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Frequency of female contacts made by different sex teachers during mathematics class

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FREQUENCY OF FEMALE CONTACTS MADE BY

DIFFERENT SEX TEACHERS DURING

MATHEMATICS CLASS

by
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ABSTRACT

Sheila M. Zackavich, Frequency of Female Contacts of Different Sex Teachers in Mathematics Class, Dr. Randall S. Robinson, Thesis Advisor, Masters of Science in Teaching
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Studies have shown that despite female students eager attempt to initiate contact in the mathematics classroom, teachers tend to respond to the males students more often than the females.

This has been a questionable factor as to why females elect not to take four years of high school mathematics which exclude them from entering many high paying careers.

The purpose of this study was to observe a male and female teacher during their mathematics class and take frequency counts of all classroom contacts. This was to investigate if there was a significant difference between different sex teachers and their frequency of female contacts during their mathematics classes.

The results indicated parallel findings to previous research; the female students initiated more contacts during mathematics class, but the teachers initiated more of their contacts with the male students.

The chi square data analysis procedure was used to determine if a significant difference existed between the two teachers

regarding their frequency of female contacts. The chi square value equalled 2.34 and was not significant at .05.

MINI-ABSTRACT

Sheila M. Zackavich, Frequency of Female Contacts of Different Sex Teachers in Mathematics Class, Dr. Randall S. Robinson, Thesis Advisor, Masters of Science in Teaching
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This study was designed to observe two fifth grade elementary teachers, one male and one female, during their mathematics class.

Frequency counts were kept for all contacts made during mathemathics class. By using the chi square data processing procedure it was determined that there was not a significant difference between the different sex teachers and their number of female contacts. Both teachers initiated more contacts with their male students.

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Lastly, I would like to dedicate this thesis to my son, Brian Thomas, who made a lot of sacrifices with me over the past fourteen months so we could have a better future.

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Chapter I

SCOPE OF THE STUDY

Introduction

Although men and women have an equal opportunity to take the same high school courses, mathematics courses continue to attract fewer women then men. Becker (1981) reports that 53% of white men and only 20% of white women, which were first-year students at the University of Maryland, had at least four years of mathematics in high school. The figures for black men and women, were 22% and 10% respectively. This means that most women are reaching college unprepared to take the mathematics courses required for entrance into many of the higher-paying careers (MacDonald, 1990).

Women have the same opportunities as men do to take as many high school mathematics courses as they want. Why do so many women choose not to? Researchers have studied numerous external factors which could contribute to women choosing not to take mathematics courses including sociocultural factors (Fennema & Sherman, 1977), gender-differentiated messages from parents (Jacobs, 1991), and birth order (Duffey, 1980). Very little research has been done to consider factors within the school environment which might contribute to the attrition rate of women in high school mathematics. Brophy & Good (1970), using an instrument which counted the frequency of contacts made between the teacher and their students, was the first to find that teachers treat males and females differently. Females received less contact from the teacher and the most discouraging comments. Becker (1981) using the same instrument found Brophy & Good's results extended into the mathematics classroom.

Statement of the Problem

Teachers can portray a lot of messages to their students. They do this by how many contacts and what types of contacts (praise, criticism) they make towards a certain group of students during a particular subject.

Many studies show the contact pattern made during mathematics class have led students to believe mathematics is "for males".

Though studies focused on mathematics teachers are few, none have been found that compare the contact patterns of a male teacher during his mathematics class with the contact patterns of a female teacher during her mathematics class.

The purpose of this study was to compare a fifth grade male teacher to a fifth grade female teacher regarding their frequency of female student contacts in mathematics class.

Hypothesis

There will be a significant difference between a fifth grade male teacher and a fifth grade female teacher regarding their frequency of female student contacts which occur during their mathematics class.

Definition of terms

<u>Response opportunities</u> - When a student publicly attempts to answer a question posed by the teacher.

<u>Recitation</u> - When a student reads aloud, describes some experience or object, or make some other extended oral presentation.

<u>Procedural contacts</u> - When the teacher-student interaction concerns permission, supplies, and equipment, or other procedural matters concerned with the student's individual needs or with classroom management.

<u>Work-related contacts</u> - When the teacher-student interaction concerns seat work, homework, or other written work completed by the student.

<u>Behavioral contacts</u> - When the teacher disciplines the student or makes individual comments concerning his classroom behavior.

<u>Observation</u> - The collection of data indicating how often a teacher makes an interaction with a student in one of 12 categories.

<u>Direct question</u> - When a teacher calls on a student by name to answer a question.

<u>Open question</u> - When the teacher asks a question, waits for students to raise their hands, then calls on a volunteer.

<u>Call outs</u> - When the teacher asks a question, a student calls out an answer, and the teacher directs his of her attention to that student.

Academic contacts - A contact involving the academic content of the mathematics lesson.

Nonacademic contacts - A contact involving conversation, joking, praise, discipline, criticism, or procedure.

Public contacts - A contact made in front of other people.

Private contacts - A contact involving a teacher and an individual student intended for only the two to hear.

Limitations

This study was conducted while the researcher was in the role of student teacher. One of the limitations of this study was that the subjects were not randomly selected. The researcher was limited to only one male classroom teacher within her practicum school, which therefore, determined the grade level and representative students for the study. The study took place in an small affluent school district. All of the students who participated in this study were white and came from intact families which included their birth parents. This study is not representative to all fifth grade students and therefore the results cannot be generalized to the entire population.

Chapter II

Review of the Literature

Introduction

Many women are denying themselves opportunities to enter high-paying careers by choosing not to study mathematics in high school. Many women do not realize the life-long consequences of the adolescent decisions. Decades of studies have shown many factors related to women making this detrimental decision during high school. These studies have pointed out factors outside of and within the school environment. Becker (1981) in her quest for factors within the mathematics classroom, found a significant difference in the way teachers treated males and females in their mathematics class. What is most surprising, is that, although females asked more questions (initiated more contacts), they received almost all the non-encouraging or discouraging comments. This could be a factor indicating a reason why a female might choose not to take further mathematics courses. The purpose of this study is to see if there is any difference in the way a male teacher and a female teacher treat females in their fifth grade mathematics class.

Mathematics and Women's Careers

It is a known truth that the income levels of American men and women are grossly unequal. This is because men and women hold very different types of occupations. The higher paying professions of medicine, science, engineering, law, architecture, and business management in America are filled with male employees. Although more women are starting to enter these fields, they are still overwhelmingly flooding into lower paying occupations such as social work, nursing, and teaching (MacDonald, 1990).

A pamphlet entitled "The Math in High School You'll Need for College" prepared by the Mathematical Association of America list Architecture, Biology, Business Management, Chemistry, Computer Science, Economics, Engineering, Environmental Sciences, Mathematics, Optometry, Pharmacy, Pre-Medicine, and Statistics as college majors that require four years of high school mathematics.

Studies have shown that women's lack of mathematics classes in high school limits their choice of college majors required to enter into these high paying fields. The Women and Math Project conducted by the American Institutes for Research (AIR) in Palo Alto, California found that high school mathematics was a vital factor in determining whether or not students entered certain kinds of occupations. The researchers concluded:

> Math skills developed during high school were both an essential component of subsequent education attainment and a significant predictor of success in establishing math-related careers independent of level of educational attainment. High school math achievement played a significant role in the development of math-related careers over the entire period from high school to age 29.

In 1973 Lucy Sells identified mathematics as the "critical filter" that prevented many women from having access to higher paying and prestigious careers. This triggered many investigations focused on gender differences in mathematics achievement.

Gender Differences and Mathematics Achievement: Are Boys Biologically Better at Mathematics?

Global conclusions tend to assert simply that males out perform females on mathematics tests (Hyde, Fennema, Lamon, 1990). In a recent article the question posed by teachers to researchers as to why boys and girls sometimes score as high as boys on mathematics tests and sometimes they score considerably lower, Adele M. Brodkin, Phd. stated:

> Experts had studied mathematical ability for many years before they began to understand why girls and women sometimes score as high as boys and men, and other times they do not. Now we know that the content of test questions accounts for much of the difference. For example, math ability tests are often full of "male content" like baseball players' averages. When the same questions are asked in terms of recipes, girls do better.

Lynn Friedman (1989) analyzed the results of studies (a meta-analysis) that took place between 1974 and mid-1987 on sex differences in mathematical tasks. She found that the average sex difference is very small and that these differences are decreasing over the years. She concluded:

> The sex difference in favor of males is decreasing over short periods of time. This is evidence for environmental explanations of sex differences, for surely it is not biology, but environmental influence that has been changing at the same time that sex differences have been decreasing.

Research also shows that in elementary grades males and females are equal, or in some instances, females outscore the boys, and that a gender gap does exist in high school. Marian Wozencraft (1963) in her study of 50,000 third and sixth grade pupils found that in both levels the girls did better in arithmetic than the boys. Hilton and Berglund (1974) used longitudinal data to investigate sex differences in mathematics achievement. They found no difference in achievement in fifth grade, but thereafter the boys pulled ahead. Janet Shibley Hyde, Elizabeth Fennema, and Susan J. Lamon (1990) performed a meta-analysis of 100 studies because they felt reviewers were consistently concluding that males perform better on mathematics tests than females. Their results from statistically combining the results from 100 previously done studies on the subject revealed that there were no gender differences in problem solving in elementary and middle school. Differences favoring men emerged in high school.

Although these reports show a gender gap in mathematics achievement at the high school level many researchers failed to account for the fact that girls take less mathematics in high school. Charlotte MacDonald (1990) stated that the difference in the twelfth grade scores of boys and girls to be explained by the difference in the amount of mathematics that the boys and girls had taken. Sherman and Fennema (1977) stated this point clearly:

> Since the time spent in mathematics classes clearly affects performance on both achievement and aptitude tests of mathematics; this factor must be considered seriously.

Environmental Reasons

Many girls may simply be unaware that mathematics is an important door-opener to many careers. Sherman and Fennema (1977) found that mathematics was perceived more useful by boys than by girls and that they would benefit from an increased knowledge of the importance of mathematics as a tool and as an entry skill to many fields.

Many studies found that students, male and female, see mathematics as a masculine subject (Stein and Smithells, 1969).

Statistics show that although even when girls do as well as boys on mathematic achievement tests they still have less confidence towards the subject (Bailey and Bailey,1974).

Fennema and Sherman (cited in Reeves 1992) have suggested the lack of math-related tasks outside of school that girls do negatively influence their achievement in mathematics.

Many studies have uncovered the fact that gender-stereotyped beliefs of parents contributed to girls lack of interest in high school mathematics (Jacklin, 1989, Fennema and Sherman, 1977, Jacobs, 1991).

Benbow and Stanley investigated gender differences in mathematical ability by checking the scores of a large population of bright boys and girls standardized tests in 1980, 1982, and 1983. In all three studies the boys scored higher than the girls. In the articles publishing these results they speculated about the biological causes of their findings, although they had no biological data. These articles caused a stir in academia and the popular press. When the popular press reported the results the speculations were exaggerated. Carol Jacklin (1989) researched the effects of the popular reports of the Benbow and Stanley results. She compared the attitudes of parents who were aware of the Benbow and Stanley work as reported in the media, "misinformed parents", with those of parents who had not heard about the work, "uninformed parents". She found that the media campaign had a direct effect on children's mathematics course taking and achievement. She concludes:

> Clearly, the effects were deleterious to girls. As mothers came to believe that mathematics was much more difficult for girls than boys, their daughters became less likely to take additional math courses.

Many avenues have been explored outside the classroom to determine why females are choosing not to take mathematics courses in high school. Very few pieces of data are available to explain what is happening in the mathematics classroom that might contribute to the decline of women to achieve in and ultimately pursue higher mathematic opportunities. Fennema and Sherman (1978) in their research to find factors related to sex-related differences in mathematics, concluded that more research is needed to examine factors within a school milieu that might have an impact on the attrition rate of females in mathematics.

Reasons within the Classroom

Brophy and Good (1970) was the first to find that teachers treat male and female students differently. Becker (1981), using the same instrument, extended Brophy and Goods research into the mathematics classroom. Becker observed 10 high school geometry classes with equal male-female student ratio. She found a significant difference in the way the teachers treated the different sex students. The teacher asked males more questions, and gave them more positive feedback. Although the females asked more public questions, they received almost all the non-encouraging or discouraging comments. Becker concluded:

> Teachers have different expectations of students based on the sex of those students. Teachers, as members of our society, come to a new class with expectations that closely reflect those stereotypical views out society holds of the roles of men and women in mathematics, social behavior, and maturity. Then, teachers treat students differently on the basis of sex in ways consistent with those expectations. Lastly, students respond differently in class in accordance with the expectations of teachers and society of their sex roles.

SUMMARY

The literature shows that there is a spectrum of factors females are faced with which contribute to them deciding not to take mathematics courses in high school. It also shows that these females are leaving themselves out of the option to pursue many majors in college which lead to high paying careers.

Chapter III

DESIGN OF THE STUDY

Introduction

The study was conducted by the researcher with two fifth grade classes of different sexed teachers during the spring of 1995. Data was collected by frequency counts of student contact made during mathematics class. Frequency counts were then put into percentages and compared.

Subjects of the Study

The subjects in this study consisted of two fifth grade teachers; one male and one female. Both teachers worked in the same elementary school. The elementary school was in a suburban public school district in southern New Jersey.

Each classroom composed of 28 students. Each class had 14 boys and 14 girls during each observation. The students were between 10 and 12 years of age.

Instrument

The Brophy-Good Teacher-Child Interaction System was designed to study interactions between teachers and students in classrooms. This instrument is very specific to record only interactions involving the teacher and an individual student; it leaves out all other classroom behaviors. The Brophy-Good System was developed to study contacts between teachers and individual students and investigate if teachers communicate differential performance expectations to different children. It has been modified to use specifically in elementary school classrooms to study sex differences.

Five different types of interaction situations are coded in the present system: response opportunities, recitation, procedural contacts, work-related contacts, and behavioral contacts. These five broad categories of teacher-child interaction are kept distinct from one another in coding, and each type has its own place for coding on the coding sheets. In addition to this physical separation of the coding for the five types of contacts, coding distinctions are also made concerning the mature and sequence of the interaction observed. For every interaction, coders note whether the initiator was the teacher or the child and also code information concerning the teacher's message or response to the child during the interaction. In addition, the coding of response opportunities and recitation turns also includes information concerning the type of question asked and the quality of the child's response, both of which are coded before coding the nature of the teacher's feedback. The latter coding also includes preservation of the sequential order of events, so that the chain of action and reaction sequences within these interactions is maintained.

The two teachers, one male and one female, were observed on alternating days for four weeks for a total of ten observations each.

Quantitative, non-parametric nominal data was collected on coding sheets to represent all response opportunities, recitations, procedural contacts, work-related contacts, and behavioral contacts which occurred during their mathematics class.

All of the data was then organized into the following 12 categories:

STUDENT-INITIATED CONTACTS BY SEX OF STUDENT

(A) Student questions

(B) Student-initiated individual academic contacts

(C) Student-initiated individual nonacademic contacts

TEACHER-AFFORDED RESPONSE OPPORTUNITIES

(A) Direct questions

(B) Open questions

(C) Call outs

TEACHER-INITIATED NONACADEMIC CONTACTS

(A) Conversation	(D) Praise
(B) Joking	(E) Criticism
(C) Discipline	(F) Procedure

A total was calculated in each category by adding up its frequency counts marked during the observations. Frequency counts were then changed into corresponding percentages and displayed separately in three tables per teacher.

The percentages were then used to investigate any significant difference between the two teachers of different sex by using the Chi Square data analysis procedure. The alpha level was .05.

Chapter IV

ANALYSIS OF FINDINGS

INTRODUCTION

This study was conducted to observe two different fifth grade mathematics classes; one with a female teacher and one with a male teacher. Frequency counts were collected on data sheets during observations to keep track of all contacts made by both teachers and students. The corresponding percentages were tallied for 12 categories and organized into three tables for easy reference. Lastly, the chi square procedure was used to determine if a significant difference existed between the two teachers of different sex and their occurrence of female student contacts.

TABULATION OF FREQUENCY PERCENTAGES

Frequency counts were taken in three areas: Teacher-afforded response opportunities, teacher-initiated nonacademic contacts, and student-initiated contacts.

Table 1 illustrates the percent of teacher-afforded response opportunities of each teacher.

table 1
PERCENT OF TEACHER-AFFORDED RESPONSE OPPORTUNITIES

	female teacher		male teacher	
Category	F	M	F	M
Direct questions	44%	56%	45%	55%
Open questions	44%	56%	43%	57%
Call outs	31%	69%	34%	66%
Total	40%	60%	41%	59%

F= contacts made with female students
M= contacts made with male students

In all three areas, direct questions, open questions, and call outs, both teachers directed their response opportunities towards the male students. Although both classes were 50% female, both teachers only made 40%-41% of their contacts with their female students.

Table 2 illustrates the percent of teacher-initiated nonacademic contacts made by each teacher.

table 2
PERCENT OF TEACHER-INITIATED NONACADEMIC CONTACTS

	Female teacher		Male teacher	
Category	F	M	F	M
Conversation	29%	71%	31%	69%
Joking	26%	74%	27%	73%
Praise	40%	60%	37%	63%
Discipline	46%	54%	47%	53%
Criticism	50%	50%	49%	51%
Procedure	49%	51%	47%	53%

F= contacts made with female students
M= contacts made with male students

Both teachers talked, joked, and praised their male students more than their female students. Also both teachers disciplined and went over procedures slightly more with the males than the females. Criticism was the only category that both teachers directed towards both the female and male students about equally.

Table 3 illustrates the percent of student initiated contacts.

table 3
PERCENT OF STUDENT-INITIATED CONTACTS

	female teacher		male teacher	
Category	F	M	F	M
Student questions	55%	45%	53%	47%
Student-initiated academic contacts	59%	41%	61%	39%
Student-initiated nonacademic contacts	58%	42%	63%	37%
Grand total	57%	43%	59%	41%

Females initiated all three kinds of contacts more often than the males in both classrooms. In the classroom with the female teacher the females students initiated 57% of the contacts and in the classroom with the male teacher they initiated 59% of the contacts.

TABULATION OF CHI SQUARE

The one-dimensional chi square was used to determine if there was a significant difference regarding the number of female student contacts made by the female teacher and the male teacher during mathematics class.

The chi square value equalled 2.34 and is not significant at .05.

ANALYSIS OF DATA RELATED TO HYPOTHESIS

It was hypothesized that there would be a significant difference between a fifth grade male teacher and a fifth grade female teacher regarding their frequency of female student contacts which occurred during their mathematics class.

The data showed that both teachers made more contacts, academically and nonacademically, with their male students.

The chi square data analysis procedure showed no significant difference between the contact patterns made towards their female students during mathematics class; both teachers made more contacts with male students.

CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

INTRODUCTION

This study was conducted in an elementary school within southern New Jersey. Two fifth grade teachers, one male and one female, were observed during their mathematics class. The researcher used the chi square data analysis procedure to determine if there existed a significant difference between the two teachers regarding their frequency of female student contacts during mathematics class.

SUMMARY OF THE PROBLEM

Many studies have shown that teachers treat their male and female students differently. Within the mathematics classroom teachers interacting more with their male students have led students to believe mathematics is "for males". Consequently, many females elect not to take four years of high school mathematics which exclude them from entering many high-paying careers.

The purpose of this study was to see if both a male and female teacher interact less with their female students during mathematics class.

SUMMARY OF HYPOTHESIS

It was hypothesized that there would be a significant difference between a fifth grade male teacher and a fifth grade female teacher regarding their frequency of female student contacts which occur during their mathematics class.

SUMMARY OF PROCEDURE

One male and one female fifth grade teacher were observed ten times each during their mathematics class. Frequency counts were marked on coding sheets to represent all response opportunities, recitations, procedural contacts, work-related contacts, and behavioral contacts which occurred during observations. Frequency counts were then changed into corresponding percentages in 12 categories. The data was displayed in three tables separating teacher-afforded response opportunities, teacher-initiated nonacademic contacts, and student-initiated contacts. Lastly, the percentages were then used to investigate if there was a significant difference between the two teachers of different sex by using the chi square data analysis procedure at level .05.

SUMMARY OF FINDINGS

In all three teacher-afforded response opportunities tallied, both teachers made 59-60% of their direct questions, open questions, and call outs towards the male students.

The finding were also similar between the two teachers regarding teacher-initiated nonacademic contacts. Both teachers talked, joked, and praised their male students more than their female students. Both teachers disciplined and went over procedures slightly more with males than the females. Criticism was the only category that both teachers directed towards both the male and female students about equally.

In all three student-initiated contacts tallied including student questions, academic contacts, and nonacademic contacts, female students initiated more contacts with their teachers that the male students.

The chi square data analysis procedure was used to determine if there was a significant difference between the two teachers of different sex regarding their frequency of female student contacts during mathematics class. The chi square value equalled 2.34 and is not significant at .05.

CONCLUSION

Reviewing the data presented here, one must conclude that the results of this study support previous research; teachers make more contacts, academic and nonacademic, with their male students. It was determined that there was not a significant difference regarding this and the sex of the teacher.

IMPLICATIONS AND RECOMMENDATIONS

The data in this study suggests that sex-biased interaction patterns do occur in fifth grade mathematics classes. Many of the implications suggested by previous research are then sustained. First, teachers have different expectations of students based on the sex of the student. Teachers, as members of our society, come to a new class with expectations that closely reflect those stereotypical views out society holds of the roles of men and women in mathematics. These differential expectations for each sex include ability in mathematics. Second, teachers then treat students differently on the basis of sex in ways consistent with those expectations. The differential treatment found in this study could indirectly benefit male students, both in their learning of mathematics and their future course choices. Third, students will respond in class accordance with the expectations of teachers and society of their sex roles (Becker, 1981).

Charlotte MacDonald (1990) recommends that teachers awareness is the key to decreasing and ultimately eliminating any sex-biased interactions within the mathematics classroom. She defines Mathematics Awareness the following way:

1. Noticing who is getting the most attention in mathematics class, the high achieving male student or the girl who needs help?

2. Paying attention to the way mathematics is presented in classroom discussions, textbooks, and tests.

3. Consider ways of reducing "math anxiety" among students of both sex.

4. Examining your own attitudes about who "needs math" and which sex does better in it.

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