Gender Usage of Computers in Grades Four Through Seven

by

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ABSTRACT

The widespread availability of computers has prompted schools to invest in computer hardware and develop courses of instruction. However, the presence of computers and computer courses in schools does not ensure equal access for boys and girls. This study investigated the relationships between gender and computer use and gender and attitudes towards computers. Results indicate a relationship between gender and use outside of school, but not between gender and use in schools. Results also indicate that the relationships between gender and attitudes toward computers are eliminated when other factors are taken into account.
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I. NATURE AND BACKGROUND OF THE STUDY

A. INTRODUCTION

The invention of the transistor in 1947 followed by the launching of Sputnik in 1957 provided the material and impetus for the beginning of the Technological Age. The computer quickly became the technological bell weather of the new age, manifesting all the advanced features: miniaturization, speed, and power. As manufacturing techniques improved, low-cost computers became available to the business world and general public by the 1980s. Cost-effective availability of microcomputers had created an Information Age: an electronic aid acting as a catalyst in the geometric knowledge explosion. Univac, the first real computer built in the United States in 1950, cost in excess of six million dollars (Haseltine, 1986). Today, a much more powerful and compact microcomputer costs less than a thousand dollars. It has been estimated that by the turn of this century there will be 50 million computers in use in the United States; 5 million in Canada (Summers and Lukasevich, 1984).

The computer has had great impact on the Canadian labor force. In a survey involving over 1000 establishments, conducted by the Economic Council of Canada, it was revealed that "in 72 percent of establishments, new technologies have led to the creation of new types of jobs or the substantial modification of existing ones" (Newton, 1987, p.3).

One of the significant trends in employment has been the increase of working women. In 1985, the United Nations published a document on employment stating that "women accounted for more than 60 per cent of labour force growth in Europe and North America since 1960" (Newton, 1987, p. 129). The report also said that "... between 1976 and 1985, the number of working Canadians increased by 1.8 million; women accounted for 70 per cent
of that increase" (Newton, 1987, p. 129). Women are directly affected by technology in the workplace. Female employment is typically found in offices in which the most common computer technologies introduced between 1980 and 1985 have been personal computers and word processors (Newton, 1987). There can be no doubt, as the report states

"... women, who represent a large proportion of office workers, have, to date, been directly affected by these technologies to a greater extent than men." (Newton, 1987, p.131)

The key to eradicating this discrepant trend is education and training. The Economic Council of Canada clearly underlines the need to train for the use of new technologies in order to exercise options in the changing face of the employment market. Barry Sullivan, who led a Royal Commision on Education in British Columbia, also sees technological change as a major focus for education. He states

"We are reminded constantly that the major educational challenge of our time is development of the human capacity to shape wisely and adapt actively to this rapid [technological] change." (Sullivan, 1988, p.35)

The sentiment expressed by Sullivan and the ever-increasing use of computers in the employment market have been reflected by the wide use of computers in schools. Public support for the use of computers in schools is very strong. However, the growth of computer use in society and the school curriculum has not provided equally for all students. A review of educational research in the area indicates that, generally, girls spend less time with computers than boys; boys have greater access to computers than girls; girls' self-inhibiting behaviour regarding computer usage increases with age; and girls will defer to boys when both sexes are competing for equal use of the computer (Anderson, Welch and Harris, 1984; Komoski, 1984; Lockheed and Frakt, 1984; Sanders, 1984; Schubert and Bakke, 1984; Miura and Hess, 1984 ; Alvarado, 1984; Underwood, 1984).
Other related issues found in the research literature are: computers have become a male-oriented domain as the result of their perceived close relationship to Mathematics and Science (Johnson, 1983; Winkle and Mathews, 1984); parents are less likely to purchase computers for their daughters than their sons (Schubert and Bakke, 1984); and girls are less likely to spend time with computers outside class hours (Lockheed and Frakt, 1984).

Becker found that the introduction of the computer into the classrooms has had major impact on the social behaviour of children (Becker, 1983a). He found that computer use by students increased their enthusiasm for school; increased co-operative learning among students; and increased students’ abilities to work independently without a teacher. Becker also discovered that teachers felt that "above-average" students learned more than "below-average" students as a result of having had a microcomputer in their school.

Studies also indicate that, although gender discrepancy in various school subjects has received much attention, there has been little done in the way of rigorous research on the gender usage of computers in elementary schools (Sanders, 1984; Anderson, Welch and Harris, 1984).

Some research has centered on the reasons why this apparent inequitable use of computers has taken place. Attitude of participants has been offered as one of the determining factors (Clement, 1981). Becker (1984c) found that the age at which these behaviours and attitudes develop also seems to be a key factor. This position is supported by other researchers who agree that stereotypic behaviour begins in the early elementary grades (Iglitzen, 1977; Winkle and Mathews, 1982). It has been the focus of a few recent studies (Anderson, Welch and Harris, 1984; Swadener and Hannafin, 1987). However, attitudes as a predeterminant of
behaviour is a controversial topic. Although the literature indicates opposing views as to whether attitude motivates behaviour, the generally held opinion is that attitude is a factor influencing behaviour towards an object (Fishbein, 1967; Koch, 1959; Shaw and Wright, 1967; Oppenheim, 1966, Lemon, 1973; Dawes, 1972).

Attitudes as learned predispositions and attitudes as influencing behaviors have policy implications for schools if gender discrepancy usage of computers can be linked to less favorable attitudes towards the use of computers. The cognitive and affective components of attitudes towards computers are within the realm of school governance. A correlation between attitude and usage has implications for how teachers and administrators proceed with introducing and implementing computer programs in schools.

B. NEED FOR THE PRESENT STUDY

1. Lack of Adequate Studies

A review of educational research literature considered in detail in Chapter II, indicates that gender discrepancy usage of microcomputers exists among elementary and secondary school students.

An increasing number of computers are being used in schools each year. Computer literacy programs, once used to introduce computers to children are now giving way to the concept of the computer "as a tool" and to the use of computers in many other curricular areas (Flodin, 1984; Jones, Porter, and Rubis, 1983; Simair and de Ryk, 1986; Schubert, 1984).

Since who uses computers is of importance to all educators, care must to be taken not to disfranchise a substantial portion of the educational constituency. Although there is much
evidence to indicate gender discrepancy usage of computers, little rigorous research has been carried out to address the reasons for any potential discrepancy in computer use (Sanders, 1984; Swadener and Hannafin, 1987).

Research conducted in the field of gender discrepancy usage of computers, as indicated in Chapter II, is limited and inconclusive. Studies with large sample populations are singular in their approach and do not address the reasons why gender discrepancy usage of computers may take place: they address the symptoms and not the causes. Other research utilizes small sample sizes, from which generalizability is limited. Some of the researchers used only one instrument of investigation, and corroboration of reliability of that instrument therefore relies upon subsequent research. While most research in this field has been conducted at the secondary school level and while many researchers would agree that adolescence is the approximate turning point of gender discrepancy computer usage, little enquiry has been carried out to address the issue of what factors influence this turning point. Peer influence, role models, and other influences on decisions made by pre-adolescents are all factors which may influence computer use by both genders.

Therefore, it is important to undertake a study which would first look at potential gender discrepancy usage and then investigate any reasons why it might exist.

2. The Problem

The purpose of this study is to investigate any potential gender discrepancy usage of computers which may exist in children in grades four through seven (ages nine through thirteen). The selection of this age group is significant. As alluded to above, the decisions made by pre-adolescents and the influences on their decisions concerning computer use may serve as the template for future adolescent behaviour, and therefore help to explain the
patterns of their discrepant behaviour regarding computer use. If a discrepancy in usage is found, then the second purpose of this study would be to investigate an association between the use of computers and the attitudes of the children. Results of this study would be useful to educators and educational policy makers who consult empirically based literature for guidance and direction.

3. Research Questions

This study examines the possibility of gender discrepancy usage of computers by children in grades four through seven. The secondary part of the study examines the relationship between attitudes of children and the use of computers. The investigator's principal hypothesis is that girls in grades four through seven use computers less than boys in the same grades. The secondary hypothesis held by this investigator is that there is a significant correlation between the use of computers and the attitudes held about computer use. The following research questions will be investigated:

1) Is there gender discrepancy usage of computers by children in grades four through seven?
2) Is there a significant correlation between computer use and attitudes held about computers?

4. Definition of Terms

Computer - This term refers to a standard desk top, stand alone style of computer or microcomputer with a keyboard, CPU, monitor, and sometimes a printer.

Computer program - This term refers to the software programs used by the computer's CPU.

Attitudes - For the purposes of this study, the term "attitudes" refers to the learned predispositions about an object which influence behaviour towards that object.
Gender - For the purposes of this study, this term refers to the biological dichotomy between the sexes, that is, male and female.

5. Design of the Study

a. Sample
Four schools in a large urban school district in British Columbia were chosen for the sample. In each school, one class in each of grades four through seven were chosen to participate. A total of 458 students were subjects for the study (219 girls; 239 boys). In a later part of the study, 16 students were randomly selected from one school to be interviewed. The four students selected from each grade (four through seven) included high computer user boy and girl, and a low computer user boy and girl. Parental permission to conduct the interview was received for 12 students, hence those 12 comprised the interview sample.

b. Procedure
Towards the end of the 1988 school year, the 458 students were administered an attitude questionnaire. The results were analyzed for computer use discrepancy and correlation with attitudes. A total of 12 students (all from one school) identified as high and low computer users in both genders were interviewed.

c. Instruments
The Likert-style attitude questionnaire is based on the Minnesota Educational Computing Consortium, Form 8 questionnaire (MECC, 1982). Interviews were planned and analyzed on the basis of a concept mapping strategy (Novak and Gowin, 1984).
d. Limitations

This study is limited by three factors. Room for error is always present when relying on self-reported data. As well, the interview sample is small. Students from only one school were chosen because of the time involved, and the ease of access to the one school. Finally, students chosen for the sample are representative of schools in which computers are used but not representative of all students.
II. REVIEW OF THE LITERATURE

A. INTRODUCTION

With increasing use of computers in elementary and secondary schools, there is a growing need to examine the equity of their use in schools. Schubert has observed computer growth as a national trend in schools in the United States:

"In one year the number of public schools with computers has doubled: few schools are without at least one micro. Few innovations have been accepted by the schools with a comparable sense of urgency." (1984, p.5)

Recent figures indicate a rapid growth of computers in American schools. A survey conducted by Johns Hopkins University states that the number of computers "in use in elementary and secondary schools has quadrupled from about 250,000 to more than one million between spring 1983 and spring 1985" (Phi Delta Kappan, 1986, p.84).

Computer growth in Canadian schools is also dramatic. From the fall of 1984 to the spring of 1988 the number of computers in Canadian elementary and secondary schools increased from 26,861 to 182,822 (Allan, 1984; Hubert, 1988).

The Canadian national trend is reflected in the local provincial growth of computers in schools. In 1983, there were approximately 2889 computers in British Columbia’s schools (Jones, Porter and Rubis, 1983). By 1986 this number had grown to approximately 11,677 (Simair and de Ryk, 1986). Initially, most school districts offered the computer as the object of study in the form of "computer literacy" (Flodin, 1984). However, over time, the use of the computer has spread into all areas of the curriculum. Aside from computer science courses, the use of computers in mathematics, science, business education, learning assistance, and language arts has become widespread (Simair and deRyk, 1986). Today the number of
computers has swollen to almost twice the number that it was in 1986.

"That British Columbia's schools have entered the information age is undeniable. Today, an estimated 21,000 microcomputers are in use for instructional purposes."
(Sullivan, 1988, p.35)

B. STUDIES RELATED TO APTITUDE

As computer use has spread across the curriculum, how computers are perceived by potential users may determine their use. Some evidence indicates that computers are thought of as being closely aligned with mathematics, and as such, predominantly a male domain (Winkle and Mathews, 1984). Researchers, seeking an explanation to this phenomenon, have addressed the issue of girls' aptitudes in mathematics and problem solving. Evidence to support girls' aptitude in mathematics can be found in the work of Sherman and Fennema who state that the

"data do not support either the expectations that males are invariably superior in mathematics achievement and spatial visualization or the idea that differences between the sexes increase with age and/or mathematics difficulty."

(Sherman and Fennema, 1977, p.69)

These research studies contradict the notion that boys' aptitude for mathematics is superior to that of girls. Similarly, boys do not demonstrate superior ability to solve problems while using computers as a tool. This viewpoint was well demonstrated by Ron Anderson's study of 7150 students in grades eight and eleven. He found that girls were better at computer problem solving than boys (Anderson, 1987). More specifically he states that with "the exception of one item, females scored significantly higher in every item of the Problem Analysis subtest" (Anderson, 1987, pp. 47-48).
Lack of aptitude, then, cannot be an explanation for gender discrepancy use of computers. Yet investigators have found that girls voluntarily absent themselves from using computers and that their absenteeism increases with age. Girls’ absence from computer science courses has become particularly noticeable in senior secondary schools. Underwood pointed out the continuous reduction in female students in senior computer science courses in a local secondary school (Underwood, 1984). On a larger scale, Miura and Hess (1984, p.22) conducted a survey of 5533 students attending summer camps in California and concluded that "the disparity [of computer use] between boys and girls increases with age, is greater in advanced than in beginning classes...". Although no specific ages of the subjects are mentioned in this study, it is implied that children of all ages who attend summer camps would have been part of the sample. This observation is also supported by Alvarado, Chancellor of New York City Public schools, who states

"... we have found that boys and girls use computers equally in the early grades, "something" seems to happen at the outset of puberty. At this age, female students show less interest in computing and tend to avoid elective classes in computing and higher-level mathematics."

(Alvarado, 1984, p.140)

This literature clearly states that girls, while having equal, if not superior aptitude for computer related tasks as compared to boys, are voluntarily opting out of computer training. As well, females begin to show disparate use about the age of puberty, the years of transition between elementary and secondary school. The researcher would posit that results from this study would show a decline in computer use from grades four through grades seven, if implications from the literature can be used as a predictor. If the literature is correct in its assessment of stereotypic views held by students towards computers, then the interviews with students conducted by this investigator should also reveal those biases and either confirm or refute the claims illustrated in the literature.
A review of the research rendered only three studies regarding the issue of computer accessibility. Gender differences in accessibility to computers outside school hours have been noted in a major study involving 400 high school students (Lockheed and Frakt, 1984). For some girls, exposure to computers at school might have been the only contact they would have with the new technology. The study indicates that "... almost half the boys, but virtually no girls, used the computer center outside the required class time" (Lockheed and Frakt, 1984, p.16). Researchers Watkins and Brimm (1985), who conducted interviews involving over six hundred households in Detroit suburbs, found that adults who have children in the home are more likely to purchase a computer and that the rate of computer ownership in households increases with the age of children.

"The percentage of personal computer ownership was somewhat affected by children in the household. A total of 6 percent of homes with at least one child aged 11 or younger reported owning a home computer, while sixteen percent of respondents in homes with at least one child aged 12 or older owned a personal computer."

(Watkins and Brimm, 1985)

Researchers Miura and Hess have also found that parents of girls are less likely to invest in computer-related activities for daughters than sons. In this same major study involving over 5000 students, Miura and Hess found that families were less likely to spend money on computer camps and classes for girls than boys (1984).

As stated earlier, a major question about gender use of computers arising from the literature is one of accessibility to computers. An analysis of the literature indicates that boys seem to have greater access to computers outside school hours, and greater accessibility seems to increase with age. Although Watkins and Brimm (1985) conducted a major study of importance in this area, they failed to dichotomize accessibility on the basis of gender; their
study included both sexes. In addition, the Miura and Hess (1984) study, in the area of gender discrepancy in terms of computer camps and classes, failed to include gender differentiation of computer ownership at home. Therefore, a study of gender discrepancy computer use ought to address computer accessibility at home and accessibility during extracurricular hours in general. This investigator accounted for these issues in an earlier study (Marriott, 1985) and again in this study using a much larger sample.

D. CHARACTERISTICS OF STUDENTS

Characteristics of students have also been cited as reasons for differentiated computer use by Becker (1985). In this study involving students in kindergarten through grade eight, in 2265 schools, Becker concluded that the impact of computers in schools was greatest for a specific group of students. He states that:

"Use of computers as well as their perceived impact is greatest for "above average" students who generally are given more opportunities to work without adult supervision and perhaps, on average, can operate in a less well-defined structure than most other students."

(Becker, 1985, p.105)

Results of Becker's examination raise the question of computer use based on characteristics of the students. Becker has uncovered the issue of students who are perceived by their teachers as "above average", and who, by virtue of that characteristic, spend more time working with computers. The research did not indicate a gender imbalance. It might be assumed, however, that there may have been a relatively even balance of both genders in the group of students who were high users of computers. However, the research cited earlier indicated that more boys than girls used computers outside school hours. If this is the case, then it follows that more boys than girls are perceived to be "above average" students. However, as mentioned earlier, the research conducted by Sherman and Fennema, and Anderson would suggest that
boys do not have greater aptitude for computer-related tasks than girls. While the research is clear on the issue of gender dichotomized aptitude, it is unclear with regard to which characteristics make male or female students more capable than others, implying that some students are more capable than others. Currently, the question remains: are boys given greater access to computers because of the notion that boys have a greater aptitude for their use? In earlier research conducted by Becker (1984c), he found that the teacher-perceived intellectual characteristics of students governed the use of computers. In this study, involving 1082 elementary and secondary schools, teachers reported "that "above-average" students (as defined by each teacher-respondent) were most often the major student users of school microcomputers" (p. 7). Although the report does not directly state it, implications were that the use of computers by students was directed by teachers. Hence, it may be the teachers' perceptions of students' abilities which are governing the use of computers by students. It is important, therefore, to conduct a study in which the entire sample of students involved would have the opportunity for access to computers during extra-sessional hours. To some degree, this would reduce the role of teacher perceptions in selecting computer users.

**E. ATTITUDES TOWARDS COMPUTERS**

A search of the literature found only three studies which dealt with student attitudes towards computers, and in the case of these studies, opposing results were obtained. Mullan (1982) conducted a small study in England in which he interviewed seven children and analyzed their attitudes toward computers. The children in the sample were between ages eight and eleven, mixed ability and gender, and all had some exposure to computers in school. While admittedly Mullan states that this was not a rigorous study, he concludes that "the reaction of the children to the microcomputer was favourable" (p.151). However, more important Mullan goes on to say "The attitudes seem to have been formed because working with the computer is fun" (p.165). This implies that the positive attitude is a result of having worked with a
computer. This is in direct contrast to the results found by Lucking (1984) who surveyed 500 grade nine students using a Likert-style attitude scale and concluded that:

"The analysis of these data indicate that girls on average are decidedly less positive in their attitudes towards computers than boys." (p.82)

However, in an earlier study reported by Lucking, his findings contradict the findings of the study reported above. Results from an earlier pilot showed that girls who used computers had more positive attitude towards them. However, through further investigation as part of the same study, he concluded that girls' contact with computers over a period of time did not necessarily alter their negative attitudes. These results are in direct conflict with each other, and the issue of attitudes related to computer use remains inconclusive.

Sawdener and Hannafrin (1987) conducted a survey of 32 grade six students solely for the purpose of measuring attitudes of the students towards computers. Randomly selected students in two classrooms were administered a seventeen item Likert-style questionnaire modelled after the MECC questionnaire. The results of the study indicate that:

"...the absence of sex-related main effects may support the notion that students at this age simply do not possess the same biases toward the opposite sex as do older students." (p. 39)

This study holds particular significance for two reasons: it employs a similar questionnaire to the one used by this investigator; and the singular purpose of the study was to measure attitudes of students. Although the sample size is small, the findings of the study conducted by Swadener and Hannafin directly contravene those found by Lucking (1984) as noted above.

In 1985 results of a similar study conducted by Marriott (1985) found significant gender differences in attitudes towards computers. This investigator conducted a similar study in a
large urban school with low socioeconomic status and high ethnic mix. A sample of 102 randomly selected students between the ages of nine to fourteen were administered a questionnaire very similar to the one used in this study. Analyses of the data showed gender discrepancy use of computers during extra-sessional hours, with the boys being dominant computer users by a ratio of two to one. As well, the Likert-style MECC attitude questionnaire revealed that girls' mean responses on nine items were significantly lower than those responses of boys.

F. SUMMARY

Results from this earlier study conducted by the investigator (Marriott, 1985) and issues raised in the literature have given rise to this research.

Outstanding issues of concern in the research are twofold: sample size and sample composition; and instrumentation. In some studies the sample was large but addressed a narrowly defined age group. Only four of the twelve studies cited have a sample size over 400. For example, Anderson's study (N = 7150) of grades eight and eleven is thorough, but addresses only two age levels in secondary school. Conversely, when the sample was small, the research addressed a variety of age groups. Still, only three of the fourteen studies included multi-age samples. The only study found which involved several age groups was the one conducted by Becker. Although the sample was large (N=2265), the primary respondents in Becker's research were the school's "primary computer-using teacher", not the students. This present study conducted by the researcher surveyed over 450 students across four grades.

In addition to the concern of sample size and composition, the investigator sees a singular approach to the instrumentation used in most of the research literature in this area. Although
interviews were used in two of the twelve studies, the remainder used a survey or test as their principal data collection instrument. No study cited used a combination of instrumentation for data collection. This study employs a combination of instruments. While reliability of the Likert-style questionnaire appears to be good, this study supplements that instrument with interviews.

One of the issues raised in the literature is the apparent lack of rigorous research on this topic. This investigator hopes that this study will be considered rigorous by design and contribute to the body of knowledge on gender use of computers.
III. DESIGN AND PROCEDURE

A. RESEARCH METHODOLOGY

The first part of this study involved sixteen classes of intermediate students, grades four through seven, from four schools. Each class as a unit was administered Likert-style attitude questionnaires. The questionnaire used in this study was an adapted form of the Minnesota Educational Computing Consortium Form 8 questionnaire used extensively in Minnesota (Anderson, Klassen, Krohn and Smith-Cunnien, 1982). Adaptation of the questionnaire was carried out by the investigator and consisted of utilizing one section of the Form 8 and adding baseline questions in a separate section such as name, grade, and age. Descriptive data on all the subjects were obtained as well as information about attitudes towards computers.

The second part of this study involved interviews of 12 subjects. These children were identified as either high or low users in either gender, and were selected from grades four through seven from one of the four schools involved in the study. A concept map of computer related items was developed and questions used in the interviews were based on the concept map. This interview design was based on the work of Novak and Gowin (1984).

B. RESEARCH QUESTIONS AND HYPOTHESES

The research sought to determine if there was gender discrepancy usage of computers by elementary school children in grades four through seven (ages nine through thirteen); and to investigate any correlation with attitude to computer use.

The following three hypotheses, stated in null form, were investigated:
H₀₁: There will be no relationship between gender and the use of computers in school.
H₀₂: There will be no relationship between gender and the use of computers out of school.
H₀₃: There will be no relationship between gender and attitudes toward computers.

C. SELECTION OF SUBJECTS

For the first part of this study, questionnaires were administered to a large group of elementary school students in grades four through seven (n=458). Sixteen classes were chosen from four different elementary schools in a large urban school district; that is, four classes from each of four schools, one class of each grade level, four through seven. The schools chosen by the investigator were based on the criteria that their different locations in the district would create a cross-section and balance of ethnic origin and socioeconomic status. As well, each school had computers as part of their program for at least one school year, and students were allowed extra-curricular access to the computers. Initial contact of the schools was done through the building Principals who were asked about their willingness to assist in the study. In each case, all of the initial contacts accepted. A contact teacher in each school was selected by the Principal. Discussions were then held with a contact teacher in each school who supervised the administration of the questionnaires in their respective schools.

The second part of the study involved conducting interviews with a small number of intermediate students. Sixteen students (boys and girls, high and low computer users, grades four through seven) were chosen from one school in the large sample. Parental permission to conduct interviews was obtained from twelve students, and hence, the interview sample became those twelve. Criteria for selection of this sample were students who were identified as either high or low frequency computer users. As well, a balance of gender in this sample
was established. Initial contact was through a request form sent to parents of the children.

D. DESCRIPTION OF THE SCHOOLS

The four schools in the study were chosen for their similar characteristics of computer use, and for their differences in student characteristics. Each of the four schools had about the same size student population: ranging in size of 480 to 550 students enrolled in kindergarten through grade seven. Each school has had computers as part of the "regular curriculum" for at least one school year, and in each case, students had access to the computers in extracurricular time: either before school or after school hours.

The schools, however, differed in their socioeconomic and ethnic composition. One school, whose student population is predominantly English-speaking Caucasian, is located in a high socioeconomic area of the city. Two schools' student populations are comprised of large pluralities of Asian origin, and are located in somewhat lower socioeconomic areas of the city. The fourth school, whose socioeconomic status is considerably lower than the other three, has a student population of high ethnic mix: pluralities from Asia, India, and Native Indian as well as Caucasian.

E. PROCEDURE

In June 1988, the building Principal in each of the four schools in the study was contacted and asked to participate in the study. All agreed. Contact teachers, who would administer questionnaires, were indentified by the Principals. A meeting was held with each contact teacher to clarify questionnaire administration procedures, and to explain the purpose of the study. During the meetings, a covering letter to each classroom teacher whose class was to be used as subjects was reviewed. A copy of the covering letter to classroom teachers is
provided in Appendix One.

In June of 1988, contact teachers in all four schools administered questionnaires to a full class of students in each of grades four through seven. Questionnaires were administered to the class as a single unit, and instructions to students were given orally. Students were allowed to receive help from their teachers if requested, and there was no required time limit placed on students to complete the answers. A copy of the questionnaire is provided in Appendix Two.

The second part of the study involved interviewing students who were either high frequency or low frequency users of computers. From the larger sample, sixteen students in both genders were initially identified as either low or high frequency computer users from one of the four schools. Parental permission was sought through a contact letter; twelve parents responded favorably, and as a result twelve students were interviewed instead of the original 16 selected. The interview sample was chosen from one school for three reasons: time constraints involved in conducting the research; the investigator was known to the staff and students; and the investigator had access to the school.

Prior to the interviews, a concept map of computer related items was developed, and from this map questions derived. The interviews involved asking each subject the same questions with the possibility of flexible follow-up questions depending on answers to the first set of questions. During the interviews, the subjects' answers were tape recorded and were later transcribed for purposes of analyses. A copy of the interview questions can be found in Appendix Three.
F. INSTRUMENTATION

The selection of instruments used in this study was based on the nature of what was to be measured and the prior use of one of the questionnaires as a reliable instrument. It was used previously by the investigator in an earlier study (1985) with a large urban sample (N = 102). Originally, the questionnaire was used by Anderson (1982) in a very large sample in Minnesota (N = 7150). The instrument used was an adapted form of the Minnesota Educational Computing Consortium Form 8 questionnaire. Reasons for adapting it were two-fold: baseline information which was necessary to part of the investigation had to be collected and this section was added to the questionnaire; and the original instrument had several sections which were unnecessary to this study. Only the "attitude" section was used.

The definition and measurement of the construct "attitude" has been a topic of much work by social scientists for many years (Fishbein, 1967). However, social scientists generally agree that attitude contains the following components: affective (feeling); cognitive (thinking); and behavioural (acting) (Katz and Stotland, 1959).

1. Sample Description Data

Sample description data refer to the characteristics of students which may be associated with either use or non-use of computers.

2. The Likert-Style Attitude Questionnaire

The questionnaire used in the study was a five point Likert attitude scale. The design was invented by Rensis Likert in 1932 and since that time it has become "one of the most widely used methods of attitude assessment" (Kubiszyn and Borich, 1984, p.147). Social researchers
have indicated that this style of attitude measurement is highly reliable (Fishbein and Ajzen, 1975; Allport, 1967).

The questionnaire used in this study, and adapted forms of it, have been used in major studies (Anderson, Klassen, Krohn and Smith-Cunnien, 1982) and in several smaller scale studies (Godfreyson, 1984; Marriott, 1985; Swadener, 1987).

3. Interviews

Sixteen children were chosen randomly from a matrix of high and low computer users, boys and girls, and from grades four through seven from one school in the sample. High users were those children who used a computer almost every day during their spare time outside school hours. Low users were those children who rarely, if ever, used a computer during their spare time. A concept map was designed modelled on the work of Novak and Gowin (1984) and based on an earlier study conducted by the investigator (Marriott, 1985). A copy of the interview questions is provided in Appendix Three.

Parental permission from twelve students was obtained and each was interviewed using the same key questions, and in some cases flexible follow-up questions were asked of subjects. Each interview was conducted by the investigator. The approximate average length of each interview was 15 minutes. Each interview was audio taped and later transcribed. Transcriptions were analyzed by placing the responses into categories in order to determine trends which appeared.
G. SAMPLE DESCRIPTION DATA

The first page of the student questionnaire included basic questions to be answered by each subject. Included in this information were age, gender, language group, the number of times a computer was used during the past two weeks, and questions about how subjects like to spend their free time and what influences their decisions when considering to use a computer.

The investigator had previously developed the sample description questions in an earlier study (Marriott, 1985).

H. STUDENT QUESTIONNAIRES

The MECC Form 8 attitude questionnaire was used as the major instrument in this study (MECC, 1982). This Likert-style questionnaire, and adapted forms of it, have been used many times with good reliability to measure the attitudes of children towards computers (Anderson, Klassen, Krohn and Smith-Cunnien, 1982; Sawadener, 1987b; Klassen, 1984). The investigator used this questionnaire in an earlier study in a single school in 1985 (Marriott). As a result of that study, it was determined that contact teachers would need instructions on how to administer the instrument. As well, instructions for students would have to be clearly delineated on each questionnaire. The questionnaire was found to be grade appropriate with minimal clarifying assistance from the contact teachers during the administration of the questionnaire. A copy of the student questionnaire is provided in Appendix Two.
I. DATA ANALYSIS

1. Sample Description Data

Chi-square and crosstabs were performed on gender groups in each age group and frequency of computer use. This analysis was supplemented by conducting ANOVAs on the mean use of computers by gender groups.

As well, a regression analysis was performed on student characteristics which might influence computer use in order to investigate a correlation with age and computer use.

2. Student Questionnaires

Each attitude question on the questionnaire was analyzed for significance in difference of means between gender groups by performing a chi-square on each item.

These data were further analyzed by ANOVA on each attitude item to investigate a relationship between attitude and computer use.

Finally a MANOVA was performed on significant attitude variables in order to determine their influences on computer use by gender groups.

3. Interviews

Transcribed student interviews were analyzed for trends in answers which could appear to either refute or corroborate the findings in the statistical analyses of the data.
J. LIMITATIONS

The study is limited by three factors: self-report data gathered in the student questionnaires; accuracy of attitude measurement; and sample selection.

The reliability of self-reported data is always questionable, particularly considering the age of the respondents. However, a number of attempts were made to counteract the deficiencies. First, the questionnaires were administered by staff members in each school who were known to the students, and this may have minimized the "attempt at impression making" by some of the respondents. As well, contact teachers who administered the questionnaires stressed the point that the questionnaire was not a test and would not be held against the respondents in any way. This was also printed in the introduction on each questionnaire. Finally, a small sample of twelve students from one of the four schools in the sample was interviewed in order to corroborate reliability with the questionnaire.

A second limitation of the study is the question of accuracy of attitude measurement. As this issue has concerned social scientists for many decades, it is outside the scope of this study to attempt to answer this question (Fishbein, 1975; Fishbein and Ajzen, 1967; Katz and Stotland, 1959; Lemon, 1973; and Dawes, 1972). However, attempts were made to maximize correspondence between attitude towards computers and measurement. First, the measurement instrument has been used several times previously with reportedly good reliability (Anderson, Klassen, Krohn, and Smith-Cunnien, 1982; Godfreyson, 1984; Swadener, 1987). Secondly, the Likert-style questionnaire, which has been used for many years in attitude measurement studies, has shown to be an instrument of good reliability (Allport, 1967; Fishbein and Ajzen, 1975; Kubiszyn and Borich, 1984). Finally, student interviews were conducted in order to confirm internal reliability of the major questionnaire.
The third limitation of this study is the selection of the sample. The four schools selected for the study had to meet two criteria: they must have had computers for at least one year; and they had to allow student access to computers outside school hours. Because of these criteria, the sample are not typical of all schools. However, they would be typical of schools owning computers.
IV. RESEARCH FINDINGS

A. INTRODUCTION

The following chapter is divided into four sections: analyses of the sample description data; analyses of the student attitude questionnaire; analyses of the student interviews; and the tests of hypotheses.

In two of the sections, sample description and student attitude questionnaires, data are analyzed using numerical calculations. The results of the numerical analyses are displayed in tabular form. Analysis of the third section, student interviews, is in narrative format question by question.

B. SAMPLE DESCRIPTION DATA

1. Sample description

The first six questions of the student questionnaire supplied the information for the sample description. Question one was a student identification number and, hence, was not included in the data analysis. Questions two through five provided basic information about the student sample: age; language; grade; and gender.

The language groups displayed in Table 1 indicate that the sample contained pre-dominantly English speaking students with 74.2% (N = 340) of the students indicating that the language most often spoken at home is English. Chinese at 10.9% (N = 50) and Punjabi at 2.6% (N = 12) comprise the next largest language pluralities.
Table 1. Characteristics of the Student Sample. (n = 458)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>219</td>
<td>48</td>
</tr>
<tr>
<td>Boys</td>
<td>239</td>
<td>52</td>
</tr>
<tr>
<td><strong>Language group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hindi</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Chinese</td>
<td>50</td>
<td>10.9</td>
</tr>
<tr>
<td>Punjabi</td>
<td>12</td>
<td>2.6</td>
</tr>
<tr>
<td>English</td>
<td>340</td>
<td>74.2</td>
</tr>
<tr>
<td>Other</td>
<td>55</td>
<td>12.0</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 4</td>
<td>110</td>
<td>24.0</td>
</tr>
<tr>
<td>Grade 5</td>
<td>109</td>
<td>23.8</td>
</tr>
<tr>
<td>Grade 6</td>
<td>138</td>
<td>30.1</td>
</tr>
<tr>
<td>Grade 7</td>
<td>101</td>
<td>22.1</td>
</tr>
<tr>
<td><strong>Age of students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 yrs</td>
<td>51</td>
<td>11.1</td>
</tr>
<tr>
<td>10 yrs</td>
<td>108</td>
<td>23.6</td>
</tr>
<tr>
<td>11 yrs</td>
<td>122</td>
<td>26.6</td>
</tr>
<tr>
<td>12 yrs</td>
<td>123</td>
<td>26.9</td>
</tr>
<tr>
<td>13 yrs</td>
<td>52</td>
<td>11.4</td>
</tr>
<tr>
<td>14 yrs</td>
<td>2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Table 1 indicates that the sample contained a relatively balanced gender composition: 48% girls (N = 219), and 52% boys (N = 239).

The Hindi language group comprised the smallest group at 0.2% (N = 1). Other language groups accounted for 12% (N = 55) of the student sample.

The sample population was evenly spread over the four intermediate elementary grades. However, age groups at the extremities of the sample are fewer in numbers than the other categories. Table 1 indicates that the range of the grade level split of students N = 110 for grade four to N = 101 for grade seven is relatively even. Table 1 also indicates that age
groups for the nine, thirteen and fourteen year-old students in the sample are fewer.

2. Computer Ownership

Question six provided information regarding computer ownership in the homes of the student sample. The results of question six are displayed in Table 2. Forty-one percent of the total sample has computers in their homes (N = 188). More boys than girls have access to computers in their homes: 61.2% (N = 115) of total ownership is accounted for in boys’ homes. This compares to 38.8% of total ownership by girls (N = 73).

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Own</td>
<td>73</td>
<td>38.8</td>
</tr>
<tr>
<td>Do Not Own</td>
<td>146</td>
<td>54.1</td>
</tr>
</tbody>
</table>

Totals: 219 100 239 100

Total ownership: 188 of 458 = 41% of entire sample.

Chi-square = 9.72
Degrees of Freedom = 1
Significance level = 0.0018

An initial look would indicate that more boys than girls have access to computers in their homes. However, the sample contained more boys than girls. Therefore, to investigate the relationship between gender and ownership, a chi-square analysis was performed. The
obtained chi-square of 9.72 was found to be significant at the 0.0018 confidence level, indicating that there is a relationship between gender and computer ownership.

3. Student Characteristics

Two questions, numbers nine and ten, provided data on student computer use.

Question nine asked students to indicate what might influence their decision to use a computer during their free time. The results of the data are displayed below in Table 3.

<table>
<thead>
<tr>
<th>Influence</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Software available:</td>
<td>90</td>
<td>41.1</td>
</tr>
<tr>
<td>What friends do:</td>
<td>25</td>
<td>11.4</td>
</tr>
<tr>
<td>Busy with other things:</td>
<td>75</td>
<td>34.2</td>
</tr>
<tr>
<td>No access to computer:</td>
<td>29</td>
<td>13.2</td>
</tr>
</tbody>
</table>

Totals: 219 100 239 100

Chi-square = 14.4
Degrees of Freedom = 3
Significance level = 0.002

The greatest gender difference on what influences computer use outside school hours was found to be what software was available. While 41.1% of girls in the sample said that their decision to use a computer would be based on software available, 57.7% of the boys would base their decision on available programs.
Only about 11% of both boys and girls would base their decision to use computers on what their friends were doing. Girls indicated that "other things" would occupy a greater portion of their time; 34.2% indicated that other interests or activities would be the determining factor on whether or not to use a computer. While only 22.6% of the boys indicated that being busy with other things would influence their use of a computer.

The lack of access to a computer (as an influence on how students use their time) registered a small difference between boys and girls. Only 13.2% of the girls said that being unable to have access to a computer would influence their choice, while 8.3% of the boys indicated lack of access to a computer would influence their choice.

A chi-square analysis of the data in Table 3 resulted in a chi-square statistic of 14.4 at the significance level of 0.002. This indicates that there is an association between gender and the factors which influence computer usage.

Question ten asked students to indicate a preference of activities during their free time. The results from the data are displayed below in Table 4.

The most popular choice for use of free time for both genders was to "be with friends". The girls chose this as their first choice in 61.1% of the cases. Boys chose this category in 48.1% of the cases. More girls, 14.1%, chose to read a book in their spare time, while only 2.9% of the boys would opt for this activity.

Another category of free time use showing a large gender difference was the desire to play with a computer. Boys chose this activity in 40.6% of the cases, while only 17.0% of the girls would choose to play with a computer during their spare time.
Table 4. Choices on Using Free Time by Gender (N = 458)

<table>
<thead>
<tr>
<th>Choice</th>
<th>Girls</th>
<th></th>
<th>Boys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Read a book:</td>
<td>31</td>
<td>14.1</td>
<td>7</td>
<td>2.9</td>
</tr>
<tr>
<td>Be with friends:</td>
<td>134</td>
<td>61.1</td>
<td>115</td>
<td>48.1</td>
</tr>
<tr>
<td>Watch television:</td>
<td>17</td>
<td>7.8</td>
<td>20</td>
<td>8.4</td>
</tr>
<tr>
<td>Play with computer:</td>
<td>37</td>
<td>17.0</td>
<td>97</td>
<td>40.6</td>
</tr>
<tr>
<td>Totals:</td>
<td>219</td>
<td>100</td>
<td>239</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 42.9  
Degrees of Freedom = 3  
Significance level = 0.000

Little gender difference was observed in the category of "watching television" during spare time. As well, this category of free-time use was the least chosen. Boys chose this activity in 8.4% of the cases while girls chose watching television as a spare time activity in 7.8% of the cases.

A chi-square analysis of the data in Table 4 produced a chi-square statistic of 42.9 at the significance level less than 0.001. This would indicate that there is a relationship between the choices which children make about the use of their free time and the use of computers.

Analysis of the relationships between gender and influences on computer use; and between gender and choices during free time were undertaken, controlling for computer ownership. The results are displayed below in Table 5 and Table 6.
Data in Table 5 (N = 188) illustrates information from students who have access to computers in their homes and the decisions they made regarding "influences on computer use".

A chi-square analysis performed on the data in Table 5 indicates a chi-square statistic of 15.1 with a significance level of 0.002. This would indicate the relationship between gender and influences on the use of computers remains when computer ownership is controlled.

Table 5. Influences on Computer Use by Gender of Students Owning Computers (N = 188)

<table>
<thead>
<tr>
<th>Influence</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Software available:</td>
<td>33</td>
<td>45.2</td>
</tr>
<tr>
<td>What friends do:</td>
<td>3</td>
<td>4.1</td>
</tr>
<tr>
<td>Busy with other things:</td>
<td>31</td>
<td>42.5</td>
</tr>
<tr>
<td>Won't get computer:</td>
<td>6</td>
<td>8.2</td>
</tr>
<tr>
<td>Totals:</td>
<td>73</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 15.1  
Degrees of Freedom = 3  
Significance level = 0.002

Data in Table 6 (N = 188) illustrates information from students who have access to computers in their homes and the decisions they made regarding "use of their free time".

Responses from this sub-sample do not appear to be significantly different from the responses from the entire sample illustrated in Table 4. A chi-square analysis was performed on the data and a chi-square statistic of 17.7 was significant at less than the 0.000 level. Among the students who own computers, there is a relationship between gender and choice.
Table 6. Choices on Use of Free Time by Gender of Students Owning Computers (N = 188)

<table>
<thead>
<tr>
<th>Choice</th>
<th>Girls</th>
<th></th>
<th>Boys</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Read a book:</td>
<td>7</td>
<td>9.6</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Be with friends:</td>
<td>46</td>
<td>63.0</td>
<td>52</td>
<td>45.2</td>
</tr>
<tr>
<td>Watch television:</td>
<td>7</td>
<td>9.6</td>
<td>10</td>
<td>8.7</td>
</tr>
<tr>
<td>Play with computer:</td>
<td>13</td>
<td>17.8</td>
<td>51</td>
<td>44.3</td>
</tr>
<tr>
<td>Totals:</td>
<td>73</td>
<td>100</td>
<td>115</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 17.7
Degrees of Freedom = 3
Significance level = 0.001

4. Computer Use by Students

a. Recoding of Data

Questions seven and eight provided data on the student use of computers during school hours and outside school hours. In the case of question seven regarding the use of computers in class, the "high-use" end of the scale from six to ten was almost all vacant. In the case of question eight regarding the use of computers outside class hours, originally trimodal results were obtained. Students appeared to be either non-users; moderate users; or high users. Crosstabulation and chi-square analyses performed on the original data rendered too many empty cells in order to produce reliable statistics. As a result, the categories of use were compressed. Table 7 illustrates how the computer use data were recoded in both questions seven and eight.
Table 7. Data Recoding For Computer Use

<table>
<thead>
<tr>
<th>Original values</th>
<th>New values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 - 5</td>
<td>1</td>
</tr>
<tr>
<td>6 - 10</td>
<td>2</td>
</tr>
<tr>
<td>10 +</td>
<td>3</td>
</tr>
</tbody>
</table>

b. Computer Use During School Hours

Question seven provided information regarding student use of computers during school hours. The results of the analysis are displayed below in Table 8.

A chi-square analysis performed on the data in Table 7 indicates that there is no significant difference between boys and girls use of computers during school hours.

No further analysis was performed on the data in Table 8.

c. Computer Use Outside School Hours

Question 8 provided information regarding student use of computers outside school hours. The results of the analysis are displayed below in Tables 9 and 10.

Originally question 8 asked for students to indicate use of computers outside school hours in a category from "0 to more than 10". Responses were re-grouped into categories found in Table 7 above.
Table 8. Crosstabs of Computer Use During School Hours by Gender

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>10+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N) 50</td>
<td>50</td>
<td>167</td>
<td>1</td>
<td>1</td>
<td>219</td>
</tr>
<tr>
<td>(%) 22.8</td>
<td></td>
<td>76.2</td>
<td>0.5</td>
<td>0.5</td>
<td>100</td>
</tr>
<tr>
<td>Boys:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N) 50</td>
<td>50</td>
<td>186</td>
<td>3</td>
<td>0</td>
<td>239</td>
</tr>
<tr>
<td>(%) 20.9</td>
<td></td>
<td>77.8</td>
<td>1.3</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 3.025
Degrees of Freedom = 2
Significance level = 0.2203

Note: the 0 value of Frequency of Use is not included in the calculation of the chi-square statistics.

Table 9. Crosstabs of Computer Use Outside School Hours by Gender

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>10+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N) 106</td>
<td>106</td>
<td>79</td>
<td>19</td>
<td>15</td>
<td>219</td>
</tr>
<tr>
<td>(%) 48.4</td>
<td></td>
<td>36.1</td>
<td>8.7</td>
<td>6.8</td>
<td>100</td>
</tr>
<tr>
<td>Boys:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N) 71</td>
<td>71</td>
<td>73</td>
<td>32</td>
<td>63</td>
<td>239</td>
</tr>
<tr>
<td>(%) 29.7</td>
<td></td>
<td>30.5</td>
<td>13.4</td>
<td>26.4</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 23.213
Degrees of Freedom = 2
Significance level = 0.000
Pearson r = +0.28713

Note: the 0 value of Frequency of Use is not included in the calculation of the chi-square statistics.
A chi-square analysis was performed on the data, and a chi-square statistic of 23.213 was found significant at the 0.000 level. This would indicate that there is an association between the frequency of use of computers outside school hours and gender.

Results from question eight which are displayed in Tables 10 and 11 hold significance for this study. Hence, the data from question eight will be utilized in analyses several times in the following sections.

d. Correlation of Computer Use With Age

The data from question four indicating the age of each subject and question eight, regarding computer use outside school hours, were analyzed together to determine the possibilities of a correlation of increasing computer use with increasing age. The analysis of the data is displayed below in Table 10.

<table>
<thead>
<tr>
<th></th>
<th>Cor. Coef.</th>
<th>D.F.</th>
<th>Sig. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>All students including ages 9 through 14 (N = 281)</td>
<td>-0.0823</td>
<td>280</td>
<td>0.084</td>
</tr>
<tr>
<td>Girls only (N = 113)</td>
<td>-0.0347</td>
<td>112</td>
<td>0.358</td>
</tr>
<tr>
<td>Boys only (N = 168)</td>
<td>-0.1073</td>
<td>167</td>
<td>0.083</td>
</tr>
</tbody>
</table>

Information displayed in Table 10 was achieved by applying a Pearson r correlation analysis. First, students of all ages (9 through 13) were analyzed for a correlation for increased
computer use. A correlation coefficient of -0.0823 resulted with a significance level of 0.084. This negligible, negative correlation indicates that the results may have been achieved by chance; there is no relationship between age and computer use outside school hours.

Similar results were achieved for the sample when selected on the basis of gender. In each gender case the correlation coefficient was negligible and negative: -0.0347 for girls; -0.1073 for boys. As well, the level of significance of the correlation coefficients was above the 0.05 confidence limits (0.358 for girls; 0.083 for boys), indicating that there is no relationship between age and computer use outside school hours when controlling for gender.

e. Effects of Student Characteristics on Computer Use

The effects of student characteristics on computer use outside school hours were investigated. Data derived from question three (sex); question four (age); question nine (influences on the decision to use computer); and question ten (choices regarding the use of free time) were grouped and measured as independent variables against computer use outside school hours as the dependent variable in a backward, multiple regression analysis.

The results of the regression analysis are displayed below in Table 11.

As can be seen from Table 11, the effects indicated by R Square and Adjusted R Square show a relationship between the independent variables and the dependent variable. All of the variables taken together explain approximately 23% of the variation in computer use.

Finally, a MANOVA was performed using computer use outside the school as the dependent variable and sex as the independent variable with covariates computer ownership; influences on decisions about use of computer; and choices on use of free time. The variable "age" was
Table 11. Effects of Characteristics on Computer Use

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Beta Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 6 (Comp. Ownership)</td>
<td>0.32507</td>
</tr>
<tr>
<td>Question 9 (Influence)</td>
<td>-0.14031</td>
</tr>
<tr>
<td>Question 4 (Age)</td>
<td>-0.09103</td>
</tr>
<tr>
<td>Question 3 (Sex)</td>
<td>0.15728</td>
</tr>
<tr>
<td>Question 10 (Choice)</td>
<td>0.14002</td>
</tr>
</tbody>
</table>

R Square = 0.24097  
Adjusted R Square = 0.23258  
F = 28.700  
Significance of F = 0.000

eliminated from this analysis because evidence from Tables 10 and 11 indicates "age" has insignificant effects on computer use outside school hours. Results of the MANOVA indicated a significant relationship between gender and computer use outside school hours (F = 7.04; significance level = 0.008) when the effects of the covariates were removed from influencing computer use.

f. Effects of Gender on Computer Use: Controlling For Ownership

The data from question six (computer ownership) were used to select those students from the sample who had access to a computer at home. A crosstabulation of gender by question eight (computer use outside school) was performed, controlling for computer ownership.

Crosstabulation and chi-square analyses performed on the original data rendered too many empty cells in order to produce reliable statistics. As a result, the categories of use were compressed. Table 7 above illustrates how the computer use data were recoded for use in Table 12 displayed below.
The chi-square analysis of the data in Table 12 rendered a chi-square statistic of 13.034 with a significance level of 0.0015. This indicates that the frequency with which boys and girls (who own computers) access computers outside school hours is significantly different. Therefore, when controlling for computer ownership, there is a relationship between gender and computer use outside school hours.

g. Effects of Computer Ownership on Computer Use:

Controlling for Gender

The data from question eight (computer use outside the school) and question six (computer ownership at home) were analyzed for a relationship, controlling for gender. The results of these analyses are illustrated below in Tables 13 and 14.

Table 12. Computer Use By Owners Outside School Hours

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>10+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls: (N)</td>
<td>23</td>
<td>28</td>
<td>13</td>
<td>9</td>
<td>73</td>
</tr>
<tr>
<td>(%) 31.5</td>
<td></td>
<td>38.4</td>
<td>17.8</td>
<td>12.3</td>
<td>100</td>
</tr>
<tr>
<td>Boys: (N)</td>
<td>18</td>
<td>33</td>
<td>17</td>
<td>47</td>
<td>115</td>
</tr>
<tr>
<td>(%) 15.6</td>
<td></td>
<td>28.7</td>
<td>14.8</td>
<td>40.1</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 13.034
Degrees of Freedom = 2
Significance level = 0.0015
The data illustrated in Table 13 shows significant results. A chi-square of 21.942 with a significance level of 0.001 indicates that there is an association between computer use outside school hours when controlling for gender (girls only).

The data illustrated in Table 14 shows significant results. A chi-square of 33.011 with a significance level of 0.000 indicates that there is an association between computer use outside school hours when controlling for gender (boys only).

C. ATTITUDE QUESTIONNAIRE

Questions 11 through 30 from the questionnaire asked students about their attitudes towards computers. Students responded by circling answers which indicated either agreement or disagreement with each statement on a five point scale. Hence, responses for each question were numerically coded from one to five.
Table 14. Computer Use By Owners Outside School Hours
Boys Only (N = 239)

<table>
<thead>
<tr>
<th>Frequency of Use</th>
<th>0</th>
<th>1-5</th>
<th>6-10</th>
<th>10+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own: (N)</td>
<td>18</td>
<td>33</td>
<td>17</td>
<td>47</td>
<td>115</td>
</tr>
<tr>
<td>Own: (%)</td>
<td>15.7</td>
<td>28.7</td>
<td>14.8</td>
<td>40.9</td>
<td>100</td>
</tr>
<tr>
<td>Not (N)</td>
<td>53</td>
<td>40</td>
<td>15</td>
<td>16</td>
<td>146</td>
</tr>
<tr>
<td>Not Own: (%)</td>
<td>42.7</td>
<td>32.3</td>
<td>12.1</td>
<td>12.9</td>
<td>100</td>
</tr>
</tbody>
</table>

Chi-square = 33.011
Degrees of Freedom = 3
Significance level = 0.000

Note: the 0 value of Frequency of Use is not included in the calculation of the chi-square statistics.

Analyses in this section are two-fold: determination of significant gender attitude differences by performing chi-square analyses on all the attitude questions, and eliminating those which are insignificant from subsequent calculations; and calculation of a MANOVA of remaining attitude variables by sex with covariates of student characteristics.

1. Determination of Significant Attitudes

Each of the attitude questions, number 11 through 30, was tested for its association with gender by performing a chi-square analysis. The attitude questions which failed to achieve significance are displayed in Table 15 below. Each of these questions, when analyzed by the chi-square technique proved to lack an association with gender. Because there were no
associations between gender and these attitude questions, these questions were eliminated from further analysis.

The remainder of the attitude questions were also analyzed by crosstabulation (gender versus attitude) and chi-square analysis. The items exhibiting a significant association with gender are displayed in Table 16 below. In each case the possibility of achieving the reported result by chance was less than five in 100 times.

<table>
<thead>
<tr>
<th>Attitude Question</th>
<th>Chi-Square</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>#12 Working with computers make me feel uneasy or tense.</td>
<td>6.965</td>
<td>0.1377</td>
</tr>
<tr>
<td>#16 I would like the idea of taking computer classes.</td>
<td>8.159</td>
<td>0.0859</td>
</tr>
<tr>
<td>#18 Walking through a room filled with computers would make me feel uneasy.</td>
<td>3.5187</td>
<td>0.457</td>
</tr>
<tr>
<td>#19 I feel uneasy when I am with people who are talking about computers.</td>
<td>6.575</td>
<td>0.160</td>
</tr>
<tr>
<td>#24 I am able to work with computers as well as most others my age.</td>
<td>3.707</td>
<td>0.447</td>
</tr>
<tr>
<td>#25 Computers are gaining too much control over peoples lives.</td>
<td>5.630</td>
<td>0.2523</td>
</tr>
</tbody>
</table>

As can be seen in the table, many significance levels are less than 0.001 indicating that they are very significant chi-square values.
<table>
<thead>
<tr>
<th>Attitude Question</th>
<th>Chi-Square</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>#11 I would like to learn more about computers.</td>
<td>24.107</td>
<td>0.0001</td>
</tr>
<tr>
<td>#13 I feel helpless around a computer.</td>
<td>17.290</td>
<td>0.0017</td>
</tr>
<tr>
<td>#14 Computers sometimes scare me.</td>
<td>12.123</td>
<td>0.0165</td>
</tr>
<tr>
<td>#15 I would very much like to have my own computer.</td>
<td>20.695</td>
<td>0.0004</td>
</tr>
<tr>
<td>#17 I enjoy using computers in my classes.</td>
<td>11.044</td>
<td>0.0261</td>
</tr>
<tr>
<td>#20 I enjoy working with computers.</td>
<td>18.399</td>
<td>0.0010</td>
</tr>
<tr>
<td>#21 I feel confident about my ability to use computers.</td>
<td>18.349</td>
<td>0.0011</td>
</tr>
<tr>
<td>#22 It is my guess that I am not the kind of person who works well with computers.</td>
<td>11.965</td>
<td>0.0176</td>
</tr>
<tr>
<td>#23 On the whole I can cope with computers in my daily life.</td>
<td>25.881</td>
<td>0.0000</td>
</tr>
<tr>
<td>#26 In general, females can do just as well as males in computer careers.</td>
<td>42.868</td>
<td>0.0000</td>
</tr>
<tr>
<td>#27 More females than males have the ability to become computer specialists.</td>
<td>28.306</td>
<td>0.0000</td>
</tr>
<tr>
<td>#28 Using computers is more for males than females.</td>
<td>60.858</td>
<td>0.0000</td>
</tr>
<tr>
<td>#29 Studying about computers is just as important for females as for males.</td>
<td>25.308</td>
<td>0.0000</td>
</tr>
<tr>
<td>#30 Men make better scientists than women do.</td>
<td>41.173</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
The attitude questions displayed in Table 16, then, represent significant differences in gender-related attitudes towards computers. Data obtained from these questions will form the basis for further attitude-related analyses. In the ensuing analyses, the term "attitude" will refer to information derived from only the questions in Table 16.

2. Gender-Related Attitudes

The data were then analyzed for the effect of interaction between gender upon significant attitude questions while controlling for student characteristics. A MANOVA was performed on the data. Each significant attitude question was used as a dependent variable with covariates of student characteristics (influences on decisions about use of computers; choices about what to do during free time; and computer ownership), and computer use outside school hours. Age of students, as illustrated earlier in Table 10, is insignificant in its effects on computer use outside school hours and therefore, was excluded as a covariate in this analysis.

As Table 17 illustrates, significant results were achieved from attitude questions 26, 27, 28, 29 and 30. In each of these questions, the MANOVA produced F values in which the probability of achieving the reported result was less than five in 100 times. The remainder of the attitude questions were outside the confidence limits.

Results show that five attitude variables (26, 27, 28, 29 and 30) show an association with gender when controlling for computer use outside school, influences on the decisions about computer use, choices about what to do during free time, and computer ownership.
Table 17 Association Between Gender and Attitude: Controlling for Choices, Influences, Outside Computer Use, and Ownership

<table>
<thead>
<tr>
<th>Attitude Question</th>
<th>F Value</th>
<th>Signif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>#11 I would like to learn more about computers.</td>
<td>0.93</td>
<td>0.337</td>
</tr>
<tr>
<td>#13 I feel helpless around a computer.</td>
<td>2.35</td>
<td>0.127</td>
</tr>
<tr>
<td>#14 Computers sometimes scare me.</td>
<td>1.42</td>
<td>0.235</td>
</tr>
<tr>
<td>#15 I would very much like to have my own computer.</td>
<td>2.12</td>
<td>0.147</td>
</tr>
<tr>
<td>#17 I enjoy using computers in my classes.</td>
<td>0.56</td>
<td>0.455</td>
</tr>
<tr>
<td>#20 I enjoy working with computers.</td>
<td>0.71</td>
<td>0.399</td>
</tr>
<tr>
<td>#21 I feel confident about my ability to use computers.</td>
<td>0.02</td>
<td>0.886</td>
</tr>
<tr>
<td>#22 It is my guess that am not the kind of person who works well with computers.</td>
<td>0.00</td>
<td>0.953</td>
</tr>
<tr>
<td>#23 On the whole I can cope with computers in my daily life.</td>
<td>0.25</td>
<td>0.616</td>
</tr>
<tr>
<td>#26 In general, females can do just as well as males in computer careers.</td>
<td>8.55</td>
<td>0.004</td>
</tr>
<tr>
<td>#27 More females than males have the ability to become computer specialists.</td>
<td>32.45</td>
<td>0.000</td>
</tr>
<tr>
<td>#28 Using computers is more for males than females.</td>
<td>17.97</td>
<td>0.000</td>
</tr>
<tr>
<td>#29 Studying about computers is just as important for females as for males.</td>
<td>3.95</td>
<td>0.048</td>
</tr>
<tr>
<td>#30 Men make better scientists than women do.</td>
<td>10.18</td>
<td>0.002</td>
</tr>
</tbody>
</table>
3. Effects of Significant Attitudes on Computer Use

A backwards, multiple regression analysis was performed on the data from Table 17 to test for an association between significant attitudes and computer use outside the school. The significant attitude questions (numbers 26, 27, 28, 29, and 30) were used as independent variables and computer use outside school hours was used as the dependent variable. An R Square value of 0.04159 was achieved (Adjusted R Square = 0.02416). This indicates that less than five per cent of the variation in computer use outside school hours can be explained by the five attitude variables: numbers 26, 27, 28, 29, and 30.

A Pearson correlation matrix was developed to investigate the intercorrelation coefficients among the significant attitude variables. The results are displayed below in Table 18.

<table>
<thead>
<tr>
<th>Variable</th>
<th>#26</th>
<th>#27</th>
<th>#28</th>
<th>#29</th>
<th>#30</th>
</tr>
</thead>
<tbody>
<tr>
<td>#26</td>
<td>0.14(0.001)</td>
<td>-0.51(0.000)</td>
<td>0.38(0.000)</td>
<td>-0.48(0.000)</td>
<td></td>
</tr>
<tr>
<td>#27</td>
<td>-0.13(0.002)</td>
<td>-0.00(0.477)</td>
<td>-0.03(0.249)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#28</td>
<td>-0.39(0.000)</td>
<td>0.55(0.000)</td>
<td>-0.33(0.000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: figures in brackets indicate significance values

Results displayed in Table 18 indicate that the attitude questions show slight to moderate interaction with each other.
D. STUDENT INTERVIEWS

1. Sub-sample Description

A sample of twelve students were selected at random from one school; grades four through seven; boys and girls; high and low frequency computer users. Originally, sixteen students were chosen for interviews, however, parental permission was received for only twelve. The researcher had access to one of the schools in the study, and time constraints inhibited wide-ranging involvement from other schools. Therefore, all twelve students in this sub-sample were chosen from one of the four schools involved in the study. The school was a high socio-economic status school, the students were primarily moderate to high academic achievers, and the largest plurality of students were of caucasian ethnicity.

2. Interview Questions

Twelve interview questions were developed by the researcher and grouped into three major categories: computer-related activities and abilities; role models and stereotypes; and school and free time activities. More than one question in each category was asked in order to establish internal validity. A copy of the interview questions is provided in Appendix Three.

3. Transcription and Analysis of the Interviews

Taped interviews were transcribed to paper to assist analysis. Results of each interview question were then placed on a grid: grade; gender; high-low frequency computer use. Each question could then be scanned for patterns on the grid, and cross-comparisons could be made between sections of the grid. The results are noted below according to categories.
a. Computer-related Activities and Abilities

Questions 1, 3, 5, 6, and 12 were in this category. These questions related to the students’ knowledge of computers, abilities to use computers, and the activities for which computers can be used.

Question 1: "Tell me five things you think about when you think of computers?"

Answers from high frequency users were concepts such as "technological games", "binary system", "monitors" and "help organize". Answers from low frequency users, with the exception of a grade six girl, emphasized that the computer was "fun".

There appeared to be no differences in answers between gender or grade groups.

Question 3: "What can people do with computers?"

Those students in the high-use category answered with words such as: "robotics", "architects use them to draw", graphics", "word processing", "research", "store information", "write programs", and "simulate activities". Those students in the low-category answered with words such as "learn stuff" and "almost any thing". However, the low-use, grade seven girl answered with "sort, list, organize and print out things".

There appeared to be no difference in answers between gender or grade group.

Question 5: "Tell me five things you can do with a computer."

Eight of the twelve students said they could play games on the computer. Three students, all high frequency users (grade six and seven girl; and grade seven boy) did not mention games
as a choice. Rather, they used terms such as "program the computer", "draw pictures", and "find out things".

Answers from the students in the high-use category included a broad range of phrases such as play, draw, program, music, do homework, and "find out". Students who were low frequency users answered with a narrower spectrum with words such as play games and write stories.

There appeared to be no differences in answers between gender and grade group.

Question 6: "Do you like to work with computers? Why?"

Ten students responded "yes". The high-use, grade four girl answered "I love it, I always do". The low-use, grade seven girl answered "sometimes, sometimes it's boring", and the low-use grade five girl did not respond.

Question 12: "If you could have your own computer, what would you do with it?"

This question was closely related to question five. While answers were similar, thus validating responses to question five, there were some differences. Answers from low users became simplified and more uniform. Writing "stories" and playing "games" were the most common answers given by low frequency users (six out of six responses). High end users maintained a broader spectrum of answers such as programming the computer, creating music, writing stories, playing games, drawing pictures, and playing games.

Again, there appeared to be no differences between gender and grade groups.
b. Role Models and Stereotypes

Question 2: "What kinds of people use computers: men, women, smart people, scientists?"

All twelve students in the interview sub-sample answered "everyone" or "anybody who wants to". The uniformity of their answers clearly indicated agreement without exception.

Question 4: "Do you think your mother would ever use a computer; father, brother, sister? How?"

Five of the six low frequency computer using students said their mothers did not use computers; four of the six low frequency users had fathers who used computers either at home or at work; and all had a brother or sister who used computers either at home or at school.

All of the (six of six) high frequency computer using students said that both their mothers and their fathers used computers either at home or at work; and all of these students who had siblings said they also used computers either at home or at school.

There appeared to be no differences between gender and grade groups.

Question 7: "What characteristics do people have who work with computers?"

This question corresponds with question two. While the answers to this question were very similar, three students changed their answers from that in question two. Two students said they were unsure and one said "smart" people. However, the remainder (nine of twelve) of the students answered either "ordinary" people or "anyone".
There appeared to be no differences in gender or grade groups.

Question 10: "Who are your idols, heroes, favorite people?"

Eight of the twelve students said they had heroes or people they admired. Only one student, the high-use grade seven boy, chose a hero outside his gender group. Two students, girls, chose aunts; one boy chose to emulate God; and the remainder chose a variety of well known people.

There appeared to be no differences in gender or grade groups.

c. Free Time and School Activities

Question 8: "Do you ever play with a computer in your spare time? Do you know any children who do?"

All the students in the high-use category (six of six) answered yes to the first question, indicating they played with computers. All but one student in this category said they also knew children who play with computers.

Four of six students in the low-use category indicated that they do not play with computers in their spare time; one said "sometimes"; and one said "yes". All six students in this category indicated that they knew children who used computers in their spare time.

There appeared to be no differences in gender or grade groups.

Question 9: "What are your favorite school subjects?"
Five students chose either mathematics or science as their most favorite school subject; four of these students were high frequency computer users. Three students chose art as their favorite subject; all were low frequency computer users. Two students chose physical education; one high-use and one low-use student. Two students chose language arts as their favorite school subject; one high-use and one low-use student.

There appeared to be no differences in gender or grade groups.

Question 11: "What games do you play with your friends?"

Six of the twelve students chose outdoor or field games as their first recall to the answer. Two high-use boys chose computer activities as their first choice of games. Two students (use and gender split) chose board games as their first activity. One low-use girl said she did not play games; and one high-use girl chose charades as her first recall of games to play.

There appeared to no differences in gender or grade groups.

E. TEST OF HYPOTHESES

In Chapter I two research questions were set forth. In order to investigate the questions as laid out in the research design, the questions were restated in the form of null hypotheses.

The first null hypothesis ($H_0$) stated: there will be no relationship between gender and use of computers in school.
Results from crosstabulations and chi-square displayed in Table 8, clearly indicate that both boys and girls in grades four through seven access computers the same number of times during school hours. Therefore, the null hypothesis is accepted for computer use during school hours.

The second null hypothesis ($H_{o2}$) stated: there will be no relationship between gender and use of computers out of school. Results of crosstabulation and chi-square displayed in Table 9, clearly indicate that boys in grades four through seven use computers more frequently than girls outside school hours. Thus, the null hypothesis is rejected for computer use outside school hours.

The third null hypothesis ($H_{o3}$) stated: there will be no relationship between gender and attitudes toward computers. Results of crosstabulation and chi-square analysis displayed in Table 16 indicate that 14 of the 20 attitude questions achieved significant gender-related differences. Therefore, the null hypothesis is rejected.
V. SUMMARY, DISCUSSION, AND CONCLUSIONS

A. SUMMARY

1. The Problem

The problems investigated in this research were two-fold:

1) Is there gender discrepancy usage of computers by children in grades four through seven?

2) Is there a significant correlation with computer use and attitudes held about computers in either gender group?

For the purposes of investigation these questions were set forth in the form of null hypotheses.

2. Research Design

In this study, 458 students in grades four through seven (219 girls; 239 boys) from four urban schools were selected as subjects for a two-part questionnaire. The first part of the questionnaire asked for general descriptive data; the second part contained 20 Likert-style attitude questions, developed for the Minnesota Educational Computing Consortium (Anderson, 1982). Crosstabulation and chi-square analyses were then performed to determine significant gender differences in frequencies in the data from student characteristics; computer usage in and out of school; and the attitude questions. As well, analysis of variance tests were performed on the attitude questions (while controlling for student characteristics) to determine their relationship with computer use.
Twelve students, mixed boys and girls, grades four through seven were selected from one of the four schools in the study for interviews. The students were identified as either high or low frequency computer users outside school hours. Interview questions, developed by the researcher, were analyzed for trends in their answers with the use of a grid: gender x grade x high/low frequency computer users.

3. Summary of Findings

a. Hypotheses
There is no relationship between gender and the use of computers in school.

There is a relationship between gender and computer use outside school hours.

There is a gender-related difference in attitudes toward computers.

b. Other Findings
There appeared to be no association between age and computer use as illustrated in Table 10.

There appears to be a significant association between computer ownership and gender: more boys own computers than girls.

B. DISCUSSION

1. Computer Use

There were no gender-related differences in computer use during school hours. The earlier study conducted by the investigator (1985) rendered the same results regarding computer use
during school hours. Non-discriminatory computer access during class hours is a credit to the teachers in the sample: ensuring equal access for all.

Outside school hours, there is significant evidence to indicate that boys access computers more frequently than girls. Reasons for gender-discrepant computer usage outside school hours are discussed below.

2. Student Characteristics

Two characteristics were of significance in their relationship to computer use. First, the choices students make about how to spend free time appeared to be gender-related: boys and girls make significantly different choices. Boys, more often than girls, choose to spend time with a computer during their free time. Second, computer ownership showed a correlation to computer use. Other student characteristics (age, influences on decisions to use the computer) showed no relationship to computer use by either gender.

Language, and its effect on computer use, was not investigated in this study. While the majority of students rated themselves as predominately English speaking, the researcher is aware that many more of the students than indicated in the data come from non-English speaking homes. However, there is no doubt that students were capable of understanding the surveys, as many of the attitude questions were arranged with reverse polarity scoring; the researcher’s scan of the results shows that students answered questions with consistency.

3. Attitudes

There was clearly a gender-related difference in attitudes held by students about computers. An observation made by the researcher while scanning the questionnaires was that girls
tended to react strongly to questions which implied sexist or stereotypic behaviour (attitude questions 26 through 30). This would also account for the large and significant F values for questions 26 through 30, displayed in Table 16.

Cause and effect was not demonstrated by this study. In the final analysis, the multiple regression analysis showed low correlation with significant gender-related attitudes and computer use outside school hours: less than five per cent. However, room for further investigation exists in this area, as the attitude questions used in the regression showed slight to moderate intercorrelations with each other.

4. Interviews

a. Computer-related Activities and Abilities
High frequency users showed a greater depth of understanding of the computer and its potential than did low frequency users of computers. High frequency users, as opposed to low frequency users, used more sophisticated computer vocabulary when describing the computer; they gave a greater range of computer capabilities when asked about what it could do; and they used the computer in a greater variety of ways.

b. Role Models and Stereotypes
There were no significant results in this area with the exception that five of six low frequency computer users said their mothers did not use computers; whereas all the mothers of high frequency users used computers.

c. Free Time and School Activities
Once again, there appeared to be little significance in this category with the exception of "favorite school subjects". There appeared to be a small relationship between high users and
science and mathematics as favorite school subjects, but these results are inconclusive.

C. CONCLUSIONS

This study has rendered important relationships: gender differences in computer usage outside school hours; and gender differences in attitude towards computers. Aside from the testable hypotheses, the study has also revealed several other significant relationships as mentioned above in the "Summary of Findings".

Little rigorous research has been carried out in this area, but the need is great. Aspects for consideration for further research would include the following issues. Since little Canadian work has been carried out, larger sample populations would be desirable. A longitudinal study to identify changes in attitudes with changes in age would help to clarify at what age students' attitudes begin to alter. Since all the contact teachers in the study were males, a look at gender roles of computer teachers would clarify the impact of role models in computer education. The multiethnic component of this study was not developed, and since Canada is a pluralistic society, there is a need for studying the relationship of language groups to computer use and attitudes. Evidence found in the research literature, covered in detail in Chapter II, points to the reduction of female students in secondary school computer courses. Reasons why girls are not taking these courses requires further investigation.

As described in Chapter I, computers continue to influence the employment market. Education is central to the issue of equal access for both genders to new technology. Policy makers who consult research for assistance require properly conducted, rigorous research.
VI. REFERENCES


VII. APPENDIX ONE

Covering Letter to Teachers
VIII. APPENDIX TWO

Student Questionnaire
Student Questionnaire Part A

Instructions: Please carefully answer each question in the space provided on the questionnaire sheet. Please try to be as accurate as possible with your answers. This is not an examination and results from this survey will not count against you in any way. Thank you.

1. Name ....  2. Grade....  3. Girl.... Boy....

4. Age(yrs.)....

5. Language most often spoken at home: (please circle one)
   - Hindi
   - Chinese
   - Punjabi
   - English
   - Portuguese
   - Spanish
   - Other

6. Does your family own a computer? (please circle one)
   - yes
   - no

7. At school during the last two weeks, please estimate the number of times that you have used the school’s computers during class hours? Please circle only one. Ask your teacher for help if you need it, but try to be as accurate as possible with your answer.
   - 0 1 2 3 4 5 6 7 8 9 10  more than 10

8. At school during the last two weeks, please estimate the number of times you have used the school’s computers outside class hours (that is, before school, lunchtime, and after school)? Please circle only one. Ask your teacher for help if you need it, but try to be as accurate as possible with your answer.
   - 0 1 2 3 4 5 6 7 8 9 10  more than 10

9. When deciding to use computers in the lab at school, what influences your decision the most? Please circle only one.
   - a) programs to use
   - b) what your friends are doing
   - c) busy with other things
   - d) might not get a computer
10. Please complete the following sentence by circling one ending that best expresses your feelings.

"If I had the choice of things to do, I would rather ..."  
a) read a book    b) be with friends  
c) watch television  
d) play with a computer
Student Questionnaire Part B

Instructions: Please read each question carefully. Then choose an answer from the column of answers on the right. Circle one answer for each statement which you think best expresses your opinion. The initials in the right hand column represent: SD = strongly disagree; D = disagree; U = undecided; A = agree; and SA = strongly agree.

Example:
All boys like chocolate ice cream... SD D U A SA

The initials SD have been circled because I strongly disagree with the statement.
Most of the following statements ask for your opinion, and as such the answers are neither right nor wrong. So, please answer each according to your opinion. Thank you.

11. I would like to learn more about computers.......................... SD D U A SA

12. Working with a computer would probably make me feel uneasy or tense.......................... SD D U A SA

13. I feel helpless around a computer.......................... SD D U A SA

14. Computers sometime scare me.......................... SD D U A SA

15. I would very much like to have my own computer.......................... SD D U A SA

16. I would like the idea of taking computer classes.......................... SD D U A SA

17. I enjoy using computers in my classes.......................... SD D U A SA
18. Walking through a room filled with computers would make me feel uneasy. 

19. I feel uneasy when I am with people who are talking about computers. 

20. I enjoy working with computers. 

21. I feel confident about my ability to use computers. 

22. It is my guess that I am not the kind of person who works well with computers. 

23. On the whole, I can cope with computers in my daily living. 

24. I am able to work with computers as well as most others my age. 

25. Computers are gaining too much control over people's lives. 

26. In general, females can do just as well as males in computer careers. 

27. More females than males have the ability to become computer specialists. 

28. Using computers is more for males than for females.
29. Studying about computers is just as important for females as for males.

30. Men make better scientists than women do.
IX. APPENDIX THREE

Interview Questions
Interview Questions - Part C

1. Tell me five things you think about when you think of computers.
2. What kind of people use computers: men, women, smart people, scientists?
3. What can people do with computers?
4. Do you think your mother would ever use a computer?
   Your Dad? Brother? Sister? How?
5. Tell me five things you can do with a computer?
6. Do you like to work with computers? Why?
7. What characteristics do people have who work with computers? 8. Do you ever play with a computer in your spare time?
   Do you know any children who do?
9. What are your favorite school subjects?
10. Who are your idols, heroes? Favorite people?
    Why are they your heroes?
11. What games do you play with your friends?
    How do you usually determine what game to play?
12. If you could have your own computer what would you do with it?