STEREOTYPING OF MATHEMATICS AS A MALE DOMAIN: A FACTOR IN FEMALES NON-PARTICIPATION IN MATHEMATICS

By

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ABSTRACT

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The purpose of this study was to determine if a relationship exists between the extent of stereotyping of mathematics as masculine in nature, and the non-participation of females in mathematics courses. Data from the 1985 B.C. Mathematics Assessment were used to determine the extent of stereotyping of mathematics as a male domain by Grade 7 and 10 students. Future mathematics plans of Grade 10 students were also examined.

The data were analyzed using t-tests and Chi square tests of significance in order to determine if a relationship existed. While it was found that males stereotyped mathematics as a male domain significantly more than females at both grade levels, the results indicated that neither males nor females stereotyped mathematics as masculine at either grade level.

When the extent of stereotyping of Grade 10 students was compared to their future mathematics plans in Grades 11 and 12, there was no significant difference between the extent of stereotyping of students who planned to take an academic mathematics course in Grade 11 and those who planned to take a non-academic course. When participation or non-participation in Grade 12 courses was examined, there was no significant difference in the extent of stereotyping between those students who planned to take a mathematics course and those who did not.

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CHAPTER ONE

BACKGROUND

REVIEW OF BACKGROUND LITERATURE

Women are presently under-represented in the field of mathematics and in mathematics-related occupations. (Kaminski, 1982) Evidence of differential participation in mathematics has been documented at both the undergraduate and graduate levels. (Ernest, 1976; Fox, 1976; Beltzner, Coleman, and Edwards, 1976; Tobias, 1978) For example, in the United States women constitute 45% of the total undergraduate population, but only 15% of the majors in mathematics are women. (Tobias, 1978, p.70) In Canada in 1976, women held 31% of the degrees in general, but only 24% of the degrees in mathematics. (Beltzner et al., 1976, p. 275) Baker (1983) reported that one-half the undergraduate majors in science in the United States are female. Postgraduate degrees obtained by women indicated different representation; for example, only 10% of doctoral degrees in physical science and 23% of degrees in biological science were awarded to women.

Fewer girls than boys enroll in high school mathematics courses in Britain, the United States and Canada. (Ernest, 1976; Sells, 1978; Fennema, Wolleat, Pedro, and Becker, 1981; Armstrong, 1981; Pallas and Alexander, 1983) Keeves (1973) reported results from the First International Mathematics Study to the effect that there were clear sex differences in participation in mathematics courses in most of the 10 countries studied. In Ontario, Raphael, McLean and Wahlstrom (1984) reported that the percent of boys enrolled in Grade 13 mathematics courses exceeded that of girls. In British Columbia results of the 1977 and 1981 Mathematics Assessments indicated that females were under-represented in most elective courses in mathematics at the senior secondary level. (Robitaille and Sherrill, 1977; Robitaille, 1981)

The under-representation of females in mathematics courses and careers has been attributed to male superiority in mathematics achievement: i.e. females did not do as well in mathematics as males and therefore did not enter mathematics courses or careers in equal numbers. (Benbow and Stanley, 1982) Four extensive assessments of achievement performed between 1960 and 1980 in the United States provided support for this argument: Project Talent, 1960; National Longitudinal Study of Mathematical Abilities, 1962-1967; National Assessment of Educational Progress, 1979; Women in Mathematics survey, 1978. In British Columbia, provincial Mathematics Assessment data indicated similar differences. (Robitaille and Sherrill, 1977; Robitaille, 1981)

Two broad categories of theories exist to explain the sex difference in mathematics achievement: one that attributes the difference to biological factors and one that suggests sociocultural factors are responsible.

Maccoby and Jacklin (1974) and Benbow and Stanley (1980) proposed that the sex difference in mathematics achievement was a result of males being genetically superior. They attributed the genetic superiority to inherited spatial ability. Evidence supporting the sex difference in spatial ability was reported by Broverman, Klaiber, Kobayaski, and Vogel (1968) and Harris (1975). Stafford (1961) produced results which indicated that spatial ability is inherited.

Ernest (1976) argued that the relationship between spatial ability and mathematics achievement was not clear. McGee (1979) pointed out that the difference in spatial ability does not appear until adolescence, and may be learned rather than inherited. Wood (1976) and Sherman (1977a) argued against the biological basis for male superiority by quoting successful intervention studies which reduced the sex difference in achievement. Other researchers pointed out that the small difference in spatial ability does not account for the large difference found in achievement. (Erickson, Erickson, and Haggerty, 1980)

The difficulty of detecting a genetic difference in mathematical ability led many researchers to investigate probable sociocultural factors which may affect mathematics achievement. Fennema and Sherman (1977) reported that the sex difference in mathematics achievement disappeared when differences in mathematics background were controlled. The failure of girls to enroll in mathematics courses led to their lower achievement in mathematics. Fennema and Sherman continued their study by collecting information about factors which might affect girls′ participation in mathematics courses. Factors they identified as significant were lack of confidence concerning mathematics and perceptions of mathematics as a male domain. The stereotyping of mathematics as masculine appeared to affect relevant attitudes, such as mathematics anxiety and lack of confidence in mathematics. In a later study, Fennema et al. (1981) reported that changing attitudes toward mathematics as a male domain, and other attitudes toward mathematics increased the participation of girls in mathematics courses.

STATEMENT OF THE PROBLEM

The under-representation of women in mathematics and mathematics-related occupations appears to be directly related to the low enrollment of girls in high school mathematics classes. In the 1977 and 1981 B.C. Mathematics

Assessments, it was reported that fewer girls than boys enrolled in senior mathematics courses in B.C. high schools. The 1985 B.C. Mathematics Assessment included a Gender and Mathematics scale, and questions concerning future mathematics plans similar to the previous assessments. Using some of the data obtained from the 1985 mathematics assessment, this study attempted to investigate the relationship between girls' and boys' attitudes toward mathematics and their subsequent enrollment in mathematics courses.

Two general questions were considered. Do girls perceive mathematics as masculine in nature? Do girls who perceive mathematics as masculine in nature avoid the study of mathematics when it becomes an optional subject? If a correlation could be found between the stereotyping of mathematics as masculine and future mathematics plans it would offer direction for plans to increase the involvement of females in mathematics-related occupations.

HYPOTHESES

In order to research the general questions, twelve hypotheses were developed. The general intent of the first six hypotheses was to test whether males and females in grade 7 and 10 stereotype mathematics as a masculine domain. Further hypotheses were then developed to test whether significant differences exist in the extent of stereotyping of mathematics as masculine between those students who plan to take academic mathematics courses and those students who plan to take non-academic courses. Finally, hypotheses were developed to test whether significant differences exist in the extent of stereotyping of mathematics as masculine between those students who plan to take mathematics in Grade 12 when it is an elective subject and those students who do not plan to take mathematics in Grade 12.

1. Males in Grade 7 stereotype mathematics as a male domain.

2. Females in Grade 7 stereotype mathematics as a male domain.

3. Males in Grade 10 stereotype mathematics as a male domain.

4. Females in Grade 10 stereotype mathematics as a male domain.

5. There is no difference in the extent to which males and females stereotype mathematics as a male domain in Grade 7.

6. There is no difference in the extent to which males and females stereotype mathematics as a male domain in Grade 10.

7. There is no difference in the extent of stereotyping of mathematics as a male domain between students who plan to enroll in non-academic mathematics courses in Grade 11 and students who plan to enroll in academic mathematics courses in Grade 11.

8. There is no difference in the extent of stereotyping of mathematics as a male domain between males who plan to enroll in non-academic mathematics courses in Grade 11 and males who plan to enroll in academic mathematics courses in Grade 11.

9. There is no difference in the extent of stereotyping of mathematics as a male domain between females who plan to enroll in non-academic mathematics courses in Grade 11 and females who plan to enroll in academic mathematics courses in Grade 11.

10. There is no difference in the extent of stereotyping of mathematics as a male domain between students who plan to enroll in a mathematics course in Grade 12 and students who do not plan to enroll in a mathematics course in Grade 12.

11. There is no difference in the extent of stereotyping of mathematics as a male domain between males who plan to enroll in a mathematics course in Grade 12 and males who do not plan to enroll in a mathematics course in Grade 12.

12. There is no difference in the extent of stereotyping of mathematics as a male domain between females who plan to enroll in a mathematics course in Grade 12 and females who do not plan to enroll in a mathematics course in Grade 12.

ORGANIZATION OF THE FOLLOWING CHAPTERS

A review of the literature relating to sex role stereotyping of mathematics as a male domain is presented in Chapter Two. The description of the method of study, including a description of the subjects, identification of the variables, and data manipulation, is presented in Chapter Three. A statistical analysis of the results and the findings for each of the hypotheses proposed are presented in Chapter Four. Chapter Five contains a discussion of the results and includes sections on implications and limitations of the study as well as suggestions for future research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

INTRODUCTION

This review of related literature includes five sections. The first section discusses literature concerned with sex differences in mathematics achievement. Next are two sections briefly reviewing literature which pertains to biological and sociocultural factors associated with mathematics achievement. Literature concerned with the perception of mathematics as a male domain is discussed next. The last section of literature review is sex differences in enrollment. The chapter concludes with a summary of the main trends of research in this area.

SEX DIFFERENCES IN MATHEMATICS ACHIEVEMENT

Four extensive assessments of mathematics achievement in the United States all report male superiority in mathematics achievement. Jacobs (1978) reviewed results obtained from Project Talent, 1969, which tested achievement of students in Grades 9 to 12. Results indicated that boys tended to do better in mathematics than girls by Grade 12. In a small followup study in 1975, students in Grades 9 to 11 were tested and the results were similar although the difference between males and females had decreased. (Jacobs, 1978, p.2)

The National Longitudinal Study of Mathematical Abilities, 1962-1967, reviewed in Jacobs (1978) found that the sex difference favoured girls at the comprehension level and boys at application and analysis levels. The National Assessment of Educational Progress (1979) reported no difference in mathematics achievement at age 9, slight disparity at age 13, and by 17 the gap in achievement was more noticeable. Carpenter (1984) reported the results of the 1982 N.A.E.P. and compared them to the 1978 assessment. The results showed virtually no change from 1978 to 1982. The Women in Mathematics survey (Armstrong, 1981) found boys did better than girls at Grade 12, particularly in higher order cognitive skills in mathematics.

A study of college-bound students (National College-Bound Seniors, 1981) reported males scored slightly higher SAT averages in mathematics. Benbow and Stanley (1982), in their Study of Mathematically Precocious Youth (SMPY), reported that in all six SMPY talent searches a large sex difference favouring males was found on the SAT-M, a test of mathematical reasoning ability. Baker (1983) compared the SAT scores of male and female undergraduates and found males had significantly higher scores than females.

In Canada similar results have been found. A 1978 study of mathematics achievement of schools in Alberta reported boys performed better than girls on all topics tested and the differences became more pronounced as grade level increased. Boys did better on the knowledge questions and a great deal better on comprehension and application. (Olson, Sawada, and Sigurdson, 1979, p.1) Another study by Giesbrecht (1980), of Saskatchewan secondary students, produced results showing a significant difference in mathematics achievement in favor of males. An examination of raw scores showed that males did better at every grade level with differences increasing with grade level.

In British Columbia, the 1977 provincial Mathematics Assessment data indicated similar differences. At Grade 8 overall achievement of girls was similar to boys but at Grade 12 boys scored higher. (Robitaille and Sherrill, 1977) In 1981, a second provincial Mathematics Assessment was performed. Differences in achievement were small, generally in favour of boys and increasing from Grade 4 to Grade 12. These differences tended to be at the higher cognitive level. (Robitaille, 1981) The 1985 provincial Mathematics Assessment also reported small achievement differences in favour of boys. (Robitaille and O'Shea, 1985)

In general, these and other studies have produced similar results. In elementary school there appeared to be little difference in mathematics achievement between boys and girls. After elementary school if there was a difference it was in favor of boys and tended to appear in the last few years of high school. (Keeves, 1973; Sells, 1978; Maccoby and Jacklin, 1974; Astin, 1974; Wood, 1976; Ernest, 1976; Aiken, 1976; Fennema and Sherman, 1977; Armstrong, 1981; Benbow and Stanley, 1982; Pallas and Alexander, 1983)

BIOLOGICAL FACTORS INFLUENCING MATHEMATICS ACHIEVEMENT

In an attempt to explain differences in mathematical achievement between boys and girls, particularly at higher cognitive levels, a biological basis was hypothesized. Differences in spatial ability, the ability to transform visual images mentally, were investigated. Male superiority at certain spatial visualization tasks was reported by Stafford (1961), Maccoby and Jacklin (1974), Hyde, Geiringer, and Yen (1975), Ernest (1976) and Harris (1975). Broverman et al. (1968) attributed this difference in spatial ability to sex hormone effects. Restak (1979) attributed the differences to developmental differences in brain lateralization.

Stafford (1961) reported evidence that spatial ability is inheritable. Benbow and Stanley (1980) also reported results indicating males had superior spatial ability which was inherited.

In later research no differences were reported between boys and girls on tests of spatial visualization. (Fennema and Sherman 1977; Sherman 1979; Armstrong 1981; Baker, 1983). Murphy (1978) concluded that the extent of the differences detected appeared to depend on the test used, as the results were far from clear. Leder (1982) and Erickson et al. (1980) also pointed out that the difference detected in spatial ability was small and did not account for the large difference in mathematics achievement.

SOCIOCULTURAL FACTORS INFLUENCING MATHEMATICS ACHIEVEMENT

Various sociocultural factors have been researched as a cause of the sex difference in mathematics achievement. Ernest (1976) examined differences in attitudes to mathematics but found no sex differences. Tobias (1978) reported anxiety about mathematics was a factor in mathematics avoidance. She also reported that more females suffered from mathematics anxiety than males. However Tobias and Weisbrod (1980) investigated males and females with the same level of anxiety and found that the males continued to take mathematics while the females did not.

PERCEPTIONS OF MATHEMATICS AS A MALE DOMAIN

Fennema et al. (1981) hypothesized that the perception of mathematics as masculine may be responsible for the failure of girls to participate in mathematics. The development of stereotyped sex roles and stereotyped career choices may contribute to this perception.

The sex role stereotypes which develop define males as verbally and physically aggressive and females as dependent, passive and conforming. (Kagan, 1964; Williams, Bennett, and Best, 1975) Competence in intellectual and academic skills are also considered an essential component of the male's sex role identity, but not the female's. (Kagan, 1964; Stein and Bailey, 1973; Restak, 1979)

Some of the effects of stereotyping can be seen in the development of sex-typed perceptions of career choices. The career choices of many girls appear to be limited to a narrow range of sex-stereotyped careers. These can be classified into three groups: the mothering role, including teacher, nurse, social worker; wife, including assistant, secretary, laboratory technician; and decorative, receptionist, flight attendant, and public relations specialist. (Astin, 1974; Iglitzin, 1977; Tobias, 1978; Frieze, 1978; Pedro, Wolleat, and Fennema, 1980)

Results of research indicate that sex typing of subjects, particularly between mathematics and science; and English and social studies also occurs. Fennema et al. (1981) reported results which indicated that mathematics was regarded as a male subject by both sexes.

A possible reason for perceiving mathematics as masculine in nature is the stereotyping of mathematicians as masculine, even in the case of female mathematicians. Entwhistle and Duckworth (Stamp, 1979) described the personality factors for mathematicians as intelligence, dominance, tough-mindedness, intellectual self-sufficiency and control. These characteristics all relate to the masculine sex role identity. Female mathematicians are often stereotyped as "six foot, grey hair, tweed suit and oxfords" (Badger, 1981, p. 605)

When masculinity-femininity ratings and mathematical ability have been researched the results tend to be contradictory and dependent on the scale used to measure masculinity-feminity. Helson (Badger, 1981) studied woman mathematicians and found that they did not rate higher than average on measures of masculinity-feminity, dominance, assertiveness or analytical ability. Elton and Rose (1967) reported no significant correlation between masculine interests and high mathematical ability. Lambert (1960) found mathematics majors scored as "more feminine" than non-mathematics majors. He took a second sample because this result was sufficiently surprising. The results of his second sample were the same. On the other hand, Mills (1981) found some evidence for a positive relationship between masculine traits and values and mathematics ability. Milton (1957) also reported a positive relationship between the masculine sex role identification and problem-solving ability.

Further clues to the perceived masculine character of mathematics are provided by the masculine orientation of problems in mathematics tests and textbooks. (Milton, 1959; Graf and Riddell, 1972; Leder, 1974; Christopolos and Borden, 1978) Milton (1959) studied the effect of altering the content of problems to make them less appropriate to the masculine role. His results indicated when content was made relevant to females, males no longer outperformed them. Leder (1982) reported similar results.

Parental attitudes toward mathematics as masculine may affect the attitudes of children. Astin (1974) reported parents encouraged boys more often than girls in academic studies. Levine (1976) reported that parents encourage sons to study mathematics even when it is difficult for them while girls are often encouraged to drop it. The results of other studies also indicated a relationship between girls' attitudes toward mathematics and parents' attitudes toward mathematics. (Ernest, 1976; Fennema and Sherman, 1977; Stamp, 1979; Sherman, 1982; Kaminski, 1982)

Teachers' attitudes toward mathematics also determine pupils' attitudes toward mathematics. (Brassell, Petry, and Brooks, 1980) Ernest (1976) reported that 41% of teachers surveyed thought boys did better in mathematics, none thought girls did better. He proposed that a Pygmalion effect may be taking place; boys perform better because teachers expect them to be better. Rowell (1971) found tentative evidence to support the hypothesis that if teachers expected boys to achieve more, they did.

Evidence of differential treatment of male and female students in mathematics classrooms was reported by Bean (1976). Becker (1981) found that teachers interact with males more than females in both blame and praise contacts. Fennema (1977) indicated that males were given more opportunity to respond to high level cognitive questions. Becker (1981) found that differences in teacher responses indirectly benefitted male students both in their learning of mathematics and future course choices. Heller and Parsons (1981) reported, however, no sex differences were found in patterns of teacher evaluative feedback.

Duval (1980) studied grading practices looking for affects of teacher bias against females. Results indicated that if teachers believed that the study of mathematics was inappropriate for females they reinforced perceptions of mathematics as masculine. Levine (1976) found that girls are encouraged to continue their mathematics studies only if they expressed great interest in the subject. Similar results were found in studies by Thomas and Stewart (1971), Haven (1972), and Luchins (1981).

There is some contradiction between results of some studies of perceptions of mathematics as masculine during adolescence. Stein and Smithells (1969) produced evidence that stereotyping of mathematics as a male domain is not strong until adolescence. On the other hand, Fennema and Sherman (1977) found that girls stereotyped mathematics as a male domain less as they became more mature. In a study by Brush (1979) most students indicated that mathematics was an appropriate subject for both sexes to study although females were much more adamant than males.

The influence of sex role identity on achievement efforts in the traditionally sex-typed subjects, mathematics and English, was studied by Kaczala (1981). She found that sex role identity affects girls' attitudes toward mathematics and the degree to which they value it. Similarly, Levine (1976) reported a decrease in girls' interest in mathematics and a sharp increase in societal pressure against women in mathematics during the students' secondary school years. Fox (1976) reported similar results indicating conflict between the feminine sex role and achievement in mathematics.

Sherman (1982) found that girls who attempted 4 years of mathematics perceived mathematics as more of a male domain than those who attempted less mathematics. She proposed that the girls who elected not to take mathematics did so because they have resolved sex role conflict by renouncing ambition. Those who continued in mathematics continued to perceive it as a masculine pursuit and continued to suffer from sex role conflict.

SEX DIFFERENCES IN ENROLLMENT

Sex differences in enrollment in mathematics courses have been well documented. A study of the mathematics background of California freshmen by Sells (1978) and replicated by Ernest (1976) revealed that a significantly larger proportion of the men had four years of secondary school mathematics than women.

The 1977-78 NAEP study reported a three-to-two ratio of 17 year old males to 17 year old females who had taken more than three years of mathematics. (NAEP 1979 p.29) Giese (1983) using data from 113 school districts for 1981/82 in the state of Michigan, found 45% of the boys and 36% of the girls in Grade 12 were studying mathematics. Haven (1972) surveyed the college-bound students who took the College Entrance Examination Board Achievement Test and indicated 56% of the girls took mathematics in Grade 12, as compared to 84% of the boys.

The Ontario results from the Second International Mathematics Study reported by Raphael et al. (1984) indicated boys were enrolled in significantly more mathematics courses than girls. In British Columbia, the 1981 Mathematics Assessment (Robitaille, 1981), reported that females were under-represented in most elective courses in mathematics at the senior secondary level. They constututed 40% of the Algebra 12 population, 30% of Computing Science 11, 30% of Geometry 12, 10% of Trades Mathematics 11 and 60% of the Consumer Mathematics 11. The Second International Mathematics Study, in British Columbia (Robitaille, O'Shea, and Dirks, 1982) found that girls made up 51% of the Grade 12 population but only 43% of the enrollment in Algebra 12. Girls formed 65% of the group which took no mathematics beyond Grade 10, which was the last year mathematics was a compulsory course at that time.

The differences in course enrollment become even more pronounced when mathematics-related courses are considered. The British Columbia Science Assessment (Hobbs, Boldt, Erickson, Quelch, and Sieben, 1978) found that boys enroll in more science courses than girls. Although there are more girls enrolled in biology courses, the percentages enrolled in the physical sciences are significantly different, eg. 38% of males and 17% of females in senior grades are enrolled in senior physics courses.

SUMMARY

Male and female sex role identities develop early. Children's perceptions of these sex roles contribute to their perceptions of career opportunities for the sexes. Most girls see the possible roles for women as limited to three categories: wife, mother and decoration. Many careers are seen as not sex-appropriate for females and mathematics is one of these.

Mathematics is perceived as masculine in nature, as are mathematicians. There are socialization factors which contribute to this attitude. The family and school environments communicate differential expectations to boys and girls through differential treatment and encouragement. Parents, teachers and peers influence girls to perceive mathematics as more appropriate for boys. These attitudes contribute to conflict between girls' wishes to achieve academically, and their desire to conform to the feminine sex role.

Evidence exists that there are more boys enrolled in mathematics courses than girls. Boys tend to take more mathematics courses and mathematics-related courses than girls in secondary school. This difference has been reported in Britain, the United States and also in Canada.

CHAPTER THREE

METHOD OF STUDY

INTRODUCTION

The purpose of this research study was to explore the relationship between students' perceptions of mathematics as masculine in nature and their future plans to enroll in mathematics courses. In May 1985, the British Columbia Mathematics Assessment was administered to all Grade 4, 7 and 10 students in British Columbia, and a 10% sample of Grade 8's. Some of the data collected from the assessment were used as the basis for this study.

RESEARCH DESIGN AND PROCEDURES

An attempt was made to discover and clarify relationships between the extent of stereotyping of mathematics as masculine by girls and boys, and future plans to enroll in mathematics courses in Grades 11 and 12. Differences in the stereotyping of mathematics by males and females in Grades 7 and 10 were examined. Future mathematics plans of Grade 10 students were also examined.

INSTRUMENT DESCRIPTION

The purpose of the British Columbia Mathematics Assessment was to provide decision-makers with factual and current information concerning the teaching and learning of mathematics. The assessment instrument consisted of four forms (Form Q, Form R, Form S, and Form T) for each grade level. Only the data from Form S, for Grades 7 and 10, were used in the present study since Form S included the Gender and Mathematics scale. Form R included Scale R, titled Mathematics in School, and Form T included Scale T, titled Calculators and Computers. Form Q included open-ended questions designed to gain information on how students approach measurement and problem-solving questions. Form S consisted of three sections, a 15-item attitude scale, 16 items concerning student background information, and a 50-item achievement survey.

TEST ADMINISTRATION

Between May 21-24, 1985, each student in Grades 4, 7 and 10, wrote one of the forms of the 1985 Mathematics Assessment. Form Q was distributed on the basis of one per class or one for every 25 students. The remainder of the students received Form R, Form S, or Form T in approximately equal numbers. The forms were ordered R, S, T, R, S, T... for distribution to the schools.

SELECTION OF ITEMS FOR ANALYSIS

The Gender and Mathematics scale in Form S contained 15 items. The items are listed below.

1. Men make better scientists and engineers than women.
2. Girls have more natural ability in mathematics than boys.
3. Boys need to know more mathematics than girls.
4. A woman needs a career just as much as a man does.
5. My father enjoys doing mathematics.
6. My mother enjoys doing mathematics.
7. My father is usually able to help me with my mathematics homework if I ask him to help.
8. My mother is usually able to help me with my mathematics homework if I ask her to help.
9. My mother thinks that learning mathematics is important for me.
10. My father thinks that learning mathematics is important for me.
11. My father wants me to do well in mathematics.
12. My mother wants me to do well in mathematics.
13. Girls can do better than boys in mathematics.
14. My mother is usually very interested in helping me with mathematics.
15. My father is usually very interested in helping me with mathematics.

Of the 15 items, six were not considered for data analysis. The omitted items were questions concerning parental enjoyment of mathematics, parental ability to assist with mathematics homework and parental desire for student to do well in mathematics.

The nine items selected (1, 2, 3, 4, 9, 10, 13, 14, and 15) were examined. It was felt that five of the items selected did not fit with the remaining four. A factor analysis of the nine selected items was conducted to provide statistical evidence of the validity of the author's hypothesis about there being more than one factor represented by the nine items.

Factor analysis was used to search for clusters of items which correlated with one another. The four items 1, 2, 3 and 13, concerning attitude toward mathematics as a male domain grouped together as one factor with an Eigenvalue of 1.37 for Grade 7 and an Eigenvalue of 1.21 for Grade 10.

Items 14 and 15 also grouped together with an Eigenvalue of 1.57 for both Grade 7 and Grade 10. It was felt that these items were not related to measurement of stereotyping of mathematics as a male domain and since they did not group with the other items these were excluded from further data analysis. Items 9 and 10 were excluded on the basis that they did not share any significant communality with the rest of the data; that is they did not group with any other items. Moreover, items 9 and 10 were attempting to measure the students' perception of their mothers' and fathers' attitudes to mathematics rather than perceptions of mathematics as a male domain. Item four was excluded since it was not mathematics specific.

The four items selected from Scale S were 1, 2, 3, and 13. These items were used as criteria for analysis of sex role stereotyping of mathematics by students in Grades 7 and 10. The questions required that the student choose one of the following five responses on a Likert scale: Strongly Disagree, Disagree, Undecided, Agree, and Strongly Agree.

In the second section of Form S, Student Background Information, questions 10 and 11 were designed to investigate the future mathematics plans of students. The two questions are as follows:

10. Which mathematics courses do you plan to take in Grade 11? (Mark all that apply.)

A. None

B. Math 10

C. Algebra 11

D. Trades Math 11

E. Business and Consumer Math 11

F. Computer Science 11

G. Algebra 12

H. Geometry 12

I. Probability and Statistics 12

11. Which mathematics courses do you plan to take in Grade 12. (Mark all that apply.)

A. None

B. Algebra 11

C. Trades Math 11

D. Business and Consumer Math 11

E. Computer Science 11

F. Algebra 12

G. Geometry 12

H. Probability and Statistics 12

For Grade 11 mathematics courses students had nine choices and could indicate more than one. Students had eight choices of Grade 12 mathematics courses and again could choose more than one. For those students enrolled in Grade 10 in 1984-85 and potentially graduating in 1986-87, a Grade 11 mathematics course is necessary to meet graduation requirements, but may be taken in Grade 11 or Grade 12. If they completed a Grade 11 course by the end of Grade 11, then Grade 12 is the only year in the British Columbia public school system in which enrollment in mathematics is optional.

Section 3 of Scale S was the 50-item achievement survey. Data from the achievement survey were not used in this study.

SELECTION OF SAMPLE

The Educational Research Institute of British Columbia (ERIBC) was responsible for test distribution, collection, marking, and coding of responses. Approximately 28 000 Grade 7 students participated in the assessment and about 2800 cases were selected randomly as the sample for this study. More than 24 000 Grade 10 students participated, and approximately 2400 cases were randomly selected.

The Form S (distributed to approximately one-third of the students) data were separated from the other data and placed in a computer file for data analysis. The sample size was 859 Grade 10's and 822 Grade 7's.

In some schools, in some school districts, Scale S had not been completed or students had been urged not to fill in the responses to those items. This occurred because certain members of the teaching profession felt that questions concerning gender might promote the development of stereotyping in students. This led to the existence of cases where none or only a few of the Scale S responses had been completed. These cases were deleted as the data were being placed in the computer file. There were approximately 30-50 such cases in each of Grades 7 and 10. Cases which were incomplete were also deleted since it was necessary to obtain responses for all four questions which were to be used in the study.

DESCRIPTION OF SAMPLE

The final sample for Grade 7 consisted of 709 cases. Since all Grade 7 students in British Columbia wrote the Mathematics Assessment, and the 10% sample of Grade 7 students which ERIBC coded on tape was randomly chosen, these subjects could be said to be representative of the whole population of Grade 7's in British Columbia.

The final sample for Grade 10 consisted of 698 cases. Approximately 24 000 Grade 10 students completed the Mathematics Assessment and again ERIBC coded a 10% random sample on the computer tape. The cases who had completed Scale S were removed from the main file and placed in a data file. The sample was considered representative of the total population of Grade 10 students.

IDENTIFICATION OF VARIABLES

Variables selected for the study were: the degree to which female and male students stereotype mathematics as a male domain, and the type and number of mathematics courses the students planned to enroll in for Grades 11 and 12. Degree of stereotyping was identified as a separate variable for each of the four items considered. A composite score on the four items was calculated for each student from the Likert scale.

Since it was possible for students to choose more than one course for Grade 11 and for Grade 12, it was necessary to consider each mathematics course in which the student planned to enroll as a separate variable. For the sake of brevity, the following courses will be referred to by the bracketed abbreviation: Mathematics 10 (MA 10), Algebra 11 (AL 11), Trades Mathematics 11 (TM 11), Business and Consumer Mathematics 11 (BCM 11), Computer Science 11 (CSC 11), Algebra 12 (AL 12), Geometry 12 (GEO 12), Probability and Statistics 12 (PS 12).

DATA MANIPULATION

The responses to the four items on the Gender and Mathematics Scale from Form S were recoded from the 5-point scale of agreement-disagreement into a 3-point scale. "Strongly Disagree" and "Disagree" were coded "1" as a general indication of lack of stereotyping of mathematics as a male domain. "Undecided" was coded "2" as neutral, and "Strongly Agree" and "Agree" were coded "3" as a general indication of some stereotyping of mathematics as a male domain. Items 2 and 13 were recoded in reverse so that a score of 3, for all four items, indicated stereotyping of mathematics as masculine.

In the Student Background Information section each of the nine choices of courses for Grade 11 and each of the eight choices of courses for Grade 12 was defined as a separate variable. The responses were coded as 1 indicating the course had been chosen, and 2 indicating the course had not been chosen.

CHAPTER FOUR

FINDINGS

STATISTICAL PROCEDURES

The present chapter contains a description of procedures used for data manipulation, measurement of the stereotyping and future mathematics plans. It also includes an analysis of future mathematics plans by comparison of academic with non-academic courses in Grade 11 and a comparison of participation and non-participation in mathematics courses in Grade 12.

STATISTICAL ANALYSIS OF DATA: MEASUREMENT OF THE EXTENT OF STEREOTYPING

A composite score for each student was calculated on the four items to give an indication of the extent to which each student stereotyped mathematics as masculine. These scores ranged from 4 to 12. In order to limit the number of scores to be discussed and give an indication of the general trend of stereotyping the composite scores were categorized into a 5 point scale. The scores were categorized using results from frequency distributions produced for Grade 7 and Grade 10. The results are displayed in Table 4.1. After examining the frequency distributions, the decision was made to rate composite scores so that scores of 4 and 5 became 1, 6 and 7 became 2, 8 became 3, 9 and 10 became 4, and 11 and 12 became 5. This recoding meant that scores of 1 or 2 indicated a lack of stereotyping of mathematics as masculine, a score of 3 would be neutral and scores or 4 or 5 indicated some stereotyping of mathematics as masculine.

Table 4.1

Frequency Distribution of Composite Scores on Four Items.

	Grade			
	7		10	
Composite Score	Frequency	Percent	Frequency	Percent
4	10	1	10	1
5	20	3	15	2
6	90	13	91	13
7	110	16	95	14
8	335	47	308	44
9	81	11	75	11
10	45	6	70	10
11	14	2	20	3
12	4	1	14	2
Total	709		698	

EXTENT OF STEREOTYPING BY GENDER: GRADES 7 AND 10

A t-test was performed on the composite scores of males and females to establish whether there was a significant difference between the extent to which males and females stereotyped mathematics as masculine. The means of the composite scores were calculated for the Grade 7 cases. The mean composite score of the males was 3.06. The males did not stereotype mathematics as masculine. The mean for the females was 2.63, slightly less than neutral. When a t-test was performed on the means there was found to be a significant difference in the extent of stereotyping by males and females. (See Table 4.2) Although the difference between the sexes was significant, neither sex stereotyped mathematics as masculine.

The means of the composite scores of the Grade 10 cases were calculated. The mean composite score of the males was 3.27, the females' mean score was 2.62. When a t-test was performed on the data, the difference was found to be significant. The results are displayed in Table 4.2.

Table 4.2

Comparison of Mean Composite Scores by Gender

Group	n	Mean	Standard Deviation	t-value
Grade 7				
Males	381	3.06	0.9	6.98*
Females	328	2.63	0.8	
Grade 10				
Males	377	3.27	0.9	10.14*
Females	321	2.62	0.8	

*p<.001

COMPARISON OF STEREOTYPING BETWEEN GRADES 7 AND 10

The means of the composite scores of the different grade levels were compared to examine changes in the extent of stereotyping of males and females from Grades 7 to 10. The mean of the females in Grade 7 was 2.63 and in Grade 10 2.62. There was no appreciable difference in means. The mean of the males in Grade 7 was 3.06 and in Grade 10, 3.27. The extent to which males stereotyped mathematics as masculine had increased very slightly from Grade 7 to Grade 10. (see Table 4.2)

FUTURE MATHEMATICS PLANS: GRADE 10

The Grade 10 test instrument included questions concerning future mathematics plans. Students had indicated which mathematics courses they planned to take in Grades 11 and 12. A table was constructed to illustrate the numbers and percentages of girls and boys who planned to take each of the mathematics courses (or no mathematics) in Grades 11 and 12. (see Table 4.3)

The composite scores for the four attitude items were compared with the future mathematics plans of the Grade 10 students using a Chi square test to find out if there was a significant difference in the stereotyping of mathematics between those students who planned to take a particular mathematics course and those who did not plan to take it. A separate test was performed on each of the choices for mathematics courses in Grades 11 and 12. These were not combined because many students indicated that they planned to take more than one mathematics course in Grade 11.

A comparison of all data, both male and female, was performed first to find out if there was a general trend in the stereotyping of mathematics by students who chose particular courses. The difference in stereotyping for each course was analyzed using a Chi square test. The results are displayed in Table 4.4.

Table 4.3

Future Mathematics Plans: Course by Gender

	Male		Female	
Course	n	% of males	n	% of females
		Grade Eleven Courses		
None	10	3	15	5
MA 10	20	5	12	4
AL 11	241	64	210	65
TM 11	87	23	27	8
BCM 11	35	9	63	20
CSC 11	66	18	36	11
AL 12	9	2	9	3
GEO 12	6	2	2	1
PS 12	3	1	0	0
		Grade Twelve Courses		
None	81	22	83	26
AL 11	23	6	16	5
TM 11	25	7	8	3
BCM 11	24	6	27	8
CSC 11	16	4	15	5
AL 12	207	55	176	55
GEO 12	40	11	27	8
PS 12	18	5	8	3

Table 4.4

Stereotyping by Future Mathematics Plans: All Data

Course	n	%	X^2	p
		Grade Eleven Courses		
None	25	4	2.5	0.64
MA 10	32	5	1.7	0.80
AL 11	451	65	4.5	0.34
TM 11	114	16	6.5	0.17
BCM 11	98	14	3.7	0.45
CSC 11	102	15	10.1	0.04*
AL 12	18	3	5.2	0.27
GEO 12	8	1	2.8	0.60
PS 12	3	1	8.4	0.08
		Grade Twelve Courses		
None	164	24	3.0	0.55
AL 11	39	6	4.5	0.34
TM 11	33	5	3.4	0.49
BCM 11	51	8	7.0	0.14
CSC 11	31	5	5.1	0.28
AL 12	383	55	3.2	0.52
GEO 12	67	10	3.6	0.47
PS 12	26	4	3.0	0.56

*p<0.05

Of the students choosing the various Grade 11 courses, only those who indicated CSC 11 displayed a significant level of stereotyping of mathematics as masculine when compared to those not planning to enroll in this course. There was no significant difference in the stereotyping between those who planned to take a course and those who did not for any of the Grade 12 choices.

EXTENT OF STEREOTYPING: MALE DATA ONLY

The extent of the difference in stereotyping of males who planned on enrolling in the various mathematics courses was then analyzed using a Chi square test. The results are compiled in Table 4.5.

The difference in stereotyping for each course was analyzed with a Chi square test. Those males who planned on enrolling in AL 11 in Grade 11 stereotyped mathematics as a male domain significantly more than those who did not plan on enrolling in AL 11.

Those males who planned on enrolling in TM 11 stereotyped mathematics as a masculine domain significantly less than those who did not plan on enrolling in this course. For Grade 12 course choices, those students who planned on enrolling in PS 12 stereotyped mathematics significantly more than those students who did not plan on enrolling in PS 12. This did not indicate a definite trend however, because there were only 3 students in the sample.

Table 4.5

Stereotyping by Future Mathematics Plans: Male Data

Course	n	%	X^2	p
		Grade Eleven Courses		
None	10	3	4.3	0.37
MA 10	20	6	1.7	0.80
AL 11	241	64	11.8	0.02*
TM 11	87	23	12.0	0.02*
BCM 11	35	9	2.5	0.64
CSC 11	66	18	9.2	0.06
AL 12	9	2	4.6	0.33
GEO 12	6	2	1.7	0.81
PS 12	3	1	17.8	0.001**
		Grade Twelve Courses		
None	81	22	2.6	0.62
AL 11	23	6	3.1	0.54
TM 11	25	7	1.3	0.86
BCM 11	24	6	3.3	0.51
CSC 11	16	4	5.1	0.28
AL 12	207	54	4.3	0.37
GEO 12	40	11	4.1	0.39
PS 12	18	5	5.3	0.26

*$p<0.05$
**$p<0.01$

EXTENT OF STEREOTYPING: FEMALE DATA ONLY

A Chi square test was used to analyze whether there was a significant difference in stereotyping of mathematics between those females who planned to enroll in a mathematics course and those who did not. The results are displayed in Table 4.6.

There was no significant difference in the extent of stereotyping of mathematics as masculine in nature between those who chose a course and those who did not, for any of the course choices in Grades 11 and 12.

ACADEMIC/NON-ACADEMIC MATHEMATICS COURSES

An analysis of the extent of stereotyping of students who elected to take an academic mathematics course in Grade 11 and those students who elected to take a non-academic course in Grade 11 was carried out. The term "academic course" was used to refer to AL 11 which is a prerequisite for college and university programs. "Non-academic courses" was used to refer to TM 11 and BCM 11. All students should have chosen a Grade 11 or 12 mathematics course unless they were presently taking a Grade 11 course but were registered in Grade 10, or were on a special program. Most students, therefore, would have chosen AL 11, TM 11 or BCM 11. By scanning the data file for Grade 10 students it was found that most multiple choices in Grade 11 were

Table 4.6

Stereotyping by Future Mathematics Plans: Female Data

Course	n	%	X^2	p
		Grade Eleven Courses		
None	15	5	5.5	.24
MA 10	12	4	1.3	.86
AL 11	210	65	6.9	.14
TM 11	27	8	2.4	.66
BCM 11	63	20	6.1	.19
CSC 11	36	11	0.2	1.00
AL 12	9	3	5.0	.29
GEO 12	2	1	3.3	.52
PS 12	0	0	-	-
		Grade Twelve Courses		
None	83	26	7.2	.13
AL 11	16	5	1.5	.83
TM 11	8	3	3.5	.48
BCM 11	27	8	3.0	.55
CSC 11	15	5	3.1	.54
AL 12	176	55	2.7	.61
GEO 12	27	8	3.4	.49
PS 12	8	3	2.6	.62

students who elected to take MA 10 and one of the Grade 11 mathematics subjects in Grade 11, perhaps in an effort to catch up, and students who had chosen one of the three previously mentioned, and CSC 11. Of the 698 students, only 17 had chosen combinations such as AL 11 and BCM 11, or TM 11 and AL 11.

For the purposes of examining future mathematics plans from the comparison of academic, non-academic courses, these 17 students were deleted, since their effects tended to negate one another. The possibility exists that these multiple responses might be errors because of the contradictory nature of taking both an academic and a non-academic mathematics course in Grade 11.

A t-test was performed in order to examine the relationship between the stereotyping of mathematics and different mathematics plans in Grade 11. Separate tests were run on all the data, female data only and male data only. The results are displayed in Table 4.7.

All data, male data and female data were compared using a t-test. When all the data were combined it was found that those who planned to enroll in an academic mathematics course did not stereotype differently than those who planned to take a non-academic course. The mean of those who planned to take an academic course was 2.98 (neutral), and the mean of those who planned to take a non-academic course was 3.04.

Table 4.7

<u>Academic/Non-academic Courses by Degree of Stereotyping</u>

Group	n	Mean	t-value	p
		All Data		
Academic	424	2.98	0.71	0.48
Non-academic	106	3.04		
		Male Data		
Academic	227	3.33	1.51	0.13
Non-academic	80	3.15		
		Female Data		
Academic	197	2.55	0.95	0.34
Non-academic	26	2.69		

The data were then separated and analyzed for males and females. When the male data were tested for a significant difference those who chose academic courses had a mean of 3.33; those who chose non-academic, 3.15. The difference was not significant. For the female data, the mean of those who chose an academic course was 2.55. The mean for those who chose non-academic courses was 2.69. The difference was not significant.

PARTICIPATION IN MATHEMATICS COURSES

A comparison was made of the stereotyping of mathematics between those students who planned to enroll in AL 12 or GEO 12, and those students who planned to take no mathematics course in Grade 12. The data file was scanned in order to test the assumption that if students planned to enroll in more than one Grade 12 mathematics course they would enroll in AL 12, and one or two of GEO 12 and PS 12. If they chose only one Grade 12 mathematics course they would choose AL 12 or GEO 12. Scanning the data supported this assumption. Only 3 students planned to take PS 12 as their only Grade 12 mathematics course. One hundred and sixty students chose no mathematics course while 392 chose AL 12, or GEO 12, or AL 12 and GEO 12.

The data were also scanned in order to gather information concerning those students who appear to be following an accelerated program of mathematics enrollment in order to maximize their mathematical experience. For example, some students in semestered schools were taking AL 11 and AL 12 in Grade 11, and GEO 12 and PS 12 in Grade 12. The t-test performed to analyze Grade 12 choices would not contain data from these students. A scan of the data revealed only 3 students in this situation. Given the small number, there would be no appreciable effect if they were left out of the sample.

A t-test was performed on the data comparing the extent of stereotyping with mathematics plans for Grade 12. The results are listed in table 4.8. When all the data were used, the mean of the non-participants was 2.96, the mean of the participants was also 2.96. There was no significant difference.

When the data from males were thus compared those students who did not plan to take a mathematics course in Grade 12 had a mean of 3.19, while those who did had a mean of 3.29. There was no significant difference. The female data when analyzed displayed similar results. The mean of the non-participants was 2.73 and the mean of the participants was 2.56. This result was not significant but due to chance alone.

Table 4.8

Participation in Mathematics Courses by Degree of Stereotyping

	n	Mean	t-value	p
		All data		
Non-participants	160	2.96	.04	0.97
Participants	372	2.96		
		Male data		
Non-participants	80	3.19	0.9	0.37
Participants	203	3.29		
		Female data		
Non-participants	80	2.73	1.6	0.10
Participants	169	2.56		

SUMMARY OF FINDINGS PERTINENT TO EACH HYPOTHESIS

Hypothesis #1. Males in Grade 7 stereotype mathematics as a male domain.

Results. Males in Grade 7 do not stereotype mathematics as a male domain.

Hypothesis #2. Females in Grade 7 stereotype mathematics as a male domain.

Results. Females in Grade 7 do not stereotype mathematics as a male domain.

Hypothesis #3. Males in Grade 10 stereotype mathematics as a male domain.

Results. Males in Grade 10 do not stereotype mathematics as a male domain.

Hypothesis #4. Females in Grade 10 stereotype mathematics as a male domain.

Results. Females in Grade 10 do not stereotype mathematics as a male domain.

Hypothesis #5. There is no difference in the extent to which males and females stereotype mathematics as a male domain in Grade 7.

Results. The extent of stereotyping of mathematics as a male domain by females in Grade 7 was significantly different from the extent of stereotyping of mathematics by males in Grade 7.

Hypothesis #6. There is no difference in the extent to which males and females stereotype mathematics as a male domain in Grade 10.

Results. The extent of stereotyping of mathematics as a male domain by females in Grade 10 was significantly different from the extent of stereotyping of mathematics by males in Grade 10.

Hypothesis #7. There no difference in the extent of stereotyping of mathematics as a male domain between students who plan to enroll in non-academic mathematics courses in Grade 11 and students who plan to enroll in academic mathematics courses in Grade 11.

Results. Students who plan to enroll in non-academic mathematics courses in Grade 11 do not stereotype mathematics as a male domain differently than students who plan to enroll in academic mathematics courses in Grade 11.

Hypothesis #8. There no difference in the extent of stereotyping of mathematics as a male domain between males who plan to enroll in non-academic mathematics courses in Grade 11 and males who plan to enroll in academic mathematics courses in Grade 11.

Results. Males who plan to enroll in non-academic mathematics courses in Grade 11 do not stereotype mathematics as a male domain differently than males who plan to enroll in academic mathematics courses in Grade 11.

Hypothesis #9. There no difference in the extent of stereotyping of mathematics as a male domain between females who plan to enroll in non-academic mathematics courses in Grade 11 and females who plan to enroll in academic mathematics courses in Grade 11.

Results. Females who plan to enroll in non-academic mathematics courses in Grade 11 do not stereotype mathematics as a male domain differently than females who plan to enroll in academic mathematics courses in Grade 11.

Hypothesis #10 There is no difference in the extent of stereotyping of mathematics as a male domain between students who plan to enroll in a mathematics course in Grade 12 and students who do not plan to enroll in a mathematics course in Grade 12.

<u>Results</u>. Students who plan to enroll in a mathematics course in Grade 12 do not stereotype mathematics as a male domain differently than students who do not plan to enroll in a mathematics course in Grade 12.

<u>Hypothesis #11</u> There is no difference in the extent of stereotyping of mathematics as a male domain between males who plan to enroll in a mathematics course in Grade 12 and males who do not plan to enroll in a mathematics course in Grade 12.

<u>Results</u>. Males who plan to enroll in a mathematics course in Grade 12 do not stereotype mathematics as a male domain differently than males who do not plan to enroll in a mathematics course in Grade 12.

<u>Hypothesis #12</u> There is no difference in the extent of stereotyping of mathematics as a male domain between females who plan to enroll in a mathematics course in Grade 12 and females who do not plan to enroll in a mathematics course in Grade 12.

<u>Results</u>. Females who plan to enroll in a mathematics course in Grade 12 do not stereotype mathematics as a male domain differently than females who do not plan to enroll in a mathematics course in Grade 12.

CHAPTER FIVE

SUMMARY AND DISCUSSION

RESEARCH FINDINGS

The purpose of the research was to explore the relationships between the stereotyping of mathematics as a male or female domain by both male and female students in Grades 7 and 10 in British Columbia, and the extent and nature of the Grade 11 and Grade 12 mathematics plans of the Grade 10 students. In the research, a portion of the data for Grades 7 and 10 from the 1985 B.C. Mathematics Assessment was analyzed. The extent of stereotyping was measured using the responses to four items on an attitude scale. Future mathematics plans were assessed on the basis of student responses to a questionnaire. Statistical tests of significance used were the t-test and the Chi square test.

RESULTS

Males did not stereotype mathematics as a masculine domain at either Grade 7 or 10. The mean of the extent of stereotyping was neutral at both grade levels. Females did not stereotype mathematics as masculine at either grade level. The mean of the extent of stereotyping was slightly less than neutral at both grade levels.

These results contradict findings by Fennema et al. (1981) and Stein and Smithells (1969) which indicated that mathematics was regarded as masculine by both sexes.

Although neither sex strongly stereotyped mathematics as either masculine or feminine, there was a significant difference in the extent of stereotyping between males and females, at both Grade 7 and 10. Females were significantly less likely to stereotype mathematics as masculine than males in Grades 7 and 10.

The mean of the extent of stereotyping for males increased slightly from Grade 7 to Grade 10. The mean of the extent of stereotyping for females was identical for both Grade 7 and 10, in contrast to the findings of Fennema and Sherman (1977) that girls stereotype mathematics as a male domain less as they become more mature.

When future mathematics plans of Grade 10 students for Grades 11 and 12 were considered, few differences in the extent of stereotyping were found. When all data were considered there was a significant difference in the stereotyping of those students who chose CSC 11 as compared to those who did not choose CSC 11. When the male data alone were considered, those males who chose AL 11 stereotyped mathematics as masculine significantly more than those males who did not choose AL 11. Those males who chose TM 11 stereotyped mathematics as masculine significantly less than those males who did not choose TM 11. When the female data were considered alone, there were no significant differences between those who chose a particular course and those who did not. Overall, although there were a few significant differences, there was no general trend in the stereotyping of students who chose a course over those who did not choose the same course.

The second area of research involved two comparisons. The first comparison was between the students who enrolled in academic courses and non-academic courses in Grade 11. The data were considered again in three separate groups, all data, male data and female data. There were no significant differences in the extent of stereotyping by students who chose an academic course and those who chose a non-academic course. The differences which occurred were the result of chance alone.

The second comparison was between students who planned to enroll and students who did not plan to enroll in a Grade 12 mathematics course. When overall data of planned participation in a Grade 12 course were examined, no difference in stereotyping was detected between those who planned to enroll in a Grade 12 course and those who did not. When the data were separated into male and female, similar results occurred. This finding contradicts those of Sherman (1982), that girls who attempt more mathematics stereotype mathematics as masculine to a greater extent than those who do not.

There were no significant relationships between the extent of stereotyping of mathematics measured and future mathematics plans of males and females.

CONCLUSIONS

Students in B.C. schools do not appear to consider mathematics a masculine domain. The results indicate that stereotyping of mathematics in junior high school is generally not evident. If anything, girls tend to consider mathematics less of a masculine pursuit, and these attitudes do not change as girls become more mature. Boys consider mathematics as an appropriate pursuit for both sexes.

With respect to stereotyping mathematics as masculine there were no significant differences between students who planned to take academic courses and those students who planned to take non-academic courses. Similarly there were no significant differences between students who planned to take a mathematics course when it became an elective subject and those who did not.

Students in British Columbia high schools appear to view mathematics as a pursuit equally suitable to both males and females. They do not appear to sex type mathematics as a masculine domain.

LIMITATIONS OF THE STUDY

One of the limitations of this study concerns one of the measurement tools, the four items on the attitude scale. These items may not be measuring stereotyping of mathematics as accurately as desired. When answering a scaled question with possible high face validity such as this, both girls and boys may respond with what they believe are socially acceptable answers since the media and other sources continually provide the message that females are to be considered equal to males.

Another limitation of the study is the differences which exist between what mathematics courses students plan to enroll in, and their actual enrollment. The 1981 assessment indicated many fewer girls than boys enrolled in Grade 12. It would be interesting to compare how many of these particular students who plan to take Algebra 12 or Geometry 12 actually do so.

SUGGESTIONS FOR FURTHER RESEARCH

At a time when the mathematics curriculum, K-12, is being revised, it seems appropriate to look at the materials and curriculum being written for evidence of sex-role stereotyping. Research has shown that although there have been attempts by publishers to display equal numbers of men and women or use gender non-specific terms, these do not reduce sex role stereotyping of career opportunities unless men and women are shown in cross sex appropriate roles.

A related area which has not been extensively researched, is the effect of female and male role models as mathematics teachers on the extent of stereotyping mathematics as a male domain. Other variables which could be considered at the same time are the supposedly greater social orientation of girls, the effect of puberty, and the effect of sex role conflict on achievement. As previously mentioned, a comparison of enrollment plans and actual enrollment of males and females in future mathematics courses might also produce interesting results.

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