SEX-RELATED DIFFERENCES
IN ATTITUDES TOWARD COMPUTERS
AT THE GRADE 4 LEVEL

by

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The purpose of this study was to determine whether there were sex-related differences in students' attitudes toward computers at the Grade 4 level. A questionnaire was constructed, consisting of twenty-five multiple choice items, two subjective items and eight background items. The multiple choice items were grouped into six reporting categories: (1) Interest in and Enjoyment in Using Computers, (2) Anxiety and Confidence About Computer Use, (3) Perceived Usefulness of Computers, (4) Perceived Sex Roles in Attitudes Toward Computers, (5) Relationship Between Mathematics and Computers, and (6) Attitudes Toward Mathematics. The questionnaire was administered to a sample of 290 students. The sample consisted of 143 girls and 147 boys.

The data were analysed to determine any sex differences in responses to each of the items in each of the reporting categories. Attitudes toward individual items and reporting categories were defined to be positive if 50% or more of the students/girls/boys responded to the item/category in a manner established by the author as positive. To identify
significantly different responses, median polish was used on the item-by-gender tables. Results of the median polish revealed items that had been reacted to, by all students, in a more strongly positive or negative manner in comparison to the other items within the category. In addition, sex differences in responses to each of the items and the reporting categories were indicated and any patterns related to either items or gender were revealed. In addition to the analysis of individual items and reporting categories, results from the 25 items for girls were compared based on whether or not their mothers use computers and also for all students based on whether or not they had computers at home.

The results of the questionnaire indicate that there were no sex differences in responses to five of the six reporting categories. Girls and boys at this age would seem to have comparable positive attitudes toward computers with regard to "Interest in and Enjoyment in Using Computers", "Anxiety and Confidence About Computer Use", "Perceived Usefulness of Computers" and "Relationship Between Mathematics and Computers", and "Attitudes Toward Mathematics". There were significant sex-related differences in one category, "Perceived Sex Roles in Attitudes Toward Computers". It was found that while both girls and boys have a positive attitude in this
category, 22% more girls than boys displayed this positive attitude. However, in view of the difficulty of interpreting these results, one cannot provide a strong argument for concluding that one gender has a stronger positive (less sexist) attitude than the other. Girls and boys at this age feel it is just as important for either sex to use and learn about computers.
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Chapter 1

INTRODUCTION

The use of computers in elementary and secondary schools is increasing rapidly. The issues of concern to educators regarding the role of the computer in the classroom are numerous.

Computer equity is one issue that has received much attention (Alvarado, 1984; Anderson, Welch & Harris, 1984; Johnson, M.L., 1983; Komoski, 1984; Lautenberg, 1984; Lipkin, 1984; Schubert & Bakke, 1984; Winkle & Mathews, 1982). Educators are concerned about the accessibility of computers to certain groups of people based on economics, race, sex, intelligence, physical disabilities, and community size and region. Of particular interest to this author was the topic of gender equity with regard to computers. This topic has also received attention (Fisher, 1984a, 1984b; Gilliland, 1984; Kiesler, Sproulls & Eccles, 1983; Kolata, 1984; Lockheed & Frakt, 1984; Marrapodi, 1984; Miura & Hess, 1984; Sanders, 1984). The authors listed suggest that the computer may be becoming a male domain and that girls may be being left behind. They suggest a variety of reasons for this state of affairs which may be loosely grouped as follows: (1) girls
have no interest in using computers and see little further usefulness for themselves, (2) girls do not have access to computers, and (3) girls lack the inherent ability to use and be successful with computers. Whether these views have been adopted by females themselves, or nurtured by males, parents, teachers, the media or society in general is not known.

Some conjectures imply that factors, inherent to the sexes, may be a cause of girls' disinterest (Kiesler, Sproull, & Eccles, 1984; Lockhead and Frakt, 1984). Others suggest that while this difference in interest is not apparent in elementary school, it does appear around the onset of puberty. Sanders (1984) suggests some socially related reasons for lack of female participation at this age. Girls, she suggests, are very social, and prefer people to things. Girls lead a more active social life than boys at this age. It is also acceptable for girls of this age to give up in the face of difficulty and to avoid competition with boys at the computer for fear of winning and appearing unfeminine and unattractive to boys (Sanders, 1984). Boss (1982) concurs with the latter and states,

Females tend to defer to males when both want to use a computer in order to avoid hostility and seek friendship - especially when females are just "discovering" boys. (p.56)
Other authors suggest that it is not that computers themselves do not interest girls but rather that the atmosphere where computers are kept and the software that is available do not interest girls. The aggressive, competitive games that are often found in the video arcade as well as the classroom have traditionally held greater interest for boys than for girls (Kiesler, Sproull, & Eccles, 1983; Fisher, 1984).

Future usefulness is perhaps the most important concern to students today who are learning to use computers. Career choices and salaries will be limited to those girls and boys who opt out of learning about computers in school (Lipkin, 1984; Johnson, B., 1983; Sanders, 1984). The best way to increase female participation, particularly at the secondary school level, may be to make students more aware of the future implications of their present choices regarding computers. Although numbers vary, there is general agreement that as our society becomes increasingly technological, career qualifications will undoubtedly involve some experience with computers (Lipkin, 1984, Nordman, 1984; Sanders, 1984; Johnson, B.D. 1983; Schubert & Bakke, 1984; Alvarado, 1984).

The question of access to computers goes beyond the classroom walls to include computer clubs, summer camps and classes and individual homes. Generally, boys are encouraged
more, and more often financially supported to attend optional sorts of computer activities (Miura & Hess, 1984; Fisher, 1984; Sanders, 1984). As well, the media tends to be more male-oriented with regard to computer advertising (Lockheed & Frakt, 1984; Fisher, 1984a).

The final theory for the gender inequity in computer use is centred around mathematics. Some people believe that girls inherently have less ability than boys in mathematics. It is easy to transfer such a belief regarding mathematics to computers (Collis, 1984; Sanders, 1984; Alvarado, 1984; Winkle, 1982). However, the computer need not be solely associated with mathematics. For example, Collis (1984) suggests utilizing the positive feelings girls have about writing to introduce the use of computers through word processing as part of English classes.

While the potential reasons for the lower rate of female interest in and participation with computers are numerous, so are the suggested remedies to equalize the rate. As educators are becoming more aware of the problems regarding accessibility, interest, and ability in regard to computers, and are willing to act upon them, the gender equity issue in the field of computers may become an unnecessary area of concern.
Major Questions Posed in the Study

Most studies reporting on sex-differences and computers have been carried out at the secondary school level. The intent of this study was to determine if any sex-differences appear at an earlier age. In particular, information was sought and differences examined in the stated attitude of Grade 4 girls and boys in regard to computer use. The topic of attitude was sub-divided into six categories. These categories were formed on the basis of information that had been reported at the secondary school level. The six reporting categories were: (1) Interest in and Enjoyment in Using Computers, (2) Anxiety and Confidence about Computer Use, (3) Perceived Usefulness of Computers, (4) Perceived Sex Roles in Attitudes Toward Computers, (5) Relationship Between Mathematics and Computers, and (6) Attitude Towards Mathematics. The primary purpose was to use information received from a sample of Grade 4 students to generalize on the attitudes of that age group with regard to each of the above mentioned reporting categories and to determine if there were any sex-related differences at such a young age.
A secondary objective was to collect baseline data, from Grade 4 students, regarding computers and to determine any sex-related differences. Examples of baseline data would be data gathered by the following type of questions:

1. Have you ever used a computer at school before?
2. Do you have a computer at home?

A final objective was to determine potential relationships between the baseline data and the six main reporting categories. The following questions were asked:

1. Is there a relationship between having a computer at home and attitude as measured in the six reporting categories?
2. Is there a relationship between girls' mothers using computers and attitude as measured in the six reporting categories?

From the following two open response questions, additional information was sought regarding the students' perceptions of future usefulness of computers and influence from home.

1. How do you think you could use a computer when you are an adult?
2. Do you think that your mother and father are enthusiastic about you learning to use a computer? Tell why or why not.
Chapter 2

REVIEW OF THE LITERATURE

Because the topics of computer equity and sex differences in regard to computers are relatively new, the review of related literature only dates back a few years. The review has been organized into two sections. The first section, "Participation", deals with the enrollment in computer-related activities and curriculum content of computer courses. In particular the relationship between mathematics and computers is discussed. The future relevance for children learning about computers now is also discussed. In the second section, "Social Issues", affecting female participation with computers are presented. Also, the atmosphere of where computers are used and the software employed are discussed.

Participation

Educators concerned with gender equity and the computer believe there are a variety of factors that produce inequitable access to computers and computer knowledge for females. This gender gap in access will eventually lead to a gender gap not only in computer knowledge, but also in experience and comfort of use for females. The consequences of
the sex differences become more meaningful when one considers that the occupational and career choices of the computer illiterate will be reduced in an increasingly technological society. The problem of a person limiting his or her future because of choices made in high school regarding computers, has summoned attention at the school district as well as the national level.

Recent reports from local school boards and the Science Council of Canada show that many girls are jeopardizing their future job prospects by deciding in their teens that math, science and computers are best left to the boys. And a national study by the Canadian School Trustees Association warns that those girls will be forced to enter low-paying jobs, many of which will be phased out within the next decade. Indeed, by 1990 most jobs will require some computer skills. (Johnson, B.D., 1983 p.45)

The U.S. Department of Labor estimates that by the time our children enter the job market, 50 - 70% of the jobs will involve computers in some way. (Sanders, 1984, p.32)

Not only is the choice to get involved in computers an important one, but so also is the form that involvement takes. Nordman (1984) asks, "Why is it so common to find a Computer Science 11 class with 24 boys and 1 girl and Data Processing with 24 girls and 1 boy?" He continues to say that "Girls seem to be blind to the implications of their choices." Lipkin of the Mid-Atlantic Centre for Sex Equity concurs. While working with the Project on Equal Rights, PEER, Lipkin found that girls
tended to take computer courses that would lead them to secretarial or computer operator jobs; jobs Lipkin terms as servants of the computer. Boys, he found, predominated in the courses that led to higher paying jobs in the computer fields such as accounting and drafting (Zakariya, 1984).

While few studies have been conducted to provide actual numbers regarding computer course choices of boys and girls, many authors stress the importance of that choice in our increasingly technological society (Sanders, 1984; Winkle & Mathews, 1982; Schubert & Bakke, 1984; Fisher, 1984; Alvarado, 1984). From a positive viewpoint, some studies have shown that girls are aware of the importance computers play in their future. In California, where the majority of studies on computer equity seem to be taking place, three reports, in particular, stated very positive results with regard to girls' awareness of the importance of computers (Lockheed & Frakt, 1984). In a statewide study of 17 861 California students, nearly three-quarters of the twelfth grade girls and two-thirds of sixth grade girls agreed that a knowledge of computers will help to get a better job. The 1983 Gallup Youth Survey reported that 65 percent of girls aged 13-19 planned to take computer courses in college and over half of that group thought it likely that they would have a computer-related major in college. And in a recent survey of high school students
enrolled in a mandatory computer science course, 80% of the girls (as compared to 82% of the boys) agreed that knowing about computers would be important for their own future.

While some authors (Kolata, 1984; Kiesler, Sproull & Eccles, 1983) suggest that sex differences with regard to computers appear as early as elementary school, others find computer use in early grades to be fairly equal but begins to change around puberty.

At this age (outset of puberty), female students show less interest in computing and tend to avoid elective classes in computing and in higher-level mathematics. (Alvarado, 1984, p.47)

The statistics that are available for the secondary school level, where computer courses are chosen, show definite differences between the number of males and females enrolled. In a California study (Kolata, 1984), only thirty-seven percent of students enrolled in high school computer classes were girls; a nationwide (U.S.) poll of 17-year-olds shows that nearly twice as many boys as girls take computer programming courses. In his project results, Lipkin (Zakariya, 1984, p.31) states that in academic courses such as mathematics-related computer science courses, boys outnumber girls two to one. However, he views that positively in that as recently as five years ago the ratio of boys to girls was eight to one. The
Toronto Board of Education found that by Grade 13, twice as many boys as girls were enrolled in both algebra and computer science (Johnson, B.D., 1983). The lower enrollment figures for females exist at the college, university and career levels as well.

At Berkeley only 23 percent of the computer science majors are women. The 1980 census (U.S.) found that just 23 percent of systems analysts and 31 percent of computer programmers are women. The more advanced the computer training, the fewer women enroll. At MIT, the male graduate students in Computer Science outnumber the females nearly ten to one. (Kolata, 1984, p.24)

Course content of secondary school computer classes is one possible cause of low female enrollment. Many authors suggest that the mathematics oriented curricula of introductory courses tends to discourage females.

While many high schools require algebra as a prerequisite for programming, unnecessary emphasis on math restricts girls' interest in programming classes. (Fisher, 1984a, p.26)

Similar concerns have been voiced by EQUALS in Computer Technology, an inservice program developed at the Lawrence Hall of Science at University of California, Berkeley, to increase educators' awareness of the importance to females of acquiring technological competence. They pose the following questions:
Is advanced math, a subject more frequently taken by boys, used as a prerequisite for programming classes?

Would English serve just as constructively?

Is it possible to base some of the programming on language content rather than on mathematics content? (Gilliland, 1984, p.43)

Certainly these are valid questions and the answers could prove quite revealing. It may be possible that it is not the computer courses themselves that discourage female enrollment, but the lack of prerequisite courses and skills that actually limit female participation. A number of authors have suggested that the focus of introductory computer courses should not be programming, but rather, should present an array of more meaningful topics to suit a variety of students. (Lockheed & Frakt, 1984; Fisher, 1984a)

Studies show that girls find little immediate practical use for simple programming skills and would rather learn applications programs for word processing, database use or graphics. (Lockheed & Frakt, 1984, p.17)

To promote more self-confidence and participation for females, remove computer studies experiences from a mathematical or scientific context. Utilize the positive feelings about writing to introduce computer use through word processing as part of English classes. (Collis, 1981, p.2)
BASIC programming, in particular, has been criticized as being too algebraic for beginners, particularly females (Marrapodi, 1984). Logo, a computer language designed for the elementary and secondary school student, has been suggested as an alternative (Zakariya, 1984; Alvarado, 1984; Sanders, 1984; Marrapodi, 1984; Nordman, 1984; Kiesler, Sproull & Eccles, 1984). Logo is based on manipulating a cursor-like 'turtle', making shapes on the screen by means of simple vocabulary commands. Its graphic nature seems to be more appealing to female students (Marrapodi, 1984), and may in turn increase female enrollment (Lockheed & Frakt, 1984; Sanders, 1984).

The Cupertino Union School District finds a maximum of 30% girls in BASIC classes, but up to 50% in Logo Classes. (Fisher, 1984a, p.26)

It is possible, then, to increase female participation if courses offer topics of greater interest to them. Specific applications might include a greater emphasis on graphics, word processing, personal filing systems and programs involving language, art and music.

Besides computer classes, the computer has been used extensively in the mathematics classroom (Lockheed & Frakt, 1984; Lipkin, 1984; Sanders, 1984). Mathematics has traditionally been deemed a male domain and at the secondary
school level, this can be supported by data. The belief is also present at the elementary school level and while not supported by data, the belief remains a popular one. If computers are associated with mathematics, will these perceived general negative feelings of interest and attitude and supposed inability of females with regard to mathematics transfer automatically to computers? In her study Collis (1984), found a positive answer to that question, when she surveyed 1293 grade 12 students and 1606 grade 8 students.

Students' attitudes toward mathematics and science are mildly predictive of their attitudes toward computers. Females are more likely than males to transfer negative feelings about mathematics to negative assumptions about computer use and users. (1984, p.2)

Winkle and Mathews (1982) also see a direct relationship between attitudes toward mathematics and attitudes toward computers. "Feelings of anxiety (by women) when confronting anything 'mathematical' readily spill over to computers" (p.315).

Besides relating to mathematics, there are conflicting views on how females' inherent ability or inability relates to suitability of computer use. "There is absolutely no question that women are equally qualified to learn about computers" (Kolata, 1984, p.24), says Stage, an educational psychologist
at the Lawrence Hall of Science at Berkeley. Fennema, an
education researcher at the University of Wisconsin, claims

Some of the very traits often considered feminine
are particularly suitable for computer
specialists: patience and attention to detail
for example. (Kolata, 1984, p.24)

There may be nothing intrinsic to computing to
discourage girls (Kiesler, Sproull & Eccles, 1983) but there
may be social factors that do. Winkle and Mathews (Lawton &
Gerschner, 1982) wrote that women's socialization make them
less receptive toward computers, and therefore they may require
special treatment to reduce anxiety and enhance learning.

Some authors view the computer as a mechanical toy and
believe that to be a reason for female disinterest.

Computer stores are also an alien environment for
most girls and women by virtue of the very
products they stock. Most women are not familiar
with electronics equipment, wires, and related
accessories. (Kiesler, Sproull & Eccles, 1983,
p.43)

A common conjecture is that young boys are more apt to tinker
and be more comfortable with machines. If the computer is
viewed simply as a machine, the sex differences in interest may
be explained. Others look at the software component of the
computer industry and link it with more typically female activities such as following a recipe or pattern (Kiesler, Sproull & Eccles, 1983).

To determine whether sex differences are caused by nature or nurture could provide direction for decreasing these differences or accepting them for what they are.

Some people claim that little can be done to increase girls' interest, because of sex differences in early socialization. (Kiesler, Sproull & Eccles, 1983, p.47)

Information available about enrollment in computer-related activities, other than school courses, varies and the numbers given are often estimates. But the underlying pattern is that there is a lack of female representation in optional school courses, summer classes and computer camps. In a study by Miura and Hess (1984) data were collected from 5533 students to determine enrollment differences in computer camps and summer classes. Some of their results showed:

The ratio of boys to girls is roughly three to one (74% boys to 26% girls).

The proportion of girls is highest in day classes sponsored by the public schools and lowest in private residential camps.

The proportion of girls decreased as cost and grade level increased.
The proportion of females enrolled in beginning and intermediate classes was 28% in advanced programming classes; it was 14%; only 5% of those enrolled in the more advanced assembly language courses were female. (p.22)

Kiesler, Sproull, and Eccles (1983) state that until recently, boys outnumbered girls in programming courses and computer camps by as much as eight to one. More recently, that figure is approaching three to one.

Social Issues

Many social issues have been listed as contributors to the gender gap in computer use. One of those is that males are more aggressive computer users. Fisher, a computer specialist in Hayward, California, has cited a number of personal observations where boys have physically intervened when a girl(s) was using a computer or where a 'pack' of boys have intimidated girls (Fisher, 1984). Another social issue is that girls will voluntarily avoid using computers. Sex segregation is particularly common in the middle grades. As a general rule, boys and girls do not do things together. This can greatly affect computer use.

Even if girls are interested in using computers, pre-existing habits of sex segregation can inhibit their desires. If the boys go to the computer center, then the girls may likely decline to enter there. (Lockheed & Frakt, 1984)
Sanders, Director for The Computer Equity Training Project in New York, suggests the following as influences of female participation, particularly around the age of puberty:

1. Girls at middle school age are very social and prefer people to things. Computers are solitary activities and non-human.

2. Boys aggressively capture computer time; girls are reluctant to insist on time for themselves.

3. It is acceptable for girls at this age to give up in the face of difficulty. Socially approved helplessness is at its strongest at puberty.

4. Girls avoid competition with boys at the computer for fear of winning and appearing unfeminine and unattractive to boys.

5. Girls prefer human rather than machine rewards for right answers of choice.

6. As compared to boys, girls at this age have many more interests that compete for their free time. (Sanders, 1984, p.32)

The issue of computer usage, then, can be looked at from two perspectives: male dominance and female restraint. Both concepts result in fewer females using computers.

However, an equally important issue may be that boys have greater access to computers, both in time and number. Some of the determinants for computer usage, by sex, at school have been identified. Generally, in a controlled situation, males and females have equal access to computers. In any sort of voluntary situation, males outnumber females.
In a study of Princeton High School students, Educational Testing Service's Marlaine Lockheed found that while 60 percent of the boys had used the school's computers voluntarily - before, during and/or after school - only 8 percent of the girls had availed themselves of the same opportunity. (Sanders, 1984, p. 31)

Tucker's observations (Zakariya, 1984) are in agreement as she states that female students are not joining computer-related extracurricular activities as frequently as boys, but she says that girls appear to be just as comfortable with computers in the classroom.

Teachers are not exempt from having stereotypic attitudes about computers and their influence can be immense. Collis found in her survey that:

There seems to be a tendency for schools with more extensive computer studies programs and more actively involved teachers, all of whom happen to be male, to promote positive attitudes among male students but relatively negative attitudes among female students in grade 8. (1984, p.2)

Stage (Kolata, 1984) states her opinion in stronger terms and says that elementary school teachers are the key to getting girls involved with computers. It is important for the teacher's attitude to be as non-sexist and encouraging as possible to all students: choose both boys and girls as computer volunteers. Very often the computer teacher is a
male, mathematics teacher who does not serve as a realistic role model for the majority of girls. For the male teacher, it is important to provide those role models, by means of discussion and guest speakers (Alvarado, 1984; Gilliland, 1984).

If the gender gap is given due attention at school, there is still the home environment to consider. Do boys have greater access to computers at home? Very little data are available. Fisher (1984b) reports data from a California survey in May of 1984 of sixth grade students. Twenty-one percent of the boys had access to computers at home while 15% of the girls did; this does not appear to be a vast difference. Schubert and Bakke (1984) are involved in an ongoing study in Palo Alto, California which is looking further into the influence from home. The study at the American Institute for Research is looking to provide some insight with answers to the following questions:

Under what circumstances do parents support their children's desires to learn about computers?

Do parents attempt to discourage their daughters from this field for one reason or another, and what are these reasons?

Do some parents attempt to get their daughters interested in educational technology?

Is there a difference between the way parents encourage their children in families with both male and female children? (p. 30)
Some studies have reported that parents have a biased attitude in regards to computers toward their sons (Fisher, 1984a; Schubert & Bakke, 1984). Parents are more inclined to encourage their sons to take computer classes and they are more willing to spend money on their sons with regard to computers. Parental involvement can be invaluable for children of both sexes. By having a computer at home, children can have more individual hands-on time on a computer. They can also view both their parents as role models.

While some students have access to micro-computers at school and others are fortunate enough to have home computers, for some, their initial and perhaps sole contact with computers are with video games at their nearest grocer or video arcade. If that is the case, it may not be computers that are turning the girls off, but the atmosphere where the computers are. Attendance at video arcades is predominantly male.

Like the poolroom of yesterday, it (the video arcade) is largely a male preserve, a place where boys and young men gather. (Kiesler, Sproull & Eccles, 1984, p.42)

If it is not the atmosphere of the arcades, it may be the suitability of the games themselves to girls' interests and abilities. Benbow and Stanley (1980) favour the hypothesis that males have superior mathematical ability which may be
related to greater male ability in spatial tasks. This may add fuel to the fire of male domination of video arcades. Alongside hand-eye coordination, ability in spatial visualization would appear to be an asset in the arcade world of shooting objects in space and journeying through mazes (Maccoby & Jacklin, 1974).

If it is not their ability that dissuades girls from playing these video games, perhaps it is disinterest. Once inside a video arcade, a girl has a choice of playing a game based on a battle, a bombing or some other form of destructive, aggressive game. Traditionally, these topics have not been as enticing to girls as to boys.

Most games, according to Dan Gutman, editor of VIDEO GAMES PLAYER are 'designed by boys for other boys'. (Kiesler, Sproull & Eccles, 1984, p.42)

Girls often prefer more cooperative, as opposed to competitive, programs (Fisher, 1984a; Sanders, 1984; Marrapodi, 1984). In addition to the game format, often the characters, symbols and language with a program are male oriented (Fisher, 1984a,). Being aware of these biases and offering a broader variety of programs within a classroom or computer centre may attract more females.
One of the most noticeable and most correctable issues in the long list of issues about sex differences in computers is the media version that "computers are for boys" (Lockheed & Frakt, 1984; Fisher, 1984; Marrapodi, 1984). Too often, advertisements in magazines and television use men exclusively or as their focal points, while women are cast as "onlookers". If women remain "onlookers" in today's computer society, they may also be cast as "Second-Class Citizens" as the title of one article suggests (Kiesler, Sproull & Eccles, 1984).

Summary

There is an increasing awareness of the issue of gender equity with regard to computers. Many studies and many personal anecdotes may indicate a general increase in female interest in this field. However, the data show a lower rate of female participation in all computer-related activities. Some of the reasons have been identified and mentioned. Remedies are being developed to alleviate the discrepancies. Certainly, the thrust is not to encourage female participation in exclusion to male participation but rather to make the field of computers attractive and accessible to as many students as possible.
Chapter 3

METHOD

The purpose of this study was to determine if there were any sex-related differences at the Grade 4 level with regard to computers through the use of an attitude questionnaire. A description of the sample, questionnaire development and field testing are found in this chapter. The details of administration are also presented. Finally, the methods of data analysis are explained.

Sample Selection

The sample used in the study was selected from the population of all Grade 4 classes in a suburban community adjoining the city of Vancouver, B.C. A wide range of socio-economic levels and ethnic backgrounds are represented in the community.

Description of the Sample

Since approximately 300 students were to be used for the study and the average class size was estimated to be 23, 13 classes were randomly selected from the population of 65
classes. All 13 teachers were requested by phone to participate and all agreed. The sample consisted of 290 students, 143 girls and 147 boys. Although the intent was to employ Grade 4 students, the actual class breakdown, due to split classes, is displayed in Table 1.

Table 1
Distribution of Subjects by Grade and Gender

<table>
<thead>
<tr>
<th>Grade</th>
<th>Girls</th>
<th>Boys</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>12</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>113</td>
<td>101</td>
<td>214</td>
</tr>
<tr>
<td>5</td>
<td>18</td>
<td>37</td>
<td>55</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>147</td>
<td>290</td>
</tr>
</tbody>
</table>

Procedures

Student Data Collection Instrument

The study was descriptive in nature and utilized the survey method of obtaining data. The data gathering instrument for students was a questionnaire, designed by the author (see Appendix B). The questionnaire was four pages in length. The first two pages contained twenty-five items in a Likert
response format. Each item had five response choices ranging from "Strongly Disagree" to "Strongly Agree". Some of the items were stated positively: "I would like to learn more about computers". Others were stated in the negative: "I don't enjoy using computers at school". The third page contained two open response questions and the last page contained background questions with multiple choice responses.

Authorization was obtained to use nine items from the MECC Computer Literacy Questionnaire (Anderson, Hansen, Johnson & Klassen, 1979). The remaining 16 attitude items were constructed by the author, for a total of 25 items. Wording of the items was taken into consideration to make them suitable for Grade 4 students. The intent of these 25 items was to obtain information about the following topics: Interest in and Enjoyment in Using Computers, Anxiety and Confidence About Computer Use, Perceived Usefulness of Computers, Perceived Sex Roles in Attitudes Toward Computers, Relationship Between Mathematics and Computers and Attitudes Toward Mathematics. Each item was placed in a specific category for reporting purposes. The six reporting categories and respective items are given below. The numbers refer to the item number given in Appendix B. Item 18 was the only item used in two reporting categories.
1. Interest in and Enjoyment in Using Computers: 1, 10, 11, 16, 22
2. Anxiety and Confidence About Computer Use: 2, 8, 15, 21, 23, 25
3. Perceived Usefulness of Computers: 5, 9, 12, 18
4. Perceived Sex Roles in Attitudes Toward Computers: 3, 7, 14, 19, 24
5. Relationship Between Mathematics and Computers: 4, 13, 18
6. Attitudes Toward Mathematics: 6, 17, 20

Two questions requiring subjective responses were included to determine students' perception of future use of computers, sex differences in those perceptions, and to determine the extent of parental support for the use of computers and any differences between "mother" and "father".

The background items on the fourth page were included to provide baseline data with regard to computers and to aid in the analysis of results.

**Teacher Questionnaire**

The teachers were asked to complete a questionnaire about computer content taught in their class during the year, the number of computers in their school, and their view of
themselves as role models in regard to computers. Of the thirteen teachers, eleven were female and two were male. Two of the teachers failed to complete their questionnaires. It was not possible to contact one of the teachers and another questionnaire was still not returned after making contact. The "Teacher Questionnaire" can be found in Appendix C.

Field Testing

The attitude questionnaire was field tested in April, of 1984, for the following reasons:

- to test format for ease of completion;
- to discover any confusing items;
- to determine length of time needed to complete the questionnaire;
- to discover any confusion or misunderstanding associated with items containing negative words: #10, 13, 18, 21, 23

Teachers of classes used in the field test were asked to note any questions raised by students regarding the questionnaire. Because the majority of field testing was done in the author's own school, many of the comments were simply relayed verbally.
The attitude questionnaire was field tested with one class at each of the following grade levels: 4, 4/5, 6, 7, 8, and 9. The original intent was to collect data from a variety of grades, thus the extensive piloting. However, in reviewing related articles and studies, it became apparent that most referred to sex differences occurring around the age of puberty and continuing through high school. A few articles referred specifically to younger children and stated that the gap between girls and boys started in elementary school (Kolata, 1984; Winkle & Mathews, 1982). The refined purpose of the study became to gather information from the youngest age group, who were likely to have had some contact with computers.

Corrections to the Attitude Questionnaire Based on Field Testing

Item 1 was originally worded, "I would very much like to have my own computer". Because of the nearly unanimous reaction of "Strongly Agree" to this item, it was noted that the phrasing may have been leading, particularly because it was the first item. The words "very much" were omitted in the final questionnaire so that Item 1 read, "I would like to have my own computer".
In response to the comments made by pilot teachers, the author constructed a supplement entitled, "Directions for Administering the Attitude Questionnaire". This can be found in Appendix A. Directions ranged from monitoring the noise level in the classroom to encouraging students to respond from their own point of view, particularly for the sex-related items.

In the Background Items, some students questioned the definition of computer. But for lack of a better word or phrase, or naming brands, the word computer was left in. Item 8 in the Background Items,

"Have you every played computer games for fun?"

appeared to be redundant and served no purpose. It was therefore omitted in the final form. For more specific information, an additional item was placed in Background Items,

"Have you ever used a computer at school before?"

Questionnaire Administration

In May, 1984, the questionnaires were sent through inter-school mail to each of the participating classes in the sample. Each teacher was responsible for administering them at
his or her leisure, but as soon as possible. All completed student questionnaires were returned in the mail by the end of May, 1984. The only necessary follow-up required were phone calls to encourage completion of teacher questionnaires. Two teacher questionnaires were not submitted and attempts to get in contact with one of the teachers failed. Another questionnaire was lost in the mail and the teacher was not willing to complete another.

Data Analysis

A total of 290 students participated in the survey. There were three information sources used to collect data to aid in understanding students' attitudes toward computers at this age level: 25 attitude items, two open response questions and eight background items.

Background data consisted of information regarding the following: (1) Student Gender, (2) Computer Experience, (3) Home Computers, (4) Parental Use of Computers, and (5) Video Arcade Experience. Background data were analyzed and are reported in the form of tables, comparing girls' and boys' responses in percentages.
All comments for the open response items were read and grouped. Recurring comments were reported. All comments were examined for differences between girls' and boys' responses in percentages.

The attitude items dealt with the following computer-related categories: (1) Interest in and Enjoyment in Using Computers, (2) Anxiety and Confidence About Computer Use, (3) Perceived Usefulness of Computers, (4) Perceived Sex Roles in Attitudes Toward Computers, (5) Relationship Between Mathematics and Computers, (6) Attitudes Toward Mathematics.

Each attitude item was to be responded to using a five-point scale with 'a' being defined as 'Strongly Disagree', 'b' as 'Disagree' 'c' as 'Can't Decide', 'd' as 'Agree' and 'e' as 'Strongly Agree'. For analytical purposes, the letters a, b, c, d and e were given the values 1, 2, 3, 4 and 5 respectively. All student data were entered into a file at the University of British Columbia's Computing Centre.

Methods of Analysis

To interpret educational significance, the author established certain criteria to define positive attitudes for individual items and reporting categories. If 50% or
more of the girls and/or boys responded to an individual item in a manner that reflected the predefined positive attitude, it could be said that girls and/or boys, in general, have a positive attitude toward that item. In the same manner, if 50% or more of the girls and/or boys responded positively to the reporting category, then it could be said that girls and/or boys, in general, at this age level, have a positive attitude toward the said reporting category. In addition to determining positive attitudes by percentage, significance of individual items and reporting categories were determined using a method called Median Polish.

Median Polish

The item-by-gender tables form the basis for the majority of analyses presented in the following chapter. Without additional analysis, however, it is difficult to describe what patterns are in the data or what, if any, differences exist. In order to detect patterns and highlight important differences, an exploratory data analysis technique called median polish was used (Vellemann & Hoaglin, 1981). This procedure partitions two-way tables into four interpretable pieces: a grand effect, row effects, column effects and the interactions of rows and columns. The example below is designed to show how this procedure works.
Suppose the participating Grade 4 girls and boys had responded to three different items and the percentages of students responding positively to each item were placed in a table.

**Items**

1. Computers are useful in many subject areas.
2. Computers are best used for mathematics.
3. Computers help you become a better writer.

<table>
<thead>
<tr>
<th>Items</th>
<th>Students</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>80</td>
<td>85</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>65</td>
<td>70</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>75</td>
<td>55</td>
</tr>
</tbody>
</table>

The results of a median polish of these data would be:

<table>
<thead>
<tr>
<th>Students</th>
<th>Items</th>
<th>Girls</th>
<th>Boys</th>
<th>Row Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0.0</td>
<td>0.0</td>
<td>15.0</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>12.5</td>
<td>-12.5</td>
<td>-2.5</td>
<td></td>
</tr>
</tbody>
</table>

Column Effects - 2.5  2.5  67.5 Grand Effect
One could interpret these results in the following way. The Overall Effect is 67.5% indicating that the median or typical response across all items by both girls and boys was that 67.5% of the students responded positively to these uses of the computer. That is a strong positive endorsement of the ideas portrayed by the items.

The Row Effects indicate the extent to which each item was endorsed by the students. In this case, Item 1 has a Row Effect of +15%. This is a moderate sized effect which shows that all students, girls and boys, responded more positively, 15% above the typical, to this item.

The Column Effects indicate the extent to which each gender responded more or less positively to the three items. In this case, boys affirmed the notion of the usefulness of computers, as measured by these three items, slightly more than the typical student's response, while girls were slightly below the typical response. The effects, plus and minus 2.5%, are small.

Finally, the cells contain the Residual Effects. These represent the extent to which the levels of endorsement of these items cannot be explained by students of this age level in general or by item differences but represent unique
patterns of response by girls or boys to items of a particular nature. In this example, girls responded much more positively than the typical response to the notion that computers help you become a better writer, while boys responded much more negatively than the typical response to the same item.

For each category table, the initial responses were determined by totalling the percentage of "Agree" and "Strongly Agree" answers from the student questionnaires. In items stated in a negative form, the responses were determined by totalling the percentage of "Disagree" and "Strongly Disagree" answers. For example, the item "Computer sometimes scare me" is stated in the negative form. For this item, the total percentages of "Disagree" and "Strongly Disagree" responses would constitute the initial table entry. In the following tables of data, the items stated in the negative form will be noted by a (-) for clarification purposes. Certain responses for each item, whether positive or negative, were predefined by the author as reflecting a positive attitude toward the item. These will be clearly identified for each reporting category and reported in the following chapter.

In addition to the reporting categories, responses were viewed from the girls based on whether or not their mothers used computers and on responses from all students, dividing them into students who had a computer at home, and those who did not.
Chapter 4

FINDINGS

In this chapter, findings are presented from the teacher questionnaire which set a general background from which the sample was taken. Background data are then presented, followed by results of the reporting categories and individual items from the student attitude questionnaire where relevant.

Teacher Questionnaire

Teachers were asked the following five questions to determine the general atmosphere from which the students, who had answered the attitude questionnaire, had come:

1. Have you taught any computer units in class this year? If so, briefly explain.
2. Have you used a computer at all in your classroom or have the students had access to a computer during class time?
3. How many computers do you have at your school?
4. Do you have a computer club at your school? Is it restricted to certain grades?
5. Do you view yourself as a role model as a computer programmer or a computer user?
Eleven of the thirteen teachers completed and returned the questionnaire. One of the teachers who did not return the questionnaire was contacted, but the form was still not returned. The author was unable to get in touch with the other teacher.

Ten of the eleven teachers had taught some sort of computer unit to their class; the unit topics varied. Example topics are computer literacy (basic vocabulary and directions for use), graphics, typing, LOGO, word processing, math drill and problem solving, and some commercial software for a variety of unnamed subjects. Eight out of the eleven teachers mentioned mathematics as one of the uses of computers in their classrooms. Five teachers have used LOGO in their classrooms and four mentioned word processing. The single teacher who had not taught a computer unit in class did state that the computer was used in her classroom.

All the schools used in the study have at least one computer. Four of the eleven schools have only one computer, four schools have three computers, one school has four computers, and two schools have six computers. All participating classes had scheduled time for classroom use of the school computer(s).
Four of the eleven schools have computer clubs; two of those are restricted to the intermediate grades.

Five of the eleven teachers view themselves as role models. They use the computer for themselves and to aid in schoolwork, eg. report cards, worksheets. Discussions are held in most classes about computers and computer users.

Student Questionnaire

Background Data

The data derived from the background questions are presented in tables in this section. Percentages are given for each of the three possible responses for girls and boys.

The percentage of students who have used computers before is extremely high, with no significant difference between girls and boys (See Table 2). The percentage of students who have used a computer at school is almost as high, with only 6% of the students claiming never to have used a computer at school (See Table 3).
Table 2  
Summary Analysis of Background Item 2  
"Have you ever used a computer before?"  
(Responses in %)  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>97</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>97</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Boys</td>
<td>97</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 3  
Summary Analysis of Background Item 3  
"Have you ever used a computer at school before?"  
(Responses in %)  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>91</td>
<td>6</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>92</td>
<td>6</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Boys</td>
<td>90</td>
<td>6</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
Almost one-third of the students have computers at home (See Table 4). It was unreasonable to delve into definitions and/or brands of computers on the questionnaire; thus the meaning of the word computer was left to the student's judgement. It is the author's opinion that most students of this age would view a computer as comparable to one of the micro-computers at their school eg. Apple and Commodore. Only 4% more boys than girls stated that they have a computer at home.

Table 4
Summary Analysis of Background item 4
"Do you have a computer at home?"
(Responses in %)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>30</td>
<td>68</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>28</td>
<td>72</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Boys</td>
<td>32</td>
<td>63</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Of the students who do not have computers at home, almost one-half stated their family has considered buying one (See Table 5). About one-fourth stated "no" and approximately one-third did not know.
Table 5
Summary Analysis of Background Item 5
"If you do not have a computer at home, has your family considered buying one?"
(Responses in %)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>32</td>
<td>16</td>
<td>19</td>
<td>32</td>
</tr>
<tr>
<td>Girls</td>
<td>28</td>
<td>20</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>Boys</td>
<td>36</td>
<td>12</td>
<td>14</td>
<td>37</td>
</tr>
</tbody>
</table>

With respect to parental use of computers, there seem to be no obvious differences when comparing use by mother or father nor in responses by girls and boys (see Tables 6 and 7). Three-fifths of the students stated that their mothers did not use computers while just under one-half stated that their fathers did not use computers. Approximately one-fifth of the students claimed that their mothers did use computers while about one-third claimed that their father did. However, while only 6% more girls stated their fathers used computers than their mothers, 17% more boys stated their fathers used computers than their mothers. Almost one-fifth of the students did not know if either their father or mother used computers at
home or work. This is quite a large percentage but reasonable considering this age group's knowledge of their parents' work.

Table 6
Summary Analysis of Background Item 6

"Does your mother use computers at work or at home?"

(Responses in %)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>22</td>
<td>60</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>Girls</td>
<td>25</td>
<td>58</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Boys</td>
<td>19</td>
<td>62</td>
<td>14</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 7
Summary Analysis of Background Item 7

"Does your father use computers at work or at home?"

(Responses in %)

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>33</td>
<td>46</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>31</td>
<td>49</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>Boys</td>
<td>36</td>
<td>42</td>
<td>18</td>
<td>4</td>
</tr>
</tbody>
</table>
A high percentage of the students have played games in a video arcade (see Table 8). While 83% of the students answered "yes" to this question, it is interesting to note that 12% more boys than girls have played games in a video arcade. Only 7% of the boys claimed to have never played games in a video arcade while 20% of the girls have not.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>I don't Know</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>83</td>
<td>13</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Girls</td>
<td>77</td>
<td>20</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Boys</td>
<td>89</td>
<td>7</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Reporting Categories

Interest in and Enjoyment in Using Computers

The items in this category were used to determine if students in the study were interested in and enjoyed using
computers, and to determine any sex differences in that interest. It was anticipated that there would be a high level of stated interest and enjoyment in using computers by students of this age. However, it was not known if there would be any significant differences in the responses between girls and boys. Based on the related literature, it might be anticipated that more boys would indicate a higher level of interest than girls.

Given that interest is one of the highest motivational factors in any learning situation, if either girls or boys are not interested in computers, they will not be motivated to use them or learn more about them. If more girls did state a lower interest in computers, that could be one explanation for the gender inequity in computer use. A student was deemed to have a positive attitude in the "Interest in and Enjoyment in Using Computers" category if he or she agreed with items 1, 11, 16 and 22 and disagreed with item 10. If 50% or more of the girls or boys responded in the defined positive manner, than it can be said that girls or boys, in general, at this age level display a positive attitude in this reporting category. The five items grouped to form this category are presented with their results in Table 9.
Table 9
Interest in and Enjoyment in Using Computers
(% Positive Attitude)

<table>
<thead>
<tr>
<th>Item</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I would like to have my own computer.</td>
<td>92.0</td>
<td>94.0</td>
</tr>
<tr>
<td>10. I don't enjoy using computers in school.</td>
<td>90.0</td>
<td>86.0 (-)</td>
</tr>
<tr>
<td>11. I would like to learn more about computers.</td>
<td>87.0</td>
<td>90.0</td>
</tr>
<tr>
<td>16. I would enjoy using computer games to learn.</td>
<td>66.0</td>
<td>67.0</td>
</tr>
<tr>
<td>22. I enjoy working with computers.</td>
<td>92.0</td>
<td>94.0</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form

Results, after median polishing, for all items in this category can be found in Table 10. It was established prior to analysis that the author would look only at those differences greater than 10.

There was a very strong positive reaction to this category as a whole. Almost all of the students, 88%, display an interest in and enjoyment in using computers. Of the five items constituting this category, one item received a significantly weaker reaction in comparison to the other four.
The item was, "I would enjoy using computer games to learn". Two percent of the students did not answer this item, 18% disagreed, 13% couldn't decide and 66% agreed with the item. While it is certainly a positive result, it is weak in comparison to the other four items, i.e. the positive reactions to the other four items were all greater than 85%.

Table 10
Interest in and Enjoyment in Using Computers
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I would like to have my own computer.</td>
<td>0.0</td>
<td>-0.0</td>
<td>4.5</td>
</tr>
<tr>
<td>10. I don't enjoy using computers in school.</td>
<td>-3.0</td>
<td>-3.0</td>
<td>-0.5 (-)</td>
</tr>
<tr>
<td>11. I would like to learn more about computers.</td>
<td>-0.5</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>16. I would enjoy using computer games to learn.</td>
<td>-0.5</td>
<td>-0.5</td>
<td>-22.0 *</td>
</tr>
<tr>
<td>22. I enjoy working with computers.</td>
<td>0.0</td>
<td>-0.0</td>
<td>-4.5</td>
</tr>
<tr>
<td>Column</td>
<td>-1.0</td>
<td>1.0</td>
<td>88.5 Grand</td>
</tr>
</tbody>
</table>

* Indicates significant result - set at absolute values 10.

(-) Indicates items stated in the negative form
The reaction to the item, "I would enjoy using computer games to learn", is difficult to interpret because of the ambiguous wording. One doesn't know whether students are disagreeing with using a computer to learn, using games to learn, or using a computer for games.

None of the differences between girls and boys for the items in this category were significant. Girls and boys at this age display a comparably high interest and enjoyment in using computers.

Anxiety and Confidence About Computer Use

The items in this category were used to determine if the students in the study were anxious or confident about using or learning to use computers. Self-confidence often leads to participation as anxiety does to seclusion. At such a young age, do children already have strong feelings about their abilities and ease with computers? The six items that made up the category and the results for each item are presented in Table 11. A student's attitude was defined as positive in the "Anxiety and Confidence About Using Computers" category if he or she agreed with items 2 and 23 and disagreed with items 8, 15, 21 and 25.
Table 11
Anxiety and Confidence About Computer Use

(\% Positive Attitude)

<table>
<thead>
<tr>
<th>Item</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I am able to work with computers as well as most others my age.</td>
<td>71.0</td>
<td>72.0</td>
</tr>
<tr>
<td>8. Computers sometimes scare me.</td>
<td>81.0</td>
<td>88.0 (-)</td>
</tr>
<tr>
<td>15. Working with a computer would probably make me feel uneasy or tense.</td>
<td>66.0</td>
<td>68.0 (-)</td>
</tr>
<tr>
<td>21. It is my guess that I am not the kind of person who works well with computers.</td>
<td>64.0</td>
<td>67.0 (-)</td>
</tr>
<tr>
<td>23. I have no trouble using computers.</td>
<td>50.0</td>
<td>53.0</td>
</tr>
<tr>
<td>25. Learning to use a computer would be harder for me than for most people</td>
<td>64.0</td>
<td>74.0 (-)</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form

Results, after median polishing, for all items in the category can be found in Table 12. Reaction to this category was positive with 68\% of the students displaying a confident feeling about using computers. Of the six items constituting this category, two items revealed significant results.

One item was, "Computers sometimes scare me". The significant result after the median polishing indicates that in
comparison to the other items in this category, students responded to "Computers sometimes scare me" in stronger terms. Since the item was in the negative form the indication is that computers certainly did not scare the students used in the study. In fact, 84% of the students disagreed that computers sometimes scared them.

Table 12
Anxiety and Confidence About Computer Use
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I am able to work with computers as well as most others my age.</td>
<td>-1.0</td>
<td>-1.0</td>
<td>3.5</td>
</tr>
<tr>
<td>8. Computers sometimes scare me.</td>
<td>-2.0</td>
<td>2.0</td>
<td>16.5 (-)*</td>
</tr>
<tr>
<td>15. Working with a computer would probably make me feel uneasy or tense.</td>
<td>.5</td>
<td>-.5</td>
<td>-1.0 (-)</td>
</tr>
<tr>
<td>21. It is my guess that I am not the kind of person who works well with computers.</td>
<td>0.0</td>
<td>0.0</td>
<td>-2.5 (-)</td>
</tr>
<tr>
<td>23. I have no trouble using computers.</td>
<td>0.0</td>
<td>-0.0</td>
<td>-16.5 *</td>
</tr>
<tr>
<td>25. Learning to use a computer would be harder for me than for most people.</td>
<td>-3.5</td>
<td>3.5</td>
<td>1.0 (-)</td>
</tr>
</tbody>
</table>

Column -1.5 1.5 68.0

* Indicates significant result - set at absolute values 10.

(-) Indicates items stated in the negative form
The following item, "I have no trouble using computers", also produced a significantly negative reaction in comparison to the other items in this category. Only 51% agreed with the item, while 26% disagreed and 22% could not decide. Thus, while half of the students have no trouble using computers, one-quarter of the students say they do, and another one-quarter could not decide. Because the interest and enjoyment level is so high at this level, it would seem that the results of this item indicate two possible interpretations. Children at this age may lack experience and knowledge of computers as opposed to actual difficulty in using them or secondly, they may have difficulty using computers, but are motivated to try.

None of the differences between girls and boys for the items in the category were significant. Girls and boys at this age are equally confident about using and learning to use computers.

Perceived Usefulness of Computers

The four items in this category were used to determine if students thought computers were useful now and would be in the future. Two items related usefulness directly to video games and mathematics, but otherwise, the intent was to gather information with respect to general usefulness of computers. A student's attitude was defined as positive in the "Perceived
Usefulness of Computers category, if he or she agreed with items 9 and 12 and disagreed with items 5 and 18. The four items and the results for each are presented in Table 13.

### Table 13
Perceived Usefulness of Computers

(\% Positive Attitude)

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Statement</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Computers are best used for playing video games.</td>
<td>55.0</td>
<td>50.0 (-)</td>
</tr>
<tr>
<td>9.</td>
<td>Learning about computers will help me in the future.</td>
<td>80.0</td>
<td>90.0</td>
</tr>
<tr>
<td>12.</td>
<td>Computers can be useful in many subject areas.</td>
<td>88.0</td>
<td>92.0</td>
</tr>
<tr>
<td>18.</td>
<td>Computers are not useful in learning mathematics.</td>
<td>85.0</td>
<td>88.0 (-)</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form

The percentage of students who can see the usefulness of computers is very high. Almost all of the students, 86\%, displayed a positive attitude in this category. That is, they responded positively to all four items. Results for all items in this category, after median polishing can be found in Table 14.
Table 14
Perceived Usefulness of Computers
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Computers are best used for playing video games.</td>
<td>4.3</td>
<td>-4.2</td>
<td>-33.2 (-)*</td>
</tr>
<tr>
<td>9. Learning about computers will help me in the future.</td>
<td>-3.2</td>
<td>3.3</td>
<td>-.7</td>
</tr>
<tr>
<td>12. Computers can be useful in many subject areas.</td>
<td>-.2</td>
<td>.3</td>
<td>4.3</td>
</tr>
<tr>
<td>18. Computers are not useful in learning mathematics.</td>
<td>.3</td>
<td>-.2</td>
<td>.8 (-)</td>
</tr>
<tr>
<td><strong>Column</strong></td>
<td><strong>-1.7</strong></td>
<td><strong>1.8</strong></td>
<td><strong>85.8 Grand</strong></td>
</tr>
</tbody>
</table>

* Indicates significant result - set at absolute values 10.
(-) Indicates items stated in the negative form

Of the four items in the category, only one had a significantly negative response in comparison to the other items. For the item, "Computers are best used for playing video games", 52% of the students disagreed, 29% agreed and 18% could not decide. Almost one-third of the students agreed that computers are best used for playing video games. Only
approximately half of the students responded with the response reflecting a positive attitude, to disagree or strongly disagree. While it is a positive result, it is weak in comparison to the other three items, i.e. the positive reactions to the other three items in this category were all greater than or equal to 80%.

None of the differences between girls and boys for the items in the category were significant. Girls and boys at this age have comparable attitudes towards the usefulness of computers.

**Perceived Sex Roles in Attitudes Toward Computers**

It was of interest in this study, not only to determine sex differences in how girls and boys responded to specified items, but also to obtain information on students' perceptions of each gender with regard to computers. The items in this category asked students to look at "girls" and "boys" in general, as opposed to any individuals. The five items that constituted this category and the results for each item are presented in Table 15.
Table 15
Perceived Sex Roles in Attitudes Toward Computers
(% Positive Attitude)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Boys learn more by using a computer than girls do.</td>
<td>87.0</td>
</tr>
<tr>
<td>7.</td>
<td>It is more important for boys to learn about computers than for girls.</td>
<td>86.0</td>
</tr>
<tr>
<td>14.</td>
<td>It is more important for girls to learn about computers than for boys.</td>
<td>69.0</td>
</tr>
<tr>
<td>19.</td>
<td>It is easier for girls to learn to use computers than for boys.</td>
<td>64.0</td>
</tr>
<tr>
<td>24.</td>
<td>Using computers is more interesting for boys than for girls.</td>
<td>81.0</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form

A positive attitude in this category of items was defined as a non-sexist attitude. Students who responded negatively to items that favoured either sex were deemed to have positive attitudes; in this category, that consisted of all five items. Over 50% of the girls and boys disagreed with each item, leading to the conclusion that students of this age have a positive, non-sexist attitude regarding computers. The boys' responses to Item 24 came very close to not reflecting a
positive attitude. Only 53% of the boys disagreed that using computers is more interesting for boys than for girls, while 81% of the girls disagreed. Results for all items in this category, after median polishing can be found in Table 16.

Table 16
Perceived Sex Roles in Attitudes Toward Computers
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Boys learn more by using a computer than girls do.</td>
<td>2.0</td>
<td>-2.0</td>
<td>0.0 (-)</td>
</tr>
<tr>
<td>7. It is more important for boys to learn about computers than for girls.</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0 (-)</td>
</tr>
<tr>
<td>14. It is more important for girls to learn about computers than for boys.</td>
<td>-18.5*</td>
<td>18.5*</td>
<td>2.5 (-)</td>
</tr>
<tr>
<td>19. It is easier for girls to learn to use computers than for boys.</td>
<td>-20.0*</td>
<td>20.0*</td>
<td>-1.0 (-)</td>
</tr>
<tr>
<td>24. Using computers is more interesting for boys than for girls.</td>
<td>3.0</td>
<td>-3.0</td>
<td>-7.0 (-)</td>
</tr>
</tbody>
</table>

Column 11.0* -11.0* 74.0

* Indicates significant result - set at absolute values 10.

(-) Indicates items stated in the negative form
There were no significant results in comparison of the items within the category; the students in general responded to all items with approximately the same intensity. However, two of the five items, as well as the reporting category as a whole, produced significant results between girls and boys. The two items were "It is more important for girls to learn about computers than for boys" and "It is easier for girls to learn to use computers than for boys". For both of these items, both girls and boys responded in a positive manner. However, it is interesting to note that for the first of these items, 84% of the boys disagreed with the item while only 69% of the girls did, and for the second item, 82% of the boys disagreed and 64% of the girls disagreed. Both items were stated in terms that favoured girls and in both cases, approximately 15% more boys than girls disagreed with the item.

For comparison purposes the following two items, identical except for sex reversals, were included in the questionnaire:

7. It is more important for boys to learn about computers than for girls.

14. It is more important for girls to learn about computers than for boys.

The results are presented in Table 17.
Table 17
Comparison of Items 7 and 14
(Responses in %)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th></th>
<th>Boys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disagree</td>
<td>Can't Decide</td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>Item 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(In favour of Boys)</td>
<td>86</td>
<td>10</td>
<td>3</td>
<td>64</td>
</tr>
<tr>
<td>Item 14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(In favour of Girls)</td>
<td>69</td>
<td>14</td>
<td>17</td>
<td>84</td>
</tr>
</tbody>
</table>

For either girls or boys to have a positive (i.e. non-sexist) attitude, the percent of disagreement with both items should be high. That is, a student should disagree with items that are in favour of both girls and boys. From the above table, one can see that this is so. However, it is interesting to note the following observations. Both girls and boys reacted in a stronger negative way to items that favoured the opposite sex. That is, more girls than boys responded negatively to items that favoured boys. And more boys than girls responded negatively to items that favoured girls. The two items that resulted in significant results for sex differences were stated in a manner that read positively for girls.
Looking at the "Perceived Sex Roles in Attitudes Toward Computers" category as a whole, sex differences were also found to be significant. At the start of this section it was stated that attitudes were deemed to be positive if students disagreed with all items. This was found to be so. In terms of the purposes of the present study the data show that both girls and boys have positive attitudes (non-sexist) in the "Perceived Sex Roles in Attitudes Toward Computers" category. It is interesting, though, that 85% of the girls displayed a positive attitude compared to 63% of the boys. One possible interpretation would be that although boys have a positive attitude in this category, it is a more sexist one than girls. However, without further interviews, this cannot be claimed. A second interpretation, based on stronger evidence is that Grade 4 boys and girls tended to respond in a defensive manner when items were worded negatively about their own gender. The significant results of the median polish, then, are reflective of the fact that 3 of the 5 items were worded in favour of boys. The two items that revealed significant differences - items worded in favour of girls - were ones that fewer girls and more boys tended to disagree with. In view of the difficulty of interpreting these results, one cannot provide a strong argument for concluding that one gender has a stronger positive (less sexist) attitude than the other. The indications from the results are that girls and
boys at this age feel it is just as important for either sex to use and learn about computers. It was noted that each sex responded in a stronger defensive manner when items were worded negatively about their own gender.

Relationship Between Mathematics and Computers

The three items in this category were used to determine if students perceived any relationship between mathematics and computers. A student's attitude was defined as positive in this category if he or she agreed with item 4 and disagreed with items 13 and 18. The three items and the results for each are presented in Table 18:

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Using a computer will help me become better at mathematics.</td>
<td>75.0</td>
<td>78.0</td>
</tr>
<tr>
<td>13. I would rather not use computers to learn mathematics.</td>
<td>69.0</td>
<td>67.0 (-)</td>
</tr>
<tr>
<td>18. Computers are not useful in learning mathematics.</td>
<td>85.0</td>
<td>88.0 (-)</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form
Table 19
Relationship Between Mathematics and Computers
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Using a computer will help me become better at mathematics.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>13. I would rather not use computers to learn mathematics.</td>
<td>2.5</td>
<td>-2.5</td>
<td>-8.5 (-)</td>
</tr>
<tr>
<td>18. Computers are not useful in learning mathematics.</td>
<td>0.0</td>
<td>0.0</td>
<td>10.0 (-)</td>
</tr>
<tr>
<td>Column</td>
<td>-1.5</td>
<td>1.5</td>
<td>76.5</td>
</tr>
</tbody>
</table>

(-) Indicates items stated in the negative form

Results for all items in the category, after median polishing can be found in Table 19. The percentage of positive responses relating mathematics and computers were high. Seventy-six percent of the students saw a relationship between mathematics and computers.

None of the differences between girls and boys for the items in the category were significant. Girls and boys at this
age have a comparable view of the positive relationship between mathematics and computers.

**Attitudes Toward Mathematics**

The three items in this category concerning attitudes toward mathematics were used to determine students' confidence in mathematics and their enjoyment of it. A student's attitude was defined as positive in this category if he or she agreed with items 6 and 20 and disagreed with item 17. The three items and the results for each are presented in Table 20.

Results for all items in the category, after median polishing can be found in Table 21. Seventy-four percent of the students responded positively to this category as a whole. There were no significant results among the items or between girls and boys for any item. Both girls and boys have a good attitude toward mathematics. It is difficult to generalize beyond the interpretation that students of this age have a positive attitude about mathematics.
Table 20
Attitudes Toward Mathematics
(% Positive Attitude)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I usually expect to do well in mathematics.</td>
<td>69.0</td>
<td>74.0</td>
</tr>
<tr>
<td>17. Math is hard for me to understand.</td>
<td>74.0</td>
<td>74.0 (−)</td>
</tr>
<tr>
<td>20. I like mathematics.</td>
<td>77.0</td>
<td>73.0</td>
</tr>
</tbody>
</table>

(−) Indicates items stated in the negative form

Table 21
Attitudes Toward Mathematics
(Results after Median Polishing)

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Row</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I usually expect to do well in mathematics.</td>
<td>-2.5</td>
<td>2.5</td>
<td>-2.5</td>
</tr>
<tr>
<td>17. Math is hard for me to understand.</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0 (−)</td>
</tr>
<tr>
<td>20. I like mathematics.</td>
<td>2.0</td>
<td>-2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

| Column              | 0.0   | 0.0  | 74.0  |
|                     |       |      | Grand |

(−) Indicates items stated in the negative form
Girls and Their Mothers

In response to the background item, "Does your mother use computers at work or at home?", 25% of the girls responded "Yes", 58% responded "No", and 15% did not know. Data were reviewed to see if there were any differences between the responses to the reporting categories of girls whose mothers use computers (potential role models) and girls whose mothers do not use computers. These results can be found in Table 22.

Table 22
Girls and Their Mothers
(Results in %)

<table>
<thead>
<tr>
<th></th>
<th>Mothers do use computers</th>
<th>Mothers do not use computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest in and Enjoyment in</td>
<td>86</td>
<td>85</td>
</tr>
<tr>
<td>Using Computers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety and Confidence About</td>
<td>75</td>
<td>61</td>
</tr>
<tr>
<td>Computer Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Usefulness of</td>
<td>82</td>
<td>74</td>
</tr>
<tr>
<td>Computers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Sex Roles in</td>
<td>87</td>
<td>75</td>
</tr>
<tr>
<td>Attitudes Toward Computers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship Between</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>Mathematics and Computers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitudes Toward Mathematics</td>
<td>79</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A positive attitude for each group of girls was defined using the equal to or greater than 50% criteria, explained earlier. Thus, positive attitudes were reflected in all six reporting categories, for both sets of respondents. In all six reporting categories percentages were higher in favour of girls whose mothers do use computers and in two cases, those differences were greater than 10%. These were "Anxiety and Confidence About Computer Use" and "Perceived Sex Roles in Attitudes Toward Computers".

Results indicate that the girls whose mothers use computers may have been influenced by such a role model. These girls are more confident about using and learning to use computers and have stronger positive views about the appropriateness of computers for both sexes than girls whose mothers do not use computers.

However, because the samples of respondents are small, it may not be possible to generalize these attitudes to a greater population. The sample of respondents for this background item consisted of 36 girls whose mothers do use computers and 83 girls whose mothers do not use computers. Twenty-two girls did not know whether their mothers used computers.
Home Computers

In response to the background item, "Do you have a computer at home?", 30% of the students responded "Yes" and 68% responded "No". Data were reviewed to see if there were any differences between the responses to the reporting categories of the students based on whether or not they had a computer at home. These results can be found in Table 23.

Table 23
Home Computers
(Results in %)

<table>
<thead>
<tr>
<th></th>
<th>Students with home computers</th>
<th>Students without home computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest in and Enjoyment in Using Computers</td>
<td>87</td>
<td>85</td>
</tr>
<tr>
<td>Anxiety and Confidence About Computer Use</td>
<td>77</td>
<td>65</td>
</tr>
<tr>
<td>Perceived Usefulness of Computers</td>
<td>81</td>
<td>77</td>
</tr>
<tr>
<td>Perceived Sex Roles in Attitudes Toward Computers</td>
<td>73</td>
<td>72</td>
</tr>
<tr>
<td>Relationship Between Mathematics and Computers</td>
<td>58</td>
<td>75</td>
</tr>
<tr>
<td>Attitudes Toward Mathematics</td>
<td>76</td>
<td>71</td>
</tr>
</tbody>
</table>
It was found that responses in all six reporting categories, for both sets of students, reflected a positive attitude, based on the equal to or greater than 50% criteria. In two reporting categories the differences in responses were greater than 10%. In the "Anxiety and Confidence About Computer Use" category, 12% more students who have a home computer responded positively than students who do not have a home computer. In the "Relationship Between Mathematics and Computers" category, 17% more students who do not have a home computer responded positively than students who have a home computer.

It would make sense to assume that students who have a computer at home would have more hands-on time and experience with computers, leading to a less anxious, more confident attitude about using them. Also, because those students may have greater access to a computer, they may be using them for a greater variety of purposes. They may have interpreted the items in the "Relationship Between Mathematics and Computers" category as exclusively linking mathematics and computers which may have led to the differences in responses by the two groups of students for that category.
Open-Response Items

Students were asked to answer the following two open response questions:

1. How do you think you could use a computer when you are an adult?
2. Do you think that your mother and father are enthusiastic about you learning to use a computer? Tell why or why not.

There were no apparent sex differences in response to either question. Students related a number of ways that they thought they could, as adults, use a computer. The most common intended uses included using a computer for their business or work, finances such as bills and taxes, typing and writing, fun (games) and keeping records and files. A variety of careers was mentioned; the most common by far was a teacher. Other careers noted were a doctor, banker, policeman, worker in a law firm, librarian, forest fire ranger, naval officer and flight manager.

A large majority of students felt that their parents were enthusiastic about them learning to use a computer. The primary reason given was that learning to use a computer would be helpful in the child's future. More specific responses were, as stated by students, that computers helped the student
learn and become smarter. A number of students mentioned "math" in particular. Some of the students who responded "no" to this second question, commented that their parents felt that the student should do his or her own thinking. Others who responded "no" stated that their parents themselves did not know much about computers or "were not the type". Conversely, a number of students who responded "yes" to this question relayed their parents' interest to also learn about computers, perhaps through their children.
Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

The purpose of this study was to determine if there were any sex-related differences at the Grade 4 level in attitudes toward computers. Data were obtained from two hundred and ninety students by means of a questionnaire containing 25 attitude-determining questions. Items had been grouped previously, but not as part of the questionnaire format, into six reporting categories. In addition, two questions requiring subjective comments and eight background information items were included in the questionnaire.

Educational significance was determined for individual items and reporting categories. The author predefined responses to the items that were to reflect positive attitudes. If 50% or more of the girls or boys, or students in general, responded in that manner, then it could be said that girls or boys or students had a positive attitude toward that item. Positive attitudes in reporting categories were determined as well, using a greater than or equal to 50% criteria. For additional analysis, median polishing was used
in analysing the data to determine any significant differences among the responses to each reporting category as a whole as well as each individual item within a reporting category.

With respect to all six reporting categories, data were analysed comparing girls whose mothers use computers to girls whose mothers do not. Also, responses of students who have computers at home were compared to responses of students who do not.

In addition to the analysis of individual items and reporting categories, other results from the questionnaire were viewed and compared. Background data were analysed using raw data percentages for girls' and boys' responses. The subjective comments were read and grouped and recurring comments were reported. Responses to the teacher questionnaire provided information that set the general background of the students completing the questionnaire.

**Reporting Categories**

The results of the attitude items on the questionnaire indicate that there were no sex-related differences in responses to five of the six reporting categories. Girls and boys at this age have comparable positive attitudes toward
computers with regard to "Interest in and Enjoyment in Using Computers", "Anxiety and Confidence About Computer Use", "Perceived Usefulness of Computers", and "Relationship Between Mathematics and Computers" and "Attitudes Toward Mathematics". There were also no sex-related differences in the reporting category, "Attitudes Toward Mathematics". There were significant sex-related differences in one category, "Perceived Sex Roles in Attitudes Toward Computers". It was found that while both girls and boys have a positive attitude in this category, 22% more girls than boys displayed this positive attitude. However, in view of the difficulty of interpreting these results, one cannot provide a strong argument for concluding that one gender has a stronger positive (less sexist) attitude than the other. Girls and boys at this age feel it is just as important for either sex to use and learn about computers.

Individual Items

Two individual items revealed sex-related differences in responses. These were both from the "Perceived Sex Roles in Attitudes Toward Computers" reporting category: "It is more important for girls to learn about computers than for boys" and "It is easier for girls to learn to use computers than for boys". For both of these items, both girls and boys responded in a positive manner. However, it is interesting to note that
for the first of these items, 84% of the boys disagreed with the item while only 69% of the girls did, and for the second item, 82% of the boys disagreed and 64% of the girls disagreed. Both items were stated in terms that favoured girls and in both cases, approximately 15% more boys than girls disagreed with the item. It is clear that the students are responding defensively to the wording.

Significant results for students, of this age in general, were found on four items. Although the responses to each of these items were positive, they were reacted to in stronger terms, either positive or negative, when compared to the responses of the other items within the category. One item in the "Interest in and Enjoyment in Using Computers" category was "I would enjoy using computer games to learn". This was reacted to in a significantly weaker manner, although still positive, than the other items in this category. Thus, while students would enjoy using computer games to learn, their endorsement of this idea is not as strong as that of the other items within this category. There were significant results for two items in the "Anxiety and Confidence About Using Computers" category. In comparison to the other items in this category, students responded to "Computers sometimes scare me" in stronger terms. Since the item was in the negative form, the indication is that computers certainly did not scare the students used in the study. The other item in this category
that produced a significant result was "I have no trouble using computers". Only 51% of the students agreed with this item. The final item in which the responses were found to be significant was in the "Perceived Usefulness of Computers" category. The results were much weaker for the item "Computers are best used for playing video games". Only 53% of the students agreed with this item, in comparison to over 80% for all other items within this category.

Further Findings

Responses of girls whose mothers do use computers and girls whose mothers do not use computers were compared. In view of the small samples it is difficult to generalize beyond the sample used in this study. Positive attitudes for both girls whose mothers do and do not use computers were reflected in all six reporting categories. In all six reporting categories percentages were higher in favour of girls whose mothers do use computers and in two cases, those differences were greater than 10%. These were "Anxiety and Confidence About Computer Use" and "Perceived Sex Roles in Attitudes Toward Computers".
Results indicate that the girls whose mothers use computers may have been influenced by such a role model. These girls are more confident about using and learning to use computers and have stronger positive views about the appropriateness of computers for both sexes than girls whose mothers do not use computers.

Results were viewed and compared for students based on whether or not they had a computer at home. It was found that responses in all six reporting categories, for both sets of students, reflected a positive attitude, based on the equal to or greater than 50% criteria. In two reporting categories the differences in responses were greater than 10%. In the "Anxiety and Confidence About Computer Use" category, 12% more students who have a home computer responded positively than students who do not have a home computer. In the "Relationship Between Mathematics and Computers" category, 17% more students who do not have a home computer responded positively than students who have a home computer.

It would make sense to assume that students who have a computer at home would have more hands-on time and experience with computers, leading to a less anxious, more confident attitude about using them. Also, because those students may have greater access to a computer, they may be using them for a greater variety of purposes. They may have interpreted the
items in the "Relationship Between Mathematics and Computers" category as exclusively linking mathematics and computers which may have led to the differences in responses by the two groups of students for that category.

Conclusions

The results of this study show that there appear to be very few sex-related differences in attitudes toward computers among ten year olds. Both girls and boys display a strong interest and enjoyment in using computers. Both show a confident attitude about learning to use and using computers. The usefulness of computers is positively viewed by both sexes. Girls and boys realize the importance of computers to both sexes although approximately 20% more girls than boys displayed this positive attitude. It was noted that each sex tended to respond defensively to items worded negatively about their own gender. Both girls and boys perceive a positive relationship between the use of computers and mathematics as well as exhibiting a positive attitude about mathematics itself.

Students suggested a variety of ways that they, as adults, could use a computer. The most common stated purpose was for use in their work or business. Most students thought their parents were enthusiastic about them learning to use a computer. Again, the reasons given varied widely but common
responses included: it would help in the student's future, and it would help them learn more. Very few generalizations could be drawn from the two open response questions.

The background information provided some baseline data for this population. Ninety-seven percent of the students have used a computer before while ninety-one percent have used a computer at school. About one-third of the students have a computer at home and approximately half of those who do not, report that their families have considered buying a computer for the home. Twenty-two percent of the students answered that their mothers use computers at work or at home and 33% say that their father do. Eighty-three percent of the students claimed to have played games in a video arcade. Twelve percent more boys than girls have played games in a video arcade and while 7% of the boys have never done so, 20% of the girls have not.

The results in the preceding paragraphs indicate that students at this age certainly have exposure to computers and are very interested in them. The finding of so few sex-related differences at this age is a good one. But the results in the area "Perceived Sex Roles in Attitudes Toward Computers" where sex-related differences did appear, suggest that educators should be aware of the possible beginning of a difference in attitudes toward computers between girls and boys.
Recommendations

To interpret the information from the 25 attitude items and two open-response questions was a difficult task. There were few significant differences among the results and where there were, it was difficult to generalize. It is recommended that with students of this age, a more thorough, individualistic study including interviews and observations be done which may produce more realistic and specific information.

Results of this study have shown some significant results in the area of sex differences with regard to computers at this age level and those areas where significant results were found may be pursued by further research. Although both girls and boys displayed a positive (non-sexist) attitude, there was a 22% difference in the responses by each gender. Eighty-five percent of the girls displayed a positive attitude compared to 63% of the boys. It would be interesting to find out exactly what this difference in responses means. Interviews may be needed to find out in more detail how both girls and boys view their own gender in general, as well as the opposite gender in relationship to computers.

A further in-depth study is suggested to view the effects of mothers as role models with regard to computers.
This could be extended to include children of both sexes and the impact of their parents, teachers and others who may serve as role models, giving consideration to their gender.

There was no attempt made to delve into the strategies and remedies being developed to alleviate gender inequity at the secondary school level in the field of computers. An examination of these may be extremely useful, particularly if educators are aware of them and incorporate them with students of a young age as a preventative measure. As educators become more aware of the issues of accessibility, interest, and ability with regard to computers, and are willing to act upon the issues, the gender equity question in the field of computers may become an unnecessary area of concern; certainly among students of the age in this study.
Bibliography


Maccoby, E. and Jacklin, C. p.23 "The Psychology of Sex Differences". *Psychology Today*


APPENDIX A

DIRECTIONS FOR ADMINISTERING THE ATTITUDE QUESTIONNAIRE

1. Indicate to your students that this questionnaire was designed at the University of British Columbia. Its intent is to find out how school children feel about computers.

2. It is not a test! Encourage students to answer honestly.

3. Read over the directions and example together.

4. Encourage careful reading of the items as some items are worded similarly but have quite different meanings. Watch for double negatives in some question-answer combinations.

5. Encourage continual reading of the scale to make sure that answers are appropriately placed.

6. Encourage students to write the questionnaire quietly. Their shouts, or moans and groans may influence others.

7. If students feel that they do not know the answer to a particular question, they should make a good guess. Remember, this questionnaire is not testing how much students know about computers, but rather, what they think, and how they feel.

8. Boys should answer questions from their point of view rather than anticipate a girl's reaction, and vice-versa.

9. The questionnaire should not take longer than 15 to 20 minutes. If possible, allow all students to finish. The questionnaire has a total of 4 pages.

10. Students should check their papers over to ensure that they have not omitted any questions and that they have circled only one answer for each question.

11. You may use your judgement in answering any questions or defining any vocabulary or phrasing. Try not to sound biased, or leading, in your definitions.

THANK-YOU FOR YOUR COOPERATION IN ADMINISTERING THIS QUESTIONNAIRE!

YOUR TIME AND EFFORT ARE GREATLY APPRECIATED!
APPENDIX B

Date ___________________  Name ____________________________

Grade __________  Age ______

ATTITUDES ABOUT COMPUTERS

This is a scale to measure how you feel about computers. Below you will find some statements about computers. Read each statement and then CIRCLE the choice which best describes how you feel about it.

EXAMPLE:

Soccer is a fun sport to play ...........  a  b  c  d  e

Please be as honest as possible in rating each statement. There is no correct answer!

1. I would like to have my own computer... a  b  c  d  e

2. I am able to work with computers as well as most others my age.................... a  b  c  d  e

3. Boys learn more by using a computer than girls do................................. a  b  c  d  e

4. Using a computer will help me become better at mathematics............... a  b  c  d  e

5. Computers are best used for playing videos................................. a  b  c  d  e

6. I usually expect to do well in mathematics................................. a  b  c  d  e

7. It is more important for boys to learn about computers than for girls... a  b  c  d  e

8. Computers sometimes scare me............ a  b  c  d  e
9. Learning about computers will help me in the future.......................... a b c d e

10. I don't enjoy using computers in school a b c d e

11. I would like to learn more about computers............................... a b c d e

12. Computers can be useful in many subject areas............................ a b c d e

13. I would rather not use computers to learn mathematics.................. a b c d e

14. It is more important for girls to learn about computers than for boys....... a b c d e

15. Working with a computer would probably make me feel uneasy or tense........ a b c d e

16. I would enjoy using computer games to learn................................... a b c d e

17. Math is hard for me to understand....... a b c d e

18. Computers are not useful in learning mathematics........................... a b c d e

19. It is easier for girls to learn to use computers than for boys.............. a b c d e

20. I like mathematics........................... a b c d e

21. It is my guess that I am not the kind of person who works well with computers... a b c d e

22. I enjoy working with computers.......... a b c d e

23. I have no trouble using computers....... a b c d e

24. Using computers is more interesting for boys than for girls............... a b c d e

25. Learning to use a computer would be harder for me than most people........ a b c d e
COMMENTS

1. How do you think you could use a computer when you are an adult?

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________

2. Do you think that your mother and father are enthusiastic about you learning to use a computer? Tell why or why not.

_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
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_________________________________________________________________________
_________________________________________________________________________
_________________________________________________________________________
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are you a boy or a girl?</td>
<td>Boy</td>
</tr>
<tr>
<td>2. Have you ever used a computer before?</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Have you ever used a computer at school before</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Do you have a computer at home?</td>
<td>Yes</td>
</tr>
<tr>
<td>5. If you do not have a computer at home, has your family considered buying one? (Don't answer this one if you already have a computer at home.)</td>
<td>Yes</td>
</tr>
<tr>
<td>6. Does your mother use computers at work or at home?</td>
<td>Yes</td>
</tr>
<tr>
<td>7. Does your father use computers at work or at home?</td>
<td>Yes</td>
</tr>
<tr>
<td>8. Have you ever played games in a video arcade?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

THANK YOU VERY MUCH FOR YOUR HELP IN COMPLETING THIS QUESTIONNAIRE!
APPENDIX C

Teacher Questionnaire

The following questions relate only to the class(es) to which the Computer Attitude Questionnaire was administered:

1. Have you taught any computer units in class this year? If so, briefly explain.

2. Have you used a computer at all in your classroom or have the students had access to a computer during class time? eg. Bank Street Writer, other commercial software

3. How many computers do you have at your school?

4. Do you have a computer club at your school? Is it restricted to certain grades?
5. Do you view yourself as a role model as a computer programmer or a computer user; i.e., do you ever talk about yourself using a computer; do your students ever see you using a computer; do you run the computer club; etc.?