The Effects of Individual and Social Factors on Academic Achievement and Learning Attitudes of Male and Female Students in Mathematics

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This present study explores the effects of individual, family, school, and geography on attitudes and achievement of male and female students in mathematics. Bem's encultured lens theory and Coleman's social capital theory are introduced as a basic framework for the analysis in terms of explaining how individual and social factors might contribute to the development of gender differences in learning attitudes and academic outcome in mathematics. The first wave of High School and Beyond (HSB) database is used in this study to examine its proposed hypotheses. The results of the analysis suggest that male students hold more positive attitudes toward

mathematics (seeing math as interesting and useful). In addition, male students outperform female students on mathematics standardized tests, and the differences are statistically significant. Thus, gender differences in academic attitudes and achievement in mathematics are shown to be associated with individual, family, school, and geographic factors.

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CHAPTER I

INTRODUCTION

Over the last decades, issues regarding gender differences in academic achievement in mathematics and science have been studied intensely. The considerable research has found ample evidence to demonstrate that gender differences in academic achievement have declined significantly. Nevertheless, previous research also suggest that male students continue to outperform female students in particular subjects (Benbow and Stanley 1980; Reyes and Stanic 1988; AAUW 1992; Ravitch 1997). For example, while the gender differences in achievement have diminished substantially, the gender gap in academic performance in mathematics and science has not completely disappeared. The research has documented that such achievement difference between males and females in mathematics and science is not apparent during their early school years (Friedman 1989). Indeed, numerous studies note that before high school male and female students demonstrate comparable levels of achievement in these subjects (Hanson and Kraus 1998; Callahan and Clements 1984). The gender discrepancy in academic achievement in mathematics and science; however, is apparent by the time the students reach their high school years (Aiken 1986-1987; Catsambis 1995; Hyde, Fennema, and Lamon 1990; Stipek and Gralinski 1991; Marsh 1989).

Presently, numerous studies have attempted to explore issues regarding gender differences in academic achievement, and have presented various explanations for the

gender gap in achievement in mathematics and science. Some researchers have concentrated their studies on the effects of individual factors. They conclude that the gender gap in academic outcomes is due to a variety of personal factors, such as gender differences in learning motivation, personal educational background in mathematics, and self-perceptions of mathematics and science (Jones et al. 1986; Reyes 1984; Steinkamp and Maehr 1984).

Other researchers have suggested that gender differences in academic performance may be attributed to factors in the family. From their perspectives, family variables, such as socioeconomic status of parents, parental gender-role socialization, parental attitude, and parental expectations act as crucial factors influencing children's educational achievement (Hanson 1996; Visser 1987; Felson and Trudeau 1991).

In addition to the analysis of personal and family factors, the effects of school factors on academic achievement have been another major focus of social research. Commonly, school factors, such as the size of school, the type of school (private or public), teachers' attitudes toward students, and the quality of education programs etc., have been a primary focus of previous studies (Clifton et al. 1986; Lee and Bryk 1989; Fennema 1990; Lee, Smith, and Croninger 1997).

Thus far, the majority of previous researchers have devoted most of their efforts to exploring and analyzing related factors that are associated with student performance generally. However, these studies frequently concentrate only on social

factors at either a micro or macro level. Seldom, have previous investigators exerted their efforts to examining the link between academic achievement in general and the influence of social factors at both micro and macro levels. In other words, previous researchers have focused their studies on one particular level instead of exploring multiple dimensions. Further, while research amply documents the differences in male and female academic achievement, the process by which individual and social factors contribute to this gender difference has not been adequately addressed.

The present study addresses some of the limitations of previous research by examining not only the differences in male and female achievement but also the ways in which individual, educational, and social factors produce this difference. The present study also contributes to the literature by focusing on multidimensional aspects at both the micro and macro level. That is, this study includes an exploration of the effects of geographic factors on students' learning attitude and educational achievement. To date, little research has these examined; therefore, the present study will consider the influences of living in the south versus non-south in the U.S. and the effects of rural versus non-rural residence.

The primary purpose of this proposed study is to perform a comprehensive analysis of individual, social and geographic factors influencing students' learning attitudes and academic achievement in mathematics. More specifically, this study will contain an inclusive examination of individual, family, school and geographic factors that are believed to contribute a significant influence on students' learning

attitudes and educational achievement in mathematics. Furthermore, this study will explore how these related factors differentially impact girls versus boys in terms of learning attitude and academic achievement in mathematics.

For example, the geographic variable, such as the region, is considered to be an influencing factor that is associated with academic achievement. That is, students residing in Northern states generally academically outperform students living in the Southern regions (Wenk and Hardesty 1995). The present study will analyze whether this geographic effect determines the educational achievement of females differently than it influences males. By taking this approach, the study is able to produce new explanations for gender differences in learning attitude and academic achievement.

Social capital theory will be applied to study the influence of social capital and class related human capital on educational achievement. Class related human capital will be examined in terms of parents' education and parents' income. In addition, the present study will explore the essential element of social capital, the interactions between parents and children. The interaction between parents and children has been found to positively influence school performance. In addition to the social capital theory, perspectives of encultured lens theory will be explored and applied to explain gender differences in learning attitudes and academic achievement in math. From the perspectives of encultured lens theory, by internalizing cultural definitions of gender differences, children develop their conception of gender-role ideology during their early childhood period. Then, when they grow into adults, they

become reproducers of cultural assumptions of gender. That is, individuals continue to behave in a way that is in accordance with their gender-role identification. Traditionally, mathematics and science have been considered masculine subjects. Thus, boys may likely perceive these subjects as appropriate for them to study while girls may view these subjects as inappropriate because of their gender. In other words, children's inclinations to study these subjects are a result of their learned gender-roles. The effects of class related human capital and parental involvement related social capital are analyzed within the context of encultured lens theory.

The male-female gap in some respects is similar to the racial gap in academic achievement. Researchers have continually noted that Black students demonstrate lower average scores on standardized math tests than white students. According to research conducted by Anick, Carpenter, and Smith (1981), standardized math test scores of both Black and Hispanic students are below the national average and this difference persists, though to a lesser degree, when controlling for class. However, over the last decade, the racial difference in math performance has receded dramatically (Jones 1987; Reyes and Stanic 1988). Nevertheless, the gap between white and Black students in academic performance remains. Considerable research indicates that the gap may be due to the fact that tests themselves are racially biased (Fish 1993-94). However, given that racial differences are present even when controlling for class, it is possible that in addition to biased tests, a race biased education system may be contributing to the lower performance of Blacks and

Hispanics. For example, particular racial/ethnic minorities may be perceiving math and science through a "race" lens in addition to a "gender" lens. Matthews (1984) contends that minority students scoring below the national average in math may attribute this to the fact that minority students tend to consider math a white domain, and they doubt the usefulness of the mathematics in their future career. Though it is not the primary focus, race and ethnic differences in mathematics achievement will be addressed in this study.

In this study, the analyses are based on a cross-sectional part of the longitudinal data from the High School and Beyond (HSB) Database. The HSB database consists of survey data collected from a nationally representative sample and its respondents are randomly selected from high schools in the United States. HSB is a cohort national study that was started in 1980 with follow-up surveys in 1982, 1984, and 1986. For this particular study, the first wave of the HSB survey including senior students (respondents) will be used to test the proposed hypotheses because it serves the essential purpose of the study.

CHAPTER II

THEORETICAL ORIENTATION

Social Capital Theory

Researchers suggest that parents with more education have more economic and social resources than parents with lower levels of education (Haveman, Wilfe, and Spaulding 1991). Therefore, students with parents who have higher levels of education and income may have more access to education related resources (computers, etc.) and may have more role modeling and encouragement that stresses education (Haveman, Wilfe, and Spaulding 1991). According to Coleman, social capital in the family, referring to the relation or interaction between parents and children, will enhance educational achievement of children. Indeed, parents are productive actors in terms of being capable of creating social capital for their children. More specifically, social capital refers to parental presence and parental involvement or participation in children's educational matters such as helping with homework, keeping track of their progress, etc. Coleman claims that children who benefit from social capital have a higher propensity to be academic achievers than children who cannot benefit from the social capital due to its unavailability in the family for one reason or another (Coleman 1988; Astone and Mclanahan 1991). This study examines the influence of class related human capital and social capital (SES, parental educational expectations for children, parental involvement in children's academics) on students' attitudes and achievement.

Social Learning Theory

Social learning theory stresses that children are inclined to behave in a manner that is positively reinforced. Children attempt not to repeat behaviors that will result in punishment. This theory indicates that children learn gendered behaviors through observing and imitating others who are either close to them or similar to them to a certain extent. For instance, girls are likely to model behaviors of their mother or other women because these women are significant role models for them. On the other hand, boys tend to imitate behaviors of their fathers or other males because they perceive them as their role models. When children's behaviors of maleness or femaleness are reinforced by compliments, they will consistently repeat the acts. However, their behaviors will discontinue when they are discouraged from performing them (Bandura 1986; Martin 1990; Fagot 1985; Feinman 1981; Bronstein 1988; Bussey and Bandura 1984; Raskin and Isreal 1981; Renzetti and Curran 1995). Behaviors that are inconsistent with a culture's view of masculinity or femininity are discouraged by family, peers, teachers, media and other socializing agents.

Bem's Encultured Lens Theory

Encultured lens theory is derived from social learning theory. According to Sandra Bem, individuals' behaviors are related to his/her living environment or culture. She states that in each society there consists a considerable number of assumptions that indicate certain ways in which people should think and behave. Since their childhood, individuals are exposed to behavior patterns (assumptions) that

are permanently embedded in their cultural discourse, social institutions, and even individual psyches. From Bem's perspectives, these cultural assumptions are lenses. That is, we come to view, interpret, and understand our world through these lenses. She particularly focuses on the analysis of gender lenses embedded in our cultural discourse and social organizations. She suggests that three major types of gender lenses (assumptions) in the society are gender polarization, androcentrism, and biological essentialism (Bem 1993).

Gender polarization refers to the perception that differences between males and females are apparent and extreme. That is, gender polarization is the assumption that males and females are polar opposite and this assumption becomes a lens through which we see the world. Males are characterized by a set of masculine features, and females are characterized by numerous feminine features, and these features are seen as polar opposites. The lens of gender polarization shows that masculinity and femininity are culturally identified, and these assumptions are strictly attached to boys and girls respectively. These differences are exaggerated even at the instant of birth when parents are more likely to describe sons as strong, alert, and coordinated while daughters are described as soft, tiny, and delicate (Power 1981). These polar opposite terms are used to describe male versus female infants, although, in actuality, both male and female newborns are completely dependent on adults and therefore vulnerable. This process continues through childhood and into adulthood. For example, toys, such as trucks, are considered appropriate for boys but not girls. In

short, the lens of gender polarization is culturally constructed. Therefore without truly understanding biological differences between genders, children are still capable of identifying differences between males and females simply by applying cultural cues, such as hair styles and clothing (Renzetti and Curran 1995; Bem 1993). These differences become exaggerated or polarized so that males and females are viewed as opposite, rather than slight variations of one type of being.

The assumption of the lens of androcentrism refers to the cultural ideology that males and behaviors associated with males, are the normative standard in the culture, which implies that females and behaviors considered feminine are a deviation from the norm. Thus, the term, "lens of androcentrism", refers to the cultural ideology that males and females are not simply polar opposite but also that males and masculinity are superior to females and characteristics considered feminine. Accordingly, the lens of androcentrism conveys a critical message that males can always do things better than females. A clear example of illustrating the assumption of male superiority is the common practice of males driving the car during the family trip, although, the women in the family are quite capable of driving (Bem 1993). Similar examples bombard the individual hundreds if not thousands of times each day within the culture and social institutions. Research consistently confirms the existence of the lens of androcentrism. For examples, Williams (1992) notes that women in non-traditional occupations generally experience a "glass ceiling" that interferes with upward mobility past a certain point. In contrast, men in non-

traditional occupations tend to experience a glass escalator up the hierarchy. In part this is due to the assumption that male job performance is superior to women's performance even in jobs traditionally held by women (Williams 1992). Hence, the individual comes to see and accept the world through the lens of androcentrism (Renzetti and Curran 1995; Bem 1993).

The third lens discussed by Bem, biological essentialism, emphasizes that gender difference is socially constructed on the basis of biological factors so it is perceived as inevitable. Because it is perceived as inevitable, it is not questioned or challenged. The perception of differences between males and females as biologically inevitable results in gender differences in many respects, such as personal characteristics, self-perceptions, and identification of social roles (Renzetti and Curran 1995; Bem 1993). These socially constructed differences then become embedded in culture, in social institutions, and in our psyches because we believe these are inevitable.

Bem claims that lenses of gender are encultured through metamessages. That is, reality is socially constructed through the assumptions of gender lenses being transmitted in societies. The process of enculturation leads boys and girls to identify themselves according to cultural assumptions of their gender characteristics and social roles. After individuals have learned gender roles through internalizing the assumptions of male/female appropriate or inappropriate manners, they are inclined to perform in a manner that conforms to cultural definitions of their gender in particular.

For instance, girls living in the society in which boys are more likely than girls to be encouraged to study mathematics and science will have lower aptitude than boys in studying subjects related to mathemathics and science (Renzetti and Curran 1995; Bem 1993). They are reacting to a process of enculturation through gender lenses in which they see girls generally to be the opposite of boys, to be lesser than boys, and in which these differences are seen as inevitable.

Bem points out the fact that individuals are not passive receptors of enculturation; instead, they are active human beings whose roles start as carriers and later become reproducers of culture. The reproduction of culture takes place in the education system by adhering to standardized norms and expectations of gender in mathematics and science. For instance, being excessively exposed to the masculine image of math and science at school or home, children have rather high inclination to presume and believe that mathematics and sciences are subjects of male domains.

These metamessages are transmitted through families and peers and also through the formal and hidden curriculum in the education system. The formal curriculum refers to general subjects, such as literature, math, and geography that all students are required to study. Unlike the formal curriculum which is explicitly taught to students, the hidden curriculum implicitly transmits particular perceptions and values attached to learners. When scientists and mathematicians are presented primarily as male in the formal curriculum, then the hidden message that science is the domain of males is conveyed. When examples and illustrations in math and

science focus on areas that boys are more familiar with, such as yardage in football, it becomes easier for males to relate to the examples and to be successful in math. Similarly, when girls experience a "chilly classroom climate" in which they are given less attention than boys, it may have a negative effect on their learning attitudes and performance. As the result of these hidden messages, girls are likely to have lower interest than boys in studying math and science.

Both males and females have embedded (carried) the cultural definition of gender and science, and then they become reproducers of the gender lens by their behaviors (Renzetti and Curran 1995; Bem 1993; Steinke 1998). However, because we are active creators of the social world and because we are exposed to varied extremes of these lenses, varieties in the behaviors of males and females can be expected. That is, not all individuals are accepting of one extreme version of the lenses and may have more moderate attitudes about the degree of polarized differences, the superiority of males, and the inevitability of gender differences.

The present study examines the influence of personal, family, school, and geographic factors on attitudes about math and achievement in math. It is proposed that these factors represent class related human capital and social capital resources. The influences of these factors are understood and interpreted within an encultured lens perspective. The data do not provide information to directly test variations in the level of enculturation. Therefore, the theory can not be directly tested. However, it will be used as a general framework for analysis. For example, gender enculturation

theory will be used to explain why girls have different attitudes about math and why girls' achievement is lower than boys even when controlling for social capital.

CHAPTER III

LITERATURE REVIEW

Presently, the gap between male and female students in achievement in mathematics and science still exists, although, the discrepancy between the two genders has declined significantly over the last decade (Benbow and Stanley 1980; Friedman 1989; Hyde 1990; Ravitch 1997). Previous studies have documented various causes of gender differences in performance. Numerous researchers have reached a consensus that gender difference in educational achievement in mathematics and science does not become substantial until the high school years (Hyde, Fennema, and Lamon 1990). The following discussion presents findings from previous studies regarding the effects of social factors on academic achievement generally and on gender differences in achievement in mathematics and science in particular. Generally, these related factors can be categorized into four distinct domains: individual, family, school, and geography.

Personal Factors

Self confidence and views

Studies have shown generally that self-confidence is positively associated with academic achievement, and more specifically, several studies have documented that achievement in mathematics is strongly related to individuals' perception of themselves in regard to academic success (Armstrong 1980; Gaspard and Burnett 1991; Tartre and Fennema 1995). In these studies, self-concept refers to students'

confidence in their own capability of learning and confidence in pursuing successful achievement in schools. Students who have confidence in themselves are more likely to succeed academically than their counterparts who lack confidence in themselves (Reyes 1984).

According to earlier research, there is a confidence disparity between male and female students. The gender gap in confidence is not formed when boys and girls are in their elementary school years. During early school years, both boys and girls confidently believe in themselves that they are capable of learning and comprehending mathematics. By the high school years, female students' confidence in their mathematics ability has declined greatly compared to male students (Eccles 1984; Linn and Hyde 1989; Catsambis 1994). Clear examples of such gender discrepancy in confidence in mathematics ability can be documented in national research. This investigation has documented that more male students than female students have positive attitudes toward themselves regarding doing well in mathematics (Dossey et al. 1988).

Researchers suggest that the greater proportion of males participating in professional fields that are related to mathematics and science is a result of gender differences in confidence in learning these subjects (Linn and Hyde 1989; Marsh 1989). Furthermore, they claim that gender difference in academic achievement in mathematics and science is also attributed to the significant difference in confidence between male students and female students.

In short, confidence has been identified as a crucial affective factor that is strongly correlated with educational performance in mathematics because it directly affects students' interest and willingness to take and learn mathematics courses (Matthews 1984; Reyes, 1984). Students with stronger willingness to learn math are more likely to continue their studies at mathematics at a higher level than students who lack that strong willingness (Fennema and Carpenter 1981). In light of encultured lens theory and consistent with previous research, it is expected that the present study will find that female students have lower levels of self confidence and the lower levels of self-confidence will have a negative impact on academic attitudes and achievement. The effect of self-confidence on males' versus females' attitudes and achievement will be compared.

Attitudes toward math

According to the previous research, attitude regarding interest in math is one of the pivotal factors that has an impact on academic outcomes. Students with high levels of interest in mathematics and science are more frequently involved in learning these subjects and participating in activities related to mathematics and science than are students who lack such interest. Furthermore, the students with great interest in mathematics and science will elect to take more courses related to mathematics and science (Linn and Hyde 1989). Consequently, they will have a strong background in these learning areas and their achievement in mathematics and science will exceed that of other students.

Research documents the gender gap in interest and in learning mathematics and science. Studies report that males are found to have more positive attitudes toward science than female students (Simpson and Oliver 1985; Linn and Hyde 1989; Catsambis 1995), and there are more males than females considering science as useful subject, which can be applied to their future lives. Additionally, male students are more likely than female students to participate in activities that are science-related (Steinkamp and Martin 1984; Linn 1987; Catsambis 1995).

While research documents a gender gap in attitudes toward mathematics, numerous studies report that there is no gender difference in interest during the elementary school. In the elementary school years, boys and girls typically have equal interest in learning these subjects. However, the gender gap in interest appears by the time that students have moved on to pursue further study at higher level institutions (Eccles, Adler, and Meece 1984; Dossey et al. 1988; Linn and Hyde 1989; Catsambis 1994). Accordingly, male students begin to show a greater interest than female students in learning mathematics and science during the high school years. Furthermore, these gender differences in interest ultimately lead to the development of achievement discrepancies between male students and female students in mathematics and science.

Drawing on Bems encultured lens theory, the present study proposes that because the gender lenses of culture teach that math and science as the domain of males, females will report lower levels of interest in math compared to males.

Similarly, consistent with encultured lens theory it is proposed that girls will see math as less useful to their lives, given that it is presented as the domain of males. Further it is proposed that these attitudes will influence male and female achievement. The differential effects of attitudes as independent variables on achievement for females versus males will be explored. That is, attitudes will be examined as independent variables influencing mathematics achievement.

In addition, to examining attitudes toward math as useful and math as interesting as independent variables, these attitudes also will be examined as dependent variables. That is, differences in the factors influencing the attitudes of males versus females will be explored. Thus, attitudes regarding math as interesting and math as useful will be analyzed as both dependent and independent variables. It is possible that attitudes will be especially significant in predicting girls' achievement because more positive attitudes would indicate a breaking of the gender lens.

Academic background in mathematics

Several studies have focused on the analysis of the correlation between the amount of mathematics courses students have taken and their academic achievement in these fields. Studies indicate that individuals' mathematical background in terms of the number of mathematics courses taken directly affects academic achievement in mathematics (Welch, Anderson, and Harris 1982; Raizen and Jones 1985; Jones 1987). A study, which utilizes data from High School and Beyond, explicitly indicates that there is a significant relationship between mathematics courses taken,

especially courses of Algebra or above and educational achievement in mathematics by high school seniors (Jones et al. 1986). In short, students who have taken more mathematics related courses usually are found to score higher in mathematics examinations than students who have taken fewer mathematics courses.

Studies have revealed that students are likely to achieve equally on mathematics tests when they have enrolled or participated in similar mathematics courses. In this case, other differences such as gender essentially do not account for the variation in achievement on mathematics tests. The individual discrepancies in achievement in mathematics seem attributable only to the issue of whether students have similar background in mathematics (Senk and Usiskin 1983).

A considerable amount of research findings do document that gender differences in courses taken in mathematics exist. Simply speaking, researchers have reported that female students generally are less likely than male students to enroll or participate in mathematics courses which are optional (Fennema and Carpenter 1981), which contributes to a lower participation rate than males in taking advanced mathematics courses.

Consequently, the gender difference in the number of mathematics courses taken during the high school years appears to be responsible in part, for the emergence of gender discrepancy in academic performance in mathematics tests (Jones et al. 1986). Thus, the existence of the gender gap in terms of the disparity between male students and female students in mathematics achievement is partially

attributed to individual differences in the number and level of mathematics related courses taken. It is plausible to conclude that the reason male students consistently outperform female students in mathematics examinations is due to the fact that high school males have taken more and higher level mathematics courses than females. Therefore, male students have developed stronger mathematical skills than female students have since mathematical ability is correlated with the number of courses taken (Benbow and Stanley 1980).

The present study examines math background by taking into account whether or not students have enrolled in advanced math classes. Based on encultured lens theory, it is proposed that girls will be less likely to have taken advanced math. The effect of this background on attitudes and achievement in math will be explored. It is possible that because girls experience a less favorable classroom environment than males in the same class (Sandler and Hall 1986), they will benefit less from the math courses taken. Hence, math background in regard to courses may have a stronger effect on boys than on girls.[1]

[1] Based on this literature review, the number of math and science course taken was included in the analysis as an independent variable but also was explored as a dependent variable. The analysis of number of math and science courses taken as a dependent variable were confusing factors that had a positive influence on math and science courses taken included items such as low SES, minority status, low self-confidence, etc. It was decided that this variable was confusing enrollment in several math and science courses. That is, students with high levels of math and science courses were those who had reached the highest levels but also may who were not passing the classes. Due to this mismeasurement, this variable was dropped and the final analysis includes only "advanced math" as a variable. Likewise, the hypotheses have been reworded to include only the variable "advanced math".

According to encultured lens theory, gender lenses which are socially constructed and embedded in the individual psyche have tremendous influences on children in terms of their perception of themselves. Through the gender lenses, female students are less likely than male students to view science and mathematics as appropriate subjects for them to study or to pursue as future careers. Additionally, girls are not as confident as boys in themselves in terms of their ability to study in these fields because of the effect of gender assumptions which not only categorize subjects, such as mathematics and science, as male domains but also emphasize the superiority of males over females.

Family Factors

Several investigators have examined the relationship between family related factors and educational achievement. Findings of numerous studies give evidence that the effect of the family factors is indeed substantial (Christenson, Rounds, and Gorney 1992; Muller and Kerbow 1993; Hanson 1996). Researchers have given particular attention to a series of family related factors including: the socioeconomic status of parents, parents' involvement or participation in children's schooling, parental expectations for children's educational achievement, parent's own socialization experiences, and the structure of the family in terms of its traditional or non-traditional composition.

SES and parental involvement

According to the previous investigations, socioeconomic status, which is

measured primarily based on educational levels, annual income, and parents' occupations has been reported as one of the most powerful family factors to influence students' academic performance in general (Edington and Martellaro 1990; Entwisle and Alexander 1996; Crane 1996; Caldas and Bankston 1997). The study by White (1982) has disclosed that there is a positive relationship between socioeconomic status and school performance. Several researchers have noted that students from high-SES families are found to achieve a higher score on mathematics examinations than their counterparts from low-SES families (White 1982; Reyes and Stanic 1988; Wilson and Fasko 1992). Likewise, Felner et al.(1995) have concluded that students with parents working in professional occupations tend to outperform students whose parents are non-professionals. Such consistent findings explicitly illustrate the close link between socioeconomic background and students' educational achievement. The common question followed by acknowledging the relationship between SES and school performance is how this factor can play such a determinant role in academic outcomes.

There are many researchers trying to find reasonable explanations for the connection between socioeconomic status and educational outcomes. Studies have shown that the variations in the level of income, education, and occupation result in differentiation among parents in providing educational resources. For example, research indicates that parents occupying a higher level of SES have access to more financial resources than parents of low SES to provide their children with a living

environment replete with educational resources which are essentially beneficial to children (Muller 1993). Moreover, the study by Lareau (1987) has implicitly indicated that these parents with high SES are more likely to emphasize the importance of obtaining an education. In other words, they are likely to educate their children to take advantage of education as an avenue for pursuing success and securing upward mobility.

Furthermore, explanations of the academic success of students from high-SES families conclude that students from better educated families are more likely than students from less educated families to enroll in mathematics and science related courses because of the difference in parental involvement (Stevenson and Baker 1987). Parents who are highly educated are more likely to engage in their children's schooling than parents who have less educational background. It should be noted that differences in involvement are not necessarily related to differences in the interest level of lower versus higher educated parents. Rather, parents with higher levels of education may have the confidence and background needed to help children with homework and may feel more comfortable talking to teachers, etc. However, it appears that better educated parents are more likely than less-educated parents to emphasize the value of learning mathematics and science, and to encourage their children to enroll in advanced courses in fields of mathematics and science (Useem 1992).

The findings related to the effects of SES on parental attitudes and

involvement and ultimately academic achievement, illustrate Coleman's perception of social capital. The present study examines the effects of class related human capital and social capital in terms of SES and parental supervision. In the present study, parental supervision involves academic as well as general supervision. Consistent with Coleman's theory, it is proposed that SES and parental involvement will have a positive influence on students' attitudes and academic achievement. However, while this general positive effect is expected, it is also essential in light of Bem's encultured lens theory, to ask how these factors might differentially affect females versus males.

Thus far, it appears that studies have not explored issues in regard to the effects of socioeconomic status and parental involvement on male students versus female students in particular. In the present study, issues concerning the effects of socioeconomic status and parental involvement on males versus females will be analyzed and discussed in terms of their effects on learning attitude and educational achievement.

Parental expectations

In general, numerous studies have suggested that parental encouragement and expectations of children's academic achievement in mathematics are significant factors in determing academic outcomes (Casserly 1980; Eccles Parsons, Alder, and Kaczala 1982; Armstrong 1985; Armstrong and Price 1982; Visser 1987; Henson 1996; Entwisle and Alexander 1996). In addition, studies have clearly indicated that sons are more likely than daughters to receive encouragement from parents in

studying mathematics (Casserly 1980; Eccles and Jacobs 1986). These findings are consistent with Bem's encultured lens theory. Parents are transmitters and reproducers of the cultural lenses. By presenting math and science as male domains and providing more encouragement to males than females, the attitudes and achievement levels of girls will be negatively affected.

Consistent with Bem's encultured lens theory, research indicates that parents tend to hold different expectations for sons than for daughters in mathematics and science achievement due to a belief that these subjects are more appropriate for males than for females to study. Moreover, parents consider that sons are more capable of studying mathematics and science than daughters. Consequently, parents have a high tendency to expect their sons to do well in these particular fields. On the contrary, parents are less likely to expect their daughters to achieve at a high level in fields related to mathematics and science (Casserly 1980; Hanson 1996). Indeed there is considerable evidence indicating that gender difference in mathematics performance is a result of the transmission of gender lens assumptions in which children are taught by their parents that mathematics and science are masculine subjects (Visser 1987; Linn 1987; Smith 1992).

In the present study, parental expectations in regard to plans that the student will attend college are explored. Because higher level expectations for girls are inconsistent with the encultured lens expectations, it is proposed that they will have an especially significant effect on girls. That is, high level expectations will have a

positive influence on girls' and boys' attitudes toward and achievement in math but because the expectations break the encultured lens for girls, they should be especially significant for girls.

Family structure

A number of researchers have explored issues about the effects of the type of household on education outcomes. Mostly, investigators have suggested that there is a connection between the type of family structure and students' achievement. Researchers have claimed that substantial findings explicitly indicate that children from traditional two-parent families academically outperform children from non-traditional families where there is either a single parent or a parent and stepparent (Zimiles and Lee 1991; Lee 1993; Featherstone, Cundick, and Jensen 1992; Entwisle and Alexander 1995).

There are numerous explanations that might be used to demonstrate the relationship between family structure and children's achievement. Some researchers propose that parents in traditional families are more likely to be involved in children's study than parents in the nontraditional family (Astone and McLanahan 1991). For example, they argue that parents in traditional families more often than parents in non-traditional families have discussions with children regarding their schoolwork (Bronstein, Clauson, and Abrams 1993). Therefore, students from two parent families tend to outperform students from one parent family because the degree of parental involvement in children's education varies according to the household

structure (Lee 1993; Balli 1996; Bronstein, Clauson, and Abrams 1993; Entwisle and Alexander 1996).

Lee (1993) stresses that parental involvement in children's education is an important form of social capital and its effects on achievement are relatively significant. Also, Griffith (1996) has found an important relationship between parental involvement and academic performance. In Coleman's study of educational achievement, he stresses the effects of social capital as the basis of explaining differences in students' academic outcomes. According to Coleman's definition, social capital is measured by the degree of parental involvement in children's schooling. Coleman firmly asserts that students possessing higher levels of social capital have a high propensity to outperform students who lack social capital (Coleman 1988).

Furthermore, other studies suggest that low achievement occurs because single-parent families are more likely to possess a lower socioeconomic status than two-parent families, so their ability to provide educational resources for their children is limited. Single parent families are less likely than two-parent families to be able to produce adequate educational resources including human capital and social capital for children (Lee 1993; Entwisle and Alexander 1995).

Parental supervision has been identified as an influencing variable that has the potential of shaping children's achievement. Investigators have noted that parents of traditional families more often spend time on monitoring children's schooling tasks.

Based on the findings of the studies regarding this issue, children of non-traditional families are less likely to be supervised at home than their counterparts from traditional families (Astone and McLanahan 1989; Dornbusch et al. 1985).

The present study takes into account family structure by controlling for whether the student was primarily raised in a single versus two-parent (including step-parent) family. Also, as noted earlier, SES is controlled for in the present study. Thus, the effects of family structure analyzed in this study will be due to factors other than economic issues. The differential effects of family structure on female versus male attitudes and achievement will be explored.

School Factors

For years, a variety of school factors has been suspected of influencing schooling performance. Several studies (Haladyna, Olsen, and Shaughnessy 1982; Simpson and Oliver 1990; Lederman, Gess-Newsome, and Zeilder 1993; Sinclair 1994) have proposed that variations between genders in learning attitudes and academic performance are attributed to a number of school factors. These influencing variables include the quality of instruction (teacher's attitude toward, teachers' interest in, and teachers' expectations of students), academic climates, the type of schools, and the size of the institutions.

Teachers' expectations

Teachers' expectation of students has been shown to have a substantial effect on students' attitude toward science (Talton and Simpson 1986), and teachers'

attitudes and expectations of students depend upon individuals' ascribed characteristics, such as gender and race (Clifton et al. 1986). The development of gender difference in academic achievement appears when teachers treat girls and boys differently due to their personal expectations based on the gender of students (Barba and Cardinale 1991).

Teachers' expectations of students affect teacher-student interactions (Clifton et al. 1986). Fennema (1981) and Licht, Stader, and Swenson (1989) have documented that teachers more frequently interact with male students than female students. Also, Barba and Cardinale (1991) have clearly noted that proportionally more boys than girls are the target students in terms of receiving maximum attention from teachers. Male students are more often requested than female students to work on science problems involving high cognitive thinking.

Teachers' belief in the usefulness of math

According to Fennema (1990), teachers' belief is predicted to have a certain degree of influence on students' mathematics achievement because educators' teaching instruction is designed based on their personal belief of what is appropriate for students to learn. Teachers may presume that only particular groups of students are capable of learning certain levels of mathematics courses (Reyes and Stanic 1988). Teachers' decisions regarding what materials to teach students affect students' learning and achievement as well. Consequently, it is apparent that male students and female students are taught differently in educational institutions, and such different

treatment creates a gender gap in academic achievement in mathematics in particular (Fennema 1990).

Furthermore, Fennema (1990) suggests that teachers' belief in the usefulness of mathematics directly affects their teaching. Teachers regard mathematics as a more useful subject for male students than for female students. Thus, teachers tend to encourage male students more than female students to study in high-cognitive mathematics areas. Male students are more often encouraged by teachers to work on challenging mathematics questions regardless of their actual ability than are female students. Explicitly, male students and female students are not equally exposed to mathematics in their learning process, and such unequal treatment will have a detrimental effect on the performance of female students in particular (Fennema 1990).

According to encultured lens theory, gender difference in learning attitudes and achievement is generated by educators who utilized gender lenses as standards to justify students' ability to learn. They expect males to be potential mathematics learners but not females, and their expectations directly reflect on their attitudes toward students. When they expect males to be high achievers of "masculine" subjects, they are likely to ask male students but not female students to resolve questions involving high intellectual ability. While teaching, they tend to show a greater interest in boys than in girls.

Teachers' interest in students

Based on the previous literature, it is proposed that teachers' interest in students' performance and teachers' expectations of the students' academic future (college attendance) will have a positive effects on students' attitudes and achievement in mathematics. In addition, however, it is proposed that for girls, high levels of teachers' interest and high expectations of students' performance are a breaking of the encultured gender lens. Therefore, while teacher interest and expectation are expected to have a positive effect on the attitudes and achievement of both males and females, it is expected to be especially significant for females.

Geographic Factors

Thus far, studies with regard to the relationship between geographic regions and academic performance are very limited compared to the research related to the effects of individual, family and school factors on achievement. Few studies focus on issues of comparing the achievement difference between students in rural regions versus students in urban regions. Commonly, researchers have given particular attention to studies in terms of the analysis of distinctive characteristics of schools either in rural regional areas or schools in urban regions.

However, when researchers have considered the influence of geographic factors on educational achievement and attainment, substantial effects on the variation of individuals in educational performance have been noted. Studies have found that residence in the rural south is an influencing variable that has a negative impact on educational attainment. More specifically, studies indicate that compared to other

regions, the rural south reports a lower proportion of students completing high school. Furthermore, researchers conclude that students residing in the South have reached a lower level in educational achievement than students in the North and elsewhere in the United States as well (Wenk and Hardesty 1995; Greenberg and Teixeira 1995).

Several researchers have documented that academically, students living in urban regions tend to outperform students living in rural regions (Dodendorf 1983; Sunal 1991; Lederman, Gess-Newson, and Zeidler 1993; Greenberg and Teixeira 1995). Previous studies have indicated that the availability of educational resources is significantly related to academic achievement (Wendling and Cohen 1981; Stephens 1993). Studies have reported that rural schools may have provided students with lower levels of educational quality compared to urban schools, such as: inadequate learning resources, a lower proportion of qualified teachers, limited advanced courses etc.(Greenberg and Teixeira 1995; Keith et al. 1996; Barker 1985; Wendling and Cohen 1981; Moreau 1987; Carlsen and Monk 1992; Greenberg and Teixeira 1995). However, researchers also have asserted that educational achievement of rural schools has improved consistently (Wendling and Cohen 1981; Randhawa and Hunt 1987; Stephens 1993; Greenberg and Teixeira 1995; Keith et al. 1996). Accordingly, numerous findings have shown that the achievement gap between rural students and urban students is narrowing.

Previous studies obviously have not given attention to the issue of whether geographic factors are implicated with gender difference in learning processes and

academic outcomes. In the present study, the impact of geographic variables on individuals' learning attitudes toward mathematics and educational performance in mathematics will be analyzed. In addition, the analysis will consider whether or not the influence of geographic factors on students' learning and performance varies between male students and female students.

Research indicates that, on average, individuals from rural areas and those from the south hold more traditional values than those from other regions (Hite, Randall, and Merrill 1994; Carney/Taylor 1980). Therefore, from the viewpoint of encultured lens theory, it is likely that on average, rural and southern region residents adhere more strongly to gender assumptions than others. As a result, students in southern and rural regions may be more likely to become reproducers of gender assumptions than their counterparts in other regions. Based on previous research, the present study proposes that residence in the south and in rural regions will have a negative effect on students' attitude and performance in mathematics. In light of encultured lens theory, it is expected that this negative effect will be especially strong for girls.

Proposed Hypotheses

The following is a summary of research hypotheses for the present study

Based on previous research and in light of Bem's encultured lens theory, it is expected that at the bivariate level compared to boys, girls will report:

1. Lower academic performance scores in mathematics
2. Lower levels of interest in math

3. Lower levels of seeing math as useful
4. Lower levels of self confidence
5. Lower likelihood of taking advanced math.
6. Lower levels of parents' encouragement, involvement, and expectations for academic achievement (college).
7. Lower levels of teacher's interest and expectations for academic achievement (college).

Hypotheses for multivariate regression analysis:

1. Being female will have a negative influence on academic attitudes (seeing math as interesting and useful) and math performance (math achievement test scores).

2. Being racial minority will have a negative influence on academic attitudes (interest in math and seeing math as useful) and math performance (math achievement test scores).

3. Positive attitudes toward mathematics (seeing math as interesting and useful) will have a positive effect on achievement. The difference in the effects of attitudes on achievement for females versus males will be explored. It is possible that the effect will be stronger for females than males because perceiving math as interesting and useful significantly weakens the encultured lens that states that math is the domain of men.

4. Higher levels of self-esteem will have a positive effect on attitudes toward mathematics (seeing math as interesting and useful) and mathematics performance. The difference in the effects of self-esteem on attitudes and achievement for males and females will be explored.

5. Higher levels of SES will be related to more positive attitudes toward mathematics (seeing math as interesting and useful) and higher levels of mathematics performance. The difference in the effects of SES in attitudes and achievement for males and females will be explored.

6. Taking advanced math will have a positive influence on attitudes toward math (seeing math as interesting and useful) and mathematics performance. The difference in the effects of math background on the performance of male and female students will be explored. Due to the "chilly classroom climate" it is possible that females do not get the same benefit from advanced math and other math courses. Therefore, this relationship may be stronger for males than females.

7. Consistent with the idea of social capital, higher levels of parent supervision or involvement (generally and academically) will be related to more positive attitudes (seeing math as interesting and useful) and mathematics performance. The difference in the effects of supervision on the attitudes and performance for males versus females will be explored.

8. Consistent with the idea of social capital, higher levels of parents' expectations (plan) for children's educational achievement will be related to more positive attitudes about math and higher levels of achievement. In light of Bem's encultured lens theory, it is noted that for girls, high parental expectations may indicate a breaking of the encultured lens. Hence, parental expectations may have a strong effect for females than males.

9. Family structure is entered as a control variable. Based on previous research and Coleman's idea of social capital, it is predicted that two parent families will have a positive influence on attitudes and performance.

10. Higher levels of teacher's interest and expectations for students will have a positive effect on attitudes and performance in mathematics. In light of Bem's encultured lens theory, it is proposed that for girls, teacher interest and high expectations may indicate a breaking of the gender lens and a violation of the norms of gender bias in the classroom. The teacher's high expectations will weaken female's beliefs in male superiority. Such a breaking of the gender lens may produce a stronger effect of teacher interest and expectations for females than males.

11. Residence in rural and southern regions will have a negative effect on attitudes and performance. In addition, because rural and southern regions hold more traditional views of gender. The negative influence of southern and rural regions may be stronger for females than males because the lenses of gender are less likely to be challenged.

CHAPTER IV

METHODOLOGY

Data

The data used in this present project are derived from High School and Beyond (HSB) survey database. The HSB study is known as a nationally representative longitudinal survey of the high school students across the United States. Base year data of HSB include more than 58,000 sophomore and senior students. The data were collected in 1980 by applying a multistage stratified cluster sample in which 1,015 high schools were sampled. All of these respondents were re-interviewed extensively two, four, and six years later. The sample for the study is limited to senior students from the base year data because this first wave provides extensive information regarding senior students' educational experiences and academic achievement in mathematics. The availability of such information is especially significant in that the present study focuses on exploring the gender differences in learning attitudes and school performance in mathematics in particular.

The HSB study has numerous advantages for research. This data set contains a considerable amount of information regarding students' family background, school's characteristics, and students' educational outcome. Additionally, HSB database includes information regarding parenting practices, which allows for analyses of parents' potential effects on children's educational performance.

Design of the Analysis

The present study will use bivariate analysis to examine the gender differences in learning attitudes and academic performance in mathematics in particular. To investigate the gender disparity in education, the study uses mathematics standardized test scores as the measurement of students' math achievement. Students' learning attitudes toward mathematics are measured in regard to their perceptions of "math as interesting" and "math as useful". Following the bivariate analysis, the study will utilize multivariate regression to examine the series of hypotheses regarding the similar or dissimilar effects of individual, family, school, and geographic factors on male students versus female students.

The major function of bivariate analysis is to examine the degree to which males and females differ in regard to individual, family, school, and geographic factors. This analysis is not used to predict achievement or attitude. Rather, it simply explores gender differences in all of areas. T-test and chi-square will be used to test for statistical significance in the differences between males and females in the bivariate analysis. In contrast, the multivariate analysis is used to predict attitudes and achievement for males and females controlling for individual, family, school and geographic factors.

Sample Description

The information in Table 1 presents a demographic profile of respondents. Briefly, the total number of respondents is 11,995 High school seniors including 47.3 percent male students and 52.7 percent female students. The racial composition of

the sample includes 24.3 percent Hispanic, 1.7 percent Native American, 3.3 percent Asian American, 24.5 percent Black, 45.2 percent While, and 1 percent "other". It should be noted that Hispanics and Blacks are over-sampling. The majority of respondents are living with two parents. For instance, 72.4 percent of students live in two-parent families versus 27.6 percent of students living in single parent families. The students are distributed across the SES quartiles as follows: 37.6 percent in the lowest quartile, 23.1 in the second quartile, 20.4 percent in the third quartile, and 19 percent in the highest SES quartile. The geographic distribution of the sample includes 12.6 percent of participants living in the rural south, 14.1 percent living in rural non-south, 24.3 percent living in non-rural south, and 48.9 percent living in non-rural non-south.

Measurement of Variables

The dependent variable, mathematics performance (**mathematics average scores**), is a mathematics standardized test score. Categories of the variable are generated by truncating the last two digits. The score range varies from 26.0 to 67.0. In this study, Mathematics average scores is used as the basis of measuring students' achievement.

Attitudes toward math as useful (**perceiving math as useful**) is analyzed as both a dependent and independent variable. It is formed by questioning students about whether or not they believe mathematics will be a useful subject in their future. Students responding "yes" are coded as 1, and others are coded as 0. In this study,

this variable is used as an independent variable to analyze its effect on mathematics achievement. Additionally, it is used as a dependent variable to examine the influence of other independent variables on the learning attitudes toward mathematics of male versus female students. Attitudes toward math as interesting (**perceiving math as interesting**) are also analyzed as both dependent and independent variable. It is formed by questioning students about whether or not math is interesting to them. Students responding "yes" coded as 1, and others are coded as 0.

Gender is a straightforward variable with male respondents coded as 1, and female respondents coded as 2. **Racial composition** consists of a series of five dummy variables with the racial categories, Hispanic/Spanish, Native American, Asian American, Black, and White coded as 1 and all others coded as 0. The original questionnaire item requested respondents to specify the category that he or she fit into. A small percentage (1.0 %) of students indicated the category of "other". To minimize potential bias of including this possibly diverse group into another category, they are treated as missing data in the final analysis. In the regression analysis, the category "white" is omitted from the analysis as the reference category.

Self concept, an independent variable, consists of a Likert Scale created within the HSB database combining four different items that requested respondents to report the degree to which they "hold positive attitude toward themselves", "consider themselves to be a person of worth", "believe in themselves as a person capable of doing things as well as others, and "are satisfied with themselves". According to the

description of HSB database, "each item used in a given composite was standardized within grade to a mean of 0 and standard deviation of 1. Then standardized items were summed to give the composite measures"(NORC 1980:19). The range of self-concept varies from -1.10 to 3.68. Due to the response categories used, low values represent high levels of self-esteem.

Social Economic Status (SES), created within the HSB database, is used as an independent variable. The SES variable is a composite of numerous variables, such as: father's occupation, father and mother's education, family income, and family possessions. Each of these items was standardized within grade prior to summing. The SES scale is coded according to the numerical order (1 to 4) from the lowest SES category to the highest SES category.

Advanced math is an independent variable, and it refers to whether respondents have participated in advanced or honor mathematics programs. Respondents with "yes" are coded as 1 and the ones with "no" are coded as 0.

Family structure, an independent variable, is a composite of four variables that asked respondents "which of the following people live in the household with you?": "father", "male guardian", "mother", or "female guardian". These variables were combined and recoded so that respondents were categorized into groups based on whether or not they were living with mother and father, mother and step-father, father and step-mother, father only, mother only, or other. To meet the purpose of the present study, family structure was again recoded into two-parent and single parent

categories. The category of two-parent family, coded as 1, includes respondents primarily living with mother and father, mother and step-father, or father and step-mother. The category of single parent coded as zero is formed by including respondents with mother only, father only, or other. Frequencies of the multicategory variable as well as the dummy variable are presented in the bivariate analysis. However, only the dummy variable is included in the regression analysis.

Mom's expectation, an independent variable, is developed by asking students about how far in school they think that their mother wants them to go in school. This variable consists of a number of categories: less than high school, high school graduate, vocational school less than two years, two-year vocational school, college less than two years, two-year college, college graduate, masters, Ph.D./MD, and don't know. The respondents (17 %) specifying the category of "don't know" were recoded to the sample mean. The coding of mom's expectation is based on the numerical order from 1 (less than high school) to 9 (Ph.D./MD).

Parental supervision (academic), an independent variable, is derived from two individual variables: father supervision and mother supervision. Each of these variables refers to whether father (step-father/male guardian) or mother (step-mother/female guardian) keeps close track of how well the student is doing in school. Students' responses to these questions include true, false, and not apply. When these two variables are combined into parental supervision, the categories of "false" and "not apply" are recoded into "all else" in order to minimize the amount of missing

data. Respondents with "true" (of either father or mother) are coded as 1 and with "all else" are coded as 0. For students living with one parent, only the response of that parent is considered. **Parental supervision** (general), an independent variable, consists of an item asking respondents whether or not they think that their parents almost always know where they are and what they are doing. Originally, the possible responses contained categories of true, false, and not apply. For this study, the respondents with "true" are coded as 1, and respondents with "false or not apply" are recoded into the category of "all else" coded as 0.

Parent plan, an independent variable, is a combination of father plan and mother plan. Students' responses to questions regarding what they thought that their father or mother might want them to do after high school including college, job, trade school, military, don't care, don't know, and not apply. The question is coded as a dummy variable with 1 indicating that mother, father, or both parents expected the student to attend college and 0 indicating all else. For respondents with only one parent, only that parent's expectation was considered.

Teacher interest, an independent variable, is taken from an item asking respondents (students) "please rate your school on the aspect of teacher interest". The responses to the single item included poor, fair, good, excellent, and don't know. Respondents reporting "don't know" were recoded to the sample mean. The coding of teacher interest is based on the numerical order from 1 (poor) to 4 (excellent). **Teacher plan**, an independent variable, is formed by questioning students "what do

your teachers think you ought to do after high school ?" Their responses broadly include the following categories: college, job, trade school, military, don't care, don't know, and not apply. To meet the needs of the present research, the category of "college" is coded as 1, and the rest of the categories are recoded as 0.

Geographic residence, an independent variable, initially is a composite of two variables: "urbanity" and "big region". The variable of "urbanity" categorized students into 3 groups (urban, suburban, and rural) based on the original school CIC urbanization code. The variable of "big region" originally asked students where their high school was located. Their responses include the following areas: "Northeast," "Northcentral," "South," or "West." These variables were combined and recoded into a series of dummy variables measuring residence in the rural south, non-rural south, rural non-south, and non-rural non-south. In the regression analysis, non-rural non-south is omitted from the analysis as the reference group.

CHAPTER V

RESULTS

Results of Bivariate Analysis

The results presented in Table 1 show that, as hypothesized, male students score higher than female students on the mathematics standardized test. The mean score for male seniors is 50.633 versus 48.774 for female seniors, and the difference in achievement is statistically significant. In regard to attitudes, male students seem to show a more positive attitude toward mathematics than female students. More precisely, 44.5 percent of males versus 43.6 percent of females report mathematics as an interesting subject. Though the direction of this difference is as predicted, the difference is not statistically significant. Furthermore, 64.9 percent of males versus 60.1 percent of females think of mathematics as useful subject in their future, and the difference is statistically significant.

The mean score of self-concept is -0.089 for male students versus 0.008 for female students, and the difference is statistically significant. Because high scores indicate low self-concept, this means that males, overall, report a higher self-concept than females. This finding supports the hypothesis that females have a lower level of self-concept than males. As expected, there are more males (26.4%) than females (22.2%) participating in advanced math program, but the difference is not statistically significant.

In regard to parents' involvement and expectation, there is no

statistically significant difference between males and females in parents' awareness of their school performance (86.2 percent versus 86.4 percent respectively). However, the differences in general supervision are dramatic and clearly statistically significant. Parents are less likely to keep a close track on their sons (69.1 percent) than daughters (82 percent). Interestingly, 65.4 percent of males versus 72.7 percent of females indicate that their mother expects them to attend college. Likewise, there is 55.6 percent of male seniors versus 60.7 percent of female seniors responding that their father expects them to go to college. These differences are in the opposite direction of that expected and the difference is statistically significant. The mean score of mother's influence on their children's plan after graduation is lower for males (2.23) than for females (2.41), and the difference is statistically significant. On the other hand, the degree of father's influence is greater on males than females (2.209 versus 2.096, respectively), and the difference is statistically significant. Also, the data disclose that mothers' expectation of daughter's educational attainment is slightly higher than their expectation of sons (6.509 versus 6.469), and the difference is statistically significant. Apparently, these findings are not consistent with the hypothesis that compared to male students, female students seem to receive a lower level of parents' encouragement, involvement, and expectations for academic achievement. In addition, though it was not a part of the hypotheses, it appears that students are more influenced by the same sex parent.

In regard to teachers' attitudes, female students are more likely to report

that their teachers expect them to attend college (55.2 percent) than male students (49.4 percent). The difference is statistically significant. The degree of teacher's influence is greater on females (1.842) than males (1.782), and the difference is statistically significant. Surprisingly, the findings do not support the presented hypothesis that females receive a lower level of teacher's academic expectations, compared to males. Nevertheless, the hypothesis that females receive a lower level of teacher's interest than males is supported by the finding. Specifically, the mean score of teacher's interest in male students is 2.609 versus 2.582 for female students, but the difference is not statistically significant.

Results of Multivariate Analysis

The multivariate analysis permits the assessment of the effect of each independent variable while simultaneously controlling for the effects of all of the other independent variables. Thus the multivariate analysis provides a more accurate estimation of each effect's influence in the presence of the other effects.

Effects of factors on mathematics achievement

The results of the multivariate regression analyses exploring and examining the differential effects of individual, family, school, and geographic factors on the mathematics achievement scores of males versus females is presented in Table 2. Column 1 of Table 2 presents results of the effects of individual, family, school, and geographic factors on mathematics performance of the entire sample. Presented in column 1 of table 2, the independent variables explain nearly 35 percent of the

variance in the dependent variable, math standardized test score. Gender (beta= -.084) is negatively associated with mathematics performance, and it is statistically significant. That is, controlling for other factors, females score significantly lower in math performance than males. All of the racial dummy variables are negatively associated with the mathematics achievement. That is, being a racial minority, compared to being White, has a significant negative influence on mathematics performance, as hypothesized. Among the racial dummies, the category of Black appears to have the strongest link with the decrease of mathematics scores (beta= -.316), compared to the reference group of "White".

As predicted, the variables of seeing math as interesting (beta= .062) and useful (beta= .092) are positively associated with the mathematics achievement, and the effects are statistically significant. The influence of self-concept on mathematics performance is not statistically significant. As expected, SES has a statistically significant positive effect on mathematics achievement (beta= .088). Advanced math has a statistically significant positive effect on mathematics performance (beta= .214), as expected.

In regard to the family's influence on educational outcome, mother's expectation for the students' educational attainment is positively associated with mathematics achievement, and this effect is statistically significant (beta= .119). Surprisingly, parental academic supervision in terms of parent's awareness of children's school performance, is negatively related to mathematics score

(beta= -.024), and its effect is statistically significant. On the other hand, general parental supervision, referring to parents keeping a close track of their children generally, has a statistically significant positive effect on children's mathematics scores (beta= .023). This finding is consistent with the hypothesis. As expected, parents' plan for their child to attend college is positively related to mathematics achievement (beta= .116), and it is statistically significant. As predicted, two-parent families have a statistically significant positive effect on mathematics scores (beta= .041).

As expected, teacher interest has a statistically significant positive influence on mathematics score (beta= .046). Also, teacher expectation regarding the educational attainment of the students has a statistically significant positive effect on mathematics performance of students (beta= .051). In regard to the effect of regional residence on mathematics scores, residence in the rural south has a statistically significant negative effect on mathematics scores (beta= -.071), compared to those residing in non-rural non-south areas. Additionally, residing in the non-rural south has a significant negative effect on math achievement (beta= -.061).

Column 2 and column 3 present the results of the regression analyses examining the effects of individual and social factors on the mathematics achievement for males and females separately. The separate models for males and females indicate that the factors influencing achievement are similar for males and females. For example, the racial dummy variables are all significant for both males

and females. Also, the effect of self-concept on math achievement for males and females is not statistically significant. Results show that SES has a statistically significant positive effect on both males (beta= .055) and females (beta=.117) in mathematics achievement. The effect of attitudes toward perceiving math as useful is statistically significant for both males (beta= .113) and females (beta=.075) in mathematics performance. It is unknown if the difference between coefficients for males versus females is statistically significant. However, the coefficient in regard to perceiving math as useful is stronger for males than females, and the result is in an unexpected direction. The effect of attitudes toward perceiving math as interesting is statistically significant for both males (beta= .047) and females (beta=.079) in mathematics achievement. However, it appears that in regard to perceiving math as interesting, the coefficient is stronger for females. This is consistent with the hypotheses. As the data show, advanced math has a statistically significant effect on both males (beta= .192) and females (beta= .234) in mathematics achievement. Whether or not the difference between coefficients for males versus females is statistically significant is unanswered. However, it appears that in regard to taking advanced math, the coefficient for females is stronger. This finding is in an unexpected direction.

In regard to the effects of family factors, the comparison of the models for males and females indicates that mother's expectation for child's educational attainment significantly influences the achievement of males (beta= .130) and females

(beta= .109) similarly. The effect of parental academic supervision is statistically significant for males but not females in achievement. However, the effect of parental general supervision is statistically significant for females (beta= .033), but not for males (.015). The comparison of the models for males and females indicates that parents' expectation for child to attend college influences the achievement of males (beta= .147) and females (beta= .093) similarly. It is not known if difference between coefficients for males versus females is statistically significant. However, it appears that in regard to parents' expectation for child to attend college, the coefficient for males is stronger than that for females. This is inconsistent with the hypotheses.

In regard to the influence of school factors, teacher interest in student has a statistically significant positive effect on the mathematics performance of male students (beta= .027) and female students (beta= .064). The coefficient in regard to teacher interest is stronger for females then males, and this finding is consistent with the hypothesis. In addition, teacher expectations for the students to attend college have a significant positive effect for both males (beta= .049) and females (beta=0.53) in predicting mathematics achievement. Regarding the effects of geographic factors, the comparison of models for males and females indicates that residence in the rural south influences the achievement of males (beta= -.086) and females (beta= -.057) similarly. The effect is statistically significant. However, it appears that in regard to the effects of residence in the rural south, the coefficient for males is stronger. This finding is not consistent with the hypothesis.

Effects of factors on attitudes toward math (seeing math as interesting)

Column 1 of Table 3 presents the results of the effects of individual and social factors on perceptions of math as interesting for the total sample. Overall, the models do not explain much of the variance in perceptions of math as interesting. That is, for each model, slightly less than 4 percent of the variance is explained according to the R^2. In regard to the individual factors, the effect of gender on perceptions of math as is not statistically significant. The racial dummy variable, Black (beta= .024), has a positive and significant effect on perceptions of math as interesting. This finding is inconsistent with the hypotheses. As expected, the self-concept (beta= -.023) has a positive effect on perceptions of math as interesting, and the effect is statistically significant. Likewise, advanced math (beta= .150) has a significant positive effect on perception of math as interesting.

In regard to the family's influence on learning attitudes, mother's expectations of the students' academic attainment (beta= .039) is positively associated with perceptions of mathematics as interesting and this effect is statistically significant. The effects of parental supervision in academics and in general, parents' plan for the student to attend college, and family structure are not statistically significant. In regard to effects of school factors, teacher interest (beta= .057) and teacher expectations for the student to attend college (beta= .030) have a statistically significant positive influence on students' attitudes toward math as interesting. This is consistent with the hypothesis.

Column 2 and column 3 present the results of the regression analyses examining the effects of individual and social factors on attitudes toward math as interesting) for males and females separately. Several differences in the two models are apparent with regard to the effect of self-perception. Self-concept only has a statistically significant influence on males (beta= -.032) perception of math as interesting. It is not significant for females. Further, SES has a significant negative effect on females' perceptions of math as interesting (beta= -.034), but it is not significant for males.

The effect of taking advanced math on perception of math as interesting is similar and statistically significant for males (beta= .146) and females (beta= .154). Mother's expectation for the students' academic attainment has a significant positive effect on both males (beta= .033) and females (beta= .046) in attitudes toward seeing math as interesting. However, as indicates by the difference in significant level, this effect is stronger for females than males. The effects of family factors on males and females, such as parental supervision (academic and general), parents' plan for child attending college, and family structure, are not statistically significant.

In regard to the influence of school factors, teacher interest has a statistically significant positive effect on males (beta= .056) and females (beta=.058) in perception of math as interesting. However, teachers' expectations that the student will attend college only has a statistically significant effect for males (beta= .037) in predicting attitudes toward math as interesting. It is not significant for females.

The effect of geographic factors on attitudes toward math as interesting is not statistically significant for males or females.

Effects of factors on attitudes toward math (seeing math as useful)

Table 4 presents the analyses of the effects of individual, family, school, and geographic factors on attitudes regarding males as useful. The R^2 for the models in Table 4 are low. Only about 3 percent of the variance in attitude is explained by the models. Column1 of Table 4 presents results of the effects of individual and social factors on attitudes toward math as useful. Gender (beta= -.051) is negatively associated with attitudes toward perceiving math as useful, and it is statistically significant. That is, as expected, females are less likely than males to perceive math as useful. Among racial dummy variables, Hispanic (beta= -.022) is negatively associated with attitudes toward math as useful, and it is statistically significant. As predicted, self-concept (beta= -.037) is positively related to attitude toward math as useful, and its effect is statistically significant. The effect of SES on attitudes toward math is not statistically significant. As the data show, taking advanced math courses (beta= .096) has a statistically significant positive effect on attitudes toward mathematics as useful. This finding is consistent with the hypothesis.

In regard to the effect of family factors on learning attitudes, mother's expectation of the students' academic attainment (beta= .047) is positively associated with attitudes toward math as useful and it is statistically significant. The effect of parental academic supervision is not statistically significant. As expected, general

parental supervision, referring to parents keeping a close track on their children, has a significant positive effect on students' attitudes toward math as useful (beta= .032). As expected, parents' plans for the child to attend college (beta= .026) are positively related to attitudes toward seeing math as useful, and it is statistically significant. Consistent with proposed hypothesis, two-parent families (beta= .025) have a positive effect on attitudes toward seeing math as useful, and its influence is statistically significant.

In regard to the effect of the school factors, teachers' interest in the students has a statistically significant positive effect (beta= .025) on students' attitudes toward math as useful. The effects of teachers' plans for students attending college and geographic factors are not statistically significant.

Column 2 and column 3 present the results of the regression analyses exploring the effects of individual and social factors on attitudes toward math as useful for male students and female students separately. While race is included only as a control variable, the effects are nonetheless interesting. The status of being Hispanic has a significant negative effect on males but not females. Also, compared to White females, both Asian Americans and Black females are significantly more than White to see math as useful. With regard to the effects of individual factors, self-concept only has a statistically significant effect on attitudes toward math as useful for males (beta= -.056). It is not significant for females.

Taking advanced math courses has a statistically significant effect on

attitudes toward math as useful for males (beta= .082) and females (beta= .109). It is unknown if the difference between coefficient for males versus females is statistically significant. However, it appears that the coefficient is stronger for females. This is inconsistent with the hypotheses. In regard to the effects of family factors, mothers' expectations for the students' academic attainment have a statistically significant effect on attitudes toward math as useful for both males (beta= .037) and females (beta= .055). Consistent with the hypothesis, this effect appears to be stronger for females than males. It should be noted that parental academic supervision only has a statistically significant effect on attitudes toward seeing math as useful for females (beta= .030). It is not significant for males. On the other hand, the influence of parent's general supervision on attitudes toward math as useful only has a statistically significant effect for males (beta= .047), but not for females.

In regard to the influence of school factors, teacher interest only has a statistically significant effect on males (beta= .037) in attitudes toward math as useful. It is not significant for females. This finding is inconsistent with the hypotheses. On the other hand, the finding in regard to the teachers' plans for the student to attend college is consistent with proposed hypothesis. That is, the influence of teacher's expectation is statistically significant for female students' attitudes toward math useful (beta= .029), but it is not significant for males. The effects of geographic factors are not statistically significant for males or females.

CHAPTER VI

CONCLUSIONS

Bivariate Hypotheses

The results support the first set of hypotheses regarding gender differences in individual factors. Females have lower test scores than males. In addition, they are less likely to perceive math as useful, have lower levels of self-confidence and are less likely to have taken advanced math. Because these factors have a positive effect on mathematics scores, it appears that females are at a disadvantage. Each of these findings supports the basic ideology of the encultured lens theory. That is, the findings are consistent with the gendered lens assumptions of male superiority and math as the domain of men.

The results of the bivariate analysis do not show strong support for the hypotheses related to gender differences and family factors. Females actually report higher levels of parental involvement (general supervision) and higher parental and teacher expectations for academic attainment than males. For instance, the parental supervision in general is much higher for daughters (82.%) than sons (69.1%). These factors, in turn, have a positive influence on math achievement (test scores). These findings are in direct contrast to the predictions of encultured lens theory. It was expected that due to the lens of "male superiority" and "mathematics as the domain of men", parents would be more interested in the educational attainments of sons compared to daughters. This proposition was not supported. In sum, the results

suggest that girls are at a disadvantage in regard to individual factors that could promote their math achievement scores. But actually, they may benefit from having higher levels of expectations from parents and teachers. Though it is not possible given the limits of this data set, it would be interesting for future research to inquire about parents' and teachers' expectations for females' versus males' specifically in the areas of math and science.

Multivariate Hypotheses

A second set of hypotheses were examined using a multivariate analysis. The first hypothesis predicts that being female will have a negative effect on perceiving math as useful and on math achievement. This hypothesis is supported. The second hypothesis suggests that belonging to a racial minority group will have a negative effect on mathematics achievement. This hypothesis is supported. However, the predicted negative effect of minority status on perceiving math as interesting and useful was not supported, except for Hispanics who perceive math as less useful.

The third hypothesis proposes that positive attitudes toward mathematics (seeing math as interesting and useful) lead to higher levels of math achievement, and that the effect will be stronger for females than males. This hypothesis is generally supported. That is, consistent with the idea of breaking the encultured lens, the perception of math as interesting has a stronger effect on mathematics achievement among female students than male students. However, the effect of seeing math as useful on mathematics performance is, in fact, stronger for male students than female

students. It is possible that female students may see the usefulness of mathematics; however, their recognition of math usefulness may not be powerful enough to increase their math scores to the level of males' scores.

The fourth hypothesis regarding higher levels of self-concept related to positive attitudes toward math as useful and interesting is supported while its relation to achievement in mathematics is not. Further, the effect of self-concept on seeing math as interesting and useful is significant for males but not females. A possible explanation for this result is the effect of the embedded gender lens. That is, usually boys and girls are socialized or educated to believe math as a masculine domain and literature as a more feminine subject. As a result, males' self-concept is more influential than females in attitudes toward math as interesting and useful. Likewise, it is plausible to conclude that self-concept may have a significant positive effect on females but not males in their attitudes toward the field of literature.

The fifth hypothesis regarding higher levels of SES correlating with higher levels of math achievement is supported. The effect of SES on math performance appears to be stronger for females than males. Nevertheless, SES has a negative effect on attitudes of perceiving math as interesting for females. This result suggests that higher SES families may place more emphasis on traditional gender roles. That is, it is possible due to parents' perception of the gender lens that high SES families might still attempt to cultivate child's interest in studying subjects which are considered to be "appropriate" for their gender orientation, although high SES

families might emphasize the importance of pursuing high levels of educational attainment. For instance, high SES families might be able to provide their child with ample educational resources; however, they might be more likely to encourage boys than girls to attend summer camps related to math or science activities.

The sixth hypothesis which states that taking advanced math is related to positive attitudes toward math (seeing math as interesting and useful) and achievement in mathematics was supported. It appears that taking advanced math has a stronger effect on female than on male students' attitudes (seeing math as useful and interesting) and achievement. A possible explanation is that females taking advanced math courses have broken through the constraint of presuming that mathematics is a masculine field of study. Ultimately, this positive effect on attitudes toward mathematics will reflect positively on female students' mathematics performance.

In regard to the effects of family factors on students' education, the seventh hypothesis suggests that higher levels of parental academic and general supervision will be related to more positive attitudes (seeing math as interesting and useful) and high levels of math performance. Indeed, parental academic and general supervision are hypothesized as having similar effects; however, the effect of abovementioned factors on attitudes toward math and achievement in math is rather different. That is, parental academic supervision has a negative effect on math achievement. On the other hand, parental general supervision has a positive effect on attitudes of perceiving math as useful and math achievement. When these effects are

considered in relation to gender differences, parental academic supervision has a negative effect on math achievement of males but not females, and parental general supervision has a positive effect on math achievement of females but not males.

A possible explanation for parental academic supervision causing the negative effect on math achievement of males but not females is that males may view parental academic supervision as negative in terms of overly intensive. Thus, males' aptitude of studying math may gradually decrease when they feel that they are been overly pushed. On the other hand, girls may consider parental academic supervision as positive in terms of encouragement, so females are likely to devote their effort in studying math. In regard to parental general supervision causing a positive effect on females but not males, this result is due to the fact that girls receive higher levels of parental general supervision which is positively correlated with math achievement. Additionally, the gender lenses assume that girls should be more controlled and obedient than males in terms of responding to authority. Consequently, parental general supervision may become more effective for girls than boys in enhancing their educational outcome.

The eighth hypothesis indicates that parent's expectations for students to attend college will be related to positive attitudes toward math and achievement in math. Further, it was hypothesized that the effect of parental expectations for their child to attend college is stronger for females than males due to the breaking of the encultured lens. These predictions are generally supported in that parental

expectation has a positive effect on attitudes toward math as useful and achievement in math. But, the effect of parental expectation is stronger for males than females in math performance. This finding contradicts the theoretical basis of encultured lens theory.

The ninth hypothesis that suggesting two-parent families will have a positive influence on attitudes of perceiving math as useful and on math achievement is supported. That is, consistent with the literature review and Coleman's idea of social capital, two-parent families produce a significant positive influence on students' academic attitudes and math performance.

In regard to school effects, the tenth hypothesis suggests that teacher interest in students and their high expectations of students will positively influence students' attitudes toward math as useful and interesting and promote their achievement in mathematics. In addition, it is supposed that the effect of the teacher's expectation on attitudes toward math and achievement is stronger for females than males due to the breaking of the gender lens. Generally, the hypothesis is supported in terms of teacher interest and expectation being positively related to attitudes toward math as interesting and achievement in math. Consistent with the hypothesis, the effect of teacher's interest and expectation on math achievement seems to be stronger for females than males. Accordingly, it is important that teachers should show female students that they hold high expectations of their educational achievement, so female students will be more encouraged to achieve higher levels of academic performance.

Teacher's interest is more important for females than males. That is, teacher's interest has a positive effect on math achievement of male and female students. However, such effect is stronger for females than males. A possible explanation is that girls usually receive less attention from teachers so females are less likely than males to receive extra help in resolving math problems from teachers. Once teachers show a great interest in females students in terms of trying to work with them on math problems involving with high levels of cognitive thinking, females will certainly make a dramatic improvement in math achievement.

It is interesting to note that teacher's interest has a significant effect on males' attitudes toward math as useful; on the other hand, a teacher's expectation has a significant effect on females' attitudes toward math as useful. A possible explanation is that teacher's interest in male students might actually indicate their frequent interaction or involvement with males in math or science discussion. On the other hand, teacher's interest in female students might only show in the class focusing on literature, history, or speech since, traditionally, females are expected to be achievers of these subjects which are culturally identified as the domain of females, or at least not the sole domain of men. Further, teacher's expectation is important for perceiving math as useful for only girls. It is due to the effect of the breaking gender lens. That is, girls' perception of math as a masculine subject will be weakened or changed when they learn that teachers actually expect them to pursue high levels of educational attainment.

The hypothesis stating that rural south is negatively related to math achievement is supported, but its effect on attitudes of seeing math as interesting and useful is not supported. A possible explanation for its (rural south) negative influence being greater for male than female students is that parents in rural south might gradually perceive that education is more important for females than males.

Summary

Accordingly, attitudes of parents and educators toward students are very influential. It is essential for teachers and parents as well to understand the dramatic changes they can possibly make for the future of female students in fields related to math if they could exert effort to acknowledge and break the encultured gender lens. In order to recognize and overcome this barrier (embedding gender lens), people need to participate in workshops which encourage people to discontinue living in the shadow of historically embedded encultured gender lenses.

The importance of the findings from the present study is to recognize the potential effects of the encultured (gender) lens on females' educational experiences and performance in mathematics in particular. The presented encultured lens theory indirectly provides explanations for why female students and male students do not hold a similar self-perception, attitudes, and achievement scores in math. Moreover, the encultured lens theory partially explains why parents' involvement (supervision) and expectation (attending college) are different for sons than daughters. Furthermore, it explains why teacher's interest and expectation are not similar for

both male and female students. In short, the findings suggest that the development of gender differences in attitudes and academic achievement in math is initially due to the encultured gender lens embedded in individual psyches, in our culture, and in educational institutions.

APPENDIX

Table 1. Sample Characteristics and Bivariate Tests of Gender Differences[2]

Variables	Males N=5675	Females N=6320	Total 11,995
Demographic Factors	47.3%	52.7%	
Race %			
Hispanic/Spanish	24.4%	24.2%	24.3%
Native American	2.1%	1.5%	1.7%
Asian American	3.3%	3.2%	3.3%
Black	23.5%	25.4%	24.5%
White	45.5%	44.8%	45.2%
Other	1.2%	0.9%	1.0%
Family Structure %			
living with mother & father	65.5%	63.1%	64.3%
living with mother & step-father	4.9%	6.3%	5.6%
living with father & step-mother	2.8%	2.3%	2.5%
living with father only	2.8%	2.4%	2.6%
living with mother only	16.8%	19.0%	18.0%
overall % living with single parent	26.8%	28.3%	27.6%
% living with two parents	73.2%	71.7%	72.4%
Social Economic Status(SES)			
lowest quartile	34.4%	40.5%**	37.6%
quartile 2	22.9%	23.2%	23.1%
quartile 3	22.0%	18.9%	20.4%
highest quartile	20.8%	17.4%	19.0%
Geographic Residence %			
rural south	12.8%	12.4%	12.6%
rural non-south	14.7%	13.7%	14.1%
non-rural south	23.8%	24.8%	24.3%
non-rural non-south	48.7%	49.1%	48.9%
Self Concept (range -1.10-3.68)	-0.089	0.008**	
Attitude toward Math %			
% perceive math as interesting	44.5%	43.6%	44.0%
% perceive math as useful	64.9%	60.1%**	62.3%
Experience with Math and Science			
% attending advanced or honor program in math	26.4%	22.2%**	24.2%
Avg. semesters of math taken 10^{th}-12^{th}grade	4.363	4.051**	
Avg. semesters of science taken 10^{th}-12^{th}grade	3.675	3.396**	
Mathematics Average Score (range 26.0-67.0)	50.633	48.774**	
Parental Involvement and Expectation			
% parents aware of their academic performance	86.2%	86.4%	86.3%
% whose parents keep a close track of them	69.1%	82.0%**	76.0%
% whose mother expects them to attend college	65.4%	72.7%**	69.3%
% whose father expects them to attend college	55.6%	60.7%**	58.3%
degree of mother's influence on children's plan(range1-3)	2.234	2.419**	
degree of father's influence on children's plan(range1-3)	2.209	2.096**	
degree of mother's expectation of attainments(range1-9)	6.469	6.509**	
Teachers' Influence and Expectation			
% whose teacher expects them to attend college	49.4%	55.2%**	52.5%
degree of teacher's influence on children's plan(range1-3)	1.782	1.842**	
level of teacher's interest in students(range1-4)	2.609	2.582	

[2] ** Differences between males and females significant at $p \leq .01$. Statistically significance determined by t-test for differences between means and chi-square for differences between percentages.

Table 2.
Regression Coefficients for Models of Factors Affecting Mathematics Achievement of Students

Variables	Total		Male		Female	
	b	Beta	b	Beta	b	Beta
Gender composition 1=male, 2=female	-1.680**	-0.084				
Hispanic/Spanish	-5.738**	-0.247	-5.815**	-0.245	-5.681**	-0.251
Native American	-5.405**	-0.071	-5.214**	-0.073	-5.498**	-0.068
Asian American	-2.196**	-0.039	-2.425**	-0.043	-1.908**	-0.035
Black	-7.315**	-0.316	-7.414**	-0.309	-7.148**	-0.321
Self-concept negative=high	-0.219	-0.016	-0.277	-0.020	-0.142	-0.011
SES quartile	0.770**	0.088	0.487**	0.055	1.014**	0.117
Perceive math useful	1.904**	0.092	2.421**	0.113	1.493**	0.075
Perceive math interesting	1.254**	0.062	0.965**	0.047	1.549**	0.079
Take advanced math	4.999**	0.214	4.443**	0.192	5.485**	0.234
Mom expectation educational attainment	0.604**	0.119	0.656**	0.130	0.549**	0.109
Parent supervision academics	-0.707**	-0.024	-0.910*	-0.031	-0.587	-0.021
Parent supervision general	0.539**	0.023	0.341	0.015	0.826**	0.033
Parent's plan for college	2.607**	0.116	3.242**	0.147	2.158**	0.093
Family structure 1=one parent family 2=two parent family	0.921**	0.041	1.031**	0.045	0.787**	0.036
Teacher's interest	0.533**	0.046	0.322*	0.027	0.724**	0.064
Teacher's plan for college	1.020**	0.051	1.000**	0.049	1.033**	0.053
Rural south	-2.124**	-0.071	-2.637**	-0.086	-1.678**	-0.057
Rural non-south	0.029	0.001	-0.357	-0.012	0.355	0.013
Non-rural south	-1.419**	-0.061	-1.698**	-0.071	-1.228**	-0.055
Constant	38.343		38.085		33.757	
R-Square	0.351		0.345		0.357	
F	249.063**		115.617**		146.33**	
N	9,231		4,192		5,025	

* Significant at the $\leq .05$ level
** Significant at the $\leq .01$ level

Table 3.
Regression Coefficients for Factors Affecting Attitudes toward Math (seeing math as interesting)

Variables	Total		Male		Female	
	b	Beta	b	Beta	b	Beta
Gender composition 1=male, 2=female	-0.003	-0.003				
Hispanic/Spanish	0.009	0.008	0.001	0.001	0.017	0.014
Native American	-0.031	-0.008	-0.084	-0.024	0.040	0.010
Asian American	0.045	0.016	0.078	0.028	0.012	0.004
Black	0.028*	0.024	0.029	0.024	0.027	0.024
Self-concept negative=high	-0.015*	-0.023	-0.022*	-0.032	-0.009	-0.014
SES quartile	-0.009	-0.020	-0.002	-0.004	-1.015*	-0.034
Take advanced math	0.174**	0.150	0.165**	0.146	0.184**	0.154
Mom expectation educational attainment	0.010**	0.039	0.008*	0.033	0.012**	0.046
Parent supervision academics	-0.018	-0.012	-0.029	-0.020	-0.007	-0.005
Parent supervision general	0.013	0.011	0.003	0.003	0.025	0.019
Parent's plan for college	-0.004	-0.003	0.002	0.001	-0.014	-0.012
Family structure 1=one parent family 2=two parent family	0.014	0.013	0.009	0.008	0.018	0.016
Teacher's interest	0.033**	0.057	0.032**	0.056	0.033**	0.058
Teacher's plan for college	0.030**	0.030	0.037*	0.037	0.025	0.025
Rural south	0.010	0.007	0.013	0.008	0.008	0.006
Rural non-south	0.018	0.013	-0.002	-0.001	0.037	0.026
Non-rural south	-0.016	-0.014	-0.017	-0.015	-0.014	-0.012
Constant	0.70		0.094		0.034	
R-Square	0.037		0.039		0.038	
F	22.239**		11.48**		12.846**	
N	10,429		4,832		5,597	

* Significant at the $\leq .05$ level
** Significant at the $\leq .01$ level

Table 4.
Regression Coefficients for Factors Affecting Attitudes toward Math (seeing math as useful)

Variables	Total		Male		Female	
	b	Beta	b	Beta	b	Beta
Gender composition 1=male, 2=female	-0.050**	-0.051				
Hispanic/Spanish	-0.025*	-0.022	-0.056**	-0.051	0.003	0.003
Native American	-0.043	-0.012	-0.034	-0.010	-0.058	-0.014
Asian American	0.040	0.015	-0.001	0.000	0.076*	0.027
Black	0.014	0.013	-0.014	-0.012	0.037*	0.033
Self-concept negative=high	-0.024**	-0.037	-0.037**	-0.056	-0.012	-0.018
SES quartile	-0.005	-0.012	-0.001	-0.002	-0.009	-0.020
Take advanced math	0.109**	0.096	0.089**	0.082	0.129**	0.109
Mom expectation educational attainment	0.012**	0.047	0.009*	0.037	0.014**	0.055
Parent supervision academics	0.027	0.019	0.007	0.005	0.043*	0.030
Parent supervision. general	0.036**	0.032	0.049**	0.047	0.024	0.019
Parent's plan for college	0.028*	0.026	0.024	0.023	0.035	0.030
Family structure 1=one parent family 2=two parent family	0.027*	0.025	0.037*	0.034	0.021	0.019
Teacher's interest	0.014*	0.025	0.020*	0.037	0.008	0.014
Teacher's plan for college	0.018	0.019	0.008	0.009	0.029*	0.029
Rural south	0.000	0.000	-0.002	-0.001	0.003	0.002
Rural non-south	0.016	0.012	0.009	0.006	0.022	0.016
Non-rural south	0.012	0.011	0.005	0.004	0.020	0.018
Constant	0.359		0.374		0.216	
R-Square	0.030		0.029		0.031	
F	17.76**		11.48**		10.595**	
N	10,429		4,832		5,597	

* Significant at the $\leq .05$ level
** Significant at the $\leq .01$ level

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