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The Effects of Teachers of Both Sexes on the Achievement of Male and Female Mathematics Students

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THE EFFECTS OF TEACHERS OF BOTH SEXES ON THE ACHIEVEMENT OF MALE AND FEMALE MATHEMATICS STUDENTS

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CHAPTER I

THE PROBLEM

Introduction

For many years, males of all ages seemed to think that they were better in mathematics than females; and if it were shown that the women were as good in pure mathematics, then the males felt they certainly were better in applied mathematics. During childhood, both boys and girls feel that their sex is better at everything, including mathematics. But after childhood, many women agree with the men's attitude that males are better in mathematics. This attitude of women is shown partly in the relative percentages of men and women in upper level, elective, high school and college mathematics courses (Sells, 1973).

This study was prompted by the disproportionate number of men mathematics teachers from the junior high level up. For instance, in Fayette County, Illinois, there are presently 12 men and 3 women teaching mathematics in grades 7 - 12 (Staff, 1975). In the Educational Service Region serving the Illinois counties of Clark, Coles, Cumberland, and Moultrie, there are 43 men and 18 women teaching mathematics in these grades (Miller, 1975). Eastern Illinois University's graduate mathematics faculty contains 19 men and no women.

The opinions expressed by many women and their children also confirm that women feel that males are better in mathematics. For example, a mother of one of the writer's students expressed concern about her daughter's science grade. When she was shown the work, the mother replied "If it required math, she can't do it. I always had trouble with math too." Many mothers were concerned that their daughters pass all of their subjects, but they really did not care if they did well in mathematics. But one woman's concern, as told to the writer, about her son seemed somewhat typical. She said, "I'd like for him to do well in everything, but I particularly want him to do well in math and science." Although students sometimes misrepresent their parents, several have commented to the writer that "Mom can't do math" or "Dad always does all the figuring." There was no reason to doubt the children's comments, especially since some of the mothers had said the same thing.

Despite the opinions and attitudes expressed above, there is no conclusive evidence to show that men are naturally better in mathematics. The National Assessment of Educational Progress, "Male - Female Achievement in Eight Learning Areas" (undated) showed males from about the sixth grade on had higher achievement as measured by tests, than females. Papers written by Elizabeth Haven (1972) and by Lynn Fox (1976) gave several possible reasons for the lower mathematical achievement of females. If all the discriminating factors were corrected,

Haven and Fox as well as several other writers mentioned in Chapter II, expressed the opinion that females could do as well in mathematics as males.

Statement of the Problem

Although many causes may be hypothesized for the lower achievement of females in mathematics, some are very difficult to measure. According to individuals quoted in Sells' (1973) study and to other studies such as those made by Haven (1972), Fox (1976), and Ernest (1975), some problems encountered by girls with average or above average ability in mathematics are caused by lack of encouragement from parents, peers, counselors, and teachers. Another problem, according to Haven (1972), is that girls often see mathematics as a difficult subject which will not benefit them in their career choice. According to many writers such as Fox (1976), many people consider mathematics as masculine, and thus unfeminine, subject.

In this investigation, only one aspect of this problem is included. That is the relationship of the teacher's and student's sex to student achievement, as measured by semester grades, in mathematics.

Significance of the Problem

As stated earlier in this paper, the majority of mathematics teachers from about grade seven on up are men. Some studies, such as those

done by the National Assessment of Educational Progress (1975), have shown that men presently have more ability than women, on the average, to solve most types of mathematics problems. Men are even more successful than women in solving most consumer related problems. Other studies, such as those done by Sells (1973) and Fox (1976), have found that females are often discouraged by male teachers from studying mathematics. The simple lack of women in mathematics, described earlier, could be enough to convince many students that women just do not belong in mathematics. Yet the American population is at least 50% female, and women as well as men need to be able to correctly solve mathematics problems in many everyday situations. People of each sex need to know how to determine the best buy when shopping, how to find percentages, and how to do numerous other mathematical problems. Since many women now are choosing careers (instead of, or in addition to, being homemakers), they should be encouraged to try the field in which they are most capable and interested, even if the field has been traditionally for men.

Both men and women need to know mathematics. Therefore, it is important that they learn it regardless of the sex of their mathematics teachers. If the sex of the teacher is found to presently have an adverse affect on the achievement of either male or female students, it is the hope of this writer that teachers will change their teaching methods

in such a way that each student will be encouraged to achieve at his or her highest possible level.

Method of the Study

To collect information, 70 questionnaires were sent or distributed to mathematics teachers in east-central and southern Illinois. A total of 29 female and 41 male mathematics teachers received questionnaires. Eighteen women and 24 men returned the questionnaire. This represented 62.1% of the women and 58.5% of the men to whom questionnaires were distributed. The respondents represented 24 schools.

The method of choosing teachers was not controlled. Many names were found in two school directories, representing 6 counties, published by superintendents of the educational service regions for those counties. Other teachers were from other regions and were personally given a copy of the questionnaire and asked to complete it. School sizes varied from those with one mathematics teacher who also taught some other subject, to those with as many as five or more mathematics teachers. The respondents taught in schools that, on the average, had two or three mathematics teachers.

After all information was gathered, each course, or grade level in junior high, was divided into two groups. One group contained the semester grades, by sex, for students of men mathematics teachers; the other group contained the same information for women mathematics

teachers. Grades of male students, as received from men and women teachers, and the grades of female students received from teachers of each sex were recorded separately.

One major problem encountered in treating the data statistically was the low number of students in upper level mathematics courses. In fact, one school either did not offer, or did not have any demand for, a senior level mathematics course.

Hypotheses

There were four hypotheses tested in this study.

H_1 There is no significant difference between the grades given by male mathematics teachers to male and female students.

H_2 There is no significant difference between the grades given by female mathematics teachers to male and female students.

H_3 There is no significant difference between the mathematics grades of male students who have male teachers and those who have female teachers.

H_4 There is no significant difference between the mathematics grades of female students who have male teachers and those who have female teachers.

CHAPTER II

Review of Literature

Many studies have shown that males do better than females in most areas of mathematical performance. The difference first appeared in the upper elementary or junior high school grades and continued through adulthood. Although neither sex had a clear advantage in computational ability, males tended to outperform females in word problems and more difficult exercises (National Assessment of Educational Progress, undated, p. 27). This was true even in most consumer areas such as household problems and cost comparisons (National Assessment of Educational Progress, 1975, pp. 2, 15).

Various writers suggested several reasons for differences in mathematical performance. In one study, Doyal and Forsyth (1972) found that anxiety interfered with the ability of girls to solve problems, while high anxiety facilitated the performance of boys. Under low levels of anxiety, girls were motivated to improve performance, but boys were not. This might explain some cited differences in ability since most tests were timed and could have easily increased anxiety.

In another study, a group of 34 male and 34 female college students were given one of two similar problems. One dealt with the cost of a dress made of 4 yards satin and 5 yards lace; the other dealt with

the brokers fee in 4 purchases and 5 sales of stock. Graf and Riddel (1972) found no significant differences in the number of correct results by males or females in either problem. It took males about the same amount of time to solve either problem. And both males and females solved the dress problem in about the same amount of time. But females took much longer to solve the stock problem. This data lends some support to the belief of Graf and Riddel that females have as much power as males with problems, but that females take longer to solve them. They thought this was because of females' lack of faith in their ability to do the problems and to their perception of the problems as being more difficult than the males' perception of the same problems.

This idea of difference in attitude toward mathematics by males and females has been given by many authors. Fennema (1974a) found that college age males have a more positive attitude and a more positive self-concept than females. She also found that females often feel inadequate when faced with a variety of mathematical situations, and she thus concluded that females tend to avoid mathematics whenever possible. She felt this caused their mathematical achievement to suffer because of lack of practice of mathematical skills. Dwyer (1974) found that sex differences in arithmetic achievement in grades 2, 4, 6, 8, 10, and 12 are more a function of the child's perception of arithmetic as sex-appropriate or sex inappropriate than of the child's biological sex, individual preference for masculine or feminine role, or his liking or disliking of the subject. She cited an article in which it was found that sex difference in problem solving performance diminished when problems were made less appropriate.

to the masculine sex. Hilton and Berglund (1970) found that after fifth grade, when boys started pulling ahead of girls in mathematics, that there emerged a parallel difference in the percentages of boys and girls who perceived mathematics as interesting and as likely to be helpful in earning a living. Sells (1973), in a study done at Berkeley, found that attitudes towards mathematics and mathematics' teachers were reasons that many girls gave for not choosing to take a fourth year of mathematics in high school.

Fox (1976) found in her studies that males and females who have high academic potential differ drastically in their career interests and aspirations, values, and perception of the importance of mathematics for their future. Since more boys see mathematics and science as related to their future careers, it is not surprising that they are more likely to take advanced mathematics and science courses in high school. Students who have taken extra courses in mathematics and science are more likely to show higher test scores in these areas than students who have had few of these courses. Sells (1973) also found that many fewer women than men at Berkeley had had the four years of high school mathematics required for entrance into the prerequisites for all areas except the "traditional female" fields of humanities, social sciences, education, and social welfare.

Many studies seemed to indicate that encouragement from parents, teachers, and peers influenced students to, or not to, study advanced

mathematics. Again, there is the accepted belief that those who study more mathematics become better in it. Haven (1972) found that encouragement was more effective in persuading girls to take advanced mathematics courses than the other factors in her study. Reasons given by individuals in Sells' (1973) study for success or failure in advanced mathematics or for not taking advanced mathematics at all in high school were parental and teacher encouragement, or lack of encouragement or even discouragement. Some individuals in the study cited counselors who discouraged females to study mathematics. Ernest (1975) cited a woman mathematician who felt that the attitude of a young woman's father, including that of the mathematician's father, influenced the academic achievement of a woman. Fox (1976) cited evidence that parents of boys are more likely than parents of girls to notice and foster their child's scientific interests. She also found that creative women mathematicians indicate encouragement from appropriate female role-models and parental support as important factors in their development. Not only did she find lack of home support, but she also found that teachers believe boys are better at mathematics than girls.

Ernest (1975) found in his studies that even many women elementary school teachers who liked teaching mathematics felt that boys do better in mathematics than do girls. Fox (1976) found that "gifted girls who attempt to accelerate their mathematics education may be ridiculed or discouraged by insensitive teachers or peers. Clearly, many girls anticipate rejection for appearing different by moving ahead in mathematics."

Mathematics and abilities related to mathematics are often sex stereotyped as being masculine. Fennema (1974b) mentioned that boys often have better spacial ability than girls. She linked this to sex stereotyped play in which boys are encouraged to use and develop perception, such as in ballgames, playing with blocks, or building models, and in which girls are encouraged to play in ways which do not develop spacial perception such as playing with paper dolls or toy dishes. This better spacial ability gives boys an edge over girls in some areas of mathematics. Fennema went so far as to encourage her readers to look for and avoid sex stereotyping in teaching their classes, with regard to their expectations, encouragement of students, and use of instructional materials.

Any review of mathematics textbooks shows that some are very guilty of sex stereotyping. Males are involved in most of the action, fun, important, and difficult things both in pictures and in word problems. An example is the seventh grade text Harbrace Mathematics (Harcourt, Brace, & World , 1967). In the first 25 pages, twelve males and two females are pictured. Also pictured are screwdrivers, boats, fishing equipment, and a few neutral mathematical pictures. There are no pictures of "typical" feminine things. In Algebra and Trigonometry (Addison-Wesley Publishing Company, Inc. 1967) the only picture in the first ten pages of chapter two is of a man. (The first chapter was not used since the first 15 pages had no pictures and few, if any, word problems.) In the word problems, all that were not neutral were masculine.

Some of these include a problem concerning the mixture of antifreeze in a radiator, one on sea water, and several distance-rate-time non-feminine problems.

Sex stereotyping is made worse by the percentage of men and women mathematics teachers. From sixth or seventh grade on, most mathematics and science teachers are men (science is the main user of more difficult mathematics in high schools). According to some studies, such as the one made by Sells (1973), many men teachers encourage female students to continue in mathematics, but many others discourage or ridicule female mathematics students. It is also possible that the personalities of students and teachers could somehow be related to any lower achievement of females in mathematics. No information was found about this for mathematics teachers, but one study showed significant personality differences between men and women science teachers. This study found that women science teachers tend to be more out-going, warm-hearted, trusting, and participating individuals than their reserved detached, suspicious, and aloof male counterparts (Main & Hounshell, 1973, pp. 67, 71). This combined with Fox's (1976) statement that female students are often ridiculed or discouraged by insensitive teachers, may show why they might do less well in science classes with men teachers.

As there are many similarities between mathematics and science teachers, many teachers having taught in the other field, some of these same differences might discourage female mathematics students

with male teachers. An aloof, detached, and suspicious teacher definitely would not improve a female student's already low self-concept; Fennema (1974b) found that more women have a low self-concept than men. A suspicious teacher might create high anxiety. Doyal and Forsyth (1972) found that high anxiety interferes with the performance of girls and increases the performance of boys. Aloof teachers tend to give less personal encouragement. The lack of encouragement is one thing that Haven (1972) and others found important in a girl's choice to take or not take more advanced mathematics courses.

No one knows if males are inherently more capable than females in doing mathematics. However, Ernest (1975) found no sex difference in the liking, or disliking, of mathematics in grades two to twelve. The lack of difference surprised him since he thought that girls liked mathematics less than boys. Several factors such as social opinions of mathematics; peer, parental, and teacher encouragement of mathematics students; and attitudes of students toward their mathematical ability and toward their personal self-worth do presently adversely affect the performance of many female students.

It takes a lot of time and effort from many people to change attitudes. However, articles cited in this review might influence readers. Another article, in the Sunday edition of the Springfield newspaper, The Illinois State Journal-Register (1976), brought the topic to more casual readers than the other articles which are found mostly in education-oriented journals and magazines. The article tried to show that men are not

better than women in mathematics. Fennema and Ernest, who have been cited in this review were two of the people quoted in the UPI article. And although there is no way to know if the sexes are equal in their mathematical ability, articles of this type found in the daily newspaper might encourage a timid girl who is considering mathematics or might reassure her doubting parents. In addition, as Fennema (1974b) stated, it is up to teachers to try to see that each student in their classes do as well in mathematics as he or she is capable.

CHAPTER III

RESEARCH PROCEDURES

Collection of Data

A questionnaire was sent to mathematics teachers asking for their cooperation in this study. They were asked to give the number of male students and the number of female students receiving each letter grade for Fall Semester 1975 in each mathematics course they taught. The teachers who were selected to receive questionnaires taught mathematics in grades seven through twelve in Illinois public schools. Many of the teachers were listed in the school directory for the educational service region serving Bond and Fayette Counties (Staff, 1975) or the directory of the region serving Clark, Coles, Cumberland, and Moultrie Counties (Miller, 1975). In addition to teachers whose names were published in these directories, the writer personally distributed copies of the questionnaire to any mathematics teachers who indicated they were willing to participate in the study. There was no attempt to randomize the selection of teachers asked to cooperate except to include as many women as possible in the survey. The only returned questionnaire that was not used was from a special education mathematics teacher.

Questionnaires were sent or distributed to 29 female and 41 male mathematics teachers. Eighteen women (62.1%) and 24 men (58.5%)

returned completed questionnaires. The total percentage of returns was 60%.

Information from each questionnaire was transferred to one or more tables. Two tables were made for each course. One was used for classes with male teachers; the other was used for classes with female teachers. The number of male and female students who received each grade in a particular class was put on the appropriate table for that course. The data for each teacher in a table was separated from the corresponding data of the other teachers. These tables were then simplified so that the revised tables contained only the total number of male and female students who received each letter grade from teachers of the same sex in a particular course.

Two additional tables were made for each course. One table included the number of students of each sex who received each letter grade from male teachers. The other included the same information about students with female teachers.

Statistics

A chi-square test was used to evaluate the hypotheses of this study. According to Siegel (1956), the chi-square test should be used when frequencies in discrete categories constitute the data of research, when the groups are independent, and when the expected frequencies in each cell are not too small. Fewer than 20 percent of the cells should have an expected frequency of less than five, and no cell should have an

expected frequency of less than one. All of these conditions were met in most cases. In a few instances, those in which there were few students in a particular course and those in which few students made low grades, the expected frequency was less than five in more than 20 percent of the cells. However, none of these instances yielded significant results. No other statistic was found which would correct the few cases of low expected frequencies and yet fit the majority of the data as well. Chi-square was also a good test to use because it is a common test; it is easy to use and understand.

Some courses with different names were grouped together. Particularly common were various names for a lower level freshman mathematics course. In some schools, it was called General Mathematics, in others, it was Consumers Math, Practical Math, Basic Math, or Introduction to High School Math. Senior level mathematics courses also had a variety of names such as Math IV, Senior Math, Trigonometry, Calculus, Analysis and Trigonometry, and Advanced Math. In both cases, these courses were grouped and given a single name, General Mathematics for the former and Senior Mathematics for the latter.

In order to use the chi-square test more effectively, some regrouping of letter grades was needed in some courses because of the low number of students in these courses and the relatively low number who received poor grades. Since there were few failures in these courses, the combining of the lower grades should have no significance on the outcome of the study. A significance level of $p < .05$ was used in this study.

In seventh grade mathematics, there was only one significant difference. This was in grades given by female teachers and is shown in Table 2. Results of grades compiled for female students approached a significant difference and are shown in Table 4. Table 1 shows the letter grades received by male and female students from male teachers and Table 3 shows the number of male students who received each grade from male and female teachers. There is no significant difference in the data in Table 1 or in Table 3. The seventh grade mathematics information came from six male and seven female teachers.

TABLE I

NUMBER OF MALE AND FEMALE SEVENTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS.

	A	B	C	D	EorF	Total
male students	26	29	55	38	14	162
female students	24	35	35	33	5	132
Total	50	64	90	71	19	294

chi-square 6.71087, df=4, Not significant.

TABLE 2

NUMBER OF MALE AND FEMALE SEVENTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D	EorF	Total
male students	30	48	62	51	16	207
female students	44	54	41	23	5	167
Total	74	102	103	74	21	374

chi-square=19.58560, df=4. Significance $p < .001$

TABLE 3

NUMBER OF MALE SEVENTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	26	29	55	38	14	162
female teachers	30	48	62	51	16	207
Total	56	77	117	89	30	369

chi-square=1.96648, df=4. Not significant

TABLE 4

NUMBER OF FEMALE SEVENTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	24	35	35	33	5	132
female teachers	44	54	41	23	5	167
Total	68	89	76	56	10	299

chi-square=8.21348, df=4. Significance $p < .10$

All data compiled for regular eighth grade mathematics classes was significant. Table 5 shows letter grades given by male teachers. Table 6 shows letter grades given by female teachers. Table 7 shows letter grades received by male students. Table 8 shows letter grades received by female students. This data was compiled from information supplied by seven male and nine female teachers.

TABLE 5

NUMBER OF MALE AND FEMALE REGULAR EIGHTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D	EorF	Total
male students	28	62	82	73	37	282
female students	45	74	80	47	11	257
Total students	73	138	182	120	48	539

chi-square=23.65041, df=4. Significance $p < .0005$.

TABLE 6

NUMBER OF MALE AND FEMALE REGULAR EIGHTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D	EorF	Total
male students	30	55	38	36	20	179
female students	53	42	35	25	10	165
Total students	83	97	73	61	30	344

chi-square=13.00777, df=4. Significance $p < .025$.

TABLE 7

NUMBER OF MALE REGULAR EIGHTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	28	62	82	73	37	282
female teachers	30	55	38	36	20	179
Total	58	117	120	109	57	461

chi-square=11.82836, df=4. Significance $p < .025$.

TABLE 8

NUMBER OF FEMALE REGULAR EIGHTH GRADE MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	45	74	80	47	11	257
female teachers	53	42	35	25	10	162
Total	98	116	115	72	21	422

chi-square=14.49104, df=4. Significance $p < .01$.

No results compiled for eighth grade Algebra I students were significant. Table 9 shows letter grades given by male teachers. Table 10 shows letter grades given by female teachers. Table 11 shows letter grades received by male students. Table 12 shows letter grades received by female stuents. One male and two female teachers taught this course.

TABLE 9

NUMBER OF MALE AND FEMALE EIGHTH GRADE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C, D, EorF	Total
male students	2	3	2	7
female students	5	10	4	19
Total students	7	13	6	26

chi-square=.23272, df=2. Not significant.

TABLE 12

NUMBER OF FEMALE EIGHTH GRADE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C, D, EorF	Total
male teachers	5	10	4	19
female teachers	7	10	0	17
Total	12	20	4	36

chi-square=4.23529, df=2. Not significant.

In General Mathematics there was one significant difference. This was in the grades given by male teachers and is shown in Table 13. Results of grades compiled for female students approached significance and are shown in Table 16. Results of grades given by female teachers and of grades received by male students were not significant. These results are shown in Tables 14 and 15 respectively. This data was compiled from information supplied by 12 male and six female teachers.

TABLE 10

NUMBER OF MALE AND FEMALE EIGHTH GRADE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C, D, EorF	Total
male students	7	13	5	25
female students	7	10	0	17
Total students	14	23	5	42

chi-square=4.01309, df=2. Not significant.

TABLE 11

NUMBER OF MALE EIGHTH GRADE ALBEGRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C, D, EorF	Total
male teachers	2	3	2	7
female teachers	7	13	5	25
Total	9	16	7	32

chi-square=.27574, df=2. Not significant.

TABLE 13

NUMBER OF MALE AND FEMALE GENERAL MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D	EorF	Total
male students	10	35	83	57	32	217
female students	11	44	49	37	17	158
Total	21	79	132	94	49	375

chi-square=9.63347, df=4. Significance $p < .05$.

TABLE 14

NUMBER OF MALE AND FEMALE GENERAL MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D	EorF	Total
male students	7	21	28	18	8	82
female students	11	14	11	10	5	51
Total	18	35	39	28	13	133

chi-square=5.76479, df=4. Not significant.

TABLE 15

NUMBER OF MALE GENERAL MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	10	35	83	57	32	217
female teachers	7	21	28	18	8	82
Total	17	56	111	75	40	299

chi-square=6.29094, df=4. Not significant.

TABLE 16

NUMBER OF FEMALE GENERAL MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS.

	A	B	C	D	EorF	Total
male teachers	11	44	49	37	17	158
female teachers	11	14	11	10	5	51
Total	22	58	60	47	22	209

chi-square=9.29684, df=4. Significance $p < .10$.

No results compiled for Prealgebra courses were significant. This data is shown in Tables 17, 18, 19, and 20. Data was compiled from information supplied by four male and one female teacher.

TABLE 17

NUMBER OF MALE AND FEMALE PREALGEBRA STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D	EorF	Total
male students	9	17	15	6	3	50
female students	9	21	17	4	4	55
Total students	18	38	32	10	7	105

chi-square=.85275, df=4. Not significant.

TABLE 18

NUMBER OF MALE AND FEMALE PREALGEBRA STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C, D, E, F	Total
male students	3	5	4	12
female students	5	5	3	13
Total students	8	10	7	25

chi-square=.60382, df=2. Not significant.

TABLE 19

NUMBER OF MALE PREALGEBRA STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	9	17	15	6	3	50
female teachers	0	3	5	4	0	12
Total	9	20	20	10	3	62

chi-square=6.26200, df=4. Not significant.

TABLE 20

NUMBER OF FEMALE PREALGEBRA STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	9	21	17	4	4	55
female teachers	0	5	5	3	0	13
Total	9	26	22	7	4	68

chi-square=5.80957, df=4. Not significant.

In Albegra I classes, there was only one significant difference. This was in grades given by male teachers and shown in Table 21. Results of grades compiled for male students approached significance and are shown in Table 23. The results of grades given by female teachers, shown in Table 22, and the results of grades received by female students, shown in Table 24, are not significant. This information was supplied by twelve male and six female teachers.

TABLE 21

NUMBER OF MALE AND FEMALE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D	EorF	Total
male students	26	57	78	61	27	247
female students	40	84	89	46	8	267
Total	66	141	165	107	35	514

chi-square=20.83458, df=4. Significance $p < .0005$.

TABLE 22

NUMBER OF MALE AND FEMALE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D, E, F	Total
male students	20	35	45	32	132
female students	27	38	51	33	149
Total	47	73	96	65	281

chi-square=.52969, df=3. Not significant.

TABLE 23

NUMBER OF MALE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	26	57	76	61	27	247
female teachers	20	35	45	27	5	132
Total	46	92	121	88	32	379

Chi-square=8.09812, df=4. Significance $p < .10$.

TABLE 24

NUMBER OF FEMALE ALGEBRA I STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	40	84	89	46	8	267
female teachers	27	38	51	31	2	149
Total	67	122	140	77	10	416

chi-square=3.51465, df=4. Not significant.

No results compiled for Geometry classes were significant. Results of grades given by male teachers, those given by female teachers, those received by male students, and those received by female students are shown in Tables 25, 26, 27, and 28 respectively. These Geometry classes were taught by ten male and five female teachers.

TABLE 25

NUMBER OF MALE AND FEMALE GEOMETRY STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D, E, F	Total
male students	45	61	46	21	173
female students	40	66	26	13	145
Total	85	127	72	34	318

chi-square=5.50616, df=3. Not significant.

TABLE 26

NUMBER OF MALE AND FEMALE GEOMETRY STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D, E, F	Total
male students	11	22	16	6	55
female students	17	27	10	3	57
Total	28	49	26	9	112

chi-square=4.14614, df=3. Not significant.

TABLE 27

NUMBER OF MALE GEOMETRY STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D, E, F	Total
male teachers	45	61	46	21	173
female teachers	11	22	16	6	55
Total	56	83	62	27	228

chi-square=1.02089, df=3. Not significant.

TABLE 28

NUMBER OF FEMALE GEOMETRY STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D, E, F	Total
male teachers	40	66	26	13	145
female teachers	17	27	10	3	57
Total	57	93	36	16	202

chi-square=.81462, df=3. Not significant.

Results of Algebra II grades received by male students approached significance as shown in Table 31. None of the other results for Algebra II classes was significant. Results of grades given by male teachers, those given by female teachers, and those received by female students are shown in Tables 29, 30, and 32 respectively. This information was compiled from data supplied by ten male and six female teachers.

TABLE 29

NUMBER OF MALE AND FEMALE ALGEBRA II STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D, E, F	Total
male students	21	35	39	24	119
female students	21	34	27	12	94
Total	42	69	66	36	213

chi-square=3.30760, df=3. Not significant.

TABLE 30

NUMBER OF MALE AND FEMALE ALGEBRA II STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D, E, F	Total
male students	12	29	31	6	78
female students	24	35	29	12	100
Total	36	64	60	18	178

chi-square=3.97072, df=3. Not significant.

TABLE 31

NUMBER OF MALE ALGEBRA II STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D, E, F	Total
male teachers	21	35	39	24	119
female teachers	12	29	31	6	78
Total	33	64	70	30	197

Chi-square=6.47897, df=3. Significance $p < .10$.

TABLE 32

NUMBER OF FEMALE ALGEBRA II STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D, E, F	Total
male teachers	21	34	27	12	94
female teachers	24	35	29	12	100
Total	45	69	56	24	194

chi-square=.10045, df=3. Not significant.

No results compiled for Senior Mathematics courses were significant. Results of grades given by male teachers, those given by female teachers, those received by male students, and those received by female students is shown in Tables 33, 34, 35, and 36 respectively. The results were compiled from information supplied by six male and four female teachers.

TABLE 33

NUMBER OF MALE AND FEMALE SENIOR MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C, D, E, F	Total
male students	10	15	10	35
female students	5	8	4	17
Total	15	23	14	52

chi-square=.15651, df=2. Not significant.

TABLE 34

NUMBER OF MALE AND FEMALE SENIOR MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D, E, F	Total
male students	7	11	3	3	24
female students	6	3	3	0	12
Total	13	14	6	3	36

chi-square=4.10440, df=3. Not significant.

TABLE 35

NUMBER OF MALE SENIOR MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D, E, F	Total
male teachers	10	15	9	1	35
female teachers	7	11	3	3	24
Total	17	26	12	4	59

chi-square=3.20537, df=3. Not significant.

TABLE 36

NUMBER OF FEMALE SENIOR MATHEMATICS STUDENTS RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C, D, E, F	Total
male teachers	5	8	4	17
female teachers	6	3	3	12
Total	11	11	7	29

Chi-square=1.69481, df=2. Not significant.

Totals of all courses combined were compiled, and the results were significant in each of the four cases. Results of grades given by male teachers had a significant difference of $p < .0005$ and are shown in Table 37. Results of grades given by female teachers had a significant difference of $p < .0005$ and are shown in Table 38. Results of grades compiled for male students had a significant difference of $p < .005$ and are shown in Table 39. Results of grades compiled for female students had a significant difference of $p < .0005$ and are shown in Table 40.

TABLE 37

NUMBER OF MALE AND FEMALE STUDENTS IN ALL COURSES RECEIVING EACH LETTER GRADE FROM MALE TEACHERS

	A	B	C	D	EorF	Total
male students	177	314	409	277	117	1294
female students	200	376	706	189	49	1520
Total	377	690	1115	466	166	2814

chi-square = 113.13794, df = 4. Significance $p < .0005$.

TABLE 38

NUMBER OF MALE AND FEMALE STUDENTS IN ALL COURSES RECEIVING EACH LETTER GRADE FROM FEMALE TEACHERS

	A	B	C	D	EorF	Total
male students	134	237	232	148	51	802
female students	189	228	185	105	24	731
Total	323	465	417	253	75	1533

chi-square=28.63829, df=4. Significance $p < .0005$.

TABLE 39

NUMBER OF MALE STUDENTS IN ALL COURSES RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	177	314	409	277	117	1294
female teachers	134	237	232	148	51	802
Total	311	551	641	425	168	2096

chi-square=16.06125, df=4. Significance $p < .005$.

TABLE 40

NUMBER OF FEMALE STUDENTS IN ALL COURSES RECEIVING EACH LETTER GRADE FROM MALE AND FEMALE TEACHERS

	A	B	C	D	EorF	Total
male teachers	200	376	706	189	49	1520
female teachers	189	228	185	105	24	731
Total	389	604	891	294	73	2251

chi-square=110.85102, df=4. Significance p <.0005.

For tables of all courses combined, grade point averages, A=4.0, were also computed. The average gradepoint of male students, as received from male teachers, was 2.1213. The average gradepoint of female students, as received from male teachers, was 2.3217. The average gradepoint of male students, as received from female teachers, was 2.3180. The average gradepoint of female students, as received from female teachers, was 2.6197.

CHAPTER IV

RESEARCH RESULTS

Analysis of Findings

An analysis of the findings relevant to the hypotheses stated in Chapter I are presented in this chapter. Tests of each hypotheses for each course and for the combination of all courses are presented.

H_1: There is no significant difference between the grades given by male mathematics teachers to male and female students.

This hypothesis cannot be rejected from results of data for seventh grade, eighth grade, Algebra I, Prealgebra, Geometry, Algebra II, or Senior Mathematics. H_1 can be rejected for regular eighth grade classes, $p < .0005$, for General Mathematics, $p < .05$, and for high school Algebra 1, $p < .0005$. Using A=4.0, male teachers gave regular eighth grade male students an average grade point of 1.897, and they gave female students an average of 2.370. In General Mathematics courses with male teachers, male students received an average grade point of 1.696, and female students received an average of 1.968. Male high school Algebra I students with male teachers received a grade point average of 1.976 while female students with the same teachers received an average of 2.382. When all courses are combined, H_1

can be rejected with $p < .0005$. In all courses, male teachers gave male students an average gradepoint of 2.1213, and they gave female students an average gradepoint of 2.3217.

H_2 There is no significant difference between the grades given by female mathematics teachers to male and female students.

This hypothesis cannot be rejected from results of data for eighth grade Algebra I, General Mathematics, Prealgebra, high school Algebra I, Geometry, Algebra II, or Senior Mathematics. H_2 can be rejected for both seventh grade mathematics, $p < .001$, and regular eighth grade mathematics, $p < .025$. Male seventh grade students with female teachers received a grade point average of 2.121; female students with the same teachers received an average of 2.653. Female teachers gave regular eighth grade male students an average gradepoint of 2.218, and they gave female students an average of 2.624. For all courses combined, H_2 can be rejected with p .0005. Male students with female teachers received an average gradepoint of 2.3180. Female students with female teachers received an average gradepoint of 2.6197.

H_3: There is no significant difference between the mathematics grades of male students who have male teachers and those who have female teachers.

This hypothesis cannot be rejected from results of data for seventh grade mathematics, eighth grade Algebra I, General Mathematics, Prealgebra, Geometry, or Senior Mathematics. H_3 can be rejected

for regular eighth grade mathematics courses with $p < .025$. Male students with male mathematics teachers received a gradepoint average of 1.897, while those with female teachers received an average of 2.218. For high school Algebra I and Algebra II, data results approached significance for rejection with $p < .10$. The gradepoint average of male high school Algebra I students who had male mathematics teachers was 1.976, while the average of those with female teachers was 2.288. Male Algebra II students with male teachers received an average gradepoint of 2.429; those with female teachers received an average of 2.590. For all courses combined, H_3 can be rejected with $p < .005$. Male mathematics students with male teachers received an average gradepoint of 2.1213. Male mathematics students with female teachers received an average gradepoint of 2.3180.

H_4: There is no significant difference between the mathematics grades of female students who have male teachers and those who have female teachers.

This hypothesis cannot be rejected from results of data for eighth grade Algebra I, Prealgebra, high school Algebra I, Geometry, Algebra II, or Senior Mathematics. H_4 can be rejected from results of data for regular eighth grade mathematics with $p < .01$. Female students with male mathematics teachers received an average gradepoint of 2.370; those with female mathematics teachers received an average of 2.624. For seventh grade and General Mathematics, data results approached significance for rejection with $p < .10$. Female seventh grade students

with male mathematics teachers received a gradepoint average of 2.303, and they received an average of 2.653 from female teachers. Female General Mathematics students received an average gradepoint of 1.968 from male teachers and an average gradepoint of 2.314 from female teachers. For all courses combined, H_4 can be rejected with $p < .0005$. Female mathematics students with male teachers received an average gradepoint of 2.3217. Female mathematics students with female teachers received an average gradepoint of 2.6197.

Summary of Results

All hypotheses rejected, and particularly those rejected when all courses were combined, seem to show two things about the teachers and students in this study. The first result is that the female mathematics teachers gave, on the average, higher grades to both male and female students than male teachers. The second result is that female mathematics students received,on the average, higher grades than male students regardless of the sex of the teacher.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

Summary

Results from much of the data for individual courses, given in Chapter III, were not significant. There was no significant difference in the data, $p < .05$, for any course above the freshman level in high school. The courses with the fewest students tended to be the ones in which the hypotheses were not rejected. This is possibly because there was not enough data for any grading trends to be significantly different from the expected values.

It is possible that, in general, female students are more serious about their studies than males, and females tend to mature earlier. Either of the above could explain why the average female student received a higher mathematics grade than the average male. Although the maturity factor would probably not affect the results of older students, it could definitely improve the average grade of females, as compared to males, in the seventh, eighth, and ninth grades. As there was a high percentage of students in this study who were in the lower grades, the differences in maturity of students might have been at least partly responsible for the outcome of the study.

Some of the studies reviewed in Chapter II indicated higher mathematical achievement for males than females. Many of the authors indicated a belief that both sexes are equally capable in mathematics. One result of this study indicated that females receive higher mathematics grades than males, yet none of the results of studies in Chapter II showed that females had higher achievement than males. If females consistently have higher grade averages in mathematics than have males, then the general idea that males are much better in mathematics is totally false. The fact that males received lower grades in this study but had higher test achievement in other studies raises a question about how well grades measure achievement. Either grades are a poor measuring device for achievement of students or the other measuring devices, such as achievement tests, are inadequate. Quite possibly neither grades nor test scores accurately measure achievement of students.

The result showing that female teachers tend to give higher grades than male teachers is consistent with some of the ideas presented by authors of other studies. If female teachers are more warm-hearted (Main & Hounshell, 1973, pp 67, 71), they might tend to grade higher. However, no results found in this study can account for the low percentage of female mathematics teachers or the relatively low number of female mathematics students in courses which are not required.

Recommendations for Further Research

Some of the implications in the summary indicate a need for more

research. A larger sample of students in the upper level courses needs to be studied. Since this study included low percentages of junior and senior high school students, the results of their grades might not be representative of the results found for all courses and grades included in the study. Another large sample of teachers in another geographic area might determine whether the results are unique to the geographic region in which this study was conducted.

Some study needs to be done to see how well mathematical achievement as measured by grades correlates with mathematical achievement as measured by standardized tests. If the correlation is high, there is a contradiction of the results of this study with those done by the National Assessments of Educational Progress (1975, undated). This would indicate a need for more study of some type to determine which result is correct. If there is a low correlation, some attempt should be made to find whether tests or grades measure achievement better. An attempt should also be made to find in which ways each of the measuring devices are inadequate. This would hopefully encourage either a new type of test or a new method of grading on the part of teachers, or both.

It is possible that male and female mathematics teachers have different personal objectives for their classes or that they give different types of tests. An examination of both of these might determine whether the teacher's objectives or tests are responsible for the differing grades given by male and female mathematics teachers.

APPENDIX

February 12, 1976

Dear

This semester I am writing a thesis concerning the achievement of male and female students in mathematics. I would like your cooperation in order to make the study as valid as possible.

Will you please send me the number of boys and girls who made each letter grade in each mathematics class you taught first semester this year. Please include the grade of the students or the class (example: 7th. 8th, general math, geometry, etc.).

I hope to include many mathematics teachers in this study. All data will be combined so the grades in your classes will be kept confidential. So that I may acbnowledge your cooperation, please include your name and school affiliation. If you would like a copy of the results of this study, please check the box below.

If you wish, you may put the information in the tables below and return it in the enclosed stamped, self-addressed envelope. Please return as soon as possible.

Thank you for your cooperation.

Sincerely,

Betty Jo Benz

☐ I would like a copy of the results of the study.

Class_____

	Males	Females
A		
B		
C		
D		
EorF		

Class_____

	Males	Females
A		
B		
C		
D		
EorF		

Class_____

	Males	Females
A		
B		
C		
D		
EorF		

Class_____

	Males	Females
A		
B		
C		
D		
EorF		

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