A STUDY OF THE RELATIONSHIPS BETWEEN STUDENTS' PERCEPTION OF MATHEMATICS AS A MALE DOMAIN AND MATHEMATICS-RELATED CAREER CHOICES

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A Study of the Relationships Between Students' Perception of Mathematics as a Male Domain and Mathematics-Related Career Choices

A Field Study
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ABSTRACT

This study examined students' perception of mathematics as a male domain. Of special interest was the implication that students' views of mathematics influenced the career choices they made. Did female students tend to eliminate careers they perceived to be mathematics-intensive and male dominated? Responses from seventy-four public high school students, all enrolled in Algebra II classes, participated in this study. The students were given a three-part questionnaire to complete in three different time intervals. The first part of the questionnaire was designed to assess students' beliefs about mathematics-intensiveness of certain careers. The second part of the questionnaire was designed to assess students' interest in those same careers, and the third part of the questionnaire was intended to measure the degree to which students perceive mathematics as a male domain. Responses from the 112 item instrument survey were machine scored and correlation coefficients were calculated to give evidence of relationships between variables. The results of this study found a statistically significant indication that males did regard mathematics as a male domain, and male students stereotyped mathematics as a male domain more strongly than did female students. Only 20 % of student responses revealed a statistically significant correlation between career interest and the level of mathematics involved in that career.

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CHAPTER 1

Introduction

The relationship between education and career choices has long been recognized (AAUW, 1992). A well-educated work force is essential to the country's economic development, yet women continue to be underrepresented in fields requiring advanced mathematics and science degrees. Careers requiring mathematics and science skills are growing at nearly double the rate of all other fields (Watson, 1989). As a result, one of the fastest growing sectors of our economy is significantly underrepresented by women (Clewell, 1992). In 1995, women represented 46 percent of the total work population, yet they earned 22 percent of all bachelor's degrees and only 13 percent of all Ph. D.'s in mathematics and science. As of 1990, only 16 percent of all scientists and engineers were women (NSF, 1990). David Shipp (1992) suggests that if present trends continue, more than 2,000 years will pass before women receive as many math doctorates annually as men do.

Interest in the underrepresentation of women in mathematics and science-related careers developed from the realization that economical demand of the twenty-first century will require significantly more mathematicians, scientists, and engineers (Cetron, Roche, & Luckins, 1988). A second concern is related to the changing composition of the workforce. Through the year 2000, two out of three new entrants to the labor force will be women. Women traditionally have not pursued careers requiring advanced courses and training in the mathematics and sciences (Hanson, 1993).

Of concern to educators are the variables affecting the continued study of mathematics and science by young women. Variables considered are how students' perceptions of mathematics as a male domain can be linked to both perceived value of mathematics and mathematics-related career plans.

Statement of the Problem

The purpose of this study was to examine the effects of students' perceptions of mathematics as a male domain and related career choices. Women are likely to pursue careers and perform better in mathematics if it is perceived to be useful to them. When women view mathematics and related career fields as male provinces, they will decide against "inappropriate" careers. Therefore, female participation in higher level mathematics courses will be decreased because they will not view these courses as useful. This, in turn, results in women being underrepresented in mathematics-related careers.

Hypotheses

The following null hypotheses were tested:

1. There will be no significant difference between students' perceptions of the mathematics-intensiveness of a career and the students' level of interest in that career;
2. There will be no significant difference between gender and the preference of careers perceived to be mathematics-intensive;
3. There will be no significant difference between gender and students' perception of mathematics as a male domain;

4. There will be no significant difference between students' semester grade and their perception of mathematics as a male domain;
5. There will be no significant difference between gender and students' college plans.

Limitations of the Study

This study was limited by the fact that the subjects were students attending a public high school in the State of Tennessee. The students participating in this study were limited to ninth through twelfth graders enrolled in Algebra II classes. Reliance upon student responses for the data might have resulted in inconsistencies and inaccuracies.

Significance of the Study

This study could have an effect on instructional techniques used by teachers in the mathematics classroom. Should this study reveal a strong correlation between students' perceptions of mathematics as a male domain and their chosen careers, this might serve as a basis for instructional change. Through instruction, students may be receiving subtle, unintentional messages as to which careers are sex-appropriate. Consequently, gender connotations associated with various careers may result in differential treatment of males and females, and this, in turn, may provoke interest in, or deter interest from beneficial careers.

CHAPTER 2

Review of the Literature

Scope of the Problem

In response to national concern over the underrepresentation of women in science, engineering, and mathematics, interest in the educational needs of females has become one of the central issues for research. The focus is on education, for it provides the potential population for many future engineers, scientists, and physicians. Education is being bombarded with demands for change, yet all too often the question as to where gender inequity begins is uncertain (AAUW, 1991).

This underrepresentation of women, without doubt, has many origins. Factors such as negative attitudes toward mathematics and science (based on gender stereotypes), limited exposure to extracurricular activities in mathematics and science, and lack of information about mathematics and science-related careers are all barriers to female participation in these fields. Based on a review of the relevant literature, Clewell (1992) observed that the reasons for the underrepresentation in the mathematics and science disciplines are varied and complex. In an effort to understand where this disparity begins, one must take a look at the past history of education.

History of Education

Viewing the history of education, one finds that for almost two centuries in American education, girls were barred from school. Education was the road to professions and careers open only to men (Sadker & Sadker, 1994). Women were viewed as mentally and morally inferior, and were relegated to learning only domestic skills.

Even in the twentieth century, there remains a curricular division through the courses of study offered by the nation's high schools. Home economics, the female field, prepares girls for their role as wives and mothers, while shop is reserved for boys. Though girls are not usually barred from mathematics and science, many educators actively counsel girls not to take these courses. Females that do enter these "male" courses often encounter blatant hostility and discrimination, often spilling over into the classroom (Sadker & Sadker, 1994).

Girls come of age in a culture in which men control most of the political and economic power. Girls read a history of Western civilization that is essentially a record of men's lives. The question arises, "where were the women and what were they doing during all these events?" (Pipher, 1994). By junior high age, today's girls sense their lack of power in society. They see that most congressmen, principals, brokers, and corporate executives are men. Even most famous writers, musicians, and artists are men (Pipher, 1994).

A 1992 report by the American Association of University Women (AAUW) states that females take fewer advanced mathematics courses than males, and choose careers in mathematics and science in disproportionately lower numbers. Yet, both males and females start out life with seemingly similar abilities to perform mathematical tasks. However, the report states that from birth and throughout childhood, society has different expectations for males and females (AAUW, 1992).

Society's Influence

To understand the differing expectations, one must look closely at the influence of these social factors. Sex socialization begins in the cradle—pink and blue tags are seen in hospital nurseries to specify gender. Adults hold tiny girl babies gently and affectionately and tell them how pretty they are. Boy babies are typically told how big, strong, and active they are (Barr, 1985). Parents encourage their children to develop sex-typed interests, in part through providing sex-typed toys for them. Barbie dolls are chosen for girls, while males receive G.I. Joes.

Toys that seem to encourage nurturing roles are selected for girls, fostering role-playing and fantasy. The Cabbage Patch Doll has for years been a favorite for girls. Boys are given manipulative toys which encourage mechanical reasoning and spatial awareness. The Transformer, a mechanical robot, can take on characteristics of a variety of objects when manipulated (Barr, 1985). In this manner parents discourage their children from engaging in activities they consider inappropriate for their sex.

Barr, reporting on a number of studies, finds that adult treatment of young children promotes dependency in girls and independence in boys. Girl babies tend to be more protected and assisted. They are encouraged to learn through "talking it over." As a result of their socialization, pleasing others becomes very important to girls. Boy babies, to the contrary, are encouraged as early as six months of age to "stand on your own" and to "do it for yourself"(Barr, 1985).

By the early age of six or seven, children have rather clear ideas about gender, based on what they have seen in their surrounding world. Both girls and boys strive for conformity with gender-stereotyped roles. From cheerleaders to football players, our society holds different expectations for boys and girls (AAUW, 1992). Gettys (1981) reported attitudes toward the sciences form in the early childhood and by the time children are five years old they have formed views of occupational segregation. To them, jobs in the sciences are not associated with women. Seeing science as "men's work" likely deters girls from enrolling and excelling in science courses.

Students are deterred from considering science as a career because of negative or narrowly defined images of scientists presented by the media and society in general. Gardner, Mason, and Matyas, (1989), in a study of hundreds of ninth and tenth graders who were asked to draw a scientist, found almost all drew pictures of a "nerdy" white male with a beard and glasses, wearing a white lab coat (New England Consortium for Undergraduate Science Education, NECUSE, 1996). With limited images of women as scientists, it is hard for young girls and women to imagine themselves in the field. However, knowing a scientist personally may make a woman much more likely to pursue her interests in the sciences. The Group Independent Study Project (GISP) at Brown University, in an informal study, found the most important factor determining whether a woman will pursue science as a career was the vocation of her mother and or father (NECUSE, 1996).

Most educators would agree that major areas of influences on the academic achievements of students are the curriculum content and materials to which students are subjected (Leder, 1990). Girls have few role models of women in science to compensate for sex-role socialization. Trade books and textbooks further promote this idea. Boys usually are depicted as the "doers" of science and girls as the recorders. Advertisements on television and in magazines depict a strong sex bias also (Barr, 1985).

"Math is hard" said the talking Barbie. Unfortunately, this statement reflects the attitudes of many females in mathematics courses (Sadker & Sadker, 1994). When stereotyped expectations are reinforced by stereotyped models, students receive more messages of "appropriate" and "inappropriate" careers, and many students learn to limit their careers and capabilities in order to fit these stereotyped roles. These stereotypes have been passed down from generations, with girls responding to these "self-fulfilling prophecies" (Carlson & Felton, 1993).

Affective Factors

Women in our society often have an extrinsic sense of self worth; they have a tendency, more so than men, to place a higher value on what others think of them. Also, women are "more likely to fix the blame internally—to cite their own inadequacy as the source of the difficulty" when encountering problems. Men, to the contrary, "place responsibility for difficulties outside themselves" (NECUSE, 1996). Males tend to blame a poor test grade on the examination itself as a poor judge of his knowledge, or blame the professor for not adequately preparing him for the examination. Women, upon receipt of a poor examination score, are more likely to belittle themselves as being unintelligent and are less confident in their performance. Subsequently they make important decisions, such as the decision to change majors, based on either an inaccurate appraisal of their performance or on an insufficient amount of data, such as poor test performance

(NECUSE, 1996). Confidence in mathematics is reflected by continual participation in mathematics course taking (Leder, 1990).

Helen Astin and Linda J. Sax at UCLA in 1993 studied seventh graders and found that although boys and girls performed comparably in science and mathematics courses, girls consistently underestimated their abilities. As a result, females took fewer mathematics and science courses than their male schoolmates, a trend that accelerated in high school. These researchers also found that, by the time the female test subjects graduated from high school, they were so poorly prepared that they were deterred from majoring in science, mathematics and engineering in college (Alper, 1993).

Spatial awareness skills, the ability to manipulate objects mentally, have been hypothesized for years to be important variables affecting gender differences in mathematics achievement. Games such as baseball, billiards, and dirt biking, which are played almost exclusively by boys, promote spatial awareness. Girls are usually encouraged to participate in less boisterous and "more ladylike" activities, which often are less valuable in developing problem solving skills (Barr, 1985). Boys score slightly higher on tests measuring spatial awareness than girls as shown by Fennema (1977). This difference is not due to innate ability, but to gender socialization (Barr, 1985).

Numerous studies before 1976 found that the perceptions of the usefulness of mathematics for one's future differ for males and females and are related to course-taking plans. More recent studies between 1977 and 1979 indicate that the perception of the usefulness of mathematics is still an important predictor of course-taking for girls (Fox, 1981). Sherman (1979) also showed the perception of the usefulness of mathematics for one's future is related to course-taking plans. Course-taking plans were shown to be closely related to career interests. More recent research indicates careers that do not seem appropriate to the sex of the student are the first to be eliminated. If a student views science as masculine and herself as feminine, then a career in the sciences would very likely be discounted (Sells, 1980).

Gettys and Cann (1981) surveyed career aspirations of children and adolescents, showing stereotypic differences in the children's interest responses. Girls were less likely than boys to enroll in advanced mathematics courses primarily because they felt mathematics was less important and less useful than did the boys (Eccles, 1987; Gettys & Cann, 1981). Again, the perception of the usefulness of mathematics is related to career interests (Fox, 1981). Armstrong and Price (1982) reported that students ranked usefulness of mathematics as the most important factor in deciding to take more mathematics.

Even when girls take mathematics and science courses and do well in them, they do not receive the encouragement they need to pursue scientific careers. A study of high school seniors found that 64 percent of the boys who had taken physics and calculus were planning to major in science and engineering in college, compared to only 18.6 percent of the girls who had taken the same subjects. Support from teachers is important, as studies report that girls rate teacher support as an important factor in decisions to pursue scientific and technological careers (AAUW, 1992).

Marsha Lakes Matyas (1992) in a study of undergraduate biology majors, determined that the women sampled had higher average GPAs than men, but dropped the major at a greater rate because of personal factors. Between 70 percent and 80 percent of females who switched out of a science major felt discouraged and suffered a loss of self-esteem even though their grades were the same as those of men (Seymour, 1993).

Mathematics as a Male Domain

For men, not women, self-esteem and feelings of competence in a general sense are related to mathematics participation and self-perceived mathematics ability. Women still seem to see mathematics as a male activity, not important in determining their success in becoming capable women (Fennema 1990). Numerous studies, both empirical and in-depth clinical studies following individual girls through school, report significant declines in girls' self-esteem and self-confidence as they progress to early adolescence. A nationwide survey by the AAUW found that on average 69 percent of elementary school boys and 60 percent of elementary school girls reported that they were "happy the way I am." Among high school students the percentages dropped to 46 percent for boys and only 29 percent for girls (AAUW, 1992).

Though the gender lines guarding male domains—mathematics, science, computer technology, athletics, and vocation education—are diminishing, harmful remnants remain. Mathematics is learned, for the most part, in classroom, but there is evidence that parents sex-type mathematics which leads to differential expectations for sons and daughters in pursuit of careers that rely on mathematics (Fox, 1981). Fox (1981) states there is little doubt that the perception of mathematics as a male domain is common. Traditionally, the physical sciences and mathematics have been male provinces, and relatively few women have crossed the border.

As recently as 1995, in a study done over a period of six years, Fennema and Tartre (1995) found consistent gender differences for stereotyping mathematics as a male domain. Almost 20 years after her 1977 study, Fennema found males still stereotyped mathematics as a male domain to a greater degree than did the females for each year of the study.

Girls who see mathematics as "something men do" do less well in mathematics than girls who do not hold this view. The role of the mathematician or scientist is perceived as masculine. A number of studies indicate that as females move into adolescence, their interest in mathematics and science usually wanes. Elizabeth Fennema and Julia Sherman (1977), in their classic study, reported a drop in girls' mathematics confidence and their achievement in the middle school years. The drop in confidence preceded the decline in achievement. In further addressing the issue of mathematics as a male domain, they found boys, more than girls, rated mathematics as a male domain. Furthermore, they found stereotyping of mathematics as a male domain related to both female achievement in mathematics and in courses taken. Additionally, they found sex differences in mathematics involvement can be linked to both perceived valued of mathematics and mathematics-related career plans.

Morgan (1994) studied 423 freshman students (298 females and 125 males) to compare attitudes by gender toward science. The data suggest that gender differences in ability ratings and expectancies are task specific: that is, females and males alike hold higher expectations for the performance of tasks presented or perceived as more appropriate for their specific gender. Females tend to view mathematics and science as male domains, in contrast to the arts and humanities, which they view as female domains (Morgan, 1994).

Summary

In 1973, Lucy Sells first identified mathematics as the "critical filter" leading to high level jobs (Sells, 1980). Fennema (1990) again has shown that mathematics has been and continues to be viewed as the critical barrier to participation in many occupations, and in career advancement. In turn, these jobs lead to high level salaries and economic power. According to Reyes and Stanic (1988), mathematics knowledge is necessary for members of our society to be unhindered in choosing a career and taking advantage of opportunities for advancement.

The differences between girls and boys in mathematics achievement are small and declining. Yet in high school, girls are still less likely to take the most advanced courses and to be in the top-scoring mathematics groups (AAUW, 1992). The gender gap in science is not decreasing, and may, in fact, be increasing. Even girls who excel in mathematics and science are much less likely to pursue scientific or technological careers than are their male classmates (AAUW, 1992). Hanson (1993) found females to be taking more mathematics and science classes in high school, but women still do not choose mathematics and science-related careers.

At a time when the demand is for more scientists and engineers, too many women do not pursue careers in these fields. Avoiding careers in fields which require high levels of mathematical skills can be seen as both a cause and effect in a somewhat circular pattern of reinforcing the idea of mathematics as a male domain.

CHAPTER 3

Methodology

As reported in the literature review, when mathematics is viewed as a male domain, females might be less willing to pursue studies in this area, thus, resulting in fewer females pursuing careers in areas they perceive as requiring a high level of mathematics. To examine the cause for the underrepresentation of women in mathematical careers, the following questions were examined in this study:

1) Is there a statistically significant correlation between students' perceptions of the mathematics-intensiveness of a career and the level of interest in that career?
2) Do females choose careers they view as not mathematics-intensive?
3) Do females eliminate careers they see as mathematics-intensive?
4) Is there a statistically significant correlation between gender and the mathematics/career interest coefficient (MCIC)?
5) Do students perceive mathematics as a male domain?
6) Is there a statistically significant correlation between gender and students' perception of mathematics as a male domain?
7) Is there a statistically significant correlation between students' last semester grade and their perception of mathematics as a male domain?
8) Is there a statistically significant correlation between gender and students' college plans?

The Sample

The sample for the study consisted of seventy-four public high school students enrolled in Algebra II classes. Forty-three female and thirty-one male participants voluntarily agreed to take part in the study. Biographical data of the sample gathered from a questionnaire (Appendix A) are summarized in Table 3.1.

Table 3.1

Biographical Data from Sample

Grade Level	9		10		11		12		Total	
Gender	M	F	M	F	M	F	M	F	M	F
Total Students	3	2	13	21	10	16	5	4	31	43
Plans to Attend College	3	2	13	20	7	16	4	4	27	42
Plans to Attend Technical School	0	0	0	1	3	0	1	0	4	1
Plans to Major in Mathematics	0	0	1	1	0	0	0	0	1	1

The Instrument

This study used a three-part questionnaire to explore students' perceptions of mathematics as a male domain , students' perception of the intensity of mathematics required in certain careers , and students' level of interest in those same careers . The first part (Appendix B) of the questionnaire contained fifty career choices that ranged from careers in business and the medical sciences to social, health and personal service careers. This 50-item inventory was designed to assess students' beliefs about the level of mathematics involved in each career. The level of mathematics required ranged from a very high level of mathematics to hardly any mathematics used. The second part (Appendix C) of the questionnaire asked students to review the same fifty career choices. This was a 50-item inventory designed to assess students' interest in certain careers. The final twelve questions (Appendix D) were intended to measure the degree to which students perceive mathematics as a male domain. A subscale, concerning mathematics as a male domain, from the *Fennema-Sherman Mathematics Attitudes Scales* (1976) was administered to assess students' beliefs. Six of the twelve items on the scale were stated positively and the other six were stated negatively with five possible responses: strongly agree, agree, undecided, disagree, and strongly disagree. Each response was scored from 1 to 5, and scores could range from 12 to 60, with higher scores indicating a strong perception of mathematics as a male domain. The lower the score the less stereotypic view one held of mathematics. Data taken from this survey were machine-scored. An individual score was assigned to each subject, and mean scores for males and for females were calculated.

Research Procedures

Subjects in this study were given a 112 item instrument and were asked to respond by using a five-point Likert scale. Students were asked to review 50 career choices and choose five careers which they thought would almost always use mathematics; next they would choose five careers which they thought would almost never use mathematics. The other 40 career choices were to be arranged on the scale according to how much mathematics they thought would be involved. Each response was given a score from 1-5. Careers that students thought would almost always use mathematics were scored a 5; careers that almost never used mathematics were given the lowest rating of 1. Responses of seldom use, sometimes use, or very often use mathematics were rated 2, 3, and 4, respectively. Students were to review the same 50 career choices a second time, and this time they were to choose five careers they would definitely be interested in and then five careers they would definitely not be interested in. The remaining 40 career choices were to be arranged on the scale according to their level of interest. Careers chosen by students stating they were definitely interested in were rated a 5, and careers they were definitely not interested in were rated 1. Responses of probably not, maybe, or probably interested were rated 2, 3, and 4, respectively. Data taken from the questionnaires were machine-scored and a correlation coefficient was calculated between the student's ratings of the mathematics-intensiveness of careers and his or her preference for those careers.

CHAPTER 4

Results

This chapter contains a summary of the data and provides a presentation of the methods used to examine the results the data provided. Appropriate data were collected and are provided in tables which show the results for each analysis.

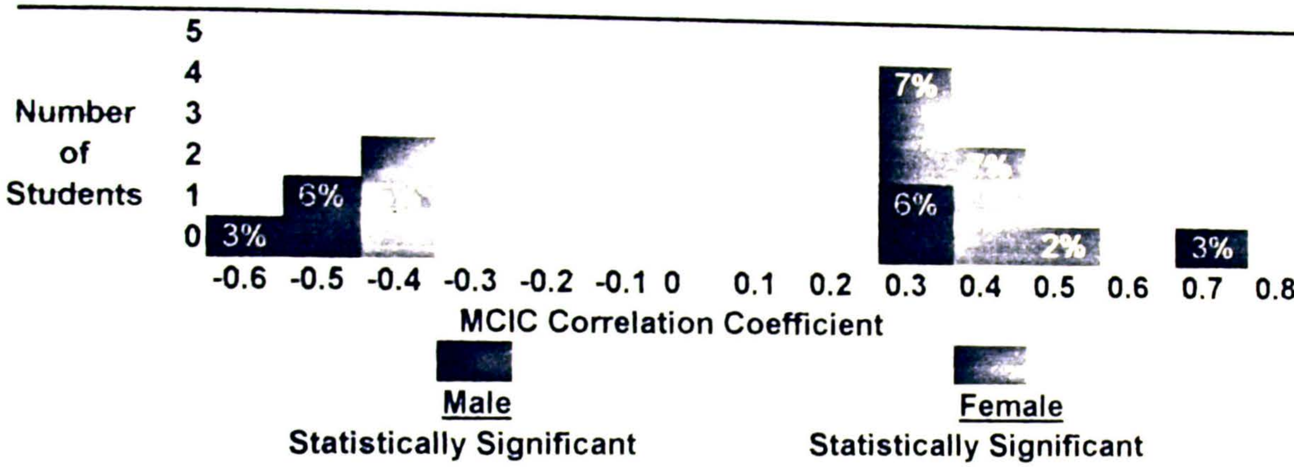
Summary and Analysis of the Data

Students' ratings of the mathematics-intensiveness of careers and their preference for those careers were used to calculate a correlation coefficient. A correlation near -1 indicates that the student plans to avoid careers seen as mathematics-intensive and prefers non-mathematics-intensive careers. A correlation near +1 indicates that the student is highly interested in careers seen as mathematics-intensive and plans to avoid careers perceived as non-mathematics-intensive. The data for Math-Related Careers Scale/Interest (MCIC), separated for females and males, show correlations ranging from -.37 to .54 for females and from -.58 to .78 for males. The analysis of data report 6 of the 31 males and 9 of the 43 females show statistically significant correlations: Males (df=31, r =.349, $p<.05$); Females (df=43, r =.304, $p<.05$). Nine percent of males and five percent of the females had a significant negative correlation stating they probably would not choose careers they considered mathematics-intensive. Nine percent of males and 16 percent of the females had a significant positive correlation stating they would consider choosing a mathematics-intensive career.

The data presented in Table 4.1 reflect the statistically significant correlation coefficients between students' perception of the level of mathematics required in certain careers and students' level of interest in that same career.

Table 4.1

Distribution of Statistically Significant Data for MCIC by Gender



An additional intercorrelation was calculated to determine whether a relationship existed between gender and MCIC. No significant relationship was found to exist between gender and mathematics-related career interests ($df=74$, $r = -.11$, $p>.05$).

One purpose of the study was to explore students' perception of mathematics as a male domain. Mean scores for males and for females are reported for each item on the Mathematics as a Male Domain Scale (MD) and summarized in Table 4.2. The closer a mean score was to 1, the less stereotypic view one held of mathematics. The higher the mean, the stronger one tended to rate mathematics as a male domain. Scores from the questions exploring students' perceptions of mathematics as a male domain are summarized in Table 4.3.

Table 4.2

Mean for Mathematics as a Male Domain Scale

Weight	Item	Mean Female	Mean Male
*(+)	1) Females are as good as males in geometry.	1.33	2.03
** (-)	2) Mathematics is for men; arithmetic is for women.	1.30	2.10
(-)	3) I would have more faith in the answer for a math problem solved by a man than a woman.	1.44	2.23
(+)	4) Girls can do just as well as boys in mathematics.	1.05	1.65
(+)	5) Males are not naturally better than females in mathematics.	1.93	2.35
(-)	6) It's hard to believe a female could be a genius in mathematics	1.09	1.65
(+)	7) Women certainly are logical enough to do well in mathematics.	1.09	1.90
(-)	8) When a woman has to solve a math problem, it is feminine to ask a man for help.	1.35	2.10
(+)	9) I would trust a woman as much as I would a man to figure out important calculations.	1.09	1.50
(-)	10) Girls who enjoy studying math are a bit peculiar.	1.47	2.35
(+)	11) Studying mathematics is just as appropriate for women as for men.	1.14	1.65
(-)	12) I would expect a woman mathematician to be a masculine type of person.	1.19	1.97

*+ means agreement with the statement is an indication that mathematics is not seen as a male domain.

** - means agreement with the statement that mathematics is seen as a male domain.

Table 4.3

Scores for Mathematics as a Male Domain Scale by Gender

Male		Female	
Score	Frequency of Score	Score	Frequency of Score
12	3	12	13
13	1	13	4
14	1	14	3
15	2	15	3
16	1	16	5
17	2	17	4
18	2	18	4
20,21	1	19	1
24,25	1	22	1
26	3	23	1
27	1	27	1
28	2		
30	1		
31	2		
32,33	1		
34,35	1		
36,38	1		
	Total 31		Total 43

The mean and standard deviation were computed for males and for females for the MD and the findings are shown in Table 4.4.

Table 4.4

Mean and Standard Deviation for MD by Gender

Group	Number	Mean	Standard Deviation
Males	31	23.54	8.09
Females	43	15.49	3.55

Males stereotyped mathematics as a male domain to a greater degree than did the females. These data yielded an approximate mean score of 15.49 for the females and 23.54 for the males. From these data, a *t* statistic was calculated to test for significant difference between the two means. There was a statistically significant difference (t=5.81, p<.05). Males' higher mean suggests that they regard mathematics as a male domain more than females. The correlation coefficient between gender and MD also was statistically significant (df=74, r =.57, p<.05) which reinforced the *t* statistic that males did perceive mathematics as a male domain more strongly than did the females.

The data for grade distribution for the 74 subjects were classified by gender, and a summary of the total percentages of letter grades was tabulated. The following results were obtained and are shown in Table 4.5.

Table 4.5

Analysis of Grades by Gender

Grade	Males	Females
A	9 (29%)	10 (23%)
B	10 (32%)	18 (42%)
C	2 (6%)	9 (21%)
D	6 (19%)	2 (5%)
F	4 (13%)	4 (9%)
Total	**31 (100%)**	**43 (100%)**

The correlation coefficient (r =.14) between students' semester grade and their perception of mathematics as a male domain was not statistically significant. Therefore no significant relationship existed between grades and perception of mathematics as a male domain. Nor was a correlation coefficient of .10 significant enough to determine a relationship between gender and college plans.

Table 4.6 contains data concerning semester grades and the highest level mathematics course a student anticipated taking in high school.

Table 4.6

Semester Grade and Highest Level Mathematics Class Student Planned to Take in High School

Grade	Course	Males	Females
A	Calculus	5 (16%)	6 (14%)
	Geometry	3 (10%)	4 (10%)
	Algebra II	1 (3%)	0 (0%)
B	Calculus	3 (10%)	7 (16%)
	Geometry	6 (19%)	9 (21%)
	Algebra II	1 (3%)	2 (5%)
C	Calculus	0 (0%)	1 (2%)
	Geometry	1 (3%)	7 (16%)
	Algebra II	1 (3%)	1 (2%)
D	Calculus	0 (0%)	0 (0%)
	Geometry	3 (10%)	2 (5%)
	Algebra II	3 (10%)	2 (5%)
F	Calculus	0 (0%)	0 (0%)
	Geometry	4 (13%)	3 (7%)
	Algebra II	0 (0%)	1 (2%)
	Total	**31 (100%)**	**43 (100%)**

The data in Table 4.6 indicates that 32% of female students and 26% of male students with a letter grade of C or better planned to complete Calculus during high school. Interesting to note is that none of the males or females with a semester grade of D or lower planned to complete Calculus. However, 16% of those students with a semester grade of D or lower did plan to complete Geometry.

Summary of Results

The first null hypothesis stated there will be no significant difference between students' perception of the mathematics-intensiveness of a career and the students' level of interest in that career. This hypothesis was rejected for 15 of the 74 students. Of the 15 significant correlations, five were negative and ten were positive. The second null hypothesis stated there will be no significant difference between gender and the preference of careers perceived to be mathematics-intensive. This null hypothesis was not rejected by analysis of the data. The third null hypothesis stated there will be no significant difference between gender and students' perception of mathematics as a male domain. This null hypothesis was rejected. The results showed males tended to stereotype mathematics as a male domain more strongly than did the females. The fourth null hypothesis stated there will be no significant difference between students' semester grade and their perception of mathematics as a male domain. This null hypothesis was supported by analysis of data. The last null hypothesis stated that there will be no difference between gender and students' college plans, and again this null hypothesis was not rejected by analysis of the data.

CHAPTER 5

Discussion

Studies, surveys, and statistical data reveal that females are underrepresented in mathematics and science related careers. Is this a problem encouraged by traditional and stereotypical thinking, or is it just a reflection of females' lack of interest in careers they tend to equate with male domination?

Although the problem of fewer women in mathematics related careers is far more complex than could be understood by surveying perceptions of 74 high school students, the results from the responses could lend support to findings of other studies. This study was designed to examine students' attitudes concerning mathematics as a male domain and how attitudes influence career interests and choices. Male students tended to stereotype mathematics more strongly than did females. Twenty percent of the students surveyed saw certain careers as mathematics-intensive and they would still be interested and certain careers were not mathematics-intensive and they were still not interested.

Although the results of this study cannot be generalized to any population, it is the opinion of this author that the results of "mathematics as a male domain" are representative of the attitudes of many males and females. Teachers might be the most important educational influence on students' attitudes toward learning mathematics. For this reason, this author suggests intervention techniques be incorporated into classroom teaching strategies for mathematics.

The objective of an intervention technique is to create a positive influence on females and career choices. Instructional practices tend to make a positive or negative impact on the learning of mathematics by students and this affects their career preferences. The results of this study concerning the assessment of students' perceptions about mathematics can alert teachers to plan instruction so as to help students develop more enlightened beliefs about mathematics and mathematics-related careers.

In light of future occupational demands, teachers need to nurture students' interest and achievement in mathematics. Females might need to be provided with career awareness activities that focus on mathematics as being critical for entry into, and success in, occupations that require use of higher level mathematics. It might be up to the educational environment to provide students the opportunity to achieve excellence. Research must continue to examine the cause for the underrepresentation of women in mathematical careers, and research findings must be instituted to reverse the trends of female underrepresentation and to increase female participation in the mathematics and science fields.

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APPENDICES

APPENDIX A

Background Information for Sample

Background Information

Circle the information that applies to you.

Grade level? 9th 10th 11th 12th

Gender? Female Male

Do you plan to go to college? Yes No

In college, do you think you will major in mathematics? Yes No

Do you plan to go to a technical school? Yes No

Math course presently enrolled in?____________________________

Previous high school math courses taken?________________________

Math course you plan to take next school year?____________________

Highest level math course you plan to take in high school?__________

Semester letter grade in last math course taken?___________________

There are no right or wrong answers. These inventories are being used for research purposes only, and no one will know what your responses are. Please think carefully about your responses and give your honest opinions.

APPENDIX B

Math-Related Careers Scale

Listed below are 50 career choices which should be reviewed. Choose and list five (5) careers in which you think you will almost always use math. Next, choose and list five (5) careers in which you think you will almost never use math. Arrange other career choices on the scale according to how much mathematics you think is involved.

Math-Related Careers Scale (MC)

1) Accountant
2) Actor/actress
3) Airplane pilot
4) Architect
5) Artist
6) Astronaut
7) Banker
8) Barber/Cosmetologist
9) Butcher
10) Carpenter
11) Chemist
12) Computer programmer
13) Cook/chef
14) Dancer
15) Dentist
16) Doctor
17) Electrician
18) Elementary teacher
19) Engineer
20) Farmer
21) Geologist
22) Interior designer
23) Janitor
24) Lawyer
25) Librarian
26) Mail carrier
27) Mathematician
28) Mechanic
29) Musician
30) Nurse
31) Nutritionist
32) Paralegal
33) Pharmacist
34) Photographer
35) Plumber
36) Police officer
37) Politician
38) Postal clerk
39) Private detective
40) Professional athlete
41) Psychologist
42) Real estate agent
43) Reporter
44) Sales clerk
45) Scientist
46) Secretary
47) Social worker
48) Surveyor
49) Telephone operator
50) TV announcer

Almost Never	Seldom	Sometimes	Very Often	Almost Always

APPENDIX C

Math-Related Careers Scale/Interest

Listed below are 50 career choices. List career preferences according to your interest. Please label careers according to your level of interest. For those careers you are definitely interested in, give a rating of "5". For those careers you are definitely not interested in, give a rating of "1". Arrange other career choices on the scale according to your level of interest..

Math-Related Careers Scale (MC)

1) Accountant
2) Actor/actress
3) Airplane pilot
4) Architect
5) Artist
6) Astronaut
7) Banker
8) Barber/Cosmetologist
9) Butcher
10) Carpenter
11) Chemist
12) Computer programmer
13) Cook/chef
14) Dancer
15) Dentist
16) Doctor
17) Electrician
18) Elementary teacher
19) Engineer
20) Farmer
21) Geologist
22) Interior designer
23) Janitor
24) Lawyer
25) Librarian
26) Mail carrier
27) Mathematician
28) Mechanic
29) Musician
30) Nurse
31) Nutritionist
32) Paralegal
33) Pharmacist
34) Photographer
35) Plumber
36) Police officer
37) Politician
38) Postal clerk
39) Private detective
40) Professional athlete
41) Psychologist
42) Real estate agent
43) Reporter
44) Sales clerk
45) Scientist
46) Secretary
47) Social worker
48) Surveyor
49) Telephone operator
50) TV announcer

Definitely not	Probably not	Maybe	Probably	Definitely

APPENDIX D

Mathematics as a Male Domain Scale

Mathematics as a Male Domain Scale (MD)

Listed below is a series of statements. These have been set up in a way which allows you to indicate the extent to which you agree or disagree with the ideas expressed. Suppose the statement is:

1) I like mathematics. SA A U D SD

As you read the statement, you will know whether you agree or disagree. Circle the letter or letters that indicate the extent to which you agree or disagree.

If you <u>strongly agree,</u>	circle SA.
If you <u>agree with reservations,</u>	circle A.
If you are <u>undecided,</u>	circle U.
If you <u>disagree with reservations,</u>	circle D.
If you <u>strongly disagree,</u>	circle SD.

1) Females are as good as males in geometry. SA A U D SD

2) Mathematics is for men; arithmetic is for women. SA A U D SD

3) I would have more faith in the answer for a math problem solved by a man than a woman. SA A U D SD

4) Girls can do just as well as boys in mathematics. SA A U D SD

5) Males are not naturally better than females in mathematics. SA A U D SD

6) It's hard to believe a female could be a genius in mathematics. SA A U D SD

7) Women certainly are logical enough to do well in mathematics. SA A U D SD

8) When a woman has to solve a math problem, it is feminine to ask a man for help. SA A U D SD

9) I would trust a woman as much as I would a man to figure out important calculations. SA A U D SD

10) Girls who enjoy studying math are a bit peculiar. SA A U D SD

11) Studying mathematics is just as appropriate for women as for men. SA A U D SD

12) I would expect a woman mathematician to be a masculine type of person. SA A U D SD

VITA

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