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **I would trust a woman just as much as I would trust a man to figure out important calculations.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **Girls can do just as well as boys in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **Males are not naturally better than females in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **Women certainly are logical enough to do well in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. **It is hard to believe a female could be a genius in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. When a woman has to solve a math problem, it is feminine to ask a man for help.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. Mathematics is for men; arithmetic is for women.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Mother Scale (M)

1. **My mother thinks I'm the kind of person who could do well in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **My mother thinks I could be good in math.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **My mother has always been interested in my progress in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **My mother has strongly encouraged me to de well in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **My mother thinks that mathematics is one of the most important subjects I have studied.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **My mother thinks that I will need mathematics for what I want to do after I graduate from high school.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. **My mother thinks advanced math is a waste of time for me.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. As long as I have passed, my mother hasn't cared how I have done in math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. My mother wouldn't encourage me to plan a career which involves math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. My mother has shown no interest in whether or not I take more math courses.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. My mother thinks I need to know just a minimum amount of math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. My mother hates to do math.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Teacher Scale (T)

1. **My teachers have encouraged me to study more mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **Math teachers have made me feel I have the ability to go on in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **My math teachers would encourage me to take all the math I can.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **My math teachers have been interested in my progress in mathematics.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **I would talk to my math teachers about a career which uses math.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. My teachers think advanced math is a waste of time for me.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. Getting a mathematics teacher to take me seriously has usually been a problem.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

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

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Usefulness of Mathematics Scale (U)

1. **I will need mathematics for my future work.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

2. **I study mathematics because I know how useful it is.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

3. **Knowing mathematics will help me earn a living.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

4. **Mathematics is a worthwhile and necessary subject.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

5. **I will need a firm mastery of mathematics for my future work.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

6. **I will use mathematics in many ways as an adult.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

7. **Mathematics is of no relevance to my life.**

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

8. Mathematics will not be important to me in my life's work.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

9. I see mathematics as a subject I will rarely use in my daily life as an adult.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

10. Taking mathematics is a waste of time.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

11. In terms of my adult life it is not important for me to do well in mathematics in high school.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

12. I expect to have little use for mathematics when I get out of school.

○ ○ ○ ○ ○

Strongly agree agree undecided disagree strongly disagree

Questions for Girls in Study

Questions about yourself and your math history

Tell me about yourself.
(Additional questions will be asked regarding age, family, likes/dislikes, interests outside of school, if not initially offered.)

Who are your friends?
What do you like to do together?

Do you like or dislike school? Why?
What is your favorite subject? Why?
What is your least favorite subject? Why?
Do you like math? Why?
Take me on a mathematical journey. Starting with your kindergarten experience, describe your mathematical experiences.

Tell me about your current math classes?

- Ms. Jones
- Ms. Smith

What do you do in each math class that helps you be better at math?
What do you do in each class that you like? Dislike?
What do they tell you about what a good math person does?
Do you have those skills? Which skills in particular?

What are your plans for taking math classes in the future?
When you get to choose whether to take a math class or not, like in high school, do you think you will continue to take math classes? Why or why not?

Questions about school, math and individual skills, and attitudes

Describe what you think a mathematician, a person who does math for a living, looks like?
What is the purpose of mathematics?
What type of activities/things do you do in math?
What do you like about math?
What do you dislike about math?
Do you look forward to going to math class?
Are you good in math?
How do you feel about mathematics?
How do you feel when a test is coming up in mathematics?
What one word would you use to describe how you feel when you are walk in a math class? Why?

Do you sometimes try to avoid doing your math work in class? If so what?
Do you sometimes try to avoid doing your math work at home? If so what?
Why do you avoid your math work?
What do you do when you have a math problem that you cannot solve right away?
Do you ever do anything else?
Are there strategies you would like to have, but don't?
How do you gain these strategies?
Do you consider yourself successful in mathematics?
What are some things that help you be more successful in mathematics?
What are some strategies that you see people who are good in math use?
Do you use the same strategies? Do you use them regularly?
How do you think they gained these strategies?

Do you notice any differences between the boys and girls in the mathematics classroom? If so, what do you notice?
How do boys respond or react to girls in math class? How do they react to "smart" girls?
Do you that people are either have the ability to math or not?
The President of Harvard, Dr. Summers, stated in a speech that men have more ability in math than women, what do you think about that?
Do you feel that boys are better at math than girls?
Have you ever heard that? From whom? How did you feel and what did you think when that person told you that?

Do you see yourself using math when you are grownup and out of school?
How will you use mathematics outside of school?
What do you want to do when you grow up?
Will you have to use mathematics in that career? How?

Questions about Parents

Tell me about your parents.
Is your Mom good at math?
Is your Dad good at math?
What do your parents think about you and your mathematical ability? How do you know how they feel?
Do you think your parents believe math is somewhat important, important, or very important? Why?
Does their belief about your math abilities help you do better in math?
When you are working on math homework at home, who do you go to for help? Why?
Do any of your siblings help you with math homework? Who?
Who do you think is good at math in your home? Why?
How do they help you? (Do they work the problem for you…)
What are some of things that you see that person doing when working math problems?

Is there anything else you want to share about mathematics?

Questions for Parents

Tell me about your daughter.

Describe what a mathematician, a person who does math for a living, looks like?

What is the purpose of mathematics?
How do you feel about mathematics?
Tell me about your mathematics experiences.
What one word would you use to describe how you feel when you think about your math experiences? Why?
What was the last math class that you took?
What do you like about math?
What do you dislike about math?

Are you good in math? What about your spouse?
Do you consider yourself successful in mathematics? Why or why not?

The President of Harvard, Dr. Summers, stated in a speech that men have more ability in math than women, what do you think about that?
Do you feel that boys are better at math than girls? Why?
Do feel that some people are "math people"? Why?
Who are more successful in mathematics? Why?

INTERACTIONS WITH DAUGHTER

When your daughter has math homework, who usually helps her with it? Why?
Do any of her siblings help her with math homework? Who?
How do family members help? (Do they work the problem, create a similar problem and work it…)

BELIEFS ABOUT DAUGHTER

Do you feel your daughter is good at mathematics?
What your expectations of your daughter in mathematics class? How do you let her know these expectations?
Do you think she is a "math person"?
What can help your daughter improve in mathematics?
How will she use mathematics outside of school?
What do you see for your daughter's future career?
Will she have to use mathematics in that career? How?

Is there anything else you want to share about your daughter and mathematics?

APPENDIX B

FENNEMA-SHERMAN MATHEMATICS ATTITUDES SCALES RAW SCORES AND MEANS

Table B.1

Attitudes Towards Success in Mathematics Scale (AS)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. It would make me happy to be recognized as an excellent student in mathematics.	5.00	2.00	3.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.50	4.50	1.069	3
2. I would be proud to be the outstanding student in math.	5.00	4.00	4.50	5.00	5.00	5.00	4.00	5.00	4.50	4.00	4.00	4.00	4.50	0.535	1
3. I would be happy to get top grades in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0	0
4. It would be really great to win a prize in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	4.88	0.354	1
5. Being first in a mathematics competition would make me pleased.	5.00	4.00	4.50	5.00	5.00	5.00	3.00	5.00	4.00	4.00	4.00	4.00	4.38	0.744	2
6. Being regarded as smart in mathematics would be a great thing.	5.00	3.00	4.00	5.00	5.00	5.00	4.00	5.00	4.50	5.00	4.00	4.50	4.50	0.756	2
7. Winning a prize in mathematics would make me feel unpleasantly conspicuous.	5.00	3.00	4.00	5.00	5.00	5.00	3.00	5.00	4.00	4.00	5.00	4.50	4.38	0.916	2
8. People who think I was some kind of a grind if I got A's in math.	1.00	3.00	2.00	2.00	2.00	2.00	3.00	2.00	2.50	2.00	4.00	3.00	2.38	0.916	3
9. If I had some good grades in math, I would try to hide it.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	4.00	5.00	4.50	4.75	0.463	1
10. If I got the highest grade in math I would prefer no one knew.	5.00	4.00	4.50	5.00	5.00	5.00	4.00	1.00	2.50	4.00	5.00	4.50	4.13	1.356	4
11. It would make people like me less if I were a really good math student.	5.00	5.00	5.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.75	0.886	2
12. I don't like people to think I am smart in math.	5.00	3.00	4.00	5.00	4.00	4.50	4.00	5.00	4.50	5.00	4.00	4.50	4.38	0.744	2
OVERALL MEAN FOR SCALE	4.67	3.83	4.25	4.58	4.50	4.54	3.92	4.25	4.08	4.17	4.42	4.29	**4.29**		

Table B.2

Effectance Motivation in Mathematics Scale (E)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. I like math puzzles.	5.00	5.00	5.00	5.00	4.00	4.50	3.00	5.00	4.00	4.00	4.00	4.00	4.38	0.744	2
2. Mathematics is enjoyable and stimulating to me.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	2.00	2.00	2.00	3.63	1.408	3
3. When a math problem arises that I can't immediately solve, I stick with it until I have the solution.	5.00	5.00	5.00	4.00	4.00	4.00	3.00	4.00	3.50	2.00	5.00	3.50	4.00	1.069	3
4. Once I start trying to work on a math puzzle, I find it hard to stop.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	4.00	4.00	2.00	4.00	3.00	4.13	0.991	3
5. When a question is left unanswered in math class, I continue to think about it afterward.	2.00	5.00	3.50	5.00	4.00	4.50	2.00	1.00	1.50	4.00	5.00	4.50	3.50	1.604	4
6. I am challenged by math problems I can't understand immediately.	3.00	5.00	4.00	3.00	3.00	3.00	3.00	1.00	2.00	2.00	2.00	2.00	2.75	1.165	4
7. Figuring out mathematical problems does not appeal to me.	5.00	5.00	5.00	5.00	3.00	4.00	2.00	1.00	1.50	2.00	1.00	1.50	3.00	1.773	4
8. The challenge of math problems does not appeal to me.	5.00	5.00	5.00	5.00	5.00	5.00	2.00	1.00	1.50	2.00	1.00	1.50	3.25	1.909	4
9. Math puzzles are boring.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	5.00	4.50	2.00	1.00	1.50	3.88	1.553	4
10. I don't understand how some people can spend so much time on math and seem to enjoy it.	5.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	2.138	4
11. I would rather have someone give me the solution to a difficult math problem than to have to work it out for myself.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	2.00	5.00	3.50	4.50	1.069	3
12. I do as little work in math as possible.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	4.00	4.00	4.00	4.63	0.518	1
OVERALL MEAN FOR SCALE	4.58	5.00	4.79	4.75	4.00	4.38	3.17	2.92	3.04	2.42	2.92	2.67	**3.72**		

Table B.3

Confidence in Learning Mathematics Scale (C)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. Generally, I have felt secure about attempting mathematics.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	5.00	4.50	2.00	2.00	2.00	4.00	1.309	3
2. I am sure I could do advanced work in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	3.50	1.00	2.00	1.50	3.75	1.753	4
3. I am sure that I can learn mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	4.00	4.00	5.00	4.50	4.63	0.744	2
4. I think I could handle more difficult mathematics.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	1.00	2.00	1.50	3.50	1.604	3
5. I can get good grades in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	1.00	4.00	1.851	4
6. I have a lot self-confidence when it comes to math.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	2.00	2.00	2.00	3.63	1.408	3
7. I'm no good in math.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	2.00	3.00	1.00	5.00	3.00	4.00	1.603	4
8. I don't think I could do advanced mathematics.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	1.00	1.00	1.00	3.38	1.768	4
9. I'm not the type to do well in math.	1.00	5.00	3.00	5.00	5.00	5.00	4.00	4.00	4.00	1.00	4.00	2.50	3.63	1.685	4
10. For some reason even though I study, math seems unusually hard for me.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	1.00	3.00	2.00	3.63	1.506	4
11. Most subjects I can handle o.k., but I have a knack for flubbing up math.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	3.50	2.00	2.00	2.00	3.88	1.553	3
12. Math has been my worst subject.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	3.50	1.00	4.00	2.50	4.00	1.604	4
OVERALL MEAN FOR SCALE	4.67	5.00	4.83	5.00	4.58	4.79	4.42	2.75	3.58	1.50	2.75	2.13	**3.83**		

Table B.4

Father Scale (F)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. My father thinks that mathematics is one of the most important subjects I have studied.	5.00	4.00	4.50	5.00	4.00	4.50	4.00	5.00	4.50	5.00	5.00	5.00	4.63	0.518	1
2. My father has strongly encouraged me to de well in mathematics	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	5.00	5.00	5.00	4.88	0.354	1
3. My father has always been interested in my progress in mathematics.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	5.00	5.00	5.00	4.88	0.354	1
4. My father thinks that I will need mathematics for what I want to do after I graduate from high school.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	5.00	4.00	4.50	4.75	0.463	1
5. My father thinks I'm the kind of person who could do well in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	2.00	2.00	2.00	4.13	1.356	3
6. My father thinks I could be good in math.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	4.00	4.00	2.00	5.00	3.50	4.25	1.035	3
7. My father wouldn't encourage me to plan a career which involves math.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	3.00	3.50	2.00	2.00	2.00	3.75	1.282	3
8. My father hates to do math.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	5.00	4.00	4.50	4.75	0.463	1
9. As long as I have passed, my father hasn't cared how I have done in math.	2.00	5.00	3.50	5.00	2.00	3.50	3.00	2.00	2.50	2.00	1.00	1.50	2.75	1.488	4
10. My father thinks advanced math is a waste of time for me.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	2.00	3.00	3.00	3.00	3.00	3.88	1.126	3
11. My father thinks I need to know just a minimum amount of math.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	1.00	2.50	1.00	2.00	1.50	3.50	1.852	4
12. My father has shown no interest in whether or not I take more math courses.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	1.00	2.50	2.00	2.00	2.00	3.63	1.685	4
OVERALL MEAN FOR SCALE	4.75	5.00	4.83	5.00	4.08	4.54	4.25	3.58	3.92	3.25	3.33	3.29	**4.16**		

Table B.5

Mathematics Anxiety Scale (A)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. Math doesn't scare me at all.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	2.00	2.00	2.00	4.00	1.309	3
2. It wouldn't bother me at all to take more math courses.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0	0
3. I haven't usually worried about being able to solve math problems.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.50	0.535	1
4. I almost never have gotten shook up during a math test.	5.00	2.00	3.50	4.00	5.00	4.50	2.00	1.00	1.50	4.00	4.00	4.00	3.38	1.506	4
5. I usually have been at ease during math tests.	5.00	5.00	5.00	5.00	4.00	4.50	2.00	1.00	1.50	4.00	5.00	4.50	3.88	1.553	4
6. I usually have been at ease in math classes.	5.00	5.00	5.00	5.00	4.00	4.50	3.00	1.00	2.00	1.00	3.00	2.00	3.38	1.685	4
7. Mathematics usually makes me feel uncomfortable and nervous.	5.00	5.00	5.00	5.00	5.00	5.00	3.00	1.00	2.00	2.00	2.00	2.00	3.50	1.69	4
8. Mathematics makes me feel uncomfortable, restless, irritable, and impatient.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	2.00	1.00	1.50	4.00	1.604	4
9. I get a sinking feeling when I think of trying hard math problems.	5.00	5.00	5.00	5.00	3.00	4.00	2.00	1.00	1.50	1.00	2.00	1.50	3.00	1.773	4
10. My mind goes blank and I am unable to think clearly when working mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	2.00	1.00	1.50	2.00	2.00	2.00	3.38	1.768	4
11. A math test would scare me.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	1.00	1.00	1.00	3.88	1.808	4
12. Mathematics makes me feel uneasy and confused.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	2.00	1.00	1.50	4.00	1.604	4
OVERALL MEAN FOR SCALE	5.00	4.75	4.88	4.92	4.67	4.79	3.25	2.83	3.04	2.50	2.67	2.58	**3.82**		

Table B.6

Mathematics as a Male Domain Scale (MD)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. Females are as good as males in geometry.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	1.00	1.00	1.00	3.88	1.808	4
2. Studying mathematics is just as appropriate for women as for men.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	1.00	1.50	4.13	1.642	4
3. I would trust a woman just as much as I would trust a man to figure out important calculations.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	4.00	5.00	4.50	4.75	0.463	1
4. Girls can do just as well as boys in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	2.00	2.00	4.25	1.389	3
5. Males are not naturally better than females in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	2.00	3.00	2.50	4.25	1.165	3
6. Women certainly are logical enough to do well in mathematics.	5.00	5.00	5.00	5.00	3.00	4.00	3.00	5.00	4.00	2.00	2.00	2.00	3.75	1.389	3
7. It is hard to believe a female could be a genius in mathematics.	5.00	5.00	5.00	5.00	1.00	3.00	5.00	5.00	5.00	1.00	2.00	1.50	3.63	1.923	4
8. When a woman has to solve a math problem, it is feminine to ask a man for help.	5.00	5.00	5.00	5.00	4.00	4.50	4.00	5.00	4.50	2.00	2.00	2.00	4.00	1.309	3
9. I would have more faith in the answer for a math problem solved by a man than a woman.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	2.00	4.00	3.00	4.38	1.061	3
10. Girls who enjoy studying math are a bit peculiar.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	2.00	2.00	4.25	1.389	3
11. Mathematics is for men; arithmetic is for women.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	1.00	1.00	1.00	4.00	1.852	4
12. I would expect a woman mathematician to be a masculine type of person.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.75	0.463	1
OVERALL MEAN FOR SCALE	5.00	5.00	5.00	5.00	4.33	4.67	4.50	5.00	4.75	2.08	2.42	2.25	**4.17**		

Table B.7
Mother Scale (M)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. My mother thinks I'm the kind of person who could do well in mathematics.	5.00	4.00	4.50	5.00	4.00	4.50	5.00	5.00	5.00	1.00	2.00	1.50	3.88	1.553	4
2. My mother thinks I could be good in math.	5.00	4.00	4.50	5.00	5.00	5.00	5.00	5.00	5.00	1.00	2.00	1.50	4.00	1.604	4
3. My mother has always been interested in my progress in mathematics.	1.00	5.00	3.00	4.00	4.00	4.00	5.00	5.00	5.00	2.00	5.00	3.50	3.88	1.553	4
4. My mother has strongly encouraged me to de well in mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	4.88	0.354	1
5. My mother thinks that mathematics is one of the most important subjects I have studied.	2.00	2.00	2.00	3.00	2.00	2.50	3.00	3.00	3.00	5.00	5.00	5.00	3.13	1.246	3
6. My mother thinks that I will need mathematics for what I want to do after I graduate from high school.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	5.00	4.00	4.50	4.75	0.463	1
7. My mother thinks advanced math is a waste of time for me.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	5.00	5.00	1.00	1.00	1.00	3.88	1.808	4
8. As long as I have passed, my mother hasn't cared how I have done in math.	5.00	5.00	5.00	5.00	3.00	4.00	3.00	5.00	4.00	1.00	1.00	1.00	3.50	1.773	4
9. My mother wouldn't encourage me to plan a career which involves math.	5.00	4.00	4.50	5.00	4.00	4.50	5.00	5.00	5.00	3.00	5.00	4.00	4.50	0.756	2
10. My mother has shown no interest in whether or not I take more math courses.	2.00	5.00	3.50	2.00	3.00	2.50	3.00	1.00	2.00	1.00	2.00	1.50	2.38	1.302	4
11. My mother thinks I need to know just a minimum amount of math.	5.00	5.00	5.00	4.00	5.00	4.50	5.00	5.00	5.00	1.00	2.00	1.50	4.00	1.604	4
12. My mother hates to do math.	1.00	3.00	2.00	5.00	5.00	5.00	4.00	1.00	2.50	1.00	2.00	1.50	2.75	1.753	4
OVERALL MEAN FOR SCALE	3.83	4.33	4.08	4.42	4.08	4.25	4.33	4.17	4.25	2.17	3.00	2.58	**3.79**		

Table B.8

Usefulness of Mathematics Scale (U)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. I will need mathematics for my future work	5.00	5.00	5.00	5.00	5.00	5.00	4.00	3.00	3.50	4.00	4.00	4.00	4.38	0.744	2
2. I study mathematics because I know how useful it is.	5.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	4.00	4.50	4.63	0.518	1
3. Knowing mathematics will help me earn a living.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	4.88	0.354	1
4. Mathematics is a worthwhile and necessary subject.	5.00	5.00	5.00	4.00	5.00	4.50	3.00	3.00	3.00	1.00	2.00	1.50	3.50	1.512	4
5. I will need a firm mastery of mathematics for my future work.	5.00	4.00	4.50	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.50	4.25	0.463	1
6. I will use mathematics in many ways as an adult.	5.00	5.00	5.00	4.00	4.00	4.00	5.00	4.00	4.50	4.00	5.00	4.50	4.50	0.535	1
7. Mathematics is of no relevance to my life.	5.00	5.00	5.00	4.00	5.00	4.50	3.00	4.00	3.50	1.00	1.00	1.00	3.50	1.69	4
8. Mathematics will not be important to me in my life's work.	5.00	5.00	5.00	4.00	5.00	4.50	5.00	4.00	4.50	2.00	1.00	1.50	3.88	1.553	4
9. I see mathematics as a subject I will rarely use in my daily life as an adult.	5.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	4.00	4.50	4.63	0.518	1
10. Taking mathematics is a waste of time.	5.00	5.00	5.00	5.00	4.00	4.50	5.00	4.00	4.50	4.00	5.00	4.50	4.63	0.518	1
11. In terms of my adult life it is not important for me to do well in mathematics in high school.	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0	0
12. I expect to have little use for mathematics when I get out of school.	5.00	5.00	5.00	5.00	2.00	3.50	5.00	5.00	5.00	3.00	2.00	2.50	4.00	1.414	3
OVERALL MEAN FOR SCALE	5.00	4.92	4.96	4.42	4.33	4.38	4.50	4.25	4.38	3.50	3.58	3.54	**4.31**		

Table B.9

Teacher Scale (T)

	High Math/High Reading			High Math/Low Reading			Low Math/High Reading			Low Math/Low Reading					
	Jennifer	Alice	Average	Kendra	Shana	Average	Debbie	Candy	Average	Vivian	Valerie	Average	Mean per Question	Standard Deviation	Range
1. My teachers have encouraged me to study more mathematics.	1.00	5.00	3.00	4.00	2.00	3.00	3.00	4.00	3.50	5.00	2.00	3.50	3.25	1.488	4
2. My teachers think I'm the kind of person who could do well in mathematics.	5.00	3.00	4.00	3.00	4.00	3.50	4.00	4.00	4.00	4.00	4.00	4.00	3.88	0.641	2
3. Math teachers have made me feel I have the ability to go on in mathematics.	4.00	5.00	4.50	4.00	4.00	4.00	4.00	4.00	4.00	2.00	5.00	3.50	4.00	0.926	3
4. My math teachers would encourage me to take all the math I can.	3.00	4.00	3.50	4.00	5.00	4.50	4.00	4.00	4.00	5.00	5.00	5.00	4.25	0.707	2
5. My math teachers have been interested in my progress in mathematics.	1.00	3.00	2.00	4.00	5.00	4.50	4.00	3.00	3.50	4.00	4.00	4.00	3.50	1.195	4
6. I would talk to my math teachers about a career which uses math.	3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00	3.00	2.00	2.50	2.63	0.518	1
7. When it comes to anything serious I have felt ignored when talking to math teachers.	5.00	5.00	5.00	5.00	3.00	4.00	5.00	1.00	3.00	4.00	2.00	3.00	3.75	1.581	4
8. I have found it hard to win the respect of math teachers.	5.00	4.00	4.50	5.00	3.00	4.00	4.00	2.00	3.00	5.00	4.00	4.50	4.00	1.069	3
9. My teachers think advanced math is a waste of time for me.	5.00	5.00	5.00	5.00	4.00	4.50	3.00	5.00	4.00	5.00	5.00	5.00	4.63	0.744	2
10. Getting a mathematics teacher to take me seriously has usually been a problem.	5.00	5.00	5.00	5.00	3.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	4.25	0.886	2
11. My teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.	5.00	5.00	5.00	3.00	3.00	3.00	5.00	5.00	5.00	2.00	4.00	3.00	4.00	1.195	2
12. I have had a hard time getting teachers to talk seriously with me about mathematics.	5.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	4.50	5.00	4.00	4.50	4.75	0.463	1
OVERALL MEAN FOR SCALE PER STUDEI	3.92	4.33	4.13	4.17	3.67	3.92	3.92	3.50	3.71	4.00	3.75	3.88	**3.91**		

APPENDIX C

MATHEMATICAL AUTO-ETHNOGRAPHIES DIRECTIONS AND STUDENTS' WORK

Mathematical Auto-Ethnography

This is an opportunity to write about your mathematical experiences throughout your life. Please discuss your likes and dislikes and your feelings about math as you have progressed through your life. Please discuss how you use mathematics outside of school and how you may use it in the future. The writing does not follow any format you can express yourself however you wish. Consider this as a journal or diary entry. Remember that everything is confidential and only the researcher is aware of your writing.

Mathematical Auto-Ethnography

Alice Holt

I don't really remember math in kindergarten, so that means it was either really boring or I didn't learn anything. In first and second grade, it was okay. It was kind of boring but I learned some things. I understood a little bit about division and completely understood adding and subtracting. I can't say most of the small addition facts automatically, but I've always thought it's a lot of fun. I had to teach my self stuff or have my dad help me because I always wanted to learn more.

In third grade I loathed math and it stayed that way until 4th grade. I still didn't like it. Math was too boring and I remember trying to come up with harder problems that took a long time to solve. We always just did worksheets, and didn't get to do fun stuff. It was up to me to make it fun for myself.

My 5th grade math teacher made things much more easy, but my brain soaked everything up. Not long later, I was bored again. So I started making problems 2X as hard as 4th grade's.

In 6th grade, now of course, I couldn't get enough of it! I enjoy math problems, especially coordinate geography, angles, and circles, along with perimeter, area and volume. I love logic problems and I'm already starting to look at my 9th grade sister's Pre-AP math book. Math is fun!

I have always liked the challenge of mathematics. However, most of the time I have had to challenge myself. But that's okay because I can. Math is exciting to me. I like to work hard and have things to think about. I am looking forward to taking math all through school because it is challenging and fun. I will use math all the time I think.

Mathematical Auto-Ethnography

Jennifer Aguirre

I've known math for as long as I can remember. My dad got me into it. When I was two, he would show me how to add. Then I went to kindergarten. I still loved math. I loved math from the age of two to the age of 12. I am very good at math. It is fun and you get to figure things out. I like working on things and figuring them out. You get to show how smart you are and how you think.

I think I am good at math because I get good grades and my friends ask me to help them with their homework. I like the problems where you make a graph and then you have to find the answer. I don't like problem solving because it takes a long time to do. Not only that, but it isn't fun. You are given a bunch of problems and told to do them. What is the fun in that? No, I like graph problems and that kind of thing.

Teachers have really helped me to understand math. My dad though too. he helped me a lot. He was the one who got me started. He helped me love math and find the fun in math. He is the one who really started me off in math. My step dad helps me a lot too. I also like using stuff in math like geoboards, and compasses. That helps you see and figure stuff out. Math and math classes make me feel curious because you never know what you are gonna learn. It is fun and exciting.

It is so important to be good in math. I see it everyday. I think I see it everyday. You just can't escape it. Math is all around you. If you aren't good at it, then you are going to be in trouble. Not just with doing everyday stuff like shopping, but with jobs and your future. You have got to be good at math to get a good job. I **know** that! I see

me using math everyday. I will use it to pay bills, figure things out and of course for my job.

I look forward to harder math because if I take AP classes in high school, I could take hours away from college and if I work hard enough I wouldn't have to take math in college. I could use that time for my job and to keep up with my social life with family and friends.

Mathematical Auto-Ethnography

Kendra

My math history is exciting. I'm good in math because I understand it and it's easy. It has always been easy and fun, even since kindergarten. That is why I have always loved it. It is just something that is easy for me.

I like multiplication and division because it's easier and I like working with ratios and whole numbers. I don't like addition.(It's easy but don't like it.) I don't like it because it is so easy. I like all the math that I do.

I do well in math because I use my brain when I think and because I have a good teacher. I am good and enjoy math. Math is fun because you get to use things to do the problems and I understand it. It makes me feel happy because I know I will understand it. I do look forward to harder math as I grow up. I know I will be able to handle it.
I think about using math out of school as a normal thing. I will use it all the time when I need it. Math is used all the time and I will use it when I am a grown up in my job. I am not sure what I am going to do when I am grown up but I know that it will involve math. It's because I love math.

Mathematical Auto-Ethnography

Shana Moore

I love math but I hated it in the first, third and fourth grades because we didn't use any math materials. In kindergarten we did fun stuff and in second we did too. In fifth grade it was alright, but not great. I know I'm very good at math because now it's easier for me. I like it too because all my hard work pays off.

I like algebra, geometry, and mixed fractions. I use charts, fingers, and math materials to help me with stuff I'm stuck on. I just keep trying and working until I solve the problem. I know that when I keep trying that I will succeed, I always do. I'm mean, I don't want to sound like bragging, but I really am good at math. I don't let it get me down if I don't get the problem right away. The trick is to always to keep trying, if you try and can't solve it one way, rethink about it and try again. You just have to look at it from a different way. I am very good at that. I see math like a bird flying but I also see it as very serious to people. To me it's fun and surprising. I can't wait for math class because I know that I will do well. It really makes me feel good, smart, very smart.

Math is fun because you can see or tell by the problem it's going to be fun and because of that I'm always happy. I do well in math. I have a hard time in reading, but math is great. I feel happy, good, and not stupid when I do math. My teachers make me feel smart because they tell me how good I am at math too. I will get things done and other people still don't get it. I want to do something with math when I grow up. I know that I can.

I am looking forward to taking more math classes because they will get harder. I think it will be fun to be good in those classes too. People will know I am smart because I will take these hard math classes and be getting good grades. I need to do well too because I'm going to use it [math] everywhere I go even my car. But math is fun too. That is why I like to do it. If I didn't like math, if I wasn't good at it, I wouldn't do it.

Mathematical Auto-Ethnography

Debbie Fuentes

My math history is in K through 2nd math was okay. We did things, we used things to help us learn math. Bu in 3rd grade, I could not get math so I just gave up math and my grades went down. I have been fighting with math ever since 3rd grade. Well, I'm not good or bad [at math]. I'm alright. Some things I understand and some things I don't. I have really had to work hard this year to learn. I have been doing it but I don't know if it worked. I won't know still for a while.

I like addition, but don't like division. The other stuff I really don't like either because it is hard. In multiplication when I forget one of my math products, I just do dots to help me. I like math when I know tricks to help me learn the math. Otherwise I sometimes get frustrated because I don't know how to do the work. It is hard, but I just have to keep trying.

Until this year, I really didn't do math outside of school. But this year was different. My dad talked to the teacher and we have been working at home to get better at math. It hasn't been as bad as I thought it would be. It is kind of good though because when we are not in school, sometimes I forget the math I have learned. Some times I feel a little nervous because I don't know what is coming up and if I will understand it or won't understand it. I used to feel really bad about math because it was so hard and I never got it, but it has been better this year. I still don't really like it, but at least I don't hate it. When I understand it, it is fun. When I don't understand it, it is boring.

I don’t know if I will keep taking math because it is going to get harder and I don’t know if I will be able to do it. But I know there is more math to learn, I just don’t know if I will be able to handle it.

Mathematical Auto-Ethnography

Candy Smith

My math history is pretty interesting. I used to love it but now I hate it. When I was little, like 1st grade, I was good at math. It was kind of easy, but in about 4th grade it got hard, really hard. I haven't liked it since then, but each year it gets worse and I don't like it more. Actually, I hate it.

I am kinda good at it but not really. I am not that bad at it but I guess you can say that I am. I guess that when I tell the truth it would be that I really am bad, I stink at math. I hate it too. It really is gross and boring and dumb. When I talk to people I don't say that because then they think I am dumb, but I am, I just hide it.

There are things I do like about math, but just a couple of them. I like possible outcomes. It is just easy for me to pick an outfit for a person who needs it. I do not like problem solving. It's too hard for me to figure it out by myself. I can't do my facts, they don't stick I my head. There is more that I don't like than I do. I think I would do better in math if I could work with a partner. It helps because I can work a lot faster when I work with someone. All the stuff that we do is always by myself and that is so hard. No one can help me understand it because I am always working alone. Math is boring to me because all you do is work-work-work-work. It is really annoying because I do not see math in my future as an important roll.

Math and math class make me feel bored and/or anxious. The boring part is the working part. It is so so boring no matter what we do. The anxious part is learning something new every day in class. Why? Because it is just not interesting. It is hard

and I don't get it. I am bad at math. I think I hate math and it hates me. Seriously, it seems like that is true.

It is just hard for me to focus on my work in school. You know with boys and/or sports. It is just complicated for me to focus. I will focus on anything else in school but not math work and the homework and all that kinda stuff. I just want to have as little to do with math as possible.

It is not that important for me to use math outside of the school because I do enough in the school and it is too hard for me to do. Math is really only done in school anyway. You use it to pay bills but that is it. Not that much else. I don't want to use it – I don't like it. If I can avoid math I do. I plan to too. I mean, no math in high school for me. I can't wait until I am done. I really kind of hate it. It is to hard and I can't figure it out. Some people find it very easy to do, but not me. I don't have that special math talent. I will not use math outside of school in my job in the future. It is not important to me.

Mathematical Auto-Ethnography

Vivian Moreno

My math history is o.k. but not that great. In kindergarten it was okay because we used counting bears and stuff like that. The teacher made it okay because it wasn't a big deal. It was okay in first and second too because it was pretty easy stuff. But when I started moving up, it has gotten a lot harder. The teacher start trying to really get you to understand – almost beating it into your head – you gotta learn this stuff. I got out of trouble though because I would always copy off people. There were times when I could understand it better, but I'm still a little bad, no kinda bad, okay bad at it. I am trying to get better at it everyday, but it doesn't seem to happen. It started getting bad in fourth grade and has just gotten worse. I never knew I could be so dumb sometimes.

I used to be pretty good, but haven't done so well lately. I like adding and subtracting fractions but simplifying, I dislike because I always miss the problems. I think I need help in problem solving and simplifying fractions. Math is a little of both boring and fun because sometimes it is hard and easy. It makes me feel anxious because I get scared if I will pass or not. I sometimes hate it because it makes me feel dumb. It is fun sometimes though. There are times that I want to just throw everything off my desk because I get so frustrated. I don't get excited about math at all.

I see math all the time outside of school, for example on T.V. sometimes and computers. I don't regularly use math outside of school, but I get around to it sometimes. I don't really have to use it outside of school because it really doesn't matter out of school. When I do use it [away from school] it's when I am doing homework. That is the only time I use math outside of school. I don't think I will use math when I grow up.

I know I won't need for what I want to be. I am going to be a hair dresser like my mom.

I don't want to do anything with math when I grow up.

Mathematical Auto-Ethnography

Valerie Sandoval

In kindergarten I loved math because we got to use blocks and it was fun. In first grade I still liked math because we got to use food and it was fun and healthy for me. In second grade, I still liked math because we got to decorate cards that were called flash cards and we would write the problem on the front and the answer on the back. I still liked math in third grade because we had used a tape that my teacher would bring and it was a song that had all the problems and the answers. I still liked math in fourth grade because they showed us how with their finger. We used it because it was so cool. In fifth grade, I didn't like math because I started to hang around with bad people. My mom said it was bad so I went back to math but still sort of didn't like it. In 6th grade, I still of don't like math but the math teacher Ms Smith is cool. She tries to help us, I just don't get it most of the time. I wish I was smart like her in math. I don't know how she does it. I didn't think we were good at math. I don't think we are, I think she is just luck to be good at it.

I think I should be good in math because of all my hard work and the effort I put into it. I think I'm bad at it because of my grades and thinking I do in math. I don't get it. It bugs me because people around me get it and I still don't. I know that I'm not dumb, but it feels like I am. My grades are really kind of bad. My mom thinks it's the people I hang around with, but I just don't get math. no matter how hard I try, it's just not my thing.

I like all sorts of math because it's fun to do problems and getting good grades and learning something new every day. But I am not like that anymore. I was like that

before 5th grade, but not now. Now it is just frustrating and boring. Frustrating because other people get it and I don't. Boring because it doesn't matter how much I listen or try to do the work, I just am almost always wrong. Maybe if I had had teachers like Ms. Smith all my life I would have done better. But it is too late now. I don't even know if that would have helped though because some people, like boys, are better at math. They are just made that way. I don't think I am one of the people who do good at math. I don't think there is anything that can help me now. I will just do keep going down.

The way I see math outside of school is okay because it's pretty much the same. Some people are good at it and I ain't. It isn't something I do outside of school. I think only people who are kind of weird do math outside of school. Like, well I guess, I shouldn't say anyone's name, but I can think of people who like math and probably do math all the time. That is just weird, not me though, I'm not weird, I don't like math.

Math used to be fun to me because you were always learning something new everyday. Now though, I have a hard time learning the stuff, it is so stinking hard. I don't like math at all really. Well Ms. Smith makes math better, but I really still don't like it. Math classes make me feel unhappy because I'm always ready to learn more and something new and fun., but it doesn't happen. I also get angry because I think I should understand and I don't. I worry about math as I get older because as you go to a higher class, you have harder math. You will learn different math instead of the math you have already used. If you haven't got it before, you sure ain't gonna get it now. That's why I don't want to take math in high school. I don't want to feel dumb or look dumb to my friends.

APPENDIX D

PARENTAL CONSENT FORM

Consent Form

We are asking your daughter to be a subject in a research project called "Gender Issues in Mathematics: Student Perceptions, Teacher Practices, and Parental Beliefs". Dr. Charles P. Geer of the College of Education at Texas Tech University is in charge of the study. His phone number is 742-1997 extension 276. You can also contact Becky Ortiz, who is the principal researcher at 742-1997 extension 279.

The purpose of this study is to look at mathematics from parent, teacher, and female student perspectives. This study is to determine how to help improve girls' self concept in mathematics and encourage them to pursue math at higher levels.

If your daughter participates she will be given several questionnaires regarding her feelings about mathematics. It will take about 30 minutes to complete the questionnaires. There will be 4-5 interviews about 20-30 minutes in length that will be held with the sixth grade participants to explore responses to the questionnaires and their feelings about mathematics. Observations in the math classroom will also be completed. We will also interview your child's mathematics teacher 1-2 times during the course of the study. Finally, we will also interview parents of the participating students 1-2 times approximately 20-30 minutes long.

There will not be any risk to participants in answering the questions on the survey, being interviewed, or in being observed.

If you and your daughter participate in this study, you will be learning about how we can help your daughter perform better in mathematics, enjoy math more, and continue to take mathematics courses.

All the information will be seen only by Dr. Geer and Mrs. Ortiz. The responses will be kept in a locked file cabinet at Texas Tech University. Your responses are confidential and will be coded in order to ensure your privacy.

Participation in this study is optional. You may withdraw anytime you want.

Dr. Geer will answer any questions you have about the study. For questions about your and your child's rights as a subject or about injuries caused by this research, contact the Texas Tech University Institutional Review Board for the Protections of Human Subjects, Office of Research Services, Texas Tech University, Lubbock, Texas 79409. Or you can call (806) 742-3884.

Please sign the form below indicating that you read this form and that all of your questions were answered. Your signature indicates that your give permission for you and your daughter to participate in this study.

_____ _____

Name of Parent(s) Name of Student

_____ _____

Signature of Parent Date

This consent form is not valid after January 31, 2006.

APPENDIX E

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Texas Tech University
Institutional Review Board for the Protection of Human Subjects
Office of Research Services
203 Holden Hall / MS 1035
742-3884

February 25, 2005

Charles Geer
Curriculum &Instruction
Mail Stop: 1071

Regarding: 100355 Gender Issues in the Mathematical Classroom: Student Perceptions, Teacher Practices, and Parental Beliefs

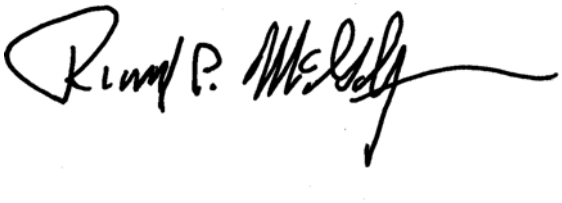
Dr. Charles Geer:

The Texas Tech University Protection of Human Subjects Committee has approved your proposal referenced above. The approval is effective from 02/25/2005 through 01/31/2006. This expiration date must appear on all of your consent documents.

You will be reminded of the pending expiration approximately eight weeks prior to 01/31/2006 and asked to give updated information about the project. If you request an extension, the proposal on file and the information you provide will be routed for continuing review.

Best of luck on your project.

Sincerely,



Richard P. McGlynn, Chair
Protection of Human Subjects Committee