

ATTITUDES ABOUT MATHEMATICS: COMPARE AND
CONTRAST BOYS AND GIRLS FROM HIGH
AND LOW SOCIO-ECONOMIC STATUS

A Thesis

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Interdisciplinary Studies:

Mathematics Education

by

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DEDICATION

This thesis is dedicated to my father, Roger Syverson. He always believed that I could do anything and being a girl should never stop me. He encouraged my dream of becoming a math teacher even though he wanted me to be an actuary. I love you! Rest in peace!

ACKNOWLEDGMENTS

Thanks to my committee, Chair Dr. LaDawn Haws, Dr. Katharine Gray, and Dr. Jorgen Berglund for all their time and encouragement. You kept me going through this long journey.

Thanks to my husband, Chuck, and my kids, Jonathan, Joseph, and Rebekah. Chuck, you held down the fort for four summers and always encouraged me! Kids, you had to do many things yourselves and not give your dad food poisoning from your cooking!

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ABSTRACT

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This study compared the attitudes about math for boys and girls in grades 3 through 8 from high and low SES. The attitudes studied were confidence in learning mathematics, perceived usefulness of mathematics, perception of teacher attitudes towards the student as a learner of mathematics, and stereotype of mathematics as a male domain. The students were given the Modified Fennema-Sherman Attitude Scales to measure attitudes. In the survey there were 12 statements for each attitude: 6 stated positively and 6 stated negatively. There were a total of 533 students surveyed. The students surveyed reside in Santa Cruz County, California. There were 282 females and 251 males. Of the 533 students, 278 were considered low SES and 255 were considered high SES. The only attitude that was found statistically significant was stereotype of

mathematics as a male domain. For this attitude, it was found that gender and SES did play a role. Girls were much less likely to stereotype math as a male domain than boys at all grade levels. High SES students were less likely to stereotype math as a male domain than low SES students at all grade levels, with the exception of grade 8. Gender and SES do not seem to play a role in the other attitudes about mathematics.

CHAPTER I

INTRODUCTION TO THE STUDY

Background

Western literature has used the word “attitude” since the 18th century (Aiken, 2002). In literature, the word “attitude” was not used much in the early 20th century, but by the end of the century, it was used many thousands of times (Aiken). Since the 1960s, the number of published articles with “attitude” in the title has more than doubled (Aiken). In the 1920s and 1930s, more systematic applications of assessing attitudes were in use when dealing with social problems (Aiken).

Fennema and Sherman (1977) brought the idea of “attitudes about math by different genders” to the public’s attention in the late 1970s with their much referenced study. This study suggested that a barrier, and not the lack of ability by females, was the explanation for the difference in achievement in mathematics. Some of the barriers faced by females are not knowing advanced math is needed for university degrees in nursing and social science, lack of societal encouragement for females to study math, and the general belief that females can’t do well in math (Fennema & Sherman). This study helped shape how future educators looked at research on gender and mathematics learning (Leder, 2004).

Lubienski’s (2000a, 2000b) research has focused on the connection between achievement in math and socioeconomic status (SES). SES is an individual’s or group’s

position within a hierarchical social structure. SES depends on a combination of variable, including occupation, education, income, wealth, and place of residence (Dictionary.com). McGraw, Lubienski, and Strutchens (2006) looked at the National Assessment of Educational Progress (NAEP) report of mathematics achievement from 1990 to 2003 and analyzed the relationships among achievement, mathematical content, student proficiency, percentile levels, race, and SES. Lubienski found that there were small gender gaps favoring males which had continued for the past 30 years. The gender gap was most consistent for white, high-SES students and non-existent for black students. Males, with respect to mathematics, tend to have a more positive self-concept than females. She also found female attitudes related to mathematics were more negative than the attitudes of male students related to math. Female students are less likely than males to believe that they are good at math. (McGraw, Lubienski, & Strutchens, 2006).

Mathematics is the gateway to many good paying jobs. In the U.S. Census Bureau's (2008) report of occupations, computer and mathematics had the second highest median earnings behind legal occupations. Architecture and engineering occupations had the third highest median earnings. Males make up 85% of these occupations (U.S. Census Bureau). Students who don't find mathematics usable or who are not confident in mathematics skills may not continue in upper-level mathematics and so will be left out of those jobs.

Statement of the Problem

Knowledge of mathematics is essential for all members of society, in order to participate fully in democratic processes and to be unrestricted in career choice and advancement, individuals must be able to understand and apply mathematical ideas. (Stanic & Hart, 1993)

There have been many studies on gender since Fennema and Sherman's original 1977 study. However, there have not been many studies on how SES affects attitudes towards mathematics. Lubienski (2003) found that in over 3,000 mathematics education research articles published between 1982 and 1998, only 2% considered SES. Of these articles, there are very few that look at SES, gender, and attitude together.

Regarding attitudes, Morriset and Vinsonhaler (as cited in Aiken, 1970, p. 555) states, "It is generally recognized that attitudes towards mathematics in adults can be traced back to childhood." By considering girls and boys between the ages of 8 and 15, this study attempt to find if and when attitudes about mathematics change. Aiken (1970) also discusses other studies that show there a correlation between attitude and achievement. This correlation is stronger in mathematics than in other academic subjects. There is also a correlation between teachers' attitude about math and their students' attitudes. Boys whose attitudes about math are more positive tend to have teachers who teach more theoretically. There were more interpersonal variables found to affect the attitude about mathematics when the student and teacher were of the same sex (Aiken). Girls' attitudes about math tend to be influenced by teacher expectation. Teachers often expect less academically from girls (Gutbezahl, 1995). Teachers may also be less likely to put girls in high-ability groups. These actions undermine girls' confidence in themselves as mathematicians (Gutbezahl, 1995).

Children from different levels of SES tend to be taught differently in the home (Lubienski, 2002). In general, children from high socio-economic families are taught to reason, discuss, initiate, and reflect. Children from low socio-economic families are

taught to conform and mimic (Lubienski). Since these children tend to be taught differently from birth, their attitudes about math could be very different.

Attitudes about mathematics are important for all students. Teachers need to understand how these attitudes relate to gender and SES so they consider their interactions with students and the way they are teaching them. How do attitudes about math compare between high socio-economic and low socio-economic boys and girls between the 3rd and 8th grades?

Attitudes examined were confidence in learning mathematics, perceived usefulness of mathematics, stereotype of math as a male domain, and perception of teacher attitudes towards the student as a learner of mathematics. These attitudes were measured with the Modified Fennema-Sherman Attitude Scales. The questions are Likert, or continuum, questions. Attitudes are defined as a “learned predisposition or tendency on the part of an individual to respond positively or negatively to some object, situation, concept or person” (Aiken, 2002, p. 3).

Purpose of the Study

This study is important because it considers gender and SES when determining a student’s attitude towards mathematics. It also compares attitudes about math of upper-elementary school students through middle-school students. It differs from the Fennema-Sherman study since they studied students in high school and didn’t consider SES (Fennema & Sherman, 1977). This study differs from the Pedersen, Bleyer, and Elmore (1992) study of attitudes and career interest of junior high school mathematics students. In the Pedersen et al. study, only 7th and 8th grade students were surveyed. Also,

the Pedersen et al. survey didn't compare SES of the students. Schreiber's (2002) study looked at achievement and found that gender and economic disparities existed. His study took information from the Third International Mathematics and Science Study (TIMSS) and looked at students who were taking advanced mathematics, pre-calculus, or higher-level mathematics. Advanced mathematics is the same level as pre-calculus or above. The Eccles and Jacobs (1986) study surveyed 7th through 9th grade students, their teachers, and their parents.

Theoretical Bases and Organization

This study is similar to the Fennema-Sherman (1977) study, which examined change in attitude over time. The Fennema-Sherman study compared sex-related differences in mathematics achievement, spatial visualization, and eight affective variables: attitude towards success in mathematics, stereotype of math as a male domain, perceived attitudes of mother, father and teacher toward one as a learner of mathematics, effectance, motivation in mathematics, confidence in learning mathematics, and usefulness of mathematics. Spatial visualization is the ability to see and think in 3D (Cockrell School of Engineering, n.d.). In this study, the attitudes were compared by gender and SES of students in grades 3 through 8.

Limitations of the Study

Limitations of the study include number of students, geographical limitations, parental permission, language barrier; the SES variable is confounded by school. The low-SES school is a public school, while the high-SES school is private and Christian. The study was limited to schools in Santa Cruz County.

CHAPTER II

REVIEW OF LITERATURE

There are many factors that contribute to a person's attitude towards mathematics. These factors can help or hinder a student's progress in mathematics. Some of these factors are SES, gender, perception of teacher attitudes towards the student as a learner of mathematics, confidence in learning mathematics, stereotype of math as a male domain, and perceived usefulness of mathematics. When these factors are combined, the total effect may be greater than the sum of the parts.

The word "attitude" has changed its meaning over time. It wasn't used as a psychological term until the 1860s (Aiken, 2002). At that time, it was used to refer to "an internal state of preparation for action" (Aiken, p. 3). In the 1970s, the definition was changed to "an internal state which affects an individual's choice of action toward some object, person, or event" (Cagne & Briggs, as cited in Aiken, p. 62). In the 1990s, Eagly and Chaiken (as cited in Aiken, p. 155) defined attitudes as "tendencies to evaluate an entity with some degree of favor or disfavor, ordinarily expressed in cognitive affective and behavioral responses."

Like other attributes, attitudes vary with nationality, culture, and other demographic variables and situations. Attitudes were assessed and applied to social problems and issues in the 1920s and 1930s. Attitudes are a product of one's environment and heredity. Attitudes which have a higher heritability coefficient exert a stronger influence

and are less changeable. Attitudes begin developing in childhood and are influenced by parents, friends, teachers, and other models. People can learn attitudes by modeling the behaviors of others (Aiken, 2002). Schreiber (2002) found that attitude can affect energy level, input, perseverance and engagement in an activity.

Attitudes may be formed from friends as well as parents (Tapia & March, 2004). Aiken (2002) found that as children grow, their attitudes become more like the attitudes of their peers than the attitudes of their parents. Schreiber (2002) found that in schools where parents have a high level of education, the students' attitudes towards math is one strong indicator of potential for advanced math achievement. Additionally, schools with more monetary resources had parents with a higher level of education. The more a student believed that success was a matter of natural ability, the higher the student scored on the math test. He also found that students with poor attitudes about math will score lower on math tests. Schreiber surveyed advanced math students and found that disparities for gender and SES exist even at the advanced math level (Schreiber, 2002).

According to Campbell (1989), "Social class and SES are equally important variables that are even more rarely factored into the mathematics and equity equation" (p. 98). Butler (as cited in Campbell, 1989, p. 98) concluded that "seldom was class as a third dimension of group membership [along with race and sex] treated in an integrated manner." Lockheed, Thorpe, Brooks-Gunn, and McAloon (as cited in Campbell, 1989, p. 98) agreed that SES was "rarely directly measured or controlled for" (p. 10), even though "differences in mathematics achievement and participation are related to differences in SES." Lubienski (2000a) notes that many seemingly objective, unproblematic

practices in school mathematics, even with the most innovative reform efforts, could be fundamentally biased against working-class, racial minority students.

High socioeconomic parents tend to guide problem-solving with questions that help focus attention to problem structure and encourage learning of general strategies. These parents encourage the use of language as an instrument of analysis and synthesis in problem-solving. These parents also help their children develop internal control and teach their children they have control over their environment (Lubienski, 2000b). Children from low socioeconomic families are taught to conform and mimic (Lubienski, 2000b). Their parents show or tell them how to solve problems with emphasis on finding the one right solution. They encourage communication and reasoning in a more contextualized manner. These parents teach children to develop an external locus of control and, thus, create feelings that their actions may not result in desired consequences (Lubienski, 2000a). How families encourage their children to learn could create different attitudes about math.

Schools use the cultural capital of the dominant class of society. Bourdieu and Passeron (1977) define cultural capital as the social relation within a system of exchange that includes the accumulated cultural knowledge that confers power and status. Since the dominant class of the United States is the middle class, schools use middle-class cultural practices and may dismiss other classes' cultural practices. Schools may not recognize the linguistic and cultural resources that minority students bring to the classroom. Around 15% of U.S. students are Hispanic and 40% of those were born outside the U.S.

(Gutierrez, 2008). These students may bring in other strategies and understanding from their country of origin.

Even when there is reform in mathematics, the language used is fundamentally biased against working class students (Lim, 2008). Bourdieu and Passeron (1977) state,

So it has to be asked whether the freedom the educational system is given to enforce its own standards and its own hierarchies, at the expense, for example, of the most evident demands of the economic system, is not the *quid pro quo* of the hidden services it renders to certain classes by concealing social selection under the guise of technical selection and legitimating the reproduction of the social hierarchies by transmuting them into academic hierarchies.
(pp. 152-153)

Success in mathematics also gives students cultural capital (Ahlquist, 2001). Students who are successful in mathematics have a larger variety of jobs to choose from and those jobs are usually challenging and well paid (Ahlquist).

Morriset and Vinsonhaler (1965) state that “it is generally recognized that attitudes towards mathematics in adults can be traced back to childhood” (p. 132). Aiken (1970) also discusses other studies that show there is a correlation between attitude and achievement. This correlation is stronger in mathematics than other academic subjects. A student’s attitude about math tends to correlate with their teacher’s attitude about math. A teacher who is more theoretically oriented has a positive effect on boys’ attitudes towards math. When the student and teacher were of the same sex, there were more interpersonal variables found to affect the attitude about mathematics (Aiken, 1970). Gutbezahl (1995) discusses how girls’ attitudes about math are influenced by teacher expectation. Teachers may expect less from girls and the successes of girls may be discounted (Gutbezahl, 1995). Girls are put in high ability groups by their teacher less often than boys

(Gutbezahl). Girls' confidence as mathematicians may be undermined by these actions (Gutbezahl).

Some attitudes have been shown to be more attributable to one gender or other. In Fennema and Sherman's (1977) original study, they found that girls had lower confidence than boys, even when girls had the same or better scores on an achievement test (Wilson & Hart, 2001). Fennema and Sherman also found that a positive attitude for girls was an important factor in selecting higher-level math classes. Girls perceived more positive attitudes about themselves as learners of mathematics from their fathers, teachers, and their own confidence in learning mathematics than boys (Fennema & Sherman). Lim (2008) states, "Researchers observed that positive effects of class/SES on girls' choice of math and science related fields were stronger than boys' choice of those disciplinary fields" (Trusty, Robinson, Plata, & Ng, 2000). As a result, "women in mathematics and related fields tend to come from middle- to upper-class families –often in significantly higher numbers than those of their male counterparts in the same disciplines" (Oakes, as cited in Lim, 2008 , p. 93). In some urban schools, girls feel that if they achieve mathematically, then the boys will feel stupid (Campbell, 1989).

In addition girls' confidence as learners of mathematics, their perception of mathematics as a difficult subject, and their views of mathematics as a gender stereotyped domain of study have all been found to have an important impact on achievement in mathematics and on participation in advanced courses during high school. (Parsons, as cited in Campbell, 1989, p. 99)

Liking of mathematics is a factor related to mathematics performance that has been investigated in the area of sex differences in mathematics. The results of that research have been consistent: Students who say they like mathematics perform better on mathematics test than students who do not like mathematics. (Lockheed et al., 1985)

Maybe the liking of mathematics is not broken down by race since black and Hispanic students liked math and believed math to be useful at least as much as white students did in the 1996 National Assessment of Educational Progress data (Lubienski, 2002).

In his article, Campbell (1989) quotes Butler:

While gender discrimination affects all girls and women and while race and class discrimination affects all minority groups there are differential effects. The combined effect (race, gender and class) is greater than the sum of the individual parts. It is apparent that a diverse population requires diverse strategies if progress toward implementing reforms for equity in education are [sic] to be realized. (p. 98)

CHAPTER III

METHODOLOGY

Design of the Investigation

This study was designed to compare students' attitudes about mathematics in grades 3 through 8 by gender and SES by surveying students in these grades at schools whose populations are primarily high SES and comparing them to students at schools whose populations are primarily low SES. Low SES is a family of four earning less than \$38,203 per year, the qualifying amount for free and reduced lunch (Press, 2008). High SES is a family of four earning more than the median income for California, \$59,000 (U.S. Census, 2010). The Modified Fennema-Sherman Attitude Scales was used. The attitudes measured are confidence in learning mathematics, perceived usefulness of mathematics, stereotype of math as a male domain, and perception of teacher attitudes toward the student as a learner of mathematics. Each scale has 12 items, six measured positively and six measured negatively. The survey used a Likert scale. The variables in this study are gender, SES and confidence in learning mathematics, perceived usefulness of mathematics, stereotype of math as a male domain, and perception of teacher attitudes towards the student as a learner of mathematics. The three low socio-economic schools were chosen because their percent of low income students and their Academic Performance Index were similar. The high socio-economic school was chosen because of

familiarity with the school. Both the low socio-economic and high socio-economic schools are set up as K-5 elementary schools and 6-8 grade middle schools.

Population

The schools which participated in the study are all in Santa Cruz County, California. One school is in the eastern part of the county, which is adjacent to Silicon Valley. The other three schools are the in Pajaro Valley Unified School District, which is in the southern part of the county and is part of the agricultural area. A total of 533 students were surveyed: 282 females and 251 males. Landmark, Chavez, and Lakeview schools (school 1) had 278 total students surveyed; Baymonte (school 2) had 255 students surveyed.

The high SES sample was taken from Baymonte Christian School. This is a private K-8 school in Scotts Valley, California. The families are professionals and most of the families have two working parents. Many of the parents work in the technology sector. The parents, on average, are highly educated. Only 2% of the students would be considered low income. None of the students are English language learners. Since students attending this school are chosen from applications and interviews, there are no students with severe learning disabilities, physical disabilities, or severe behavioral problems. There is a very low turn-over of families each year. At each grade level for the K- 5 school there were 50 students per grade, on average. At each grade level for the 6-8 grade school, there were, on average, 60 students per grade. In a given year, there are usually close to 50% boys and 50% girls per grade. Baymonte is a high performing school which won the federal Blue Ribbon Award in 2003 for its test scores. The Stanford

Achievement Test is given every year to every student in grades 1-8, and the school performs at grade level or higher, on average, in every subject.

The low SES sample was taken from Landmark Elementary, Cesar E. Chavez Middle School, and Lakeview Middle School. All of these schools are located in Watsonville, California. Landmark Elementary is a K-5 grade school and Cesar E. Chavez and Lakeview are 6-8 grade middle schools.

Landmark Elementary had a population in which 81% of the students were classified at low income (Table 1). About 63% of the students were English language learners. Only 30% of the students scored proficient or higher on the math portion of the California Standards Test. At Landmark, 31% of boys and 29% of girls scored proficient or higher on the math portion of the test. Of the students who scored proficient or higher on the test, 26% were classified as low income, and 50% of students were classified as not low income. Landmark's Academic Performance Index (API) score was 628; scores for the API ranged from 200 to 1,000, with an elementary school average of 777 (Press, 2008).

Cesar E. Chavez Middle School had a population made up of 39% English language learners, with 77% classified as low income (Table 1). Of their algebra students, 50% of the students scored proficient or higher on the California Standards Test. Of their non-algebra students, 24% of the students scored proficient or higher on the California Standards Test. Of the algebra students, 60% of boys and 39% of girls scored proficient or higher on the math portion of the test. Of the non-algebra students, 25% of boys and 24% of girls scored proficient or better on the math portion of the test. The school's API

Table 1

Low SES School Profiles

	School		
	Landmark Elementary	Chavez Middle	Lakeview Middle
% Low income	81	77	71
% English language learners	63	39	32
% Proficient or higher on Math CST	30	24	27
% Algebra students		50	43
API	628	683	690

score was 683; scores for the API ranged from 200 to 1,000, with a middle school average of 743 (Press, 2008).

Lakeview Middle School had a population made up of 32% English language learners, with 71% classified as low income (Table 1). Of their algebra students, 43% scored proficient or higher on the California Standards Test. Of their non-algebra students, 27% scored proficient or better on the California Standards Test. Of the algebra students, 44% of boys and 41% of girls scored proficient or higher. Of the non-algebra students who scored proficient or better, 29% were boys and 25% were girls. The school's Academic Performance Index (API) score was 690. The scores for the API ranged from 200 to 1,000, with a middle school average of 743 (Press, 2008).

The populations were selected by SES and the willingness of the teachers to survey their students. Students selected from Cesar E. Chavez Middle School were 6th graders and students from Lakeview Middle School were 7th and 8th graders.

Treatment

After gaining permission from teachers and principals, teachers were sent parental permission letters (Appendices A and B), mathematic attitude surveys, and instruction scripts. After teachers received the parental permission letters back, they then gave the survey when it was convenient. At Landmark Elementary, the principal gave the survey to 3rd and 4th graders. She read through each question with them and explained any words they didn't understand. Landmark has a high percent of English language learners and the principal wanted to make sure they understood the language of the survey. The teachers returned the completed parental permission slips and surveys.

Data Analysis Procedures

Each survey was scored in each of the four areas: perception of teacher attitudes towards a student as a learner of mathematics, confidence in learning mathematics, perceived usability of mathematics, and stereotype of math as a male domain. Each survey statement provided five responses on a Likert-style rating scale (A=strongly agreed; B=agreed; C= not sure; D= disagreed; E=strongly disagreed). Statements positively worded were assigned numbers in descending order (A=5, B=4, C=3, D=2, E=1); statements negatively worded were assigned numbers in ascending order (A=1, B=2, C=3, D=4, E=5). Responses then were added up and the sum was the score for the survey. Scores were analyzed using SPSS and a three-way ANOVA. They were compared at each grade level by school, gender, and grade.

CHAPTER IV

RESULTS AND DISCUSSION

Presentation of the Findings

As shown in Table 2, the following factors and interactions were statistically significant ($p < 0.01$): perception of teacher attitudes towards the student as a learner of mathematics by grade, confidence in learning mathematics by grade, perceived usefulness of mathematics by grade, and stereotype of math as a male domain by gender, grade, and school.

For perception of teacher attitudes towards the student as a learner of mathematics, grade 8 was statistically significant for school and gender. For school 1, the mean for females was 46.43 ($SD=6.81$) and 45.53 ($SD=7.52$) for males. For school 2, the mean for females was 45.51 ($SD=7.90$) and 44.07 ($SD=8.49$) for males. This means that boys at these schools, on average, thought that their teachers do not believe in them as mathematicians as much as girls thought their teachers believed in them as mathematicians. The mean for 8th graders at school 1 was 46.20 ($SD=7.49$) and 41.32 ($SD=9.774$) for school 2 (Fig. 1). The 8th grade students at the low socio-economic school felt, on average, that their teachers had a higher belief in them as mathematicians than the students at the high SES school.

The variables that were significant for confidence in learning mathematics were statistically significant for grades 7 and 8 by school ($p < 0.01$). The mean for 7th

Table 2

F and P Values for Attitudes Surveyed

	Teacher		Confidence		Usability		Male domain	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Gender	1.595	.207	2.854	.092	1.147	.285	85.358	.000
Grade	3.554	.004	4.705	.000	5.051	.000	9.267	.000
School	.965	.326	2.097	.148	.014	.904	29.037	.000
Gender*grade	1.700	.133	.392	.854	3.041	.010	2.814	.016
Gender*school	.232	.630	.622	.431	.243	.622	.022	.881
Grade*school	2.377	.038	3.144	.008	6.538	.000	2.619	.024

graders at school 1 was 49.74 ($SD=6.91$) and 45.98 ($SD=9.83$) at school 2. The mean for 8th graders at school 1 was 47.99 ($SD=8.42$) and 41.50 ($SD=12.14$) at school 2 (Fig. 2).

Seventh and eighth graders at the low SES school had more confidence in themselves as

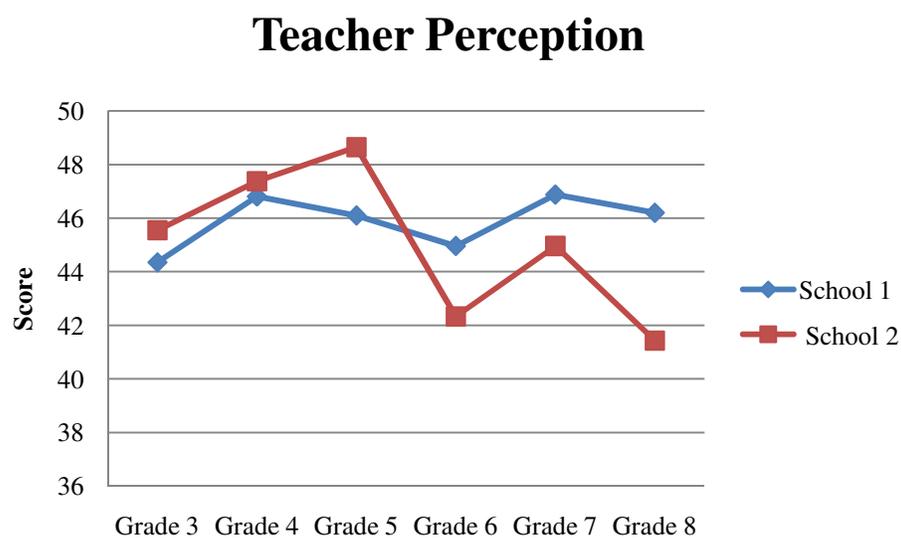


Fig. 1. Perception of teacher attitudes toward the student as a learner of mathematics.

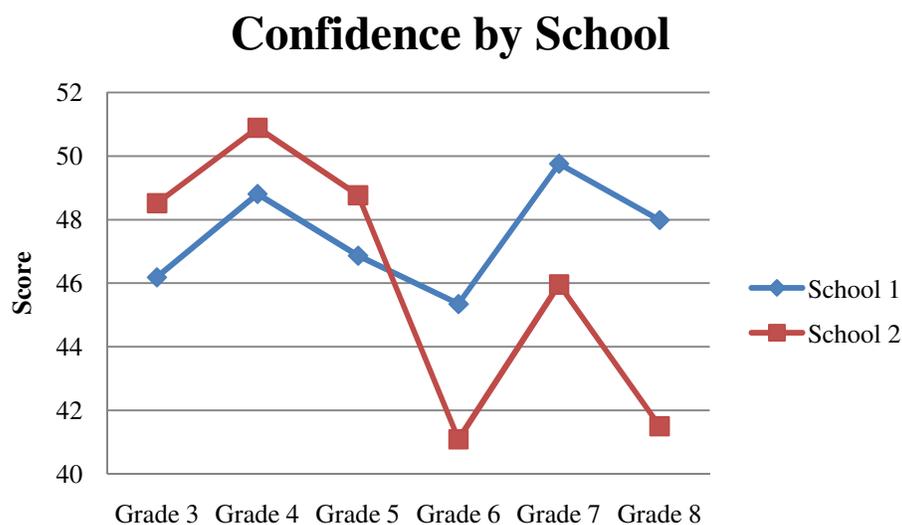


Fig. 2. Comparing schools at each grade level for confidence in learning mathematics.

mathematicians than the students at the high SES school. Confidence in learning mathematics could be related to teacher perception.

Usability was statistically significant for grades 3 and 5 by school and grade 8 by school and gender ($p < 0.01$) (Figs. 3 and 4). The mean for 3rd graders at school 1 was 45.23 ($SD=9.78$) and 51.90 ($SD=10.42$) at school 2. The mean for 5th graders at school 1 was 48.74 ($SD=9.33$) and 54.26 ($SD=6.19$) at school 2. The mean for 8th graders at school 1 was 49.61 ($SD=8.01$) and 41.61 ($SD=13.42$) at school 2. The mean for 8th grade girls was 49.29 ($SD=1.31$) and 42.93 ($SD=1.22$) for boys. The students at the high socio-economic school in grades 3 and 5 found math more usable than their counterparts at the low SES school. This could be because more of their parents work in the technology sector. The 8th graders from the low socio-economic school found math more usable than the 8th graders from the high socio-economic school.

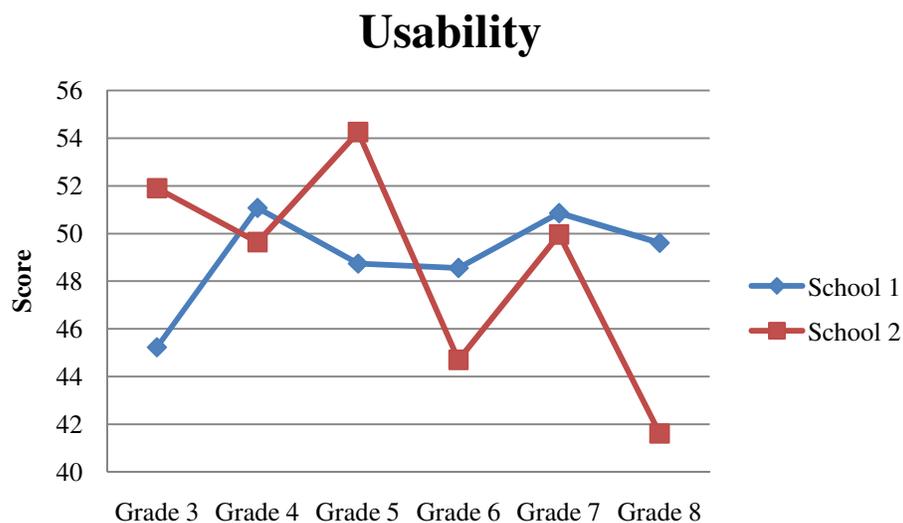


Fig. 3. Comparing schools at each grade level for perceived usefulness of mathematics.

Stereotype of math as a male domain was statically significant for gender, grade, and school ($p < 0.01$), as shown in Figures 5 and 6. The mean for females was 46.194 ($SD = .46$) and 39.847 ($SD = .51$) for males. Females saw math as stereotyped as a

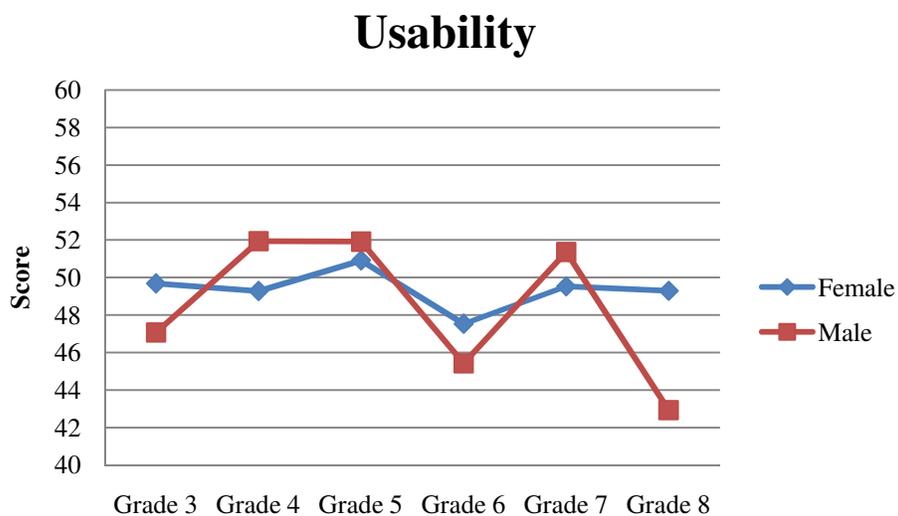


Fig. 4. Comparing gender at each grade level for perceived usefulness of mathematics.

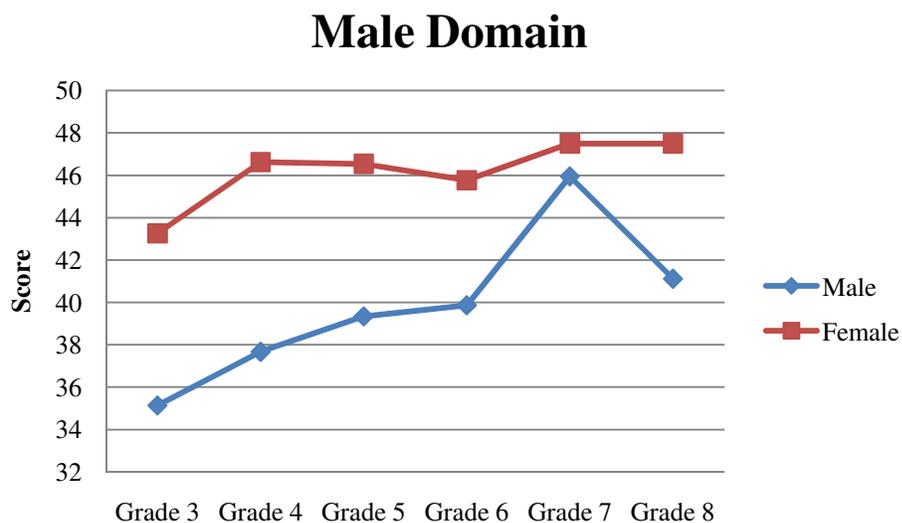


Fig.5. Comparing gender at each grade level for stereotyping of math as a male domain.

male domain much more than males. The students in 7th grade were the only students who were not statistically significant for stereotype of math as a male domain by gender. As shown in Table 3, boys and girls in the 3rd grade had the lowest mean. Since they were

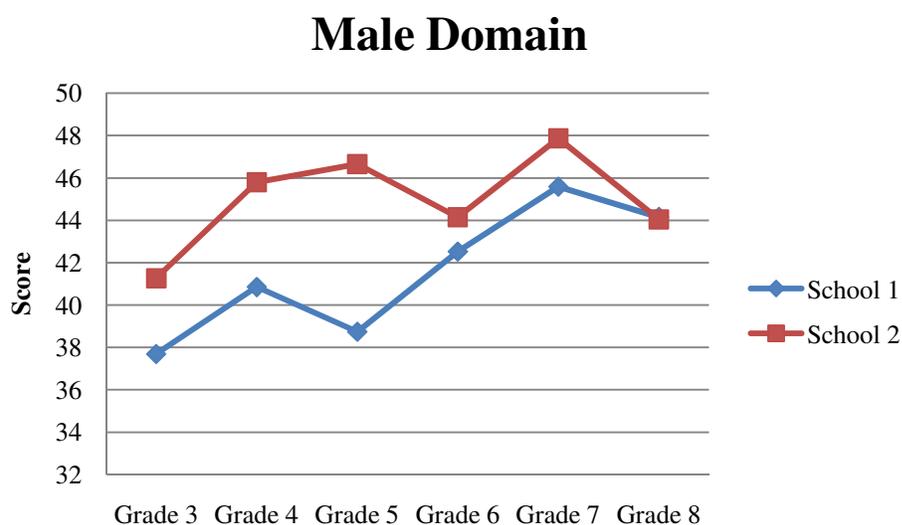


Fig.6. Comparing schools at each grade level for stereotyping of math as a male domain.

boys and girls. One encouraging note is that as the students became older, for the most part, they realized that math was not a male domain. Girls had a higher mean at all grades. The mean for school 1 was 42.70 ($SD=8.04$) and 44.91 ($SD=8.51$) for school 2. Grades 3, 4, and 5 were statistically significant by school ($p<0.01$). The mean at school 1 for grade 3 was 37.69 ($SD=7.59$) and 41.26 ($SD=8.78$) for school 2. The mean for grade 4 at school 1 was 40.85 ($SD=10.44$) and 45.80 ($SD=7.85$) at school 2. The mean for grade 5 at school 1 was 38.74 ($SD=10.70$) and 42.69 ($SD=7.36$) at school 2.

Table 3

*Mean and Standard Deviation by Gender and Grade**Level for Stereotype of Math as a Male Domain*

Gender	Grade	Mean	SD
Female	3	43.26	1.24
	4	46.62	1.15
	5	46.54	1.38
	6	45.77	.98
	7	47.50	.99
	8	47.48	1.04
Male	3	35.14	1.41
	4	37.67	1.51
	5	39.34	1.28
	6	39.87	1.17
	7	45.95	1.01
	8	41.12	.97

CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Discussion of the Findings

The results for comparing students by socioeconomic status (SES) did not yield many results. Where SES played a role seemed to depend on the grade of the student more than the entire school. Perception of teacher attitudes towards a student as a learner of mathematics was only statistically significant in 8th grade. Many teachers are women and boys in the 8th grade may not feel a connection with their teacher and so feel that their teachers do not believe in them as mathematicians. Confidence in learning mathematics was only statistically significant in the 7th and 8th grades. Students in these grades are preteens and are questioning their own self-confidence and the perception that others have of them. Grade level was statistically significant for perceived usefulness of mathematics. This could be the kind of mathematics they are studying. Grade 3 is the usual beginning of multiplication and division. In grade 5, students are taught fractions and decimals. Grade 8 is Algebra I, which may be new to many students. In grade 8 there could also be a combination of the perception of teacher attitudes towards the student as a learner of mathematics and confidence in learning mathematics, where the student feels the teacher doesn't believe in them and so loses confidence in learning mathematics.

The only attitude that was generally statistically significant for both SES and gender was stereotype of math as a male domain. In both SES groups, the females' mean was much higher than the males' mean. School 1 may have had a lower mean because it had a large percentage of Hispanic students and the Hispanic culture is heavily patriarchal. Females do think of themselves as mathematicians but the males may need some more time to come to that realization. This could be culture-related. Around 50 years ago, girls in some high schools were not allowed to take physics because girls were believed not to be able to understand its concepts. In recent years, schools were not allowed to discriminate on basis of gender but there are still underlying negative attitudes about women and math.

Summary, Conclusions, and Recommendations

This study was designed to compare student's attitudes about math from 3rd through 8th grades. Attitudes were looked at in four areas: perception of teacher attitudes towards the student as a learner of mathematics, confidence in learning mathematics, perceived usability of mathematics, and stereotype of math as a male domain. There were 12 statements for each attitude. Six of those statements were worded positively and six were worded negatively. The factors considered were gender and SES. A total of 533 students took the survey. Of the 533 students, 282 were female and 251 were male. There were 278 low SES students and 255 high SES students. Those scores were compared by gender and SES at each grade level. The limitations of this study were that it only considered 533 students in one county in California, and the number of students who were allowed to be part of the study by their parents.

The difference in students' attitudes about math between high and low SES was not, for the most part, statistically significant. The only grade where there were consistent statistically differences was 8th grade, where the low SES school scored higher than the high SES school.

Stereotype of math as a male domain was the only attitude that was statistically significant for both SES and gender. Math is slowly becoming less stereotyped as a male domain, but even the U.S. Census (2008) indicates that those occupations that are math intensive employ a majority of males.

Progress has been made in the areas of perception of teacher attitudes towards the student as a learner of mathematics, confidence in learning mathematics, and perceived usefulness of mathematics. Males and females, both high and low SES, are believing in themselves as mathematicians and gaining confidence. They are finding self-confidence from teachers who believe in them as mathematicians. It seems that the work that has been done since the Fennema-Sherman (1977) study has really helped change the attitudes of both genders towards girls and mathematics. This research could be expanded to the whole state or even the nation to obtain better results.

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APPENDIX A

PARENTAL CONSENT LETTER

Parental Consent Letter

Dear Parent or Guardian:

I would like to include your child in a research project on students' attitudes about math. This research is being done for my masters' thesis at California State University, Chico.

If you give your permission, your child will be given a survey about their attitudes about math. Your child's name will not appear on the survey. Your child will be asked to check a box identifying his/her gender. This survey will be taken in their classroom and will take about 20 minutes.

Participation in this project is voluntary and involves no unusual risks to your child. You may rescind your permission at any time with no negative consequences. Your child can refuse to participate at any time with no negative consequences. This survey will have no impact on your child's math grade.

Your child's participation in this project will help me look at the differences in attitudes about mathematics between boys and girls. If it is all right for your child to participate, please sign the study CONSENT at the bottom of the page. If you have any questions, please feel free to contact me at 425-558-9130. Thank you for considering this request.

Sincerely,

Kristin Jazdzewski

I voluntarily give my permission for my child to participate in a survey on math attitudes. I have read and understand the letter describing the purpose and procedures of the survey. I understand the either I or my child may ask questions and that either of us may withdraw our permission at any time.

Child's Name (Please Print)

Signature of Parent

Date

APPENDIX B

CARTA DE CONSENTIMIENTO DE PADRES

Carta de Consentimiento de Padres

Estimado Padre o Guardián:

Me gustaría incluir a su niño(a) en un proyecto de investigación en las actitudes estudiantiles sobre el matemáticas. Esta investigación es para mi tesis de maestría de la Universidad de California en Chico.

Si da su permiso, su niño(a) tomará una encuesta sobre sus actitudes de matemáticas. El nombre de su hijo(a) no aparecerá en la encuesta. Su hijo(a) se le pedirá que indique su género en una cajita. Esta encuesta será tomada en su aula y se tomará solamente 20 minutos.

Participación en este proyecto es voluntario y no tendrá ningún riesgo para su hijo(a). Puede rescindir su permiso cuando quiera sin ninguna consecuencia negativa. Su hijo(a) puede negar participar cuando quiera sin ninguna consecuencia negativa. Esta encuesta no afectará la nota de su niño(a) en matemáticas.

La participación de su hijo(a) en este proyecto me ayudará a mi ver la diferencia en las actitudes sobre la matemática entre los chicos y las chicas. Si usted da el permiso para que su hijo(a) participe, favor firme el CONSENTIMIENTO al fondo de la página. Si tiene alguna pregunta, puede llamarme a 425-558-9130. Muchas gracias por considerar esta solicitud.

Sinceramente,

Kristin Jazdzewski

Yo voluntariamente doy permiso para que mi hijo(a) participe en la encuesta sobre las actitudes de matemáticas. He leído y comprendido la carta describiendo el propósito y el procedimiento de la encuesta. Entiendo que yo o mi hijo(a) preguntar y que cualquiera de nosotros podemos remover nuestro permiso a cualquier tiempo.

Nombre del niño(a) Favor de escribir en molde

Firma de Padre

/ /
fecha