HIGH SCHOOL STUDENTS' PERCEPTIONS OF MATHEMATICS

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by

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ABSTRACT

This is a study of students' perceptions of mathematics, and an examination of factors which may influence these perceptions.

Three high schools participated in the study: 1) an all-girls' school; 2) an all-boys' school; and 3) a co-educational school. The subjects comprised the following four groups:

Group 1: males in a male school

Group 2: females in a female school

Group 3: males in a co-educational school

Group 4: females in a co-educational school

Students were required to answer a three-part questionnaire which provided both quantitative and qualitative data. The questions in the first and third parts of the questionnaire were designed by the author. The questions in the second part of the questionnaire were taken from the Fennema-Sherman Mathematics Attitudes Scales.

The author found no significant differences among the four groups in: 1) attitudes toward success in mathematics; 2) mathematics anxiety; 3) students' perceptions of mathematics as a male domain; 4) students' perceptions of the usefulness of mathematics; 5) encouragement given by the mother to the student in his or her study of mathematics; and 6) encouragement given by

the teacher to the student in his or her study of mathematics.

It was found that males are significantly more confident than females in the learning of mathematics. More males than females stated they would select a career involving mathematics. Males in a male school received significantly more encouragement from their fathers in their study of mathematics than did males in a co-educational school.

A much higher percentage of females in a female school than females in a co-educational school stated they would select a career involving mathematics. Females in a co-educational school received significantly more encouragement from their fathers in their study of mathematics than did females in a female school.

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CHAPTER 1

INTRODUCTION

Mathematics is a key which opens the doors to many careers. It is very important that students are in possession of this key when they graduate from high school. When students elect not to study mathematics much beyond minimum high school requirements, they are severely limiting the educational and occupational opportunities available to them. This seems to be of special concern with respect to females as many researchers report of problems with females' perceptions of mathematics.

Many studies (e.g., Fox, 1983; Preece, 1979) have shown that girls have lower confidence in their mathematical ability then boys. Researchers (Fennema and Sherman, 1977, 1978) indicated that boys perceive more positive reinforcement about themselves as learners of mathematics from their mothers, fathers and teachers. Larger numbers of females were found in the career categories that require less high school mathematics (Daniels, 1981; Preece, 1979). Giese (1983) and Sherman (1982) reported of declines in female enrollment in advanced mathematics courses.

Significance of the Study

Males, as well as females, must have a knowledge of mathematics beyond minimum high school requirements in order to have access to many career opportunities. Given the problems with females' perceptions of mathematics, it is quite likely that many females will study only the required mathematics courses, thus severely limiting their career opportunities. This fear is supported by the fact that in Newfoundland during the 1983-84 school year eight percent more males than females were studying advanced mathematics in their final year of high school (Boone, 1984). (The ratio of males to females was approximately 1/1.)

Purpose of the Study

The term, "type of school" which occurs in the following questions is defined to be either single-sex or co-educational.

The purpose of the study is to investigate the following questions:

Question 1: Are the type of school and the sex of the student factors which influence a students's attitude toward success in mathematics?

Question 2: Are the type of school and the sex of the student factors which influence mathematics anxiety?

Question 3: Are the type of school and the sex of the student factors which influence a student's perception of himself or herself as being confident in the learning of mathematics?

Question 4: Are the type of school and the sex of the student factors which influence a student's perception of mathematics as a male domain?

Question 5: Are the type of school and the sex of the student factors which influence a student's perception of mathematics as being more useful for males than females?

Question 6: Are the type of school and the sex of the student factors which influence a student's decision to elect a career requiring a knowledge of mathematics?

Question 7: Are the type of school and the sex of the student factors which influence encouragement given by parents, teachers or peers to the student in his or her study of mathematics?

Question 8: Do factors such as confidence in the learning of mathematics; stereotyping mathematics as a male domain; attitude toward success in mathematics; perceptions of mothers', fathers' teachers' and peers' attitudes toward them as learners of mathematics; and perceived usefulness of mathematics influence: (a) a student's decision to select a particular math course or (b) a student's career choice?

Scope and Limitations

One of the limitations of this study is that all three schools are located in the same urban area. Only grade 12 academic mathematics students were involved in the study.

Generally the best students take an advanced high school mathematics course, while the weakest students take a vocational mathematics programme. Consequently, the academic mathematics students consist of approximately the middle 70 percent of mathematics students.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter presents a review of literature relating to students' perceptions of mathematics. The Review of Literature has been divided into the following categories:

1. Self-Confidence in the Learning of Mathematics and Attitude Toward Mathematics.
2. Mathematics as a Male Domain.
3. Factors Influencing Students' Attitudes Toward Mathematics and Their Learning of Mathematics.
4. Mathematics Anxiety.
5. Effectance Motivation in Mathematics.
6. Performance in Mathematics.
7. Decline in Female Enrollment in Mathematics Courses.
8. Sex-Segregated Classes.

Self-Confidence in the Learning of Mathematics and Attitude Toward Mathematics

Fox (1983) studied 120 seventh graders all identified by the Study of Mathematically Precocious Youth at Johns Hopkins University as having superior mathematical ability and concluded that girls had lower levels of self-confidence in mathematics than boys.

Sherman (1982) compared the mathematics attitudes of 84 ninth grade girls who had similar mathematics

achievement. Sherman found that less confidence in oneself as a learner of mathematics caused girls to elect fewer preparatory courses from the college preparatory sequence. Girls did not change their views much from grade 9 to grade 12 except they became less "fearful" of success in mathematics.

Fennema and Sherman (1977) conducted a study involving students in grades 9 - 12. Five hundred eighty-nine females and 644 males participated in the study. They found that confidence in mathematical ability was significantly higher in males than in females at three schools and tended to be higher in the fourth school.

Fennema and Sherman (1978) conducted a study involving 1320 sixth - eighth graders enrolled in middle schools that were feeder schools for the four high schools studied in the previous study. They indicated that males were consistently more confident of their ability to learn mathematics.

Using Dulton's scale Norman (1977) studied the attitudes of cross-sectional samples of 1974 students in various grades and college toward mathematics. The analysis of the data showed no significant sex differences in the four elementary grades examined. Females had significantly poorer attitudes than males in grade 9, as well as, later grades.

Preece (1979) investigated attitudes toward mathematics of 1250 second-year secondary pupils in five

Sheffield comprehensive schools. He concluded that boys exhibited a greater degree of self-confidence in mathematics and had a greater expectation of success. Girls did not expect to succeed and they felt no one else expected them to succeed; therefore, there was no point in trying.

Heller and Parsons (1981) utilized a questionnaire to assess the expectancies for success on familiar and unfamiliar tasks in mathematics of 251 students in seventh and ninth grades. While sex differences were not found in students' expectancies for success on familiar tasks, they found girls had lower expectancies for success than boys on unfamiliar or future tasks.

Haladyna (1977) administered a two-instrument battery, the Affective Reporting System, to 2,846 elementary school children. Before grade six, little if any differences in attitudes toward mathematics were detected.

Dweck and Bush (1976) conducted a study of 55 males and 53 females in grades four and five. Girls tended to attribute failure relatively more to lack of ability and chose not to persevere at the task, while boys tended to blame the teacher.

In conclusion, females seemed to have lower confidence in their mathematical ability than males. Females' poorer attitudes toward mathematics became evident at the grade nine level.

Mathematics as a Male Domain

Mills (1984) administered a battery of self-report personality tests to 166 males and 68 females, aged 12 - 15 years, who were enrolled in a summer residential program for talented youth. High math ability girls tended to be socially introverted and "thinking" types when compared to normal ability girls of the same age. Mills suggested the possibility that males are socialized to be "thinkers" rather than "feelers" and regard mathematics as being more appropriate for their sex.

Swetz, Langgulung and Johar (1983) conducted a study involving 1,000 thirteen-year-old Malaysians. Five hundred males and 500 females from ten urban and ten rural schools took part in the study. A similar study was carried out in Indonesia. It was found that males had more positive mathematics attitudes and females had more positive school attitudes.

Mills (1981) investigated the relationships between sex role-related personality variables and two intellectual variables often associated with sex differences: mathematics and verbal ability. Three separate populations were used in the study: (a) 188 males and 90 females identified as being mathematically talented; (b) 43 males and 72 females from a public school; and (c) 90 males and 25 females from a private school. All subjects were seventh and eighth grade students. Evidence indicated a positive relationship

between masculine traits and values and mathematics ability and feminine traits and values and verbal skills (for both sexes).

Dwyer (1974) examined the relationship between sex role standards (the extent to which the individual considers certain activities appropriate to males or females), reading and arithmetic achievement. Subjects were 385 middle-class caucasian children in grades two, four, six, eight, ten and twelve. A checklist was used to assess children's sex role standards. Dwyer suggested that reading and arithmetic sex differences are more a function of the child's perception of these areas as sex-appropriate or sex-inappropriate than of the child's biological sex, individual preference for masculine or feminine sex role or liking or disliking of reading or arithmetic.

Fennema and Sherman (1978) found that males stereotyped mathematics as a male domain at significantly higher levels than females.

In conclusion, a positive relationship between masculine traits and values and mathematics ability has been found. Males regarded mathematics as being more appropriate for their sex.

Factors Influencing Students' Attitudes Toward Mathematics and Their Learning of Mathematics

Parents and Teachers

Fox (1983) administered a questionnaire to the parents of 120 seventh graders, all identified as having superior mathematical ability by the study of Mathematically Precocious Youth at Johns Hopkins University. He found that mothers of boys noticed ability in their sons at a much earlier age than mothers of girls. Most parents of girls felt careers would need to be interrupted for child-bearing purposes. Although all the girls were extremely talented in mathematics, they had not been viewed as unusually gifted or unique by teachers.

McNamara and Scherrei (1982) undertook a longitudinal study to assess the characteristics and persistence of young women who entered college during the 1970's and expressed an interest in science, mathematics and engineering. The study also included interviews with 30 professional women in scientific and technical fields. The following three major findings resulted from the study:

1. Parental emphasis on educational attainment and encouragement of or at least neutrality toward their daughter's interest in science, mathematics or engineering were far more important to science achievement than parental education, occupation or income.

2. Women aspiring to careers requiring a mathematics background were discouraged by high school counselors.

3. The support and encouragement of high school teachers and college faculty appeared to be important to women's persistence and achievement in scientific and technical fields.

Swetz et al. (1983) reported a survey conducted by Kulkarni involving women in the Indian region of Mangalore in which Kulkarni found that females outperformed their male counterparts in mathematics. These findings contrasted sharply with the findings of the rest of India where males were superior to females in mathematics performance. Mangalore possesses a matriarchal society where women control the family finances. Thus, sex-role modeling in an Asian context may result in the transmission of basic mathematics skills from mother to daughter.

Sherman (1982) suggested that the perceived attitude of the father and teacher may be important causal factors in determining girls' enrollment in mathematics classes.

Luchins (1979) interviewed mathematicians at various professional meetings. The interviews revealed more women mathematicians recalled being discouraged in their studies by family and friends than did males. Women told of differential treatment as mathematics students and as professionals at all levels of training and employment.

Becker (1981) observed ten high school geometry teachers. Seven of the teachers were female and three were male. Three of the ten classes in the sample were accelerated ninth-grade geometry classes and the other classes consisted primarily of tenth graders. The student sample was comprised of 50 percent male and 50 percent female students. Becker suggested that sex-biased interaction patterns do occur in high school geometry classes. Becker indicated that teachers behave in ways that involve young women less in classroom interactions and give them less encouragement in mathematics.

Fennema and Sherman (1977) found that boys perceived more positive attitudes about themselves as learners of mathematics from their mothers and fathers. They suggested that positive attitudes from parents and teachers may be especially important for girls.

Fennema and Sherman (1978) found that boys perceived both parents as being more positive toward them as learners of mathematics than did girls. Boys perceived their teachers as being more positive toward them as learners of mathematics than did girls.

Preece (1979) concluded that girls did not expect to succeed. They felt that no one else expected them to succeed and therefore there was no point in trying.

Heller and Parsons (1981) observed five types of praise and criticism, feedback and attribution statements by teachers in 15 junior high schools. No sex differences

were found in the patterns of evaluative feedback used by teachers.

Career Interests and Perceived Usefulness of Mathematics

Sherman (1982) concluded that girls' perceived usefulness of mathematics was an important factor in their enrolling in mathematics courses.

Daniels (1981) conducted a study involving ninth and tenth grade females enrolled in algebra and geometry courses. He reported that female high school students planned to study less mathematics than their male classmates both in and after high school. Daniels also found that larger numbers of females were found in the career categories that require less high school mathematics.

Fennema and Sherman (1977, 1978) indicated that boys perceived mathematics as being more useful than females.

Preece (1979) stated that teachers reported clear signs of girls moving away from preferred choices of career simply because a mathematics entry qualification was required.

Cultural Influences

Swetz et al. (1983) reported that women in the Indian region of Mangalore outperformed their male counterparts in mathematics. Thus, sex-related differences in

mathematics are not universal and must be examined within their cultural and social context.

Schratz (1978) investigated sex differences in mathematical and spatial skills in three ethnic groups: black, hispanic and white. Entire classes of third, fourth, fifth and ninth graders were used. Results supported the theory of the influence of cultural factors in the development of sex differences in cognitive skills, as well as supporting the idea that adolescence was the period during which sex differences emerged.

Mathematics Anxiety

In an effort to measure the correlates of Mathematics Avoidance. Chisholm (1980) administered nine Likert-type scales, constructed and validated by Fennema and Sherman to 500 subjects ranging in age from 15 to 87. Chisholm found that anxiety was a significant predictor of Mathematics Avoidance.

De Bronac-Meade and Brown (1982) administered the Mathematics Anxiety Rating Scale (MARS) developed by Richardson and Swim to 44 volunteers recruited from a two year college, a four year college and a senior high school, all located in central California. The subjects ranged in age from 14 to 58 years. In this sample higher levels of mathematics anxiety were demonstrated by females.

Streim and O'Brien (1981) conducted a study involving 633 female and 572 male high school students enrolled in algebra and geometry. Mathematics anxiety was measured using the Fennema-Sherman Mathematics Attitude Scales. In this study females reported more anxiety about mathematics; they were less likely to attribute their mathematics success to their ability and planned to study fewer semesters of high school mathematics.

Rounds and Hendel (1980) administered the Mathematics Anxiety Rating Scale, the Fennema-Sherman Math Anxiety Scale, and an arithmetic placement test to 124 volunteer female participants from a large midwestern university. Participants' ages ranged from 18 to 65 with a mean age of 35.4. They found that participants who reported high anxiety about mathematics and who performed poorly on the arithmetic placement test also reported negative attitudes toward learning mathematics on the Fennema-Sherman Scales of Confidence in Learning.

Gabel and Sherwood (1983) conducted an aptitude by treatment interaction study to determine the effectiveness of four instructional strategies for teaching problem solving to high school chemistery students of various proportional reasoning ability, verbal and visual preference and mathematics anxiety. Six hundred and nine high school students in eight schools participated in the study. They concluded that mathematics anxiety is negatively correlated with science achievement.

Furthermore, students with high mathematics anxiety scored significantly lower than students with low mathematics anxiety.

Perl (1982) analyzed data from the National Longitudinal Study of Mathematics Achievement (NLSMA) which was based on longitudinal observations of two groups of high school students. One group of approximately 22,000 students was followed from the 10th through 12th grades; the second, about 40,000 students, was studied from the 7th through 11th grades. Although significant sex differences in the Debilitating Anxiety scale were present, with girls more anxious than boys, this factor seemed to have no discernible effect on students' decisions to continue the study of mathematics beyond minimal requirements for high school graduation or college entrance.

Armstrong and Price (1982) conducted a national survey designed to identify the relative importance of the many factors that may be affecting women's participation in mathematics. Thirty-five high school seniors from 71 schools participated in the survey. A positive attitude toward mathematics, indicated by confidence in mathematics, low anxiety and enjoyment of mathematics was highly correlated with participation in mathematics.

In conclusion, mathematics anxiety was a significant predictor of mathematics avoidance and may have caused poor achievement in mathematics. Females reported more

anxiety about mathematics, than males. Students whose parents encouraged them to study mathematics were less anxious.

Effectance Motivation in Mathematics

The dimension of Effectance Motivation ranges from lack of involvement in mathematics to active enjoyment and seeking of challenge.

Fennema and Sherman (1976) in a study involving 555 females and 574 males in grades 9-11 found that the correlation of effectance motivation and mathematics achievement is higher for males than females.

Chisholm (1980) found that effectance motivation is the largest predictor of Mathematics Avoidance.

Performance in Mathematics

Decore (1984) conducted a study at the University of Alberta which showed that comparisons between mean male and mean female grade-point averages show superior female performance in the Faculties of Agriculture, Arts, Business, Education, Engineering, Physical Education and Science. Analysis of the data did not provide any support for the commonly held belief that males are better in sciences while females are advantaged in the social sciences and humanities. As well, females were less

likely to fail than males. Results from the University of Calgary (1981), Simon Fraser University (1977) and the University of Guelph (1982) were consistent with the data from the University of Alberta.

Carpenter, Matthews, Lindquist and Silver (1984) conducted a study dealing with the performance of nine, thirteen and seventeen-year-old students on mathematics exercises and on exercises from the 1973, 1978 and 1982 National Assessment of Education Progress. It was concluded that at ages nine and thirteen the overall performance of males and females was not significantly different. At age seventeen, males scored higher by about three percent. For the most part, these findings were consistent over the four levels of exercises: Knowledge, Skills, Understanding and Problem Solving.

Benbow (1982) found that scores on the Mathematics and Verbal Scholastic Aptitude Test (SAT) of 873 mathematically-talented students, eighth grade and under, revealed that boys and girls performed similarly on the verbal SAT but that boys had a significantly higher mean score on the Mathematics SAT.

An interview by Brandt (1982) with Stanley, Director of Johns Hopkins University's Study of Mathematically Precocious Youth, revealed that in the large mathematics talent searches involving the mathematically top three percent, substantial differences were found in the scores every year - from 30 to 48 points higher for boys than girls.

Giesbrecht (1980) conducted a study which examined Saskatchewan high school students' achievement of selected mathematical competencies, which are outlined in the 1972 report of the National Council of Teachers of Mathematics (NCTM). It was found that after adjustments were made for intelligence male high school students attained a significantly greater number of mathematical competency totals than female high school students.

Fennema and Sherman (1977) found that when only students with similar mathematics backgrounds were considered, differences between male and female groups in mathematics achievement were very small.

Fennema and Sherman (1978) found that when sex-related differences in mathematics learning in favor of males were found, sex-related differences in favor of males were also found in six affective variables: (a) mathematics confidence; (b) stereotyping mathematics as a male domain; (c) attitude toward success; (d) perceptions of mothers' and fathers' attitudes toward them as learners of mathematics; and (e) usefulness of mathematics.

Herman (1975) examined selected assessment results of male - female achievement in eight learning areas. At age nine, females were better at computation. Males were more successful with geometry and measurement. At age thirteen, males increased their advantage in the areas of geometry and measurement and displayed an advantage in

probability and statistics. By age seventeen, males had an advantage over females in numerical operations, geometry, measurement, variables and relationships, probability and statistics and consumer mathematics. At all ages, males generally did better than females on the more difficult exercises and on word problems.

In conclusion, many researchers indicated that males outperform females in mathematics. These differences became evident usually during adolescence. However, there were other researchers which revealed superior female performance in mathematics and mathematics-related fields. When males and females had similar mathematics backgrounds, differences in mathematics achievement was very small. There was evidence to indicate that affective variables may be influencing sex-related differences in the learning of mathematics.

Decline in Female Enrollment in Mathematics Courses

Giese (1983) reported on the mathematics data collected from 113 school districts throughout the state of Michigan. She found a drop in enrollment in mathematics courses of over 50 percent after students complete Algebra 1. By grade twelve only 45 percent of boys and 36 percent of girls were taking mathematics. Regardless of the size of the school district, there was a drop in female enrollment in mathematics.

Sherman (1982) found that girls elected fewer mathematics courses from the college preparatory sequence due to a lack of confidence in themselves as learners of mathematics.

Brandt (1982) interviewed the Director of Johns Hopkins University's Study of Mathematically Precocious Youth. The interview revealed that fewer girls than boys participated in the large math talent searches conducted by the University.

Fennema and Sherman (1977) found that more boys were enrolled in mathematics classes in the eleventh and twelfth grade. More boys studied mathematics for four years in high school.

Boone (1984) reported eight percent more males were studying Advanced Mathematics in the senior high schools in the province of Newfoundland and Labrador during the 1983-84 school year.

In conclusion, females enrolled in fewer mathematics courses in high school than males. Females elected fewer college preparatory mathematics courses. Fewer females than males participated in mathematics competitions. In particular, with reference to the province of Newfoundland and Labrador, fewer females than males studied Advanced Mathematics in 1983-84.

Sex Segregated Classes

Recent studies have investigated the effects of sex-segregated classes on students' attitudes toward mathematics and their achievement in mathematics.

Silcock (1984) conducted a study to determine if bright girls' attitudes toward mathematics differed when the learning environment was either co-educational or sex-segregated. One hundred eighty-five subjects were administered the Fennema-Sherman Mathematics Attitude Scales (FSMAS). Analysis of this study revealed that girls in co-educational and sex-segregated schools did not significantly differ on any of the scales of the FSMAS. Silcock suggested that the sex-composition of the learning environment had no significant impact on the mathematics attitudes of the population under investigation.

Macfarlane and Crawford (1985) conducted a study to determine the effects of sex-segregated classes on students' attitudes towards mathematics and students' achievement in mathematics. The items which measured students' attitudes towards mathematics were taken from the Fennema-Sherman Mathematics Attitudes Scales. The Mathematics Concepts and Applications sub-test of the Canadian Achievement Test (C.A.T.O.) Level 19 was administered to all subjects.

Students who enrolled in grade 10 advanced mathematics at A.Y. Jackson S.S. in September, 1984 were placed in sex-segregated mathematics classes and will

continue in such classes until the end of grade 12. During the 1984-85 school year, all classes of female students were taught by female teachers while all classes of male students were taught by male teachers. One hundred fifty-one females and 166 males at A.Y. Jackson and 125 females and 127 males at the Comparison school participated in the study.

The results of the first year of the study were as follows:

1. A quarter of all students at A.Y. Jackson indicated that the classes had been effective in improving their attitudes, with females responding more positively than males.

2. While the career aspirations of students at the comparison school remained relatively unchanged, a greater number of students at A.Y. Jackson listed careers requiring grade 13 mathematics on the post-test than had been the case on the pre-test.

3. There was no difference between the scores of the schools on the C.A.T. mathematical subtest.

4. Approximately one-quarter of all students at A.Y. Jackson indicated that the segregated classes had been effective in improving achievement, with females giving more positive responses than males.

5. One-third of the female students indicated that they appreciated the more relaxed atmosphere and were less

hesitant to answer questions; express difficulties and seek extra help.

Conclusion

Males received more encouragement than females from parents, teachers and peers in their study of mathematics and regarded mathematics as being more appropriate for their sex. Females had lower confidence than males in their mathematical ability and had poorer attitudes toward mathematics. Females enrolled in fewer mathematics courses than males and chose careers that required less high school mathematics.

Although both males and females could perform well in mathematics, researchers indicated that sex differences in the learning of mathematics may have been influenced by such affective variables as: (a) confidence in the learning of mathematics; (b) stereotyping mathematics as a male domain; (c) attitude toward success in mathematics; (d) perceptions of mothers', fathers', teachers' and peers' attitudes toward them as learners of mathematics; and (e) perceived usefulness of mathematics.

Based on this review sex differences are clearly a factor influencing students' perceptions of mathematics. Few of these researchers have examined the issue of co-educational versus single-sex schools, especially where the whole school system is oriented this way. It would be interesting to know whether sex-segregated classes do

influence students' perceptions of mathematics. Therefore, this study will be conducted in an all-girls' school, an all-boys' school and a co-educational school.

CHAPTER 3

Population and Sample

The sample was chosen from an urban centre of approximately 110,000 people. Three schools participated in the study: (a) an all-girls' school; (b) an all-boys' school; and (c) a co-educational school. Ninety-five females in the all-girls' school, 40 females in the co-educational school, 45 males in the co-educational school and 69 males in the all-boys' school participated in the study. The subjects were all grade 12 students enrolled in an academic mathematics program.

Development of Questionnaire

A three-part questionnaire was administered to all subjects. The first part of the questionnaire contained both qualitative and quantitative questions. The purpose of these questions was to provide background information on all subjects.

The questions in the second part of the questionnaire were taken from the Fennema-Sherman Mathematics Attitudes Scales. Fifty-one items were selected from the scales with the greatest number coming from those areas most likely to be affected by the introduction of segregated classes. These scales assessed the important domain-specific attitudes which have been hypothesized to be

related to the learning of mathematics and include the following:

attitude toward success in mathematics scale
mathematics as a male domain scale
mother/father scale
teacher scale
confidence in learning mathematics scale
mathematics anxiety scale
effectance motivation scale in mathematics
mathematics usefulness scale

A list of items included in each attitude scale may be found in Appendix A.

Part III of the questionnaire consisted of eleven qualitative questions. The purpose of these questions was to determine any perceptions of mathematics that students might have had that would have affected their attitudes toward mathematics or their learning of mathematics. The entire questionnaire was answered by all subjects.

Pilot Study

The questionnaire was piloted in one class in the co-educational school. Most subjects completed the questionnaire within sixty minutes. As a result of the pilot study, some questions were omitted from the questionnaire and other questions were added. Some of the questions were reworded.

Analysis

Both quantitative and qualitative data is presented in answer to the questions proposed in the Purpose of the Study. In each analysis of variance that was conducted the following four groups were involved:

Group 1: males in a male school

Group 2: females in a female school

Group 3: males in a co-educational school

Group 4: females in a co-educational school

If significant differences were found three contrasts were tested by means of a Scheffé test:

(1) group 1 versus group 3

(2) group 2 versus group 4

(3) male versus female

The following analyses were used for each question:

Question 1: Are the type of school and the sex of the student factors which influence a student's attitude toward success in mathematics?

The quantitative data on attitude toward success in mathematics were analyzed by a one way analysis of variance. Qualitative data were also presented.

Question 2: Are the type of school and the sex of the student factors which influence mathematics anxiety?

The quantitative data obtained on mathematics anxiety were analyzed by a one-way analysis of variance. Qualitative data were also presented.

Question 3: Are the type of school and the sex of the student factors which influence a student's perception of himself or herself as being confident in the learning of mathematics?

The quantitative data obtained on confidence in the learning of mathematics were analyzed by a one-way analysis of variance. The Scheffé method of multiple comparisons was used to investigate the indicated comparisons. Qualitative data were also presented.

Question 4: Are the type of school and the sex of the student factors which influence a student's perception of mathematics as a male domain?

The quantitative data obtained on student's perceptions of mathematics as a male domain were analyzed by a one-way analysis of variance. Qualitative data were also presented.

Question 5: Are the type of school and the sex of the student factors which influence a student's perception of mathematics as being more useful for males than females?

The quantitative data obtained on students' perceptions of mathematics as being more useful for males than females were analyzed by a one-way analysis of variance.

Question 6: Are the type of school and the sex of the student factors which influence a student's decision to elect a career requiring a knowledge of mathematics?

Qualitative data were presented in answer to this question.

Question 7: Are the type of school and the sex of the student factors which influence encouragement given by parents, teachers or peers to the student in his or her study of mathematics?

Three one-way analyses of variance were conducted. The Scheffé method of multiple comparisons was used to investigate the indicated comparisons. Qualitative data were also presented.

CHAPTER 4

ANALYSIS

In this chapter both the quantitative and qualitative data obtained is presented. The answers to the first seven questions proposed in the Purpose of the Study are provided. Question eight is discussed in Chapter 5.

For each of the nine attitude scales a one-way analysis of variance was carried out. The groups in the analysis of variance were:

Group 1: males in a male school

Group 2: females in a female school

Group 3: males in a co-educational school

Group 4: females in a co-educational school

If significant differences were found three contrasts were tested by means of a Scheffé test. They were:

(1) group 1 versus group 3

(2) group 2 versus group 4

(3) male versus female

Question 1

Are the type of school and the sex of the student factors which influence a student's attitude toward success in mathematics?

Hypothesis: There are no differences in the attitudes toward success in mathematics among the four groups.

Table 1

Analysis of variance of the quantitative data on attitude toward success in mathematics

Source	df	SS	MS	F	P
Between Groups	3	94.8679	31.6226	0.83	0.48
Within Groups	245	9281.1161	37.8821		
Total	248	9375.9839			

Qualitative Data

The table below gives the percentages of students from each group who stated that they were not afraid that they would not be successful in mathematics.

Table 2

Percentages of students who stated they were not afraid that they would not be successful in mathematics

Group			
1	2	3	4
71	47	84	63

The students who were afraid that they would not be successful in mathematics stated such reasons as the following for their fear:

1. Last year, I didn't do very good and I'm a little nervous about it this year.
2. Because I find math very difficult and I hate not to be successful in something.
3. Because it gets harder every year.

There are no significant differences in the attitudes toward success in mathematics among the four groups. However, a higher percentage of students of each sex in the co-educational school than in the single-sex schools stated they were not afraid that they would not be successful in mathematics.

Question 2

Are the type of school and the sex of the student factors which influence mathematics anxiety.

Hypothesis 2: There are no differences in mathematics anxiety among the four groups.

Table 3

Analysis of variance of the quantitative data on mathematics anxiety

Source	df	SS	MS	F	P
Between Groups	3	395.2514	131.7505	1.45	0.28
Within Groups	245	22214.6843	90.6722		
Total	248	22609.9357			

Qualitative Data

In order to determine why students may or may not suffer from mathematics anxiety they were asked to state positive and negative experiences in their study of mathematics. All students stated similar negative and positive experiences in their study of mathematics. The most frequently stated positive and negative experiences were receiving high and low marks respectively.

Some typical answers to the question, "Describe any negative experiences you have had in mathematics" were:

1. Getting 26% in a grade 10 math test.
2. I studied a whole week, every night for at least 2-3 hours on one section and got 17% on the test.
3. I was at one point failing level 2 math because I did not understand the teacher and he really did not care.

Some typical answers to the question, "Describe any positive experiences you have had in mathematics" were:

1. I got 80% in June in grade 4.
2. Positive experiences in math are passing the test.
3. Coming out with 79% as my final mark in grade 11.

There are no significant differences in mathematics anxiety among the four groups.

Question 3

Are the type of school and the sex of the student factors which influence a student's perception of himself or herself as being confident in the learning of mathematics?

Hypothesis: There are no differences in confidence in learning mathematics among the four groups.

Table 4

Analysis of variance of the quantitative data on confidence in learning mathematics

Source	df	SS	MS	F	P
Between Groups	3	236.5940	78.8647	2.97	0.032*
Within Groups	245	6497.0285	26.5185		
Total	248	6733.6225			

* $p < 0.05$

There is a significant difference in confidence in learning mathematics among the four groups. The Scheffé method of multiple comparisons was used to investigate the indicated comparisons.

Table 5

Contrasts in confidence in learning mathematics

Contrast	S. Error	T Value	T. Prob
1	0.9867	0.033	0.97
2	0.9706	-0.567	0.57
3	1.3841	-2.942	0.004*

* $p < 0.05$

It can be concluded from the contrasts provided in the table above that males are significantly more confident than females in the learning of mathematics.

Qualitative Data

Males' confidence in the learning of mathematics is revealed in their answers to the question, "What is it about mathematics that you like?". Some typical responses were:

1. The thrill of solving a hard problem.
2. I find it natural but it sometimes gives me a challenge and I like challenges.
3. That every new problem is different, you have to use your head for problem solving, remember equations, I find that math doesn't bore you like history or language.

Females revealed their lack of confidence in the learning of mathematics in the following comments:

1. I dislike the work, the problems, the tests, the frustration I feel when working at math and also the nervousness I feel when I'm about to enter a math class or start a test.
2. I dislike math because it makes me worry and very nervous.
3. It is abstract and I cannot store mathematical information.
4. I hate math because I know I can't do it.

Question 4

Are the type of school and the sex of the student factors which influence a student's perception of mathematics as a male domain?

Hypothesis: There are no differences in students' perceptions of mathematics as a male domain among the four groups.

Table 6

Analysis of variance of the quantitative data on mathematics as a male domain

Source	df	SS	MS	F	P
Between Groups	3	183.5396	61.1799	2.08	0.10
Within Groups	245	7198.5889	29.3820		
Total	248	7382.1285			

Qualitative Data

Most students stated that studying mathematics is just as appropriate for women as for men. Males, as well as females, stated they would study math each year of high school even if not required because they felt that math was necessary in order to have a good career. Some of the comments given were as follows:

1. I would because if you want to get a good job you need a good education. Math helps a lot.

2. You need some type of (knowledge of math to enter into almost every profession.

3. Because math is a part of your every day life. If you don't have a knowledge of math your chances of getting a good job is drastically reduced.

4. People need math when looking for a job. Important for me to do math.

Question 5

Are the type of school and the sex of the student factors which influence a student's perception of mathematics as being more useful for males than females?

Hypothesis: There are no differences in students' perceptions of the usefulness of mathematics among the four groups.

Table 7

Analysis of variance of the quantitative data on the usefulness of mathematics

Source	df	SS	MS	F	P
Between Groups	3	287.3053	95.7684	2.09	0.10
Within Groups	245	11214.0280	45.7715		
Total	248	11501.3333			

There is no significant difference in students' perceptions of the usefulness of mathematics.

Question 6

Are the type of school and the sex of the student factors which influence a student's decision to elect a career requiring a knowledge of mathematics?

Hypothesis: There are no differences among the four groups in a student's decision of whether or not to elect a career requiring a knowledge of mathematics.

Qualitative Data

The more popular career choices of females in the co-educational school were: secretary, lawyer and physiotherapy. Some of the more popular career choices of females in the female school were: secretary, lawyer, teacher, police officer and beautician.

Some of the more frequent career choices of males in a male school were: police officer, business administration and engineering. The more frequent career choices of males in the co-educational school were: engineering, music and the police force.

The table below gives the percentages of students in each group who stated that they would select a career involving mathematics.

Table 8

Percentages of students stating they would select a career involving mathematics

Group			
1	2	3	4
55	54	64	33

The majority of females stated they would not select a career involving mathematics. Some comments were as follows:

1. No, it is too hard.
2. No, because I don't like math.
3. No, because math is my worst subject.
4. No, math isn't one of my stronger subjects and I think I could do better in a job without it.

The majority of male students stated they would select a career involving mathematics. Some comments were as follows:

1. Yes, because I like math, and I think I would do good in a math job.
2. Yes, because business requires math.
3. Yes. It can bring good money.
4. Yes, because I am good at it.

Sex and type of school appear to be factors influencing a student's decision to elect a career

requiring a knowledge of mathematics. More males than females stated they would select a career involving mathematics. A much higher percentage of females in a female school than females in a co-educational school stated they would select a career involving mathematics.

Question 7

Are the type of school and the sex of the student factors which influence encouragement given by parents, teachers or peers to the student in his or her study of mathematics?

Father

Hypothesis: There are no differences among the four groups in encouragement given by the father to the student in his or her study of mathematics.

Table 9

Analysis of variance of the quantitative data on encouragement given by the father

Source	df	SS	MS	F	P
Between Groups	3	342.6579	114.2193	5.01	0.002*
Within Groups	243	5534.8158	22.7770		
Total	246	5877.4737			

* $p < 0.05$

There is a significant difference among the four groups in encouragement given by the father to the student in his or her study of mathematics. The Scheffé method of multiple comparisons (listed on page 28) was used to detect the difference.

Table 10

Contrasts of encouragement given by the father

Contrast	S. Error	T Value	T. Prob
1	0.9145	-2.047	0.042*
2	0.9024	3.046	0.003*
3	1.2848	-0.033	0.974

* $p < 0.05$

The contrasts revealed that females in a co-educational school received significantly more encouragement from their fathers in their study of mathematics than do females in a female school. The contrasts also revealed that males in a male school received significantly more encouragement from their fathers in their study of mathematics than do males in a co-educational school.

Mother

Hypothesis: There are no differences among the four groups in encouragement given by the mother to the student in his or her study of mathematics.

Table 11

Analysis of variance of the quantitative data on encouragement given by the mother

Source	df	SS	MS	F	P
Between Groups	3	133.7790	44.5930	2.36	0.07
Within Groups	244	4608.3137	18.8865		
Total	247	4742.0927			

There are no significant differences among the four groups in encouragement given by the mother to the student in his or her study of mathematics.

Teacher

Hypothesis: There are no differences among the four groups in encouragement given by the teacher to the student in his or her study of mathematics.

Table 12

Analysis of variance of the quantitative data on encouragement, given by the teacher

Source	df	SS	MS	F	P
Between Groups	3	82.6110	27.5370	1.26	0.29
Within Groups	245	5353.9914	21.8530		
Total	248	5436.6024			

There are no significant differences among the four groups in encouragement given by the teacher to the student in his or her study of mathematics.

Qualitative Data

The vast majority of students from each school had been encouraged in their study of mathematics by parents and teachers. Most students stated that their parents felt that math was an essential subject and wanted them to do well in math. Some typical comments were as follows:

1. Parents - you need math for MUN.
2. My father said that you need math to get good jobs, because he only got his grade 8 education and he works hard for a living.
3. My parents encourage me to do well in this subject because it is important in careers.

4. My father believes it is a good subject. Father helps me with problems I'm having in math.

The majority of students stated that their teachers were very encouraging and willing to provide extra help. Some typical comments were as follows:

1. My math teachers seem to feel that I can do good.
2. He is always trying to help me and encouraging me to do well.
3. They feel it is very important to me and good for looking for a job.
4. She takes it very seriously and wants her students to do well.
5. They want me to do as well as I can. They're willing to give me the extra time and help I need to do better.

Most students stated that their friends did not really care if they did well in math or not. Some typical comments were as follows:

1. They don't care ... Be Real.
2. It doesn't really bother them whether or not I do good in math.
3. Neutral, more or less.
4. They don't care.

The majority of students said that they had never been discouraged from studying mathematics.

There were no significant differences among the four groups in the attitudes toward success in mathematics; mathematics anxiety; students' perceptions of mathematics as a male domain; students' perceptions of the usefulness of mathematics; encouragement given by the mother to the

student in his or her study of mathematics; and encouragement given by the teacher to the student in his or her study of mathematics.

Males were significantly more confident than females in the learning of mathematics. Females in a co-educational school received significantly more encouragement from their fathers in their study of mathematics than did females in a female school. Males in a male school received significantly more encouragement from their fathers in their study of mathematics than did males in a co-educational school. Sex and type of school appear to be factors influencing a student's decision to elect a career requiring a knowledge of mathematics.

CHAPTER 5

SUMMARY, DISCUSSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

Summary

The motivation for this thesis was the realization that mathematics is a necessary requirement for many careers today. When students elect not to study mathematics much beyond high school requirements, they are severely limiting the educational and occupational opportunities available to them.

Many studies have reported sex differences in the learning of mathematics (Fox, 1983; Preece, 1979; Heller and Parsons, 1981; Fennema and Sherman, 1978). Fennema and Sherman (1978) found that when sex-related differences in mathematics learning in favor of males were found, sex-related differences in favor of males were also found in six affective variables, as previously mentioned in Chapter 2.

Recent studies have investigated the effects of sex-segregated classes on students' attitudes toward mathematics and their achievement in mathematics. Macfarlane and Crawford (1985) reported that females stated that sex-segregated classes were effective in improving both their attitude toward mathematics and their achievement in mathematics.

Researchers indicated a drop in female enrollment in advanced mathematics courses (Giese, 1983; Sherman, 1982;

Boone, 1984). Some researchers reported larger numbers of females were found in the career categories that require less high school mathematics (Daniels, 1981; Preece, 1979).

The purpose of this study was to investigate whether or not the type of school and the sex of the student were factors influencing:

1. a student's attitude toward success in mathematics;
2. mathematics anxiety;
3. a student's perception of himself or herself as being confident in the learning of mathematics;
4. a student's perception of mathematics as a male domain;
5. a student's perception of mathematics as being more useful for males than females;
6. a student's decision to elect a career requiring a knowledge of mathematics;
7. encouragement given by parents, teachers or peers to the student in his or her study of mathematics.

The author also attempted to determine whether or not such factors as confidence in the learning of mathematics; stereotyping mathematics as a male domain; attitude toward success in mathematics; perceptions of mothers', fathers', teachers' and peers' attitudes toward them as learners of mathematics and perceived usefulness of mathematics influence: (a) a student's decision to select a particular math course or (b) a student's career choice.

Ninety-five females in an all-girls' school, 69 males in an all-boys' school, 40 females in a co-educational

school and 45 males in a co-educational school participated in the study. All subjects were enrolled in Academic Mathematics 3203.

The Fennema-Sherman Mathematics Attitudes Scales were used to assess the important domain-specific attitudes which have been hypothesized to be related to the learning of mathematics. Students were also required to answer a number of qualitative questions. The purpose of these questions was to determine any perceptions of mathematics that students might have that would affect their attitudes toward mathematics or their learning of mathematics. A copy of the questionnaire may be found in Appendix B.

Discussion

The results are best summarized by discussing question 8.

Question 8: Do factors such as confidence in the learning of mathematics; stereotyping mathematics as a male domain; attitude toward success in mathematics; perceptions of mothers', fathers', teachers' and peers' attitudes toward them as learners of mathematics; and perceived usefulness of mathematics influence: (a) a student's decision to select a particular math course or (b) a student's career choice?

Data presented in answer to the previous seven questions from Chapter 4 led the author to conclude that sex and the type of school were not factors influencing:

(1) students' attitudes toward success in mathematics; (2) students' perceptions of mathematics as a male domain; (3) mathematics anxiety; (4) students' perceptions of the usefulness of mathematics; (5) effectance motivation in mathematics; (6) encouragement given by the teacher to the student in his or her study of mathematics; and (7) encouragement given by the mother to the student in his or her study of mathematics.

One significant finding was that males were more confident than females in their learning of mathematics. Similar findings were made by Fennema and Sherman (1977); Preece (1979) and Fox (1983). Confidence in the learning of mathematics could possibly influence a student's decision to enroll in a particular math course. This is supported by research conducted by Sherman (1982).

Another important finding in the study was that males more often than females select careers involving mathematics. Daniels (1981) and Preece (1979) obtained similar findings. Males' superior confidence in the learning of mathematics could possibly influence this decision as well.

The study also revealed that females in a co-educational school received more encouragement from their fathers in their learning of mathematics than do females in a female school. However, a higher percentage of females in a female school than females in a co-educational school (72% versus 63%) stated that they would

study math each year of high school even if they did not have to do so. A much higher percentage of females in a female school than females in a co-educational school (54% versus 33%) stated they would select careers involving mathematics.

Another significant result was that males in a male school received more encouragement from their fathers in their study of mathematics than do males in a co-educational school. However, a higher percentage of males in a co-educational school than males in a male school (71% versus 64%) stated that they would study math each year of high school even if they did not have to do so. A higher percentage of males in a co-educational school than males in a male school (64% versus 55%) stated that they would select a career involving mathematics.

Consequently encouragement received from the father does not seem to have a significant effect on a student's decision to select a particular math course or to choose a career involving mathematics.

More males in a co-educational school than males in a single sex school stated that they were not afraid that they would not be successful in mathematics. More males in a co-educational school than males in a single sex school stated that they would study math each year of high school even if they did not have to do so and also stated that they would select a career involving mathematics. Fear of not being successful in mathematics may possibly

influence a male high school student's decision to choose a particular math course or to select a career involving mathematics.

It seems that confidence in the learning of mathematics; fear of not being successful in mathematics; sex and type of school may all be factors influencing a student's decision to select a particular math course or to choose a career involving mathematics.

Recommendations for Future Research

A significant finding of this study was that males were more confident than females in their learning of mathematics. Future researchers must therefore answer the question:

> Why are male high school students more confident in their learning of mathematics than female high school students?

It would be very worthwhile to know whether or not a relationship exists between confidence in the learning of mathematics and achievement in mathematics. Future researchers should address the question:

> Is there a relationship between confidence in the learning of mathematics and achievement in mathematics?

A very important finding of the study was that more male high school students than female high school students select careers requiring a knowledge of mathematics. Future researchers should address the question:

> Why do more male high school students than female high school students select careers requiring a knowledge of mathematics?

Another important finding of the study was that a much higher percentage of female high school students in a female school than female high school students in a co-educational school select careers requiring a knowledge of mathematics. Future researchers should therefore address the question:

> Why do more female high school students in a female school than female high school students in a co-educational school select careers requiring a knowledge of mathematics?

The author also reported that a higher percentage of male high school students in an all male school than male high school students in a co-educational school were fearful of not being successful in mathematics. Future researchers should address the question:

> Why are more male high school students in an all male school than male high school students in a co-educational school fearful of not being successful in mathematics?

All subjects live in the same urban area and were in the same grade level. Future researchers should therefore address the question:

> Would the same results be obtained if this study were conducted in a rural area or at different grade levels in the junior and senior high school?

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APPENDICES

APPENDIX A

STUDENT QUESTIONNAIRE ITEMS BY SCALE

ATTITUDE TOWARD SUCCESS IN MATHEMATICS

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

I'd be happy to get top grades in mathematics.

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

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

People would think I was some kind of a browner if I got A's in math.

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

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

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

MATHEMATICS AS A MALE DOMAIN

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

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

Girls can do just as well as boys in mathematics.

Males are not naturally better than females in mathematics.

It's hard to believe a female could be a genius in mathematics.

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

Girls who enjoy studying math are a bit peculiar.

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

MATHEMATICS ANXIETY

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

I usually have been at ease in math classes.

I usually have been at ease during math tests.

Mathematics usually makes me feel uncomfortable and nervous.

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

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

CONFIDENCE IN LEARNING MATHEMATICS

Generally, I have felt secure about attempting mathematics.

I am sure that I can learn mathematics.

I can get good grades in mathematics.

I'm no good in math.

I'm not the type to do well in math.

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

TEACHER

My teachers have encouraged me to study more mathematics.

My teachers think I'm the kind of person who could do well in mathematics.

My math teachers have been interested in my progress in mathematics.

Getting a mathematics teacher to take me seriously has usually been a problem.

Math teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.

USEFULNESS OF MATHEMATICS

Knowing mathematics will help me earn a living.

Mathematics is a worthwhile and necessary subject.

Mathematics is of no relevance to my life.

Mathematics will not be important to me in my life's work.

I expect to have little use for mathematics when I get out of school.

EFFECTANCE MOTIVATION IN MATHEMATICS

Mathematics is enjoyable and stimulating to me.

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

Figuring out mathematical problems does not appeal to me.

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

I do as little work in math as possible.

MOTHER

My mother has strongly encouraged me to do well in mathematics.

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

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

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

FATHER

My father has strongly encouraged me to do well in mathematics.

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

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

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

APPENDIX B

Questionnaire

Part I

Complete the following information:

1. School: All girls ☐
   All boys ☐
   Co-educational ☐

2. Age: _____

3. Male ☐ Female ☐

4. Level I ☐ Level II ☐ Level III ☐

5. How many children are in your family? _____

6. Indicate your position in your family:

   Oldest 1 ☐
   2 ☐
   3 ☐
   4 ☐
   5 ☐
   Youngest 6 ☐

7. Indicate the math course you are presently enrolled in:

1201	☐	1202	☐	1203	☐
2201	☐	2202	☐	2203	☐
3201	☐	3202	☐	3203	☐

8. Who influenced your decision to enroll in this particular math course?

_____

_____

_____

9. In what range does your math mark usually fall? Make only one choice.

Less than 50 ☐
50 - 60 ☐
60 - 70 ☐
70 - 80 ☐
80 - 90 ☐
90 - 100 ☐

10. Do you think you could do better in mathematics?

Yes ☐ No ☐

If yes, how could you do better in math?

_____

_____

_____

If no, why not?

_____

_____

_____

11. List the careers you know of that depend on a knowledge of mathematics.

_____

_____

_____

12. (a) Have you already made a career choice?

Yes ☐ No ☐

(b) If yes, what career have you chosen? _____

(c) If yes, when did you make your decision?

Grades K - 6 ☐

Grades 7 - 9 ☐

Level I ☐

Level II ☐

Level III ☐

(d) If yes, who helped you most to make your decision?

Father ☐
Mother ☐
Brother ☐
Sister ☐
Friend ☐
Teacher ☐
Other ☐ Please specify _____

13. (a) Do you participate in activities involving mathematics outside of school?

Yes ☐ No ☐

(b) If yes, what activities?

_____
_____
_____

(c) If no, why not?

_____
_____
_____

14. (a) If you did not have to study mathematics each year of high school, would you do so?

Yes ☐ No ☐

(b) If yes, why?

(c) If no, why not?

15. (a) Are you afraid that you will not be successful in mathematics?

Yes ☐ No ☐

(b) If yes, why are you afraid?

16. Sex of teacher:

This year - Male ☐ Female ☐

Last year - Male ☐ Female ☐

17. (a) Would you select a career involving mathematics?

Yes ☐ No ☐

(b) If yes, why?

_____

_____

_____

(c) If no, why not?

_____

_____

_____

PART II

For each of the following statements, choose only one of the choices provided. Place a check mark (✓) beside your choice.

		Strongly Agree					Strongly Disagree
		1	2	3	4	5	6
1.	Being regarded as smart in mathematics would be a great thing.	☐	☐	☐	☐	☐	☐
2.	Studying mathematics is just as appropriate for women as for men.	☐	☐	☐	☐	☐	☐
3.	I get a sinking feeling when I think of trying hard math problems.	☐	☐	☐	☐	☐	☐
4.	My mother wouldn't encourage me to plan a career which involves math.	☐	☐	☐	☐	☐	☐
5.	I'm no good in math.	☐	☐	☐	☐	☐	☐
6.	My teachers have encouraged me to study more mathematics.	☐	☐	☐	☐	☐	☐
7.	I expect to have little use for mathematics when I get out of school.	☐	☐	☐	☐	☐	☐
8.	I don't understand how some people can spend so much time on math and seem to enjoy it.	☐	☐	☐	☐	☐	☐
9.	My father thinks that mathematics is one of the most important subjects I have studied.	☐	☐	☐	☐	☐	☐

	Strongly Agree					Strongly Disagree
	1	2	3	4	5	6
10. It would make me happy to be recognized as an excellent student in mathematics.	☐	☐	☐	☐	☐	☐
11. Males are not naturally better than females in mathematics.	☐	☐	☐	☐	☐	☐
12. I usually have been at ease during math tests.	☐	☐	☐	☐	☐	☐
13. My mother has shown no interest in whether or not I take more math courses.	☐	☐	☐	☐	☐	☐
14. I can get good grades in mathematics.	☐	☐	☐	☐	☐	☐
15. Getting a mathematics teacher to take me seriously has usually been a problem.	☐	☐	☐	☐	☐	☐
16. Mathematics is of no relevance to my life.	☐	☐	☐	☐	☐	☐
17. I am challenged by math problems I can't understand immediately.	☐	☐	☐	☐	☐	☐
18. My father has strongly encouraged me to do well in mathematics.	☐	☐	☐	☐	☐	☐
19. I'd be happy to get top grades in mathematics.	☐	☐	☐	☐	☐	☐
20. I would have more faith in the answer for a math problem solved by a man than a woman.	☐	☐	☐	☐	☐	☐

	Strongly Agree					Strongly Disagree
	1	2	3	4	5	6
21. Mathematics usually makes me feel uncomfortable.	☐	☐	☐	☐	☐	☐
22. Mathematics usually makes me feel nervous.	☐	☐	☐	☐	☐	☐
23. My mother thinks that mathematics is one of the most important subjects I have studied.	☐	☐	☐	☐	☐	☐
24. I'm not the type to do well in math.	☐	☐	☐	☐	☐	☐
25. Math teachers would think I wasn't serious if I told them I was interested in a career in science and mathematics.	☐	☐	☐	☐	☐	☐
26. Mathematics will not be important to me in my life's work.	☐	☐	☐	☐	☐	☐
27. Mathematics is enjoyable for me.	☐	☐	☐	☐	☐	☐
28. Mathematics is stimulating to me.	☐	☐	☐	☐	☐	☐
29. My father wouldn't encourage me to plan a career which involves math.	☐	☐	☐	☐	☐	☐
30. It would be really great to win a prize in mathematics.	☐	☐	☐	☐	☐	☐

		Strongly Agree					Strongly Disagree
		1	2	3	4	5	6
31.	I would trust a woman just as much as I would trust a man to figure out important calculations.	☐	☐	☐	☐	☐	☐
32.	My mind goes blank and I am unable to think clearly when working mathematics.	☐	☐	☐	☐	☐	☐
33.	My mother has strongly encouraged me to do well in mathematics.	☐	☐	☐	☐	☐	☐
34.	Generally, I have felt secure about attempting mathematics.	☐	☐	☐	☐	☐	☐
35.	My math teachers have been interested in my progress in mathematics.	☐	☐	☐	☐	☐	☐
36.	Mathematics is a worthwhile subject.	☐	☐	☐	☐	☐	☐
37.	Mathematics is a necessary subject.	☐	☐	☐	☐	☐	☐
38.	Figuring out mathematical problems does not appeal to me.	☐	☐	☐	☐	☐	☐
39.	My father has shown no interest in whether or not I take more math courses.	☐	☐	☐	☐	☐	☐
40.	I don't like people to think I'm smart in math.	☐	☐	☐	☐	☐	☐
41.	Girls can do just as well as boys in mathematics.	☐	☐	☐	☐	☐	☐
42.	I usually have been at ease in math classes.	☐	☐	☐	☐	☐	☐

		Strongly Agree					Strongly Disagree
		1	2	3	4	5	6
43.	For some reason even though I study, math seems unusually hard for me.	☐	☐	☐	☐	☐	☐
44.	My teachers think I'm the kind of person who could do well in mathematics.	☐	☐	☐	☐	☐	☐
45.	Knowing mathematics will help me earn a living.	☐	☐	☐	☐	☐	☐
46.	I do as little work in math as possible.	☐	☐	☐	☐	☐	☐
47.	People would think I was trying to get on the good side of the teacher if I got A's in math.	☐	☐	☐	☐	☐	☐
48.	I would expect a woman mathematician to be a masculine type of person.	☐	☐	☐	☐	☐	☐
49.	I haven't usually worried about being able to solve math problems.	☐	☐	☐	☐	☐	☐
50.	I am sure that I can learn mathematics.	☐	☐	☐	☐	☐	☐
51.	It would make people like me less if I were a really good math student.	☐	☐	☐	☐	☐	☐
52.	Girls who enjoy studying math are a bit peculiar.	☐	☐	☐	☐	☐	☐
53.	If I had good grades, in math, I would try to hide it.	☐	☐	☐	☐	☐	☐

	Strongly Agree					Strongly Disagree
	1	2	3	4	5	6
54. It's hard to believe a female could be a genius in mathematics.	☐	☐	☐	☐	☐	☐

PART III

Qualitative Questions

1. What do you see to be the value in studying Mathematics?

2. Describe any negative experiences you have had in Mathematics.

3. Describe any positive experiences you have had in Mathematics.

4. (a) What is it about Mathematics that you like?

   (b) What is it about Mathematics that you dislike?

5. (a) Describe the attitude of your parents toward your study of Mathematics.

(b) Describe the attitude of your friends toward your study of Mathematics?

(c) Describe the attitude of your mathematics teacher toward your study of Mathematics.

(d) Describe the attitude of your other teachers toward your study of Mathematics.

6. (a) Has anybody ever said or done anything to discourage you from studying Mathematics?

(b) If so, what have they said or done?

(c) How often have they said or done something?

7. (a) Has anybody ever said or done anything to encourage you to study Mathematics?

(b) If so, who has said or done something?

(c) If so, what have they said or done?

(d) How often have they said or done something?

8. Give examples of any problems you may have had in studying Mathematics.

9. Would you select a career involving Mathematics? Why or why not?

10. Would you prefer to go to a co-educational school? Why or why not?

11. Are there any other comments you would like to add concerning the study of Mathematics?