Gender Differences in Educational Computing in Montreal Francophone Secondary Schools

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ABSTRACT

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Previous studies have shown that girls do not participate in educational computing activities as much as boys do. Evidence does suggest that girls' lack of technological skills will become a handicap in their future search for employment. Educational computing in Quebec francophone schools is potentially unique due to the delayed introduction of computers and cultural differences, and may not suffer from the gender differences found elsewhere. A total of 422 students of secondary levels 1, 3 and 5 (ages 12, 15 and 17 respectively) from two francophone schools in Montreal filled out questionnaires pertaining to their attitudes toward computers and strategies to promote gender equity in computer education. Results showed that overall students' attitudes were positive. However, sex and level differences were found. Boys and younger students tended to be more more positive. While a pattern of social and sexual stereotypes did emerge, high levels of computer experience appeared to eliminate differences. Increased exposure to computers is recommended. Discussed are strategies for increasing such positive experience.

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CHAPTER 1
INTRODUCTION

Less than ten years ago most schools did not have computers. Since, computers, and most importantly the idea of computers have invaded our school systems. So pervasive is this idea that it got students, parents and school personnel scrambling for funds, organizing bake sales and car washes, selling raffle tickets and re-organizing school budgets to find enough money to buy a computer. It would not be an exaggeration to say that, at least in the beginning, schools were buying computers just to own computers, not in response to any educational need (and this may still be the case). In this respect there was a loss of control which can be described as the "buy now, think later" mentality. How many times has a situation been described where after a flurry of fundraising, the computer arrived and was unpacked and connected, and as students and teachers beamed at their new acquisition, the inevitable question came up — Now what? Is there any other time in the history of education when we have put so much energy into acquiring something we knew so little about? It looked so promising, a solution to our educational problems that you could touch, manipulate and especially admire its new age design.

To be fair, it is important to say that we did learn from our earlier mistakes and that the madness that prevailed the first two or three years of the introduction of computers died down considerably. More judicious choices were made concerning the purchase of hardware and software. Now, seven or eight years later, we can look back at the path we have travelled and see where we have erred. One of our errors has been the failure to provide equitable computer education.

What does educational equity mean? The definition is twofold. The first part is simple; it refers to the requirement that all students have access to the same educational benefits regardless of sex, religion, race, socio-economic status, handicaps and area of residence. In theory this is easily done. It is doubtful that any school in Canada would refuse to provide education for a student for any of the reasons cited above, at least not overtly. The second part of the definition of educational equity is that students should not only have equal access, but should be equally motivated to access educational benefits. This is more subtle, less easily observable and therefore more difficult to control. It is always the subtle manifestations of racism, sexism and other discriminations that are hard to fight against. Our society is now in a phase of tolerance which is to say that it is socially unacceptable to demonstrate discriminatory attitudes. It does not necessarily mean that our attitudes have changed (though some hopefully have), only that we now question the judiciousness of expressing those attitudes. Similarly in education, overt examples of discrimination may have disappeared, while subtle discrimination remains.

This study is concerned with gender equity in computer education. Gender inequity and sexism have existed in education for a long time. Changes have only come very recently; it was not so long ago that in high school girls had to take sewing while the boys hammered away building bird houses in woodworking class. This issue needs attention because educational computing is a new field with old ancestors and unfortunately we cannot expect equity gained elsewhere to be applied to educational computing. In parallel, because it is a new field equitable standards developed here can guide the way in other areas. The study of gender inequity in education is important because not only will it help girls and boys, women and men to acquire a richer education, but because it provides insight into other inequities in our education system and in society at large.

The following chapter provides a review of the literature on girls and computing and related issues, as well as a rationale for this study.

CHAPTER 2

RATIONALE AND LITERATURE REVIEW

Participation in Computer Activities

It was not long after the introduction of the computer in schools that educators began to notice the lack of enrollment of girls in computer classes and their general lack of participation in computer activities. At first anecdotal reports prevailed but soon researchers began to look at girls' enrollment in computer courses more systematically. Journals began devoting special issues on this topic (*The Computing Teacher*, 1984; *Sex Roles*, 1985; *The Monitor*, 1986). Anderson, Welch and Harris (1984) reporting on the results of the 1981-82 National Assessment in Science, found that girls in the U.S. are less likely than boys to be enrolled in computer classes; 8% of the girls and 14% of the boys had signed up for at least one programming course. Linn (1985) reports that "in California, females comprise 42% of the 51,481 participants in high school instruction which involves computers; when they participate, females are 85% of the students in word processing courses and only 37% of the students in programming courses" (p. 15) The same trend can be found in older students. At the Lawrence Hall of Science 26% of 2,693 students who registered for computer courses were females. In the introductory computer course 24% of the students were females but the number dropped to 19% in the intermediate BASIC course (Linn, 1985). Vredenburg and Flett (1984) conducted a survey to investigate possible sex differences in psychological reactions to computers. A total of 462 undergraduate students (157 men and 305 women) completed a self-report survey. It was found that while men and women had equal access to computers, men were more likely to have used a computer, be enrolled in a computer course and to plan to buy a computer. Specifically, men were six times more likely than women to be enrolled in a computer course. In her study of the use of computers in elementary school Hawkins (1985) found that boys spent more hours programming than did girls. Alvarado (1984) reports that while there is no sex difference in the early grades, differences begin to reveal themselves at the onset of puberty.

Computer use is not restricted only to the school. Over the past few years children have been flocking to summer camps armed with diskettes, leaving behind camping gear. The enrollment of students in computer camps may in fact be more representative of females' and males' differing interest in learning to use computers since this is a voluntary activity. For this reason Hess and Miura (1985) conducted a survey of computer camps and summer classes offered throughout the United States. Twenty-three camps responded to the survey encompassing a total of 5,533 students in 132 different instructional groups. Results show that males far outnumbered females in all types of computer camps. Overall males formed 73.8% of the computer camp population. The enrollment of females decreased as age increased. Similarly, as courses became more difficult fewer females were enrolled. Since different types of camps were surveyed the authors looked at gender differences by cost. They found that the more expensive the camp, the less female enrollment was to be found, indicating that parents are less likely to invest money in their daughters' computer education. Similar patterns of enrollment have been reported in Canada. Johnson (1983) gives examples of camps in Ontario and British Columbia where the male-female ratio is 5 to 1. In a New Jersey school where computer courses are compulsory, boys were reported to use the computer on a voluntary basis more than the girls. They used computers more before school (18% boys, 2% girls), after school (21% boys, 2% girls), and during free periods (40% boys, 8% girls) (Kolata, 1984).

Computer ownership is another area where sex differences can be found. Harvey and Wilson (1985) report that in Britain of the students who participated in their study twice as many boys as girls owned computers. This is especially interesting since the results of the students' responses to a semantic differential attitude scale showed that girls were more likely than boys to qualify the computer as "expensive". The authors suggest that parents may be hesitant in investing in a computer for their daughters and "...consequently inform them that microcomputers are 'too expensive'" (p. 186). Gilliland (1986) reports that 93% of home computer users are male and similarly in Britain Gerver and Lewis (1984) report that 90% of early purchasers of the BBC computers were men. Miura and Hess (1983) also found that boys were more likely to own computers;

> Home ownership offers increased access to the computer and may also indicate parental effort to promote computer literacy. In a survey of 87 middle and upper income students in grades five through eight, the 13% who reported owning home computers were all boys. (p. 2)

As we can see from the above studies the level of enrollment of girls in computer classes and in summer camps as well as the percentage of computer owners vary considerably from one study to the other. However, whatever the actual figures the consistent trend is for girls to be under represented both in enrollment and in computer ownership. Is this so surprising? Women and girls have long been under represented in math, physics and science in general. Why is the field of computers different and why is it justified to give it particular attention? The main difference is that the field of computer science is relatively new and educational computing even newer. Marrapodi (1984) expressed these thoughts:

> Fortunately, we are addressing the issue at a time when computers in the schools are still a relatively new phenomena. We will not repeat the mistake of excluding a large portion of our youngsters from the freedom of choosing their future roles in society. (p. 58)

Similar thoughts have been expressed by Kolata (1984) and, in Quebec, Picard (1984). As educators we are given a chance to take action while the use of computers in education is still in its childhood. For this reason it is important to understand the impact of computer technology on our schools, on our life, on our work and in particular on the work of women.

Computers and Work

It is increasingly evident that almost every occupation will be affected by computer technology. The U.S. Department of Labor estimates that in the next generation 50 to 75% of jobs will involve the computer in some way (quoted in Sanders & Stone, 1986). Authors on the subject warn that computer skills will be essential in tomorrow's job market (Johnson, 1982; Lipkin, 1984; Linn, 1983) and Brecher (1985) further states that "the most obvious reason for learning about technology is to simply have the option to work" (p. 9). It is difficult to establish exactly what the impact of computer technology will be on future employment but in general there can no longer be any doubt that the prospect for those with no technological skills is grim while those who are well equipped to enter technologically rich fields will prosper. For only this reason it would seem logical to encourage both girls and boys to participate in computer activities and to gain as many technological skills as possible, but there is more. The next section looks at women in the workforce and how women are affected by the advent of computer technology in the workplace.

Women's Work in Canada

Armstrong and Armstrong (1984) have documented the work of women in Canada. The information that follows is taken from *The Double Ghetto: Canadian Women and their Segregated Work*. Their statistics are derived from Canada census.

Women, especially married women have tended to form a reserve army of labour, entering the work force during high demands (for example during wartime when men are away and during economic peaks) and then retreated back to the home when there is no longer a need. For example during the Second World War "the female participation rate rose from 24.4% in 1939 to 33.2% in 1945" and in 1946 "the female participation rate had dropped back to 25.3% as many women disappeared again into the home" (Armstrong & Armstrong, 1984, p. 21). As temporary, part-year or part-time workers women do not usually receive the same pay or benefits that full-time workers receive. Now because of the substantial increase of women in the work force they can no longer be considered a reserve army. Although the percentage of women's participation in the work force has increased since 1941, and this despite the increasing rate of women pursuing full-time studies and the increasing percentage of women over 65, there have been relatively no change in the type of work women do. Women are segregated by the industry for which they work and by the occupation they hold in these industries. The authors state that "The segregation of women in specific industries and occupation characterized by low pay, low skill requirements, low productivity, and low prospects for advancement has shown remarkable stability throughout this century" (Armstrong & Armstrong, 1984, p. 22). Women's work is segregated by a high proportion of women working in the service, clerical and sales occupations. Women hold employment in a small range of occupations. Armstrong and Armstrong (1984) report that in Canada in 1981 60% of women worked in only 21 different occupations. The occupations of stenographers and typists tops the list with 10.1% of all women workers holding these occupations (p. 36) or viewed differently, 98.7% of stenographers and typists are women. The authors state, "Not only were women concentrated in a limited number of occupations, they also tended to dominate these occupations, that is, to outnumber men in them" (p. 38). Menzies (1981) states that in "1979 clerical, sales or service occupations accounted for two thirds of all Canadian women in the paid labour force" (p. 9). In Quebec in 1981 five occupations accounted for 40% of women in the work force. Again, clerical work, stenographers and typists represented 28% of female workers (Secrétariat à la condition féminine, 1985). Similar figures can be found for England (Huws, 1982), Sweden (Berner, 1984) and Australia (Earley, 1981).

Furthermore, Armstrong and Armstrong (1984) report that women make less money than men, even within the same occupations, that women are more likely to accept part-time work, that their rate of participation in an occupation is inversely proportional to the prestige accorded to those occupations and that although female union membership has increased, 78% of women work without the protection of a union. In addition to the above information we find that in Canada "most women work out of necessity" (Canadian Advisory Council on the Status of Women [CACSW], 1984, p. 4). The high divorce rate, increased birth control and other factors have contributed to women's participation in the work force. Reporting on a variety of predictions on females' participation in the work force Menzies (1981) notes that "All of the studies project increasing female participation in the labour force at least until the end of the 1980's" (p. 5). Women are in the work force to stay and prevailing conditions indicate that women need to extend their occupational horizons. This is especially true in view of the impact of technology on women's work.

New Technology and Women's Work

It has become increasingly evident that because of women's occupational segregation it is the work traditionally done by women that will be disproportionately affected by the advent of new information technology. Armstrong (1984) reports that:

> Even the most optimistic researchers agree that there will be at least a short term loss of jobs resulting from the introduction of the new technology, especially in offices and the service industry, where productivity is low and where much of the new technology has more obvious applications. And, while frequently hesitant to make predictions in other areas, most investigations of the impact of the new technology agree that women will lose more. (p. 145)

Menzies (1982) gives two good examples of the impact of technology in occupations traditionally held by women. The first example is the automatic teller machines which hand over the work to the customer, thus decreasing the need for clerical support staff. As a second example, because of "the introduction of the electronic call switching, operator requirements in some Canadian cities (Vancouver and Toronto, for instance) have been reduced by between 24 and 40 percent" (p. 4). It is not only the lower skill jobs that are affected but it seems that due to a lesser need for supervision because of decreased clerical staff and electronic surveillance, the "low level management jobs, the ones that women have just recently attained, will also disappear" (Armstrong & Armstrong, 1983, p. 120). And finally, new technology not only makes clerical work more scarce but it will also deskill many of the jobs that remain. Menzies (1982) describes these support-type jobs as those "which are currently being eliminated or reduced to trivial boredom through automation and related deskilling" (p. 3). In its report on women and microtechnology the Canadian Advisory Council on the Status of Women states that microtechnology has the potential of improving peoples' lives but:

> ...a substantial number of women are not experiencing the

> benefits of microtechnology. In fact they are suffering hardships because of increasing levels of unemployment in the service sector and because of a decreasing quality of the work environment. (CACSW, 1984, p. 2)

In light of this information girls' lack of enrollment in computer classes takes on a heightened significance. Clearly, girls must acquire technological skills (as well as science and math skills) and the bridge to technology for girls may well be the computer as has been suggested by Turkle (1984): "It [the computer] provides an entry to formal systems that is more accessible to women" (p. 118). This section dealt with women who are already in the work force. How will the work patterns of girls who are in high school today differ or resemble those work patterns observed now? The following section examines girls' occupational aspirations.

Girls' Occupational Aspirations

Maureen Baker (1985) conducted a survey for the Canadian Advisory Council on the Status of Women on the aspirations of Canadian adolescent women. The general question this study attempted to answer was "Are adolescents being adequately prepared for the future of the 1980s or the year 2000?" (p. 1). One hundred and twenty-two adolescent women were interviewed about their present lives, their educational plans, the work they expected to do, how they would organize their personal lives and what a typical weekday would be for them at age 30.

The study found that many adolescent women held views about their future that were unrealistic or contradictory. Many indicated the desire to pursue a career but many were not fully aware of the requirements of a career or, for that matter, of being a mother. For example, a 17-year-old girl from Toronto wanted to get a Ph.D. in psychology and lecture around the world despite her "C" average in grade 12 (p. 51). Another mentioned being a physiotherapist by the age of twenty and that she would have 2 school age children by the age of 30 (p. 87). Yet another said that she would be married by the age of 30, have three children and be a doctor (p. 88). Although these scenarios are not impossible, they are improbable. Those who want a career but are not planning adequately for it will probably end up on the job market with little or no skills. Twenty-three percent of the participants said that they wanted to do office work. The author concluded that "they are making stereotyped educational choices which will put them in the poor working conditions of most females in the country" (p. 159). The same situation can be found in Quebec. Many high school girls are opting for secretarial vocational programs and other traditionally female occupations and there is fear that they will be victims of technological change (Secrétariat à la condition féminine, 1985). Hence, there seems to be no indication that there has been any substantial change in the career orientation of high school girls. It seems all the more justified to accentuate computer education so that girls will have a better chance in the job market. In the words of Sanders (1984), director of the Computer Equity Project, "lack of computer skills is likely to relegate future workers to low-skilled, low-pay jobs. We do not need any more female job ghettos than we already have" (p. 32).

Employment, important as it may be, is not the only reason we should encourage our youngsters to acquire computer skills. The two following sections look at other reasons.

Survival Skills and Power

It has been suggested by many authors that the need for computer skills goes beyond the simple requirement for employment. Anderson et al. (1984) state that "not only is computer literacy important for success in the world of work but computer literacy is also becoming essential for successful citizenship and useful for everyday living (p. 10). Brecher (1985) echos this idea when she states that knowledge of computer is necessary to "...be a full-fledged member of the 20th century, able to understand the world around you" (p. 5). In discussing societal consequences of the advent of computers Sanders and Stone (1986) state:

> Students who are uncomfortable with the computer and avoid it are likely to continue to feel threatened by computers as adults. They are likely to see technology not as a tool we elect to use, but a force against which we are helpless. Refusing to deal with technology or becoming obsessed with its power are products of this fear. Both are dangerous for citizens to make decisions about the role of technology in our government and our lives. Since women are half of our citizens we need to make sure that girls have enough contact with computers so that they can make informed decisions when they grow up. (p. 12)

There is also an issue of power. Computer literacy is easily compared to literacy in our society. Clearly, those persons who do not know how to read and write do not participate fully in our society and therefore can not benefit fully either since they must relegate power to others. Anderson et al (1984) state "educational computer inequity threatens to separate groups and communities by giving some people more effective tools for living in the age of computer information" (p. 10). Specifically, in terms of gender inequity Bakon, Nielsen and McKensie (1983) state "The social consequences of preparing a tiny male technological elite to provide leadership are ominous and foreboding" (p. 27). Pursuing the point further, in reference to computer inequity, Molner states "power is not distributed evenly now and computers are widening the gap (Molner in Sturdivant, 1984, p. 65).

Computers and Education

There has been much debate over the usefulness of computers in education. While some dismiss computers as just another fad, others welcome their arrival gratefully. One thing that is clear is that computers are merely tools and the use we make of these tools will define their value. Certainly, the computer has much potential and many authors have suggested that by shying away from computers girls may not only lack technological skills but they may also miss out on a variety of educational experiences. Del Seni (1984) states "computers have the potential to become an evolutionary educational advance because these technological devices can assimilate the teaching-learning process" (p. 68). Linn (1983) writes that "The well documented differential participation of males and females in computer learning environments could lead to corresponding differences in cognitive attainment and career access" (p. 3). Lipkin (1983) has described the computer as a "tool that aids learning and develops intellectual capacities" (p. 7) and that it "...can provide beneficial learning experiences in a wide variety of ways to a broad range of students" (p. 9). Furthermore, there are experiences that are available only through computers. For example, simulation software brings into the classroom experiences that are not readily available to most students.

In summary, there are four main reasons to involve girls more in computer courses or computer-related activities. First, computers will have an impact on all work, and knowledge of computers can only be an asset. Secondly, it has been reported that because a large portion of women are segregated into clerical and service occupations (and that girls in high school are still heading this way) their work will (or is being) disproportionately affected by technology. Thirdly, computers and related technology affect almost every aspect of our lives and to be knowledgeable of technology may mean to be able to participate more actively in our society. Finally, the educational potential of the computer makes it a tool that can bring rich educational experiences to all students.

Reasons for Girls' Lack of Participation

This section examines several reasons that have been cited in the literature for girls' lack of participation in computer activities. Note that most of these are not single reasons for this complex phenomenon. They do not explain in themselves the fact that girls are underrepresented in computer activities. Rather they combine in different ways, possibly differently for each individual, to form a more complex explanation.

Association with mathematics. One commonly cited reason is that computers are associated with mathematics and that girls are uncomfortable enough with math to stay away from anything related to it. Clarke (1985b) states, "the underrepresentation of girls in computing activities may be partly attributed to the association of computers with mathematics, science and technology" (p. 3). In the same line of thought Hawkins (1985) writes "...computers are commonly thought of as 'built' from mathematical ~~elements and~~ concepts. This leads to the inference that in order to work with computers people must be mathematically inclined or have prior skills - an inference that may not be accurate" (p. 167). Winkle and Mathews (1982) consider that this association of computers with math creates a "handicap" for girls for learning about computers. Reinforcing this is the fact that computers are often introduced in programming courses offered in conjunction with mathematics (Lockheed, 1985) and that much of the software available for computers is math oriented (Hess & Miura, 1983). Gressard and Loyd (1984) investigated the affects of math anxiety and sex on three computer measures: "Results indicated that after controlling for computer experience, math anxiety explained a significant addition of variance for computer anxiety, computer confidence and computer liking" (p. 3). As long as computers are perceived as being an extension ~~of math~~, it is doubtful that girls' enrollment in computer classes will increase.

Sex-role stereotyping. Sex-role stereotyping begins early in children. Hageman and Gladdings (1983) report that elementary school children already have very definite occupational stereotypes. Keller (1985), scientist and author of *Reflections on Gender and Science,* reports a remarkable example of the depth within which stereotypes about math and science are ingrained.

> From strikingly early ages, even in the presence of astereotypic role models, children learn to identify mathematics and science as male. "Science," my five-year old son declared, confidently bypassing the fact that his mother was a scientist, "is for men!" The identification between scientific thought and masculinity is

> so deeply embedded in the culture at large that children have little difficulty internalizing it. (p. 77)

Children are generally reinforced for showing appropriate sex-role behaviour (Maccoby & Jacklin, 1976) and children perceive that their parents expect them to conform to appropriate sex-role behaviour (Albert & Porter, 1982). In discussing achievement motivation Horner (1972) states "...otherwise achievement motivated young women, when faced with a conflict between their feminine image and expressing their competencies or developing their abilities or interest, adjust their behavior to their internalized sex-role behavior" (p. 173). Since computers are likely to be viewed as male domain (Clarke, 1985b; Vredenburg & Flett, 1984; Lockheed & Frakt, 1984), it is likely that girls would avoid computers in order to conform to appropriate sex roles. This is especially true at the onset of puberty when girls are concerned about appearing feminine (Sanders, 1986).

Male and female role models. Females are continuously being presented with male role models operating computers (Clarke, 1985b). Reporting on the results of a survey of computer using and nonusing teachers carried out by the National Education Association, Stasz, Shavelson and Stasz (1985) report that although the majority of both using and nonusing teachers were females, the percentage of males was larger among users than among nonusers" (p. 151). It is unlikely that girls will identify using computers as an activity that is appropriate for them if all they have are male role models. However, other authors contend that the sex of the teacher doesn't matter. Sanders and Stone (1986) state:

> One factor commonly thought to be at the root of the computer gender gap is the sex of the computer teacher. If there were more women in this job, the thinking goes, the role model influence would close the gap. The best evidence indicates this is barely true. Asked if "seeing female teachers use computers" would encourage them to use computers more, only 11 percent of the girls we asked in our pilot test said yes. (p. 16)

It is difficult to gauge what the actual influence of a role model is because what students report affects them (or not) may not be a correct indication of what in fact affects them.

Publicity. Publicity is at once a reflector of the values held by our society and a perpetuator of these values. Overwhelmingly, the publicity surrounding computers depicts men and boys using computers. Women, if shown, are often shown in a passive role. Sanders and Stone (1986) examined four issues of large-circulation computer magazines. They found that women were portrayed in passive roles in 36% of the photographs in these magazines and in active roles in 17%. Gerver and Lewis (1984) counted the number of males and females in computer magazines in Britain and found a 10 to 1 male-female ratio. Ware and Stuck (1985) analysed the roles attributed to men and women in illustrations in computer magazines.

> Many stereotypic portrayals were found: men appeared in illustrations almost twice as much as women; women were overrepresented as clerical workers and sex objects, while men were overrepresented as managers, experts, and repair technicians. Women were shown significantly more often in a passive role vis-a-vis computers. In mixed-sex illustrations, men were most often shown in the position of authority. Only women were shown as rejecting the computer or portrayed as sex objects. (p. 205)

Clearly, there is nothing in the publicity of computer hardware and software that would incite females to become more involved in computer activities.

Sex differences in ability. In studying males and females the discussion inevitably leads to sex differences in ability. An examination of the literature just coming out concerning sex differences in computing ability reveals varying results. This is not surprising since most researchers are using different scales of measurement and indeed are measuring different things. Until valid instruments are developed and used in repeated experiments, little light will be shed on the sex differences in computing ability. However, the following studies provide some information.

Hawkins (1984) conducted a study of children (8-9 and 11-12 year olds) and found that "for both age groups, boys performed considerably better on all measures of programming expertise and, in general, showed more enthusiasm for the work and spent more time programming" (p. 11). In a statewide survey of the knowledge, attitude, and experiences of California sixth- and twelth-grade students in the areas of computer science and computer literacy, Fetler (1985) found that for all of the objectives assessed boys' performance was superior. Clarke (1985a) obtained different results. She found that girls in an all-girl school performed as well as boys in a mixed school but that girls in a mixed school did not. Miura and Hess (1983) report that differences in ability to learn programming did not seem to be a factor in the differences in enrollment in summer camps. The Minnesota Educational Computer Consortium found that boys and girls "were roughly equal in overall computer literacy as well as programming test scores" (quoted in Chen, 1985, p. 10).

Fennema and Sherman (1977) note that a careful review of literature revealed that studies of sex differences in math abilities did not take into consideration previous experience. Once this is accounted for the gap in abilities between boys and girls is considerably smaller. It is possible that similar results could be found in studies of computing abilities. If boys are spending more time with computers, either at school or at home, then their familiarity, interest and ability with computers are likely to increase. Although sex differences in computing ability may be a reason girls stay away from computers, studies so far are not conclusive. More research needs to be done in this area to establish if differences in ability exist and how they account for differences in enrollment.

Software. Several authors have suggested that the available software is inappropriate or uninteresting for girls (Alvarado, 1984; Fisher, 1984; Gerver and Lewis, 1984; Hawkins, 1984; Hess & Miura, 1983; Keisler, Sproull & Eccles, 1983; Lockheed & Frakt, 1984). Many games have themes of violence, destruction and competition that have very little appeal for girls (Keisler et al., 1983) and games may be the first encounter children have with computers. Gerver and Lewis (1984) in reference to games of violence and destruction believe that "girls may spend less time in practical experience with computers because such games violate their ethical code" (p. 11). Even when software does not encourage violence many of the characters and symbols used in software are male-oriented. Fisher (1984) gives as examples a math drill that uses race cars as reinforcement, software that has eight of its ten stories about boys (the other two being about dogs), and LOGO sprites being balls, cars, trucks and airplanes. Characters in software are more often identifiably male than females (Moe, 1984). Sanders (1986) contends further that much of the software is biased, that their language and sex roles are stereotyped. Several authors suggest screening material for subtle and overt evidence of sexism (Alvarado, 1984; Marrapodi, 1984; Sanders, 1986). Finally, it is suggested by Keisler et al. (1983) that since much of the software requires visual and spacial skills, an area in which boys consistently outperform girls, the appeal for girls is lessened even more.

What are girls' preferences if any? Keisler et al. (1983) believe that "at this point on one really knows what that software [for girls] would be like but games based on combat, aggression and competition sports are certainly not the answer" (p. 48). Authors have observed girls' preferences for software that involves cooperation (Gilliland, 1984; Hawkins, 1984; Wheeler, 1986), fantasy, (Gilliland, 1984; Malone in Fisher, 1984) and music, graphics and puzzles (Williams, Coulombe and Lievrow, 1983). Sanders and Stone (1986) suggest that violent software is inappropriate for both sexes because it teaches anti-social values. In an effort to attract girls to the computer, software companies have begun designing software for girls. One such company is Rhiannon. The founders of Rhiannon see games as being a vehicle to interest girls in computers. They claim to have "characters, plots and processes that we believe appeal primarily to females" (Stott in Carey & Carey, 1984). Their software involves "two independent female protagonists who must use their wits, courage and intelligence to survive" (Brady & Slesnick, 1985, p. 24). Their software has been criticized as being too slow and ends up being interesting to neither sex (Brady & Slesnick, 1985; Carey & Carey, 1984). Other efforts have focussed on developing software with contents supposedly of special interest to females such as interior decoration, recipe records and shopping mall games (Sanders & Stone, 1986). Brady and Slesnick (1985) point out that the problem with this "fluffware" as they call it, is that although it may get girls to the computer it reinforces sexist stereotypes. They suggest that software should not only be sex-neutral but that it should also encourage students to explore non-stereotypical interest. They cite *Voyage of the Mimi* as a good example of such software. It is designed for students of 11 to 19 years of age and is about an expedition to study whales. It is singled out by the authors because it combines skills and interests associated with females, with skills and interests traditionally associated with males. Clearly, educators will have to be judicious in their choices of software so as to attend to the interests of both sexes without reinforcing stereotypes.

Types of Interactions. It has been suggested that people relate to computers in different ways, with more or less ease. It may be that the type of interaction most often required between a person and a computer is less appealing for girls. Gilligan (1982) has noted that females' psychological profile includes the desire of intimacy, and the need for connectedness with others. Men feel threatened by images of intimacy but females feel threatened by images of competition which they feel leads to isolation. In their study Pollack and Gilligan (in Gilligan, 1982) gave college students the *Thematic Apperception Test*, a test of pictures about which subjects must write stories. They found that males were more likely to project images of violence in the pictures where people are close together. For the females the violence appeared in their stories about a picture of a man at his desk, the only picture of a person in isolation. Similarly, Keller (1985) argues that the object relationship found in science is more appealing to men who are less inclined toward connectedness and more likely to feel comfortable with separateness. The opposite is true for women. In the context of computer education Gerver and Lewis (1985) suggest that "women, who are intimidated by isolation, experience considerably more difficulty in establishing a relationship with a machine which is perceived as non-intimate" (p. 11). Horner (1972), in her studies on Motive to Avoid Success, (defined as "an internal psychological representative of the dominant societal stereotype which views competence, independence, competition and intellectual achievement as qualities basically inconsistent with femininity" (p. 157)), found that girls who scored high in the Motive to Avoid Success performed significantly lower in mixed-sex competition. Since girls are more likely to score high on Motive to Avoid Success, and since most schools don't have enough computers for all students, girls find themselves in a mixed-sex competition, a condition in which they're not likely to succeed. This may explain studies like Clarke's (1985a) in which girls performed better on computer tasks when they were in sex-segregated environments.

In her book *The Second Self* Turkle (1984) has described two types of interactions with computers that she has observed in children. She refers to these as "hard mastery" and "soft mastery" and describes them as follows:

> Hard mastery is the imposition of will over the machine through the implementation of a plan. A program is the instrument of premeditated control. Getting the program to work is more like getting "to say one's piece" than allowing ideas to emerge in the give-and-take of conversation. Soft mastery is more interactive...like a painter who stands back between brush-strokes, looks at the canvas, and only from this contemplation decides what to do next. Hard mastery is the mastery of the planner, the engineer, soft mastery is the mastery of the artist. (p. 104)

Not surprisingly, girls tend to be "soft masters". Although both types of interactions can be equally productive and satisfying, Turkle points out that "not all computer systems, not all computer languages offer a material that is flexible enough for differences in style to be expressed" (Turkle, 1984, p. 105). Similarly, the structure found in most schools and the general structure of programming courses probably favor the "hard master" style. The answer to getting girls to the computer may lie in the types of interactions we introduce them to. The following section looks at projects for promoting computer equity.

Projects

In the United States girls' lack of participation in computer activities has prompted the development of several courses and projects to promote gender equity in computer education. Deborah Brecher (1985) has written a book entitled *The Women's Computer Literacy Handbook.* The book is the product of her work at the school she founded in San Francisco, the Women's Computer Literacy Project. She explains that the idea for a women's course arose from the difficulty she had in finding books and classes that were not ladden with technical jargon that makes learning about computers intimidating and difficult. Her book is said to have a feminist approach to technology: "The key element of this approach is holistic awareness of the entire system, which includes both the human operator as well as the machine" (p. 15). The book, completely stripped of technical jargon and using examples that are familiar, covers all topics usually found in an introductory course, in a manner that is clear and concise.

Sanders and Stone (1986) have written a book entitled *The Neuter Computer.* The authors developed a Computer Equity Training Project at the Women's Action Alliance, a group dedicated to the improvement of educational equity for girls and women. The book contains suggested activities for achieving equity in computer education as well as guidelines for implementing a computer equity program and resources. The authors report that "using many of the strategies in this book, girls at the field test schools increased their computer use 144 percent in one term. Girls went from being a quarter of the optional-time computer users at the beginning to half of them at the end" (p. ix).

The Lawrence Hall of Science at Berkely has developed a program called EQUALS in Computer Technology. It is an inservice program developed to:

> increase educators' awareness of the importance to females of acquiring technical competence. EQUALS in Computer Technology provides educators with classroom strategies and materials designed to encourage girls and underrepresented minorities to participate in computer courses, to help develop thinking skills in the areas most necessary for technical work, and to provide information and experiences which will enable students to master new technology (Gilliland, 1984, p. 42).

The project, Practical Solutions to Overcoming Inequitable Computer Use was developed by the American Institute for Research through a grant from the Women's Educational Equity Act Program (WEEAP), U.S. Department of Education. This project has three main objectives: First, to define the factors that produce inequitable access; secondly, to generate potential solutions and thirdly, to develop self-assessment instruments to identify inequitable factors in the classroom (Schubert, 1986).

The Project on Equal Education Rights (PEER, 1985) has developed a Computer Equity Action Kit. This kit offers instruments to assess computer inequity, strategies for change as well as an impressive list of resources in the U.S. In each of these projects the strategies suggested are similar and relatively straight forward (for example, checking software for sex bias). However, what is more complex is making people aware of computer inequity and getting them to access these projects.

Computers in Quebec Francophone Schools

The arrival of computers in Quebec schools is fairly new. In July of 1983 the Minister of Education made public his implementation plan for microcomputers (Ministère de l'éducation (MEQ), 1983). The plan outlined the main courses of action to be taken for the following five years. The plan included the training of school personnel, the purchase of hardware and software, the implementation of computers in schools and plans for research and development.

Starting in the 1983-84 school year and ever since, students of secondary four and five can take an introductory computer science course (Initiation à la science informatique). The course is an optional half-year course. The focus of the course is the nature and functioning of the computer, of software and of programming (Commission des écoles catholiques de Montréal, (CECM) 1986). Except for isolated cases and for vocational courses, most of the use of the computer at the secondary level is limited to this course (Leclerc, 1986a). Aside from technical difficulties, one of the problems with this course is its scheduling which often requires students to make choices between this course and courses which they need as pre-requisites to higher education (CECM, 1986) or simply courses that they feel will be more useful or interesting (for example, English for francophone students) (Leclerc, 1986a). The computers at the secondary level are mostly located in computer labs (Centrale de l'enseignement du Québec, (CEQ), 1985) to which students have access only during class or if a teacher is on duty to supervise the lab (Leclerc, 1986b).

At the primary level the situation is different. No official program exists and the presence of computers and their use vary from school to school. For example, in the CECM 8% of primary schools have eight computers or more, 29% have none and the rest have between one and seven (CECM, 1986). This school board reports a large variety of brands of computers and an impressive array of computer-related activities. The activities seem to be particular to each school and no uniformity of programs exist. Word processing and graphic processing are popular uses (CECM, 1986). In primary schools computers are more often found in the classroom although they also tend to be spread out throughout the school or be mobile (CEQ, 1985). It has been reported that there is more enthusiasm and initiative at the primary level, although most teachers report that much of the work involved in implementing computers in their classrooms is done on their own time (Leclerc, 1986b).

It has been suggested that teacher training may be the most important element in the implementation of computers in schools (CEQ, 1985). For teachers in Quebec, this is clearly a source of dissatisfaction. The CEQ reports that only a little over 1% of teachers surveyed felt that they were adequately trained for each of the nine computer uses that were suggested (CEQ, 1985). Furthermore they report that the training available to teachers is inappropriate in terms of length of course, content and available funds. The CEQ (1985) describes the need for training at the primary level as urgent (p. 17). An article in La Presse about teachers' computer training describes that at first most teachers eagerly enrolled in computer courses but that the enthusiasm quickly faded (Une formation..., 1986).

Two other problems have made the introduction of computers in Quebec schools difficult: Problems of hardware and software. The choice of the Max-20 computer by the government has been highly criticized. Technical problems have manifested themselves and the number of computers allotted was clearly insufficient (CECM, 1986). Problems of software are even more difficult to solve. Since the Max-20 is not used anywhere else but in Quebec schools, no software is designed especially for it except those developed by the MEQ which were given to each schoolboard. These were not very satisfactory and were even described as "anti-pédagogique" (CECM, 1986, p. 29). Development of software is a slow process (and requires funds) and the private sector does not see the production of francophone educational software as being particularly lucrative. Despite these problems, according to the CEQ, Quebec is not significantly behind other Canadian provinces (CEQ, 1985).

Computers and Sex Differences in Quebec

Although the focus of this study is the differences in computer use between male and female students, it is interesting to note differences between male and female teachers.

Teachers. The CEQ reports that 29.4% of male teachers own a computer and 18.9% of female teachers own a computer. Although the majority of teachers at the primary level are females, male teachers use computers more than do female teachers at this level (CEQ, 1985). They also report that male teachers of both primary and secondary levels demonstrate a greater interest in using computers than do female teachers. Note that computer users were defined as those teachers that used computers for educational pruposes. Hence, the number of owners is greater than the reported number of users.

Students. A preliminary study done by this author has revealed that very little information is available about sex differences in computing in Quebec. The issue has been mentioned briefly in the popular press mostly warning about the possibility of computer inequity based on American studies (Picard, 1984). Interviews with educational advisers for computer education (conseiller pédagogique en micro-informatique) of four Montreal school boards revealed that the issue of girls and computers has not been addressed. All agreed that the enrollment in the introductory computer science course does not seem to indicate a sex difference, but not all agreed that this meant no problem exists. The MEQ (1985) reports that in the 1984-85 school year, 46.7% of students enrolled in the introductory computer science course were girls. An informal survey by this author of four introductory computer science classes revealed that 34% of the students in the course were girls. No data are available on girls' participation in computer activities in primary school and secondary levels 1 to 3, and in view of the wide variety of activities at these levels, none of which are uniform across schools, such data would not be generalizable. The CEQ reports that 75.9% of teachers who use computers do not perceive a difference of interest between boys and girls; 9.9% did not know, while 14.2% noted that girls showed less interest. The CEQ suggests two hypotheses to explain this: Either the situation in Quebec concerning girls and computing is fundamentally different from that reported in the United States, or the teachers are not aware of the reality of the situation. They recommend that further research on girls and computing, and particularly on girls' attitudes, be conducted as soon as possible.

The Study

The purpose of this study was to provide further insight into the situation of girls and computing in Quebec francophone schools. The logical place to start was to examine how males and females used computers and if any differences in use existed. Interviews with the educational advisers for computer education in four Montreal Schoolboards revealed that: First, the only systematic use of computers across francophone schools (other than in special vocational programs) was in the introductory computer science course. Secondly, no centralized statistics were kept regarding who took this course. Schools keep their own records which do not usually differentiate students by sex. Thirdly, none of the interviewees knew of any records or research done regarding sex differences in computer use. In view of this information, it was decided to examine possible computer inequity by collecting information about students' attitudes.

There were two parts to this study. The first part of the study measured secondary school students' attitudes toward computers, focussing particularly on the differences between the sexes. It is important to be aware of students' attitudes in order to fully understand the factors influencing educational events. Shaw and Wright (1967) state "if the attitude of a person toward a given object, or a class of objects, is known, it can be used in conjunction with situational and other dispositional variables to predict and explain reactions of the person to that class of objects" (p. 1). If we know what attitudes exist we can begin to find factors influencing those attitudes and hence, if necessary, begin to find ways to alter those attitudes. Developing positive attitudes towards various school subjects has always been an important part of the educational process and "...it seems likely that students' attitudes toward computers and toward learning about computers may be an important factor in the success or failure of the new computer programs" (Gressard & Loyd, 1984, p. 501). It is probable that if boys and girls have different attitudes toward computers there will be other differences relating to computers (i.e., in enrollment, performance or other). If differences exist, educators should be aware of them so that computer education programs may be adapted to respond to the needs of students.

The second part of the study examined students' responses to a variety of strategies that have been suggested to promote equity in computer education. If a situation of gender inequity arises it will be useful to have more information on the strategies available for changing the situation. The strategies toward which students react more favorably would be more successfully implemented.

Several strategies for change have been suggested in the literature. Students were questioned on the following proposed strategies:

1. To require that all students take a computer course (PEER, 1985; Linn, 1985). (1 question)
2. To use the computer more as a tool rather than only for programming (Lockheed, 1985;

Hawkins, 1985). (1 question)

3. To decentralize the computer from the math curriculum (Gressard & Loyd, 1984). (1 question)
4. To promote collaborative work (PEER, 1985). (1 question)
5. To segregate computer activities by sex (Clarke, 1985a). (1 question)
6. To offer more female role models (PEER, 1985; Vredenburg & Flett, 1984). (2 questions)
7. To inform girls about the pertinence of computers in their future life (PEER, 1985). (2 questions)
8. Avoid "boys only" settings like the computer lab (McGregor, 1985). (1 question)
9. To increase the number of computers. (Clarke, 1985a) (1 question)

Research Questions

The following research questions were examined.

1) *Attitudes toward computers*
   - Do males and females differ in their attitudes toward computers?
   - Is there a difference between students of different levels?
2) *Experience with computers*
   - Do females and males differ in their experience with computers at school, outside of school, with games and non-games?
   - Do they differ in the number of hours per week that they use computers?
   - Do they differ in their intention to take a computer course?
   - Does having experience affect their attitude toward computers?
3) *Attitude toward other school subjects*
   - Do females and males differ in their attitude toward math, science and writing?
   - Are there differences in their overall attitudes of these three subjects?
4) *Attitudes about females' competency*
   - Do males and females feel that females are as competent as males in learning to use computers?
   - Do females feel that they are personally competent to use computers?
5) *Strategies to promote equity in computer education*
   - How positively or negatively do females and males respond to each strategy?

CHAPTER 3

METHOD

Subjects

The subjects were 422 students from two large francophone secondary schools in Montreal. The total number of females was 199 and the males numbered 223. Data were collected from 182 students in secondary level I (86 females and 96 males), 124 students in secondary level III (57 females and 67 males) and 116 students in secondary level V (56 females and 60 males). The age of the students were approximately 12, 15 and 17 respectively for each level. The students were given the questionnaire in intact classes chosen by the contact person in the school. The class subjects were all ones that were compulsory for all students of each level. The data were collected in January and February 1987.

The two schools were very similar. The total student population of the first school was 1225, while the second school had a total of 1150 students. Both schools contained secondary levels 1 to 5. The principals reported that the socio-economic level of their student population to be "middle" for the first school and "middle to upper middle" for the second school. Both schools had computers for the use of the students, 26 and 18 respectively and both offered the course Introduction à la science informatique, the introductory half-year course offered in secondary levels4 and 5. On a yearly basis this course is taken by 90 students in the first school and by 100 students in the second school.

Instrumentation

The instrument used in this study was the Instrument to Measure Attitudes of Secondary School Males and Females toward Computers (Collis, 1984), referred to hereafter as the Collis questionnaire. Several reasons guided the decision to use this questionnaire. The first reason is that it was designed specifically to measure students' attitudes toward computers, as opposed to other scales that measure computer literacy or other facets of computer education.

Secondly, the Collis questionnaire was developed for use with secondary school students. It is felt that it is important to use a questionnaire especially designed for this group so as to capture the particularities of the attitudes of secondary school students.

Thirdly, the questionnaire was developed using a model of attitude measurement developed by McKennell (1974). This model distinguishes itself by the fact that the content is defined by a large representative sample of the target population instead of by the investigator. In a field as new as educational computing this model of attitude measurement development seemed particularly appropriate.

Finally, since no such questionnaire had been developed in Quebec, the Collis questionnaire developed in British Columbia would be a more appropriate instrument than one developed in the United States or elsewhere. Although clearly, students in British Columbia and Quebec differ culturally, their experience with computers, taking into account the general thrust of Canadian education and the development of technology in education in Canada, is more similar than with students of other countries.

The Collis questionnaire contains 24 questions pertaining to students attitudes toward computers, 14 questions on their attitude toward other school subjects and 4 questions on their computer experience, for a total of 42 questions. The students respond to each of these on a 5 point scale, "1" being "Strongly agree" and "5" "Strongly disagree". Since we have little information concerning students' use of computers in Quebec one more question on students' computer experience was added (see question 53). Note that question 52 on the original ("I have taken or I am taking computer science 11/12") was changed to the equivalent Quebec content.

Since this study wanted to provide more information on the strategies that have been suggested for promoting equity in computer education, 11 questions were added pertaining to strategies to promote computer equity suggested in the literature. The strategies chosen to be included in the questionnaire were those that involved the students directly.

An English version of the final questionnaire can be found in Appendix A. Each question has been identified according to the following code: Questions identified with the letter "C" are questions pertaining to attitudes about computers; "M" indicates questions pertaining to math; "Sc" to science; "W" to writing; "E" to experience with computers; and "ST" to proposed strategies. This coding was not on the copies given to the students.

Procedures

Preliminary interviews. Since the information on the use of computers in Quebec is fairly limited especially pertaining to attitudes, preliminary interviews were conducted with the educational advisers for computer education (conseiller pédagogique en informatique) in four Montreal school boards. These interviews provided background information on the use of computers in Montreal schools. The interviews revealed that at the secondary level computers were used mostly in the introductory computer science course and in vocational courses. At the primary level, the uses of computers was varied. The persons interviewed did not perceive a difference of interest between males and females.

Translation and pilot. The questionnaire was professionally translated from English to French. The translator was told who would be answering the questionnaire and was asked to translate it in a way that would be appropriate to the age of the students.

In order to ensure the appropriateness of the translation, a pilot study was conducted. Seven students aged 12 to 18 completed the translated questionnaire. They were asked to make a note of words or questions that they did not understand or that were unclear. All students reported that the questions were clear and that they had no problems with the vocabulary. No changes were made. A copy of the translated questionnaire as it was given to the students can be found in Appendix B.

In order to collect information about the schools where the data were collected, a series of questions were put together and formed a second questionnaire to be answered by the principal or another resource person in the school. This questionnaire can be found in Appendix C.

Proposal to the CECM (Commission des écoles catholiques de Montréal). A proposal was submitted to the research committee of the CECM. The proposal was accepted and arrangements were made with two schools.

Administration of the questionnaire. The questionnaire was given to intact classes of secondary levels 1, 3 and 5. The students were told to read and follow the instructions on the top of the first page of the questionnaire. They were told that their answers should be marked on the answer sheet and were reminded to indicate their sex in the appropriate space.

No time limit was provided and all students completed the questionnaire within 20 minutes. No talking was allowed although it was never necessary to reinforce this.

The principals completed the questionnaires destined for them. The data were then coded and prepared for analysis.

CHAPTER 4

RESULTS

The data were coded so that a lower score indicates a more positive attitude. The negatively-worded questions were coded so that disagreeing with a negative statement obtained a low score (i.e., a positive attitude). On the five-point scale "1" was "Strongly agree" and "5" was "Strongly disagree". Means and standard deviations for all questions answered on the five-point scale can be found in Appendix D. For the True-False and the multiple choice questions frequencies are given in Appendix E.

Parametric analyses were used to detect differences among groups in spite of the ordinal nature of these data. Tests for homogeneity of variance were applied throughout and violations noted and these results were not discussed. The primary reason for using these techniques is that no non-parametric analyses exist which are capable of the comparisons central to this study. Stringent alpha levels were maintained (.05 or less) and caution exercised in interpretation. The role of these tests was principally to highlight possible differences, not disprove theoretical hypotheses.

Research Question #1: Attitudes Toward Computers

A 2x3 (sex by level) MANOVA was performed on the students' responses to the 24 questions pertaining to attitudes toward computers. No significant sex by level interaction was found. The data revealed an overall significant effect for sex ($F(24,353) = 3.171$, $p < .001$) and for level ($F(48,706) = 4.271$ $p < .001$). Means and standard deviations for this analysis can be found in Table 1 (see next page).

Sex differences. Overall males were more positive than females. Five questions showed significant differences for sex. These were questions 2, 6, 7, 33 and 27. For question 2 ("People managed before without computers, so computers are not really necessary now") ($F(1,376) = 8.74$, $p < .01$), question 7 ("Computers are exciting") ($F(1,376) = 7.93$, $p < .01$), and question 33 ("I enjoy working with computers") ($F(1,376) = 5.88$, $p < .01$), males showed a more positive response. Question 6 ("People who like computers are often not very sociable") was marginally significant ($F(1,376) = 3.23$, $p < .07$), with females being more positive. Similarly for question 27 ("Females have as much ability as males when learning to use computers") ($F(1,376) = 12.26$, $p < .001$) females were more positive.

Table 1
Means and standard deviation for 24 questions pertaining to computers

	Males			Females		
Secondary Level	1	3	5	1	3	5
Question	Mean S.d.	Mean S.d.	Mean S.d.	Mean S.d.	Mean S.d.	Mean S.d.
1	1.29	1.43	1.72	1.46	1.76	1.53
	.63	.59	.90	.64	.93	.71
2	2.41	2.45	2.25	2.82	2.78	2.47
	1.15	1.06	1.05	1.17	1.11	1.00
4	1.31	1.53	1.63	1.36	1.65	1.78
	.60	.83	.75	.56	.89	.87
6	2.45	2.36	2.04	2.31	2.00	1.91
	1.23	.92	1.02	1.23	1.04	.76
7	1.86	1.98	2.05	1.99	2.48	2.31
	.98	.75	.97	.94	1.06	.87
9	2.60	2.77	1.89	2.42	1.93	1.88
	1.34	1.23	1.01	1.09	.93	.93
10	1.42	1.87	1.68	1.58	1.56	1.65
	.88	1.13	.89	1.06	.77	.90
12	2.27	2.15	1.86	2.32	2.12	1.65
	1.30	.97	.95	1.10	1.03	.83
14	3.19	3.07	2.12	2.83	2.67	2.29
	1.24	1.17	1.14	1.25	1.18	1.02
15	2.30	2.40	2.00	2.50	2.37	2.16
	1.05	1.08	1.01	.92	1.06	.75
17	1.87	2.25	1.95	2.22	2.01	2.04
	1.08	1.12	.85	1.23	1.12	1.08
18	3.42	3.62	4.11	3.49	3.80	4.27
	1.28	1.35	1.03	1.14	1.11	.93
20	1.42	1.70	1.60	1.60	1.74	1.65
	.85	1.04	.73	.94	1.03	.88
21	2.00	1.93	1.82	2.06	1.98	2.00
	1.15	1.02	1.00	1.19	1.14	1.12
23	1.42	1.55	1.82	1.31	1.46	1.51
	.79	.77	1.12	.57	.64	.58
24	2.68	2.75	2.84	2.88	2.88	2.73
	.98	.89	.98	.72	.63	.70
26	1.99	1.85	2.19	2.04	2.07	2.12
	1.28	.97	1.12	1.17	1.21	1.21
27	1.76	1.78	1.81	1.56	1.37	1.22
	1.19	1.09	1.19	.96	.88	.55
30	2.65	3.00	3.04	3.09	2.83	3.10
	1.32	1.30	1.34	.98	1.33	1.18
31	3.02	3.71	4.14	3.26	3.87	4.24
	1.28	1.28	1.19	1.33	1.18	.80
33	1.51	1.80	2.15	1.71	2.17	2.26
	.80	.94	.86	.79	1.02	.76
34	1.83	1.65	2.47	1.50	1.83	2.37
	1.14	.97	1.32	.88	1.00	1.15
35	2.38	2.43	2.33	2.54	2.50	2.42
	1.20	1.13	1.09	1.10	1.24	.98
36	1.49	1.83	2.02	1.51	1.65	2.02
	.90	1.15	1.01	.75	.87	1.09

Note that questions 23 and 9 were significant but violated the test of homogeneity of variance and so the results are not discussed.

Level differences. Nine questions were significantly different for level and did not violate the test of homogeneity of variance. These were questions 4, 6, 7, 14, 15, 18, 31, 33 and 36. Questions that were significant but did not pass the test of homogeneity of variance were questions 1, 9, 12, 23 and 34.

Post hoc comparisons (Tukey) for question 6 ("People who like computers are often not very sociable") revealed significant differences between levels 1 and 5 ($q(384) = 4.33$, $p < .01$), with level 1 students being more likely to agree with this statement.

Post hoc comparisons for question 4 ("I would like to learn to use a computer") revealed significant differences between levels 1 and 3 ($q(384) = 5.8$, $p < .01$) and between levels 1 and 5 ($q(384) = 8.16$, $p < .01$). In both instances more Level 1 students positive than the other two levels. The same pattern was revealed for question 7 ("Computers are exciting"). Significant differences were found between levels 1 and 3 ($q(384) = 3.82$, $p < .01$) and levels 1 and 5 ($q(384) = 3.03$, $p < .01$). In both cases the younger students showed more positive attitudes.

For question 14 ("If you like science, you like computers") post hoc comparisons revealed significant differences between levels 3 and 5 ($q(384) = 5.87$, $p < .01$) and levels 1 and 5 ($q(384) = 7.78$, $p < .01$). For this question the students of level 5 were more positive.

For question 15 ("The world would be better off if computers were never invented"), post hoc comparisons revealed differences between levels 1 and 5 ($q(384) = 3.67$, $p < .01$) and between levels 3 and 5 ($q(384) = 3.18$, $p < .01$). Level five students were more positive.

For question 18 ("Typing would be the biggest problem I would have in learning to use a computer") post hoc comparisons revealed significant differences between levels 1 and 3 ($q(384) = 2.58$, $p < .05$), 1 and 5 ($q(384) = 7.13$, $p < .01$) and 3 and 5 ($q(384) = 4.25$, $p < .01$). The level 1 students were more positive about this statement than the level 3 students, and the latter more than the level 5 students.

Question 31 ("I would rather spend an evening doing something new with a computer than go out with my friends") and question 36 ("Computers are boring") produced similar results in the post hoc comparisons. Significant differences were found between students of levels 1 and 3 (respectively for questions 31 and 36: $q(384) = 8.89$, $p < .01$, $q(384) = 2.79$, $p < .05$), levels 1 and 5 (respectively for questions 31 and 36, $q(384) = 14.05$, $p < .01$, $q(384) = 6.08$, $p < .01$) and for levels 3 and 5 (respectively for questions 31 and 36, $q(384) = 4.90$, $p < .01$, $q(384) = 3.09$, $p < .01$). In both instances the level 1 students were more positive that the students of levels 3 and 5, and the students of level 3 were more positive than those of level 5.

For question 33 ("I enjoy working with computers"), significant differences were found between levels 1 and 3 ($q(384) = 4.98$, $p < .01$), levels 1 and 5 ($q(384) = 7.95$, $p < .01$) and between levels 3 and 5 ($q(384) = 2.82$, $p < .05$). For this question level 1 students were more positive than both levels 3 and 5, and level 3 students were more positive than level 5 students.

Research Question #2: Experience with Computers

Several questions pertained to the students' experience with computers. These were questions 49 ("I have studied about computers in school"), 50 ("I have used a computer outside of school to play games"), 51 ("I have used a computer outside of school to do something other than play games") and 52 (for this question the phrasing differed depending on the level. For levels 1 and 3 "I plan to take the course Introduction to Computer Science" and for level 5 "I have taken or I plan to take the course Introduction to Computer Science"). These questions were answered by True or False.

Question 53 was a multiple choice question. The statement was "During one week I use computers:" and the choices were "a) 0-1 hour; b) 2-5 hours; c) 6-10 hours; d) 11 hours or more."

In order to see if a difference existed between the males and females in terms of their computer experience, an experienced student was defined as one who answered True to both questions 51 and 49. An inexperienced student was defined as one who answered False to both these questions.

A chi-square revealed that for levels 1 and 3 males were more likely to fall into the "experienced" category than females. The differences, however were not significant. The differences in level 5 were significant with the same patterns emerging, males being more frequently "experienced" ($X^2 = 6.183$, 2 d.f.). Percentages are shown in Table 2.

Table 2

Percentages of "experienced" and "inexperienced" males and females in levels 1, 3 and 5

	M	F	M	F	M	F
	1		3		5	
"experienced"	48.5%	34.3%	37.5%	25.7%	67.6%	33.3%
"inexperienced"	51.5%	65.7%	62.5%	74.3%	32.4%	66.7%
	100%	100%	100%	100%	100%	100%

Using the same criteria as above for "experienced" and "inexperienced", males and females were compared on their mean score on the 24 questions pertaining to attitudes toward computers. An ANOVA revealed the following results. No interaction was found between "experienced" students at each level. An effect was found for level of experience ($F(3,104) = 31.13$, $p < .001$). As might be expected "experienced" students were more positive in their attitudes towards computers than were "inexperienced" students. No significant difference was found between the attitude toward computers of "experienced" males and "experienced" females. However, a significant difference was found between "inexperienced" males and "inexperienced" females, with females having a more negative attitude toward computers ($F(1,29) = 5.57$, $p < .02$). This indicates that females' preconceptions of computers are different from the males'. Means and standard deviations for this analysis are found in Table 3.

Table 3
Means and standard deviations for "experienced" and "inexperienced" males and females, on the 24 questions pertaining to computers

	Males Means S.d.	Females Mean S.d.	Entire Population Means S.d.
"experienced"	47.60 8.71	49.18 9.06	48.19 8.82
"inexperienced"	55.40 7.52	61.75 8.40	59.03 8.54

For question 50 ("I have used a computer outside of school to play games:) a chi-square revealed a significant difference between males and females ($X^2 = 14.32$, 1 d.f.). Males were more likely to have played games than females (58.7% of males answered True as opposed to 41.3% of females).

Question 52 asked students if they had taken or were planning to take the course Introduction to Computer Science. Although a greater percentage of males responded that they had taken or were planning to take this course, the differences between the males and females of all levels were not significant.

Finally, the students were asked in question 53 to indicate the amount of time they spent using a computer during a week. A chi-square revealed significant differences ($X^2 = 9.74$, 3 d.f.). Overall all males used computers more than females on a weekly basis. Ten percent of males answered that they used computers for 11 hours or more a week as compared to 3.3% of females. Table 4 shows the percentages for the other categories.

Table 4
Amount of time spent at computer weekly

	Male	Female
0-1 hrs.	52.4%	61.0%
2-5 hrs.	26.2%	28.6%
6-10 hrs.	11.4%	7.1%
11+ hrs.	10.0%	3.3%
	100.0%	100.0%

Research Question #3: Attitudes Toward Other School Subjects

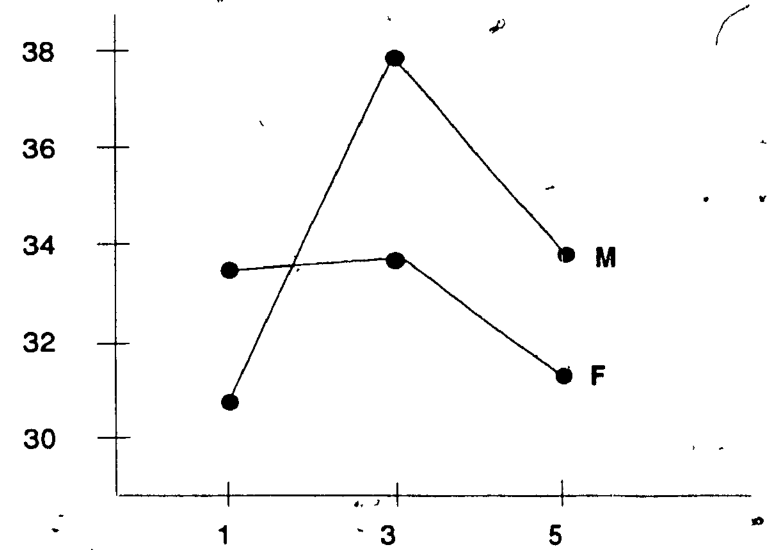
Although the intent of this study was to examine attitudes toward computers, it is useful to look at the students' attitudes toward other school subjects in order to see if the differing attitudes toward computers is specific to computers or whether the males have a more positive attitude overall. Also, looking at students' attitudes toward other subjects gives us an idea of how our sample compares with other secondary school students in the literature.

Four questions pertained to math (question 3, 13, 19 and 25), five to science (questions 8, 16, 29, 32 and 37) and five to writing (question 5, 11, 22, 28 and 38). An ANOVA performed on the mean score of each respondent from the items on all three school subjects revealed a significant sex by level interaction ($F(2,315) = 5.4$, $p < .01$) (see Figure 1 on following page). As is shown in Figure 1, the males were positive in level 1, then became more negative in level 3 and went down again in level 5 to a more positive score, but not as positive as in level 1. Post hoc comparisons revealed significant differences between levels 1 and 3 ($q(168) = 2.90$, $p < .05$).

The females' scores followed a slightly different pattern. They also became more negative in level 3 but their level 5 mean was more positive that both the means of levels 1 and 3. Post hoc comparisons revealed no significant differences for the females. Further, post hoc comparisons revealed no differences between the males and females of each level.

ANOVAs were also performed on the means for each of the three school subjects separately. The results of the ANOVA for math revealed no significant interaction and no significant differences for sex. A significant difference was found for level ($F(2,416) = 12.34$ $p < .001$), but post hoc comparisons revealed no further differences.

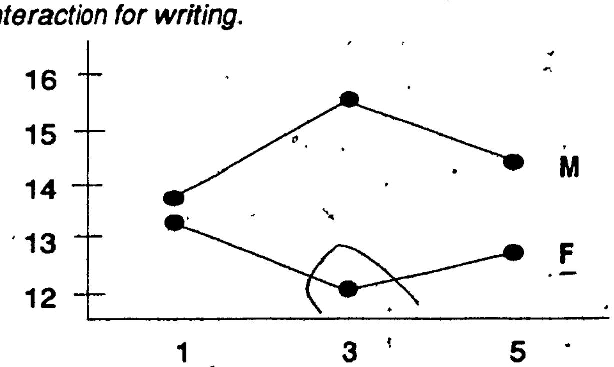
Figure 1.
Sex by level interaction on combined school subjects (math, science and writing).



The ANOVA performed on the responses to the science questions showed no interaction, no sex differences and no level differences. The mean for the males was 2.22 and for the females, 2.33.

The results were different for the questions on writing. A sex by level interaction was found ($F(2,416) = 4.15$, $p < .05$) (see Figure 2). Post hoc comparisons revealed significant differences between males and females of level 3 ($q(124) = 3.32$, $p < .01$) and between the males and females of level 5 ($q(116) = 2.48$, $p < .05$). In both instances the females were more positive than the males. These results are concordant with similar comparisons found in the literature (Wilder, Mackie & Cooper, 1985).

Figure 2.
Sex by level interaction for writing.



Males' and females' attitudes toward these school subjects are very similar. Where sex differences exist, as in writing, females are more positive. There is no reason to believe that males have a more positive attitude in general. The observed sex differences in attitude toward computers pertain specifically to computers.

Research Question #4: Attitudes About Females' Competency with Computers

An ANOVA was performed on the males' and females' means for question 27 ("Females have as much ability as males when learning to use a computer"). Results showed a significant effect for sex ($F(1,414) = 13.31$, $p = .001$). No significant effect was found for level. As might be expected females responded more positively to this statement than males, although both were positive. The overall mean for males was 1.8 and 1.43 for females ("1" representing as before, "Strongly agree").

The next comparison looked at the females' responses to question 27 ("Females have as much ability as males when learning to use a computer") and compared them to their responses to question 35 ("It would be hard for me to learn to program a computer") to see if the females had as much confidence in themselves individually in learning to use a computer as they do in females as a group.

Results of t-tests ($t(196) = 12.16$, $p < .001$) indicate that females are significantly more positive about the abilities of females in general than in their own individual capabilities. This is in concordance with previous research that has noted this "We can, but I can't" paradox (Collis, 1984).

Research Question #5: Strategies

A 2x3 (sex by level) MANOVA was performed on the data of the students' responses to the strategies. Ten questions (39 to 48) pertained to various strategies, question 46 having three parts (a), (b) and (c), and were answered on the five-point Likert scale. The eleventh question, number 54, was a multiple choice question. Since it was important to know how students felt toward each strategy (not only those that showed differences), each question is reported here, even those that did not show an interaction or an effect. Means and standard deviations for these questions can be found in Table 5 (see next page). Table 6 shows the results for question 54.

The results of the MANOVA revealed a significant sex by level interaction ($F(2,334) = 2.44$, $p < .001$). The questions that were significant for the sex by level interaction were questions 42 ("I would feel more comfortable learning about computers if the teacher was a man") ($F(2,334) = 11.65$, $p < .001$), question 46b ("I would like to use a computer in social sciences") ($F(2,334) = 4.02$, $p < .01$) and question 46c ("I would like to use a computer for literature") ($F(2,334) = 5.6$, p<

Table 5
Means and Standard deviations for males' and females' responses to question on strategies

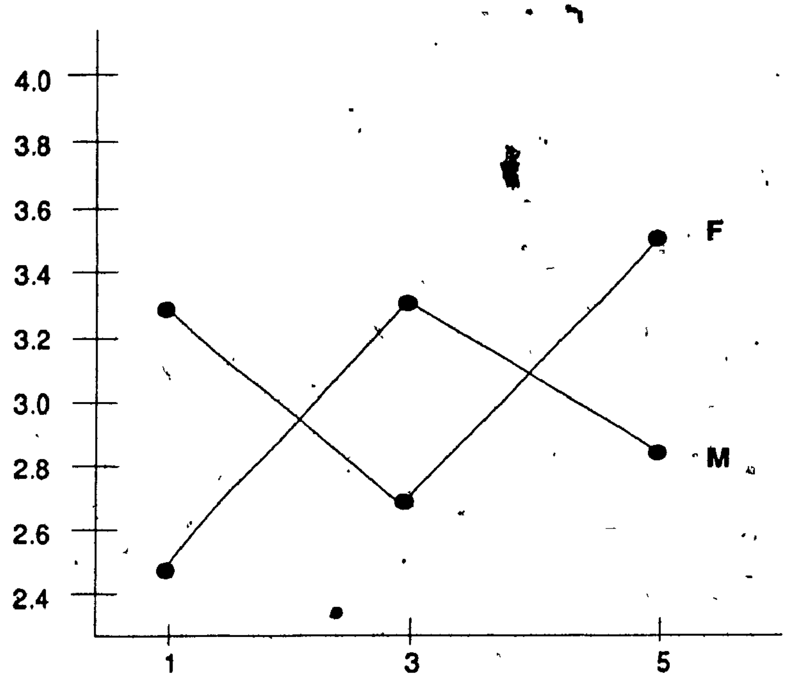
	Males			Females		
Secondary Level Question	1 Mean S.d.	3 Mean S.d.	5 Mean S.d.	1 Mean S.d.	3 Mean S.d.	5 Mean S.d.
39	3.54	4.02	4.40	3.78	3.96	4.38
	1.40	1.26	.96	1.28	1.30	.99
40	1.60	1.72	2.29	1.55	2.04	2.28
	1.00	.87	1.27	.83	.92	1 05
41	2.69	2.41	2.69	3.04	3.30	3.50
	1.08	1.10	1.16	1.21	1.11	1.16
42	2.57	3.40	2.87	3.27	2.78	3.50
	1.07	1.23	1.10	1.09	1.11	1.15
43	1.47	1.66	1.88	1.72	1.48	1.68
	.91	.97	1.17	1.01	.89	.77
44	1.69	1.86	1.92	1.84	1.89	2.04
	.89	.80	1.08	.86	1.04	.95
45	1.70	1.79	1.80	1.88	1.85	1.78
	.87	.87	.90	.88	.89	.74
46a	1.39	1.50	1.79	1.66	1.35	1.96
	.79	.73	1.00	.88	.64	1.14
46b	1.94	2.33	2.88	2.55	2.39	2.70
	.95	1.10	1.20	1.05	1.02	1.30
46c	2.16	2.38	3.00	2.69	2.43	2.44
	1.11	1.31	1.39	1.17	1.19	1.30
47	2.47	2.22	2.65	2.55	2.61	2.92
	1.34	1.23	1.28	1.27	.93	1.28
48	1.49	1.88	2.12	1.88	1.93	2.46
	.83	1.07	.98	1.01	1.08	1.09

.01). All of these passed the test of homogeneity of variance.

Question 42. ("I would feel more comfortable learning about computers if the teacher was a man") (see Figure 3 for the diagram of this interaction on next page). Significant differences were found between the males of levels 1 and 3 ($q(180) = 5.88$, $p < .01$) and 3 and 5 ($q(180) = 3.49$, $p < .01$). Level 3 distinguished itself by being more negative than both levels 1 and 5. For the females significant differences were found between levels 1 and 3 ($q(160) = 3.19$, $p < .01$) and levels 3 and 5 ($q(160) = 4.44$, $p < .01$). Again the level three students distinguished themselves, but contrary to the males, the female level 3 students were more positive than students of both levels 1 and 5. Significant differences between males and females were found at all levels: for level 1 ($q(134) = 5.09$, $p < .01$), for level 3 ($q(104) = 3.95$, $p < .01$), and for level 5, ($q(102) = 4.00$, $p < .01$). For levels 1 and 5, the males were more positive but for level 3 the females were more positive.

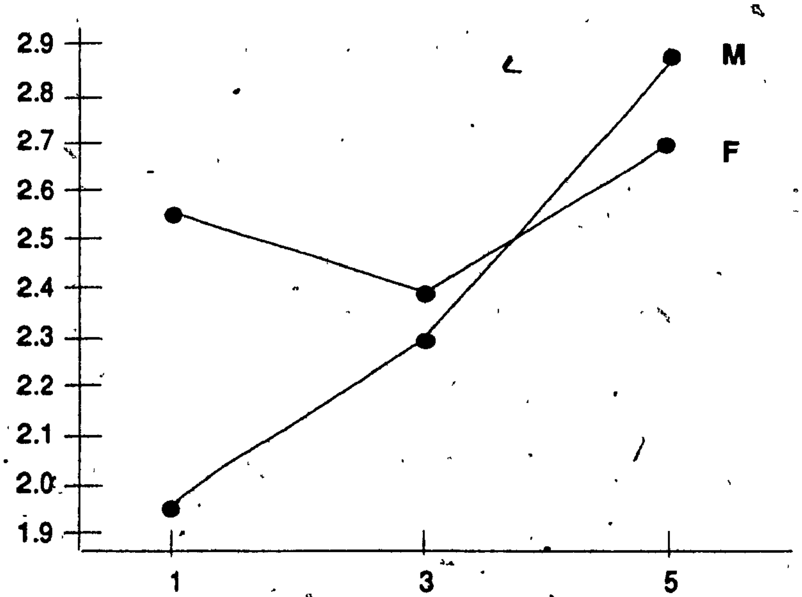
Question 46b. ("I would like to use a computer in social sciences") (See Figure 4). Post hoc

Figure 3.
Interaction for Question 42



comparisons revealed significant differences between the males of levels 1 and 3 ($q(180) = 6.74$, $p < .01$), between levels 3 and 5 ($q(180) = 3.71$, $p < .01$), and between levels 1 and 5 ($q(180) = 10.41$, $p < .01$). The level 1 males were more positive than the males of both levels 3 and 5, and

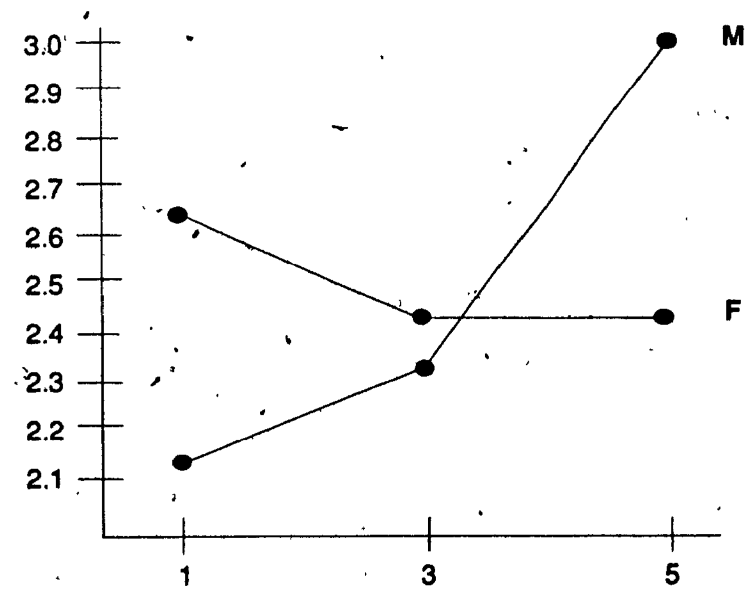
Figure 4.
Interaction for Question 46b



the males of level 3 were more positive than those of level 5. No significant difference was found for the females. A significant difference was found between the males and females of level 1 (q(134) = 4.54, p< .01), males being more positive, but no differences were found between the males and the females of the other two levels.

Question 46c ("I would like to use computers for literature") (see figure 5). For this comparison significant differences were found between the males of levels 1 and 5 (q(180) = 5.24, p< .01), and levels 3 and 5 (q(180) = 3.71, p< .01). The males of levels 1 and 3 were more positive than the males of level 5. No differences were found for the females. Significant differences were found between the males and females of level 1 (q(134) = 3.50, p< .01), males being more positive, and between the males and females of level 5 (q(102) = 3.23, p< .01) with females being more positive.

Figure 5.
Interaction for Question 46c



Differences in level. The following question are those for which there were no interaction but that showed an effect for level. These were questions 39 (F(2,334) = 10.46, p< .001), 47 (marginally significant, F(2,334) = 2.58, p< .07), and 48 (F(2,334) = 10.60, p≤ .001). Note that questions 46a and 40 were significant but did not pass the test of homogeneity of variance.

For question 39 ("I would feel more comfortable learning about computers if all the students in the class were the same sex [either all boys or all girls]), significant differences were found between students of levels 1 and 3 (q(340) = 2.95, p< .05), levels 1 and 5 (q(340) = 6.42, p<

.01) and levels 3 and 5 ($q(340) = 3.32$, $p < .01$). The students of level 1 were more positive than the students of both levels 3 and 5, and students of level 3 were more positive than those of level 5.

For question 47 ("I would prefer working with the computer in the classroom rather than in the computer lab"), significant differences were found between the students of levels 3 and 5 ($q(340) = 3.03$, $p < .01$) and 1 and 5 ($q(340) = 2.43$, $p < .05$). Students of level 3 were the most positive, followed by those of level 1.

For question 48 ("If my school had more computers, I would use computers more"), significant differences were found between students of levels 1 and 3 ($q(340) = 2.47$, $p < .05$), 1 and 5 ($q(340) = 6.52$, $p < .01$) and 3 and 5 ($q(340) = 3.83$, $p < .01$. The students of level 1 were the most positive, followed by those of level 3.

Differences by sex. Two questions did not show an interaction but showed differences by sex. These were questions 41 and 48.

Question 41. ("I would feel more comfortable learning about computers if the teachers was a woman") ($F(1,334) = 28.52$, $p < .001$). The males were more positive than the females on this question.

Question 48. ("If my school had more computers, I would use computers more") ($F(1,334) = 6.57$, $p < .01$). Again, the males responded more positively to this question.

Other questions. The following questions showed no interaction and no effects: 40 ("I would like to use a computer to write stories, draw pictures or make music"), 43 ("I think that students should have to take at least one computer course in school"), 44 ("I would be interested in knowing more about how computers will affect my future life"), 45 ("I would be interested in knowing more about how computers will affect my future job opportunities") and 46a ("I would like to use computers for science and math"). For all of these questions the students' responses were very positive, all means being below 2.

Question 54. ("I would prefer working at the computer: a) alone; b) with one other person; c) in a small group of 3-5"). Three chi-squares were performed for question 54. No significant differences were found between the males' and females' preferences in working with the computer. Both males and females preferred working with computers with one other person (42.9% of the males and 47.1% of the females chose this category (see Table 6). A chi-square performed on the responses of the males of the 3 levels showed a significant difference ($X^2 = 9.11$, 2 d.f.) (see Table 7). Level 1 males seem to be more inclined to indicate that they would prefer to work with one other person or in a small group than the males of the other two levels who showed a preference for working alone. No differences were found for the females.

Table 6
Percentages for Question 54 by sex

I would prefer working at the computer:	Males	Females
Alone	40.6%	40.2%
With one other person	42.9%	47.1%
In a small group	16.5%	12.7%
	100.0%	100.0%

Table 7
Percentages for question 54 for the males of each level

I would prefer working at the computer:	Level 1	Level 3	Level 5
Alone	30.7%	50.0%	45.0%
With one other person	45.5%	39.1%	43.3%
In a small group	23.9%	10.9%	11.7%
	100.0%	100.0%	100.0%

CHAPTER 5
DISCUSSION

Overwhelmingly this study has shown that the situation of females and computers in Quebec is not substantially different from that reported in the literature. The data from the two schools tested have revealed that stereotypes about computers are still present in schools. The five research questions are discussed in this section. For the purposes of this discussion in order to define what is meant by a positive attitude, the five-point scale was divided in three parts. Students are said to be positive if their mean falls within 1 and 2.33, inclusively. Students with means above 2.33 and up to 3.66 are uncertain about a question. If their mean is above 3.66, students are considered to have a negative attitude. Note that these limits were chosen arbitrarily to facilitate the discussion and do not represent absolute values.

Attitudes About Computers

Overall students have a positive attitude toward computers. The students' overall mean indicated a positive response to seventeen of the twenty-four questions pertaining to attitudes toward computers. Students responded with uncertainty to six questions and negatively to one. The statistical analysis revealed no sex by level interaction but showed an effect for both sex and level. The sex differences revealed that overall males were more positive than females but the differences in their respective means was very small. Significant sex differences were found for five questions. For question 2 ("People managed before without computers, so computers are not really necessary now") both sexes responded with uncertainty, with males having a slightly lower (and therefore more positive) mean (M = 2.37, F = 2.69). Both males and females responded positively to questions 7 ("Computers are exciting") and 33 ("I enjoy working with computers") but males were more positive. The means for males and females on question 7 were, respectively, 1.96 and 2.26, and on question 33, 1.84 and 2.05. For questions 6 ("People who like computers are often not very sociable") and 27 ("Females have as much ability as males when learning to use a computer") both males and females were positive but females were more positive. Two points about the results of this analysis are noteworthy. The first is that females are positive about computers and that this will greatly facilitate attempts to get females more involved with computers and technology in general. The second point is that we cannot ignore that sex differences exist. Although in most cases the males' and females' means were close, the delicate balance could easily be upset if the females' needs are not attended to. The differences in school level revealed interesting and somewhat unexpected results. Although generally students responded positively, younger students tended to score lower on the twenty-four questions pertaining to computers than did older students. Of the nine questions which revealed significant level differences, six showed younger students being more positive. As examples, the means of levels 1, 3 and 5 for question 33 ("I enjoy working with computers") were, respectively, 1.61, 1.98, 2.21; for question 4 ("I would like to learn to use a computer") the means were 1.34, 1.59 and 1.70.

Students of all three levels had means that fell into the positive category but the consistency with which younger students were more positive is worth noting. There are several possible explanations for this trend. The first reason that comes to mind is that level 1 students know less about computers and that they see computers as toys which to them is positive. Secondly, it may be that level 1 students have had a different type of exposure to computers than level 5 students. This sample is particular in that computers are new enough in schools that the level 5 students probably did not use computers when they were in primary school but the students of level 1 almost certainly did. Level 1 students may be more positive simply because of the quality of their experience. The use of the computer at the primary level and the educational structure found in the primary schools (i.e., student-teacher ratio, classroom arrangements, location of the computer) may be more condusive to fostering rich and satisfying interactions with the computer. For level 1 students the computer may be a more natural part of their learning environment, hence their more positive attitudes. The results obtained may very well be idiosyncratic to this unique period of history.

Of the three questions on which level 5 students responded more positively, two were questions pertaining to stereotypes about computer users; question 6 ("People who like computers are often not very sociable") and question 14 ("If you like science you like computers"). Since level 5 students are more likely to be computer users (at least in school) and since they are more likely to be conscious of their social status, it is understandable that they are more sensitive to stereotypes about computer users. The third question was number 15 ("The world would be better off if computers were never invented"). Given that younger students were usually more positive it is surprising to find that level 1 and level 3 students were uncertain about this question with means of 2.4 and 2.38 respectively. The level 5 students were positive with a mean of 2.08. One explanation for the level 1 and 3 students' uncertainty about this question is that they do not have a good basis of comparision; they do not know what a world without computers is like. They cannot speculate or compare with what is for them an unknown.

A recently published report (Rhéaume, 1986) of a pilot study conducted with students of levels 1 and 5 revealed results very similar to this study. The author reports that males are consistently more positive in their attitudes toward computers than are females and that the students of level 1 are often more positive than those of level 5.

Experience with Computers

The results of the analyses pertaining to the question of students' experience with computers revealed that overall males had more experience with computers than did females. In levels 1 and 3 males and females were equally likely to be experienced with computers. Sex differences manifested themselves in level 5 with males being more likely to be experienced. It is disturbing, though not surprising, to find that the difference in experience occurs when students have access to a computer course and when they are making decisions about their post-secondary future. A significant difference in attitude toward computers was found between students that qualified as "experienced" and those that were "inexperienced". As might be expected "experienced" students were more positive with a mean of 2.00 and "inexperienced" students were uncertain with a mean of 2.45. (Note that these analyses were conducted with only a portion of the sample; those students that qualified either as "experienced" and "inexperienced" totaled 199.) Of greater interest were the comparisions of sex by experience. No differences in attitudes was found between "experienced" males and females. However, a significant difference was found between "inexperienced" males and females. The males were positive with a mean of 2.31 and the females were uncertain with a mean of 2.57. Males were also more likely to have used computers to play games and they spent more time using computers on a weekly basis. All of these results highlight not only sex differences but they also show the relationship between experience and attitude toward computers. Inasmuch as the definition used to differentiate "experienced" and "inexperienced" students is appropriate, these results suggest that experience with computers may promote more positive attitudes toward computers. Since females are both initially less positive than males and have less experience, it follows that overall they are not quite as positive as their male counterparts in their attitudes towards computers. These results would be discouraging were it not for the fact that when females have as much experience as males, there is no difference in attitude toward computers. This reveals two conclusions: that males and females do not start on an equal footing and each has special needs that must be attended to; and that if attending to them leads to equal experience, a balance occurs at least attitudinally.

Attitudes Toward Other School Subjects

The main reason for this comparison was to see if males held more positive attitudes in general (as reflected by these three subjects) or if sex differences in atttitudes was particular to computers. No sex differences were revealed on the three subjects (math, science and writing) taken as a group and no sex differences were revealed for math and science when examined individually. Students were generally positive and occasionally uncertain. A sex by level interaction for writing revealed sex differences for levels 3 and 5. The mean for level 3 females was 2.43 and for level 3 males the mean was 3.08. For the level 5 students the females' mean was 2.49 and the males' 2.98. Overall males' and females' attitudes toward these subjects is very similar. There seems to be no reason to believe that males are generally more positive about school.

Attitudes About Females' Competency

Both males and females responded positively to question 27 ("Females have as much ability as males when learning to use a computer") but the males and the females were still statistically different. The males' mean was 1.8 and the females' 1.43. It is encouraging to see that males do not reveal blatant bias toward the females' competency but somewhat discouraging to see that differences are still revealed, (though some difference might be expected simply because the question itself calls sex differences to the respondent's attention). What is disturbing is to see how females' attitudes differ when they respond to females' competency in general and when they respond to questions about their own individual competency. The "We can but I can't" paradox that Collis (1984) found in her study is clearly present in this study. The females have no hesitation in saying that females are competent (as seen in question 27), but, sadly, they do not feel that they are personally competent to work with computers, as revealed in their responses to question 35. More will be said on this latter.

Strategies for Computer Instruction

The students responded positively to six of the twelve strategy questions that were answered on the five-point scale (questions 40, 43, 44, 45 46a, 48). For five of these the means were under 2.00. All of these strategies could probably be successfully implementated. This is not to say that they would be effective (further research is needed to establish this), but at least they would be well accepted by the students. The students responded with uncertainty to five of the strategy questions (41, 42, 46b, 46c, 47). It is noteworthy that students responded with uncertainty to questions 41 ("I would feel more comfortable learning about computers if the teacher was a woman") and 42 ("I would feel more comfortable learning about computers if the teacher was a man"). The students' mean for these questions were, respectively 2.90 and 3.05. It is interesting to note that for question 41 a sex difference was found; in a direction opposite one would expect. Males produced a lower score (the males' mean was 2.60 and the females' 3.28). It is surprising to see that males feel more positive than females about having a female teacher, especially in view of the fact that females were more positive than males in their response to question 27 ("females have as much ability as males when learning to use a computer"). Although it is difficult to interpret such seemingly contradicting results, it may be that females are competent in a general sense, but they still feel that males hold more credibility as teachers of computing. Figure 3 on page 35 which shows the interaction for question 42 ("I would feel more comfortable learning about computers if the teacher was a man") is difficult to interpret and does not offer any further clues as to the students' preference for the sex of their teachers. What stands out for both questions 41 and 42 is the students' uncertainty about this issue which suggests that further investigations are needed. Speculations about the students' preferences for teachers of either sex should be withheld until more information is available.

Finally, the students responded negatively to question 39 ("I would feel more comfortable learning about computers if all the students in the class were the same sex (either all boys or all girls)"). The students' mean on this question was 3.97. Clearly, for these students, the sex segregation of classes is not an appropriate strategy. Finally the last question pertaining to strategies was question 54 ("I prefer working at the computer a) alone b) with one other person c) in a small group of 3-5"). Level 1 students showed a preference for working with one other person or in a small group whereas the levels 3 and 5 students tended to prefer working alone.

Conclusions and Recommendations

The results of this study suggest that sex stereotypes surrounding the use of computers exist in the schools tested. The stereotypes found in this study are not blatant and might easily be overlooked. The subtlety of the stereotypes are revealed in several examples. The "We can but I can't" paradox probably exemplifies the situation for females today: overt sexism may have disappeared but we are still far from equality of the sexes. Their responses to question 27 showed that the males think that the females are competent, but sex differences in the means were revealed nonetheless. Although the idea is not to always have a fifty-fifty split, the persistent sex differences revealed in this study indicate that the sex differences exist and must be addressed. Schools could benefit from a program that makes teachers and parents aware of the gender inequity in computer education, such as the ones mentioned in the "projects" section of the literature review. This would not change stereotypes at large but at least it would give females a chance to learn about computers. Positive effects in school may have repercussions elsewhere. As Baker's (1985) study showed, girls in high school today are still heading for the same job segregation of their foremothers. Although most of the girls in this study planned to take the introductory course, Baker's study showed that girls' plans and the ensuing reality are quite different. We cannot rely on changes to take place by themselves. Whatever strategies are used, we do not have a choice but to address the issue because we cannot let females continue on this "collision course" (Menzies, 1981) with technology even if the problem is beyond the realm of the present role of education.

The level differences found in this study may prove to be valuable in making decisions about the future use of computers. Students should be given experience with the computer earlier in secondary school when students seem to hold more positive attitudes. This would foster positive attitudes for both males and females. Also, by getting females involved with computers at an earlier age they may transend the social stereotypes associated with computers. It would certainly be worthwhile to examine the use of computers at the primary level to see how to best continue using computers at the secondary level, not only to assure a logical educational continuity but also to make sure that students continue to have positive attitudes. Although the uses of computers are highly varied at the primary level, one common factor that seems to be present is that computers are more intergrated in the curriculum (i.e., having the computer in the classroom, using "tool" software such as word and graphic processors) and this may be a more appropriate use of computers than studying computers as a separate subject as is now being done at the secondary level. Furthermore, since increased experience seems to eliminate gender differences in attitudes toward computers, it is recommended that students have increased exposure to using computers. However, it would be important to investigate more specifically the types of exposure to computers that promotes positive attitudes so that changes can be made qualitively as well as quantatively. This is an area for further research.

The assessment of participation rates in computer activities should not be neglected as an area for further investigation. When records at the secondary level become more accessible and when formal programs at primary level are developed, valuable data can be collected. This will become especially important if intervention programs are introduced.

The students' positive responses to some of the proposed strategies showed that they could be easily implemented. The purpose of this part of the study was not to explore each strategy in depth but rather to give leads on further uses of these strategies. More research needs to be done to determine exactly the effectiveness of each strategy, the feasibility of implementing them in the schools and the long-term and short-term benefits and short-comings. This study suggests that those strategies to which students responded with uncertainty or negatively should not be implemented until further research is available. It should also be remembered that no strategy will ever be successful if the person implementing it is not convinced of its worth. The first step in providing equitable computer education may be educating the school personnel.

The problem of inequity in education is a complex one not likely to be overcome by one solution. However, as educators, it is our responsibility to attempt to provide learning environments in which males and females not only have equal access but are equally motivated to access certain features of education. As educational technologists our responsibility lies not only in designing software, course material and curricula that are free of sexism and other discriminations (this is the minimum expectation), but in acting as agents of social change, these materials must transcend discrimination, allow each student and each teacher to explore learning at a higher level, and leas towards growth as a person. Systemic educational design includes the analysis of components from specific cognitive, affective and psychomotor skill development to broad social considerations. Positive attitude is usually a prerequisite to effective learning. The present study has addressed both the identification of a problem (continuing attitude differences in the target population) and possible solutions for solving that problem. While by no means being the only obstacle which the educator faces, we must strive to move out of the dark ages of gender inequtiy and into a more enlightened, equitable education system.

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APPENDIX A

English Version of Final Questionnaire

QUESTIONNAIRE FOR STUDENTS

For each of the statements, indicate how much you AGREE or DISAGREE by filling in the appropriate circle on the answer sheet according to the following procedure:

Fill in "A" if you STRONGLY AGREE with the statement.
Fill in "B" if you AGREE with the statement.
Fill in "C" if you are UNDECIDED about whether you agree or disagree with the statement.
Fill in "D" if you DISAGREE with the statement.
Fill in "E" if you STRONGLY DISAGREE the statement.

We are interested in your attitudes and opinions. There are no right or wrong answers to any of the statements.

STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE
A	B	C	D	E

C 1. I think that a home computer can be very interesting.

C 2. People managed before without computers, so computers are not really necessary now.

M 3. Mathematics is one of my best subjects.

C 4. I would like to learn to use a computer.

W 5. When I hand in an essay I feel I'm going to do poorly.

C 6. People who like computers are often not very sociable.

C 8. I want to learn all I can about science.

C 9. I would not expect a good athlete to like computers.

C 10. Computers will never interest me.

W 11. I look forward to writing down my ideas.

C 12. I would be embarassed to tell my friends that I would like to join a computer club.

C 13. If I don't see how to do a mathematics problem right away, I never get it.

C 14. If you like science you like computers.

C 15. The world would be better off if computers were never invented.

SC 16. I hope I never have a job where I have to use science.

C 17. Working with computers is not my idea of fun.

C 18. Typing would be the biggest problem I would have in learning to use a computer.

M 19. No matter how hard I try I cannot understand mathematics.

C 20. Computers do not interest me.

C 21. You have to be smart to like computers.

W 22. I feel confident in my ability to clearly express my ideas in writing.

C 23. Computers are fun.

C 24. Microcomputers are easy to use.

M 25. I am proud of the work I do in mathematics.

C 26. If my family had a computer, I would probably use it more than anyone else.

C 27. Females have as much ability as males when learning to use a computer.

W 28. I sometimes write stories at home even if the are not assigned for school.

SC 29. Learning science is just as important for girls as for boys.

C 30. I am concerned that people might make computers too powerful in the future.

C 31. I would rather spend an evening doing something new with a computer than go out with my friends.

SC 32. I never find myself thinking about science.

C 33. I enjoy working with computers.

C 34. Using a computer in math class would make math more fun.

C 35. It would be hard for me to learn to program a computer.

C 36. Computers are boring.

SC 37. Girls are as good as boys in science.

W 38. I do not enjoy writing stories or essays.

ST 39. I would feel more comfortable learning about computers if all the students in the class were the same sex either all boys or all girls.

ST 40. I would like to use a computer to write stories, draw pictures or make music.

ST 41. I would feel more comfortable learning about computers if the teacher was a woman.

ST 42. I would feel more comfortable learning about computers if the teacher was a man.

ST 43. I think that students should have to take at least one computer course in school.

St 44. I would be interested in knowing more about how computers will affect my future life.

ST 45. I would be interested in knowing more about how computers will affect my future job opportunities.

ST 46. I would like to use computers for the following subjects.
a) Math and science.
b) Social sciences.
c) Literature.

ST 47. I would prefer working with the computer in the classroom rather than in the computer lab.

ST 48. If my school had more computers, I would use computers more.

Please answer the following questions TRUE or FALSE on your answer sheet. Fill in "T" for TRUE or "F" for FALSE.

E 49. I have studied about computers in school.

E 50. I have used a computer outside of school to play games.

E 51. I have used a computer outside of school to do something other than play games.

E 52. I plan to take Introduction to Computer Science (for level 5: I have taken or I plan to take Introduction Computer Science).

Select a), b), c), or d) for the following questions.

E 53. During one week I use computers:
a) 0-1 hour b) 2-5 hours c) 6-10 hours d) 11 hours or more

ST 54. I would prefer working at the computer:
a) Alone.
b) With one other person.
c) In a small group of 3-5.

APPENDIX B

Original Version of Final Questionnaire

QUESTIONNAIRE À L'INTENTION DES ÉLÈVES

Pour chacun des énoncés qui suivent, indiquez à quel point vous êtes d'accord ou en désaccord, en encerclant la lettre correspondante sur la feuille de réponse. Procédez comme suit:

-Encerclez la lettre A si vous êtes TOUT À FAIT D'ACCORD avec l'énoncé.

-Encerclez la lettre B si vous êtes D'ACCORD avec l'énoncé

-Encerclez la lettre C si vous êtes INCERTAIN face à l'énoncé.

-Encerclez la lettre D si vous êtes EN DÉSACCORD avec l'énoncé.

-Encerclez la lettre E si vous êtes EN TOTAL DÉSACCORD avec l'énoncé.

Ce qu'il nous intéresse de connaître, ce sont vos attitudes et vos opinions. Il n'y a pas de bonne ni de mauvaise réponse à aucun des énoncés.

TOUT À FAIT D'ACCORD	D'ACCORD	INCERTAIN	EN DÉSACCORD	EN TOTAL DÉSACCORD
A	B	C	D	E

1. Je pense qu'il peut être très intéressant de posséder un ordinateur personnel.
2. On s'est toujours débrouillé sans l'ordinateur, alors je n'en vois pas vraiment l'utilité.
3. Les mathématiques sont une de mes matières fortes.
4. J'aimerais apprendre à me servir d'un ordinateur.
5. Quand je remets un travail écrit, je ne m'attends pas à de bons résultats.
6. Les gens qui aiment les ordinateurs sont souvent peu sociables.
7. L'ordinateur est un outil excitant.
8. Je veux apprendre le plus possible dans le domaine des sciences.
9. Selon moi, un bon athlète peut difficilement aimer l'ordinateur.
10. L'ordinateur ne m'intéressera jamais.
11. J'ai toujours hâte de mettre mes idées par écrit.
12. Je serais mal à l'aise de dire à mes amis que j'aimerais me joindre à un club d'usagers d'ordinateur.
13. Si je ne trouve pas d'un seul coup la solution à un problème de mathématiques, c'est que je n'y arriverai jamais.
14. Si on aime les sciences, on aime forcément les ordinateurs.

TOUT À FAIT D'ACCORD	D'ACCORD	INCERTAIN	EN DÉSACCORD	EN TOTAL DÉSACCORD
A	B	C	D	E

15. Si l'ordinateur n'avait jamais été inventé, le monde s'en porterait mieux.

16. J'espère n'avoir jamais un travail qui exige de recourir aux sciences.

17. L'idée d'avoir recours à l'ordinateur est loin de m'enchanter.

18. Si j'apprenais à me servir d'un ordinateur, l'usage du clavier serait pour moi le plus gros problème.

19. Malgré tous mes efforts, je ne comprends rien aux mathématiques.

20. L'ordinateur ne m'intéresse pas.

21. Pour aimer l'ordinateur, il faut être intelligent.

22. Je suis convaincu de pouvoir exprimer clairement mes idées par écrit.

23. On peut avoir beaucoup de plaisir à se servir d'un ordinateur.

24. Il est facile de se servir d'un micro-ordinateur.

25. Je suis fier du travail que j'accomplis en mathématiques.

26. Si on avait un ordinateur à la maison, c'est probablement moi qui m'en servirais le plus.

27. Les femmes sont aussi douées que les hommes pour apprendre à se servir d'un ordinateur.

28. Il m'arrive à la maison de faire des compositions qu'on ne m'a pas données en devoir à l'école.

29. Il est aussi important pour les filles que les garçons d'étudier les sciences.

30. Je crains que l'ordinateur ne devienne un outil trop puissant.

31. Je préférerais m'amuser toute une soirée avec un ordinoteur que de sortir avec des amis.

32. Il ne m'arrive jamais de penser aux sciences.

33. J'aime travailler avec l'ordinateur.

34. Si on se servait de l'ordinateur au cours de math, on aurait plus de plaisir.

35. J'aurais de la difficulté à apprendre à programmer un ordinateur.

36. L'ordinateur m'ennuie.

37. Les filles sont aussi fortes que les garçon en sciences.

38. Je n'aime pas faire des compositions ni des dissertations.

TOUT À FAIT D'ACCORD	D'ACCORD	INCERTAIN	EN DÉSACCORD	EN TOTAL DÉSACCORD
A	B	C	D	E

39. Je me sentirais plus à l'aise de m'initier à l'ordinateur si la classe ne comprenait que des élèves du même sexe (rien que des filles ou rien que des garçons).

40. J'aimerais me servir de l'ordinateur pour écrire, dessiner, ou faire de la musique.

41. Je préférerais que ce soit une femme qui m'apprenne à me servir de l'ordinateur.

42. Je préférerais que ce soit un homme qui m'apprenne à me servir de l'ordinateur.

43. Je trouve qu'on devrait avoir au moins un cours d'initiation à l'informatique à l'école.

44. J'aimerais en savoir davantage sur l'impact qu'aura l'ordinateur sur ma vie à venir.

45. J'aimerais en savoir davantage sur l'impact qu'aura l'ordinateur sur mes perspectives d'emploi.

46. J'aimerais me servir de l'ordinateur pour les matières suivantes:
 a) mathématiques et sciences
 b) sciences sociales
 c) littérature

47. Je préférerais travailler avec l'ordinateur dans la classe plutôt que dans le laboratoire d'informatique.

48. S'il y avait plus d'ordinateurs à mon école, je m'en servirais davantage.

Veuillez répondre VRAI ou FAUX aux questions suivantes. Sur la feuille de réponse indiquez V pour VRAI ou F pour FAUX.

49. J'ai appris quelque chose à l'école au sujet des ordinateurs.

50. Je me suis servi d'un ordinateur en dehors de l'école pour jouer à des jeux.

51. Je me suis servi d'un ordinateur en dehors de l'école pour autre chose que des jeux.

52. J'ai pris (ou je vais prendre) le cours Introduction à la science informatique.

Indiquez un choix a), b), c) ou d) sur la feuille de réponse.

53. À l'intérieur d'une semaine j'utilise l'ordinateur de:
 a) 0 à 1 heure b) 2 à 5 heures c) 6 à 10 heures d) 11 heures et plus

54. Je préférerais travailler à l'ordinateur: a) seul b) avec une autre personne c) en petit groupe de 3 à 5 personnes

FEUILLE DE RÉPONSE

Tout à fait d'accord	D'accord	Incertain	En désaccord	En total désaccord
A	B	C	D	E

SEXE F____ M ____

1.	A	B	C	D	E	31.	A	B	C	D	E
2.	A	B	C	D	E	32.	A	B	C	D	E
3.	A	B	C	D	E	33.	A	B	C	D	E
4.	A	B	C	D	E	34.	A	B	C	D	E
5.	A	B	C	D	E	35.	A	B	C	D	E
6.	A	B	C	D	E	36.	A	B	C	D	E
7.	A	B	C	D	E	37.	A	B	C	D	E
8.	A	B	C	D	E	38.	A	B	C	D	E
9.	A	B	C	D	E	39.	A	B	C	D	E
10.	A	B	C	D	E	40.	A	B	C	D	E
11.	A	B	C	D	E	41.	A	B	C	D	E
12.	A	B	C	D	E	42.	A	B	C	D	E
13.	A	B	C	D	E	43.	A	B	C	D	E
14.	A	B	C	D	E	44.	A	B	C	D	E
15.	A	B	C	D	E	45.	A	B	C	D	E
16.	A	B	C	D	E	46.					
17.	A	B	C	D	E	a)	A	B	C	D	E
18.	A	B	C	D	E	b)	A	B	C	D	E
19.	A	B	C	D	E	c)	A	B	C	D	E
20.	A	B	C	D	E	47.	A	B	C	D	E
21.	A	B	C	D	E	48.	A	B	C	D	E
22.	A	B	C	D	E	49.		V	F		
23.	A	B	C	D	E	50.		V	F		
24.	A	B	C	D	E	51.		V	F		
25.	A	B	C	D	E	52.		V	F		
26.	A	B	C	D	E	53.	a)	b)	c)	d)	
27.	A	B	C	D	E	54.	a)	b)	c)		
28.	A	B	C	D	E						
29.	A	B	C	D	E						
30.	A	B	C	D	E						

APPENDIX C

Questionnaire for Schools

ÉCOLE PARTICIPANTE

1. Nom de l'école: ______________________

2. Nom et fonction du répondant: ______________________

3. À quel niveau socio-économique appartient la population de votre école?
   1) Faible ____ 2) Moyen ____ 3) Moyen-élevé ____ 4) Élevé ____

4. Quel est le nombre total d'élèves de votre école? ______
   Nombre de filles ______
   Nombre de garçons ______

5. Quels niveaux du secondaire retrouve-t-on dans votre école?
   1 à 3 ____ 3 à 5 ____ 1 à 5 ____

6. Combien de micro-ordinateurs sont-ils accessibles aux élèves? ____

7. De combien de logiciels éducatifs disposez-vous (approximativement)? ____

8. Votre école offre-t-elle le cours Initiation à la science informatique (ISI)? ______

   Sinon, veuillez passer à la question 14.
   Si oui,

9. Combien d'enseignant-e-s dispensent ce cours? ____ Nombre de femmes ____
   Nombre d'hommes ____

10. Depuis quand ce cours est-il offert? ________

11. Ce cours est-il accessible à tous les élèves de 4e et 5e secondaire? ____

12. Combien d'élèves prennent ce cours chaque année? ____

13. À l'intérieur de quelles options s'inscrit le cours Introduction à la science informatique? Autrement dit, si les étudiants ne choisissent pas ce cours, que choisissent-ils?

   ____

Afin de déterminer la proportion de filles et de garçons qui prennent le cours Introduction à la science informatique, il me serait utile d'avoir la liste des élèves qui y sont inscrits cette année et, si possible, les listes des dernières années. Merci!

14. Pouvez-vous décrire sommairement l'utilisation des ordinateurs de votre école pour des fins éducatives?

   ____

   ____

Si vous avez d'autres commentaires, n'hésitez pas à me contacter. Merci de votre collaboration!

Sonia Ribaux
523-1319

APPENDIX D

Means and Standard Deviations by Sex and Level for all Questions on the Five-Point Scale

MEANS AND STANDARD DEVIATIONS FOR ALL QUESTIONS ON THE FIVE-POINT SCALE

	MALE			FEMALE		
	1	3	5	1	3	5
	mean s.d.	mean s.d.	mean s.d.	mean s.d.	mean s.d.	mean s.d.
Question						
1	1.27 0.61	1.40 0.58	1.70 0.88	1.47 0.65	1.75 0.91	1.54 0.69
2	2.49 1.17	2.45 1.08	2.22 1.04	2.85 1.13	2.82 1.14	2.41 0.99
3	2.22 1.15	2.73 1.49	2.25 1.37	2.34 1.28	2.74 1.28	2.39 1.26
4	1.29 0.58	1.52 0.81	1.64 0.76	1.34 0.54	1.63 0.88	1.78 0.83
5	2.46 1.44	2.88 1.07	2.28 1.11	2.71 1.22	2.23 1.13	1.89 0.97
6	2.52 1.22	2.33 0.93	2.08 1.07	2.40 1.25	2.00 1.03	1.93 0.80
7	1.82 0.98	1.99 0.83	2.08 1.00	2.01 1.00	2.50 1.08	2.36 0.87
8	2.04 1.01	2.45 0.97	2.31 1.26	2.69 1.07	2.74 1.13	2.73 1.30
9	2.60 1.32	2.75 1.25	1.93 1.04	2.43 1.04	1.91 0.92	1.95 0.96
10	1.43 0.89	1.83 1.11	1.70 0.89	1.56 1.03	1.59 0.83	1.68 0.88
11	2.82 1.23	2.94 1.25	3.10 1.04	2.34 1.18	2.39 0.82	2.69 1.14
12	2.27 1.29	2.14 0.97	1.88 0.96	2.31 1.09	2.16 1.09	1.64 0.82
13	1.80 1.00	2.15 1.23	1.45 0.70	1.82 1.09	2.04 1.03	1.63 0.82
14	3.19 1.27	3.04 1.16	2.13 1.11	2.87 1.27	2.70 1.11	2.23 0.99
15	2.29 1.07	2.42 1.03	2.00 1.04	2.52 0.93	2.35 1.06	2.15 0.76
16	2.27 1.01	2.52 1.19	2.38 1.24	2.65 0.99	2.39 1.01	2.38 1.15

	MALE			FEMALE		
	1	3	5	1	3	5
	mean s.d.	mean s.d.	mean s.d.	mean s.d.	mean s.d.	mean s.d.
Question						
17	1.92	2.24	1.98	2.24	1.98	2.07
	1.13	1.12	0.85	1.24	1.11	1.03
18	3.44	3.58	4.03	3.47	3.86	4.25
	1.26	1.32	1.07	1.12	1.11	0.92
19	2.00	2.36	1.77	2.20	2.53	1.77
	0.96	1.15	1.05	1.20	1.28	1.08
20	1.43	1.69	1.63	1.62	1.74	1.70
	0.86	1.02	0.76	0.92	1.03	0.87
21	2.10	1.95	1.88	2.09	2.02	2.09
	1.29	1.03	1.04	1.19	1.19	1.10
22	2.46	2.64	2.67	2.35	2.18	2.23
	1.06	1.11	1.06	0.99	0.89	0.83
23	1.41	1.52	1.88	1.31	1.47	1.60
	0.76	0.75	1.15	0.62	0.63	0.68
24	2.61	2.81	2.85	2.92	2.86	2.75
	1.01	0.91	0.98	0.73	0.64	0.67
25	2.13	2.70	2.43	2.27	2.60	2.46
	1.17	1.35	1.28	0.99	1.21	1.17
26	1.94	1.87	2.24	2.07	2.05	2.14
	1.28	1.01	1.13	1.18	1.19	1.17
27	1.81	1.76	1.82	1.56	1.39	1.27
	1.23	1.06	1.16	0.94	0.86	0.65
28	2.73	3.49	3.73	2.80	2.64	3.02
	1.38	1.41	1.34	1.44	1.23	1.36
29	1.77	1.91	1.87	1.75	1.79	1.78
	1.07	1.07	1.10	1.02	0.92	1.12
30	2.70	3.00	3.05	3.06	2.77	3.05
	1.32	1.33	1.33	0.97	1.32	1.14
31	2.98	3.72	4.08	3.21	3.84	4.27
	1.31	1.30	1.24	1.32	1.11	0.80
32	2.12	2.64	2.13	2.68	2.60	2.32
	0.94	1.16	1.02	1.10	1.18	1.16

Question	MALE 1 mean s.d.	MALE 3 mean s.d.	MALE 5 mean s.d.	FEMALE 1 mean s.d.	FEMALE 3 mean s.d.	FEMALE 5 mean s.d.
33	1.56	1.84	2.18	1.66	2.16	2.27
	0.83	0.93	0.85	0.78	1.01	0.73
34	1.78	1.63	2.50	1.52	1.88	2.41
	1.11	0.93	1.30	0.89	1.07	1.17
35	2.46	2.42	2.36	2.54	2.56	2.48
	1.22	1.12	1.09	1.10	1.24	0.97
36	1.62	1.81	2.08	1.56	1.68	2.05
	1.08	1.12	1.06	0.77	0.97	1.10
37	2.20	2.06	2.07	2.02	1.79	1.70
	1.34	1.11	1.31	1.36	1.11	0.99
38	2.90	3.34	3.15	2.67	2.48	2.59
	1.31	1.39	1.29	1.24	1.16	1.23
39	3.58	4.00	4.39	3.75	3.93	4.25
	1.42	1.24	0.97	1.28	1.32	1.13
40	1.67	1.82	2.30	1.61	2.05	2.32
	1.09	0.95	1.25	0.83	0.93	1.05
41	2.71	2.37	2.71	3.13	3.35	3.45
	1.12	1.14	1.15	1.22	1.13	1.11
42	2.65	3.28	2.86	3.20	2.84	3.42
	1.12	1.23	1.04	1.05	1.17	1.15
43	1.60	1.66	1.98	1.71	1.61	1.71
	1.06	1.02	1.21	1.03	1.01	0.88
44	1.70	1.93	1.93	1.87	1.95	1.07
	0.95	0.93	1.05	0.90	0.98	0.97
45	1.76	1.88	1.83	1.93	1.96	1.80
	0.94	1.01	0.92	0.90	0.96	0.73
46a	1.39	1.46	1.79	1.57	1.40	1.91
	0.78	0.70	0.98	0.84	0.84	1.10
46b	1.97	2.37	2.91	2.51	2.40	2.72
	0.99	1.10	1.21	1.03	1.09	1.28
46c	2.16	2.39	2.98	2.69	2.46	2.47
	1.10	1.26	1.36	1.15	1.25	1.32
47	2.41	2.24	2.73	2.56	2.56	2.80
	1.37	1.25	1.24	1.28	1.00	1.29
48	1.51	1.87	2.29	1.90	1.93	2.45
	0.84	1.09	1.10	1.10	1.10	1.07

APPENDIX E

Frequencies for True-False and Multiple-Choice Questions

Frequencies for True-False and multiple-choice questions

	Absolute Frequency	Relative Frequency (PCT)
Question 49		
TRUE	126	29.8
FALSE	278	65.7
OUT OF RANGE	19	4.5
Question 50		
TRUE	293	69.3
FALSE	113	26.7
OUT OF RANGE	17	4.0
Question 51		
TRUE	245	57.9
FALSE	162	38.3
OUT OF RANGE	16	3.8
Question 52		
TRUE	226	53.4
FALSE	174	41.1
OUT OF RANGE	23	5.4
Question 53		
0-1hr	221	52.2
2-5hr	107	25.3
6-10hr	37	8.7
11hr+	27	6.4
OUT OF RANGE	31	7.3
Question 54		
ALONE	162	38.3
WITH 1 PERSON	180	42.6
SMALL GROUP	59	13.9
OUT OF RANGE	22	5.2