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GENDER DIFFERENCES IN ADOLESCENT STUDENTS' COMPUTER EXPERIENCES, ATTITUDES, AND FUTURE CAREER PLANS.

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis, entitled "Gender Differences in Adolescent Students' Computer Experiences, Attitudes, and Future Career Plans" submitted by Stephanie Lyn Teasdale in partial fulfillment of the requirements for the degree of Master of Science.

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ABSTRACT

The current study was conducted under a larger project at the University of Calgary entitled Gender Differences in Student Participation and Achievement in the Sciences: Choice or Chance? This project used an adapted version of Eccles and colleagues' Michigan Study of Adolescent Life Transitions Questionnaire (MSALTQ). The adapted version, Academic Choices and Achievement Survey, was created using Eccles Expectancy Value Model as a contextual model.

The purpose of the current study was to examine the relationship between gender and junior and senior high school students' computer experiences, attitudes, and future career ideations. For this study, 1416 students (868 girls and 548 boys) completed the Academic Choices and Achievement Survey.

Multivariate analysis of variance (MANOVA) were conducted for grade and gender, which indicated no overall interaction effect. However, significant main effects were found for both gender and grade. These results were further examined via response frequency distributions. Three selected questions were analyzed with chi-square analysis due to the categorical nature of their responses. Results of the combined analyses indicate gender and grade differences for a number of computer related variables. Implication of significant differences and response frequencies in relation to gender and grade are discussed.

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Introduction

"If women do not keep up with advances in computer technology, they will become tomorrow's illiterates" (Vogelheim, 1984; quoted by Hoffman, 1996).

Vogelheim's quote describes the state of gender imbalance that is so readily witnessed in the fields of information technology and computer science. From the junior high computer lab to the university computer science department, female students are seriously lagging behind their male classmates in terms of exposure and sophistication of skills. Recent developments in the investigation into the noticeable gender differences in the number of males versus females in the fields of information technology and computer sciences has uncovered some startling results.

Operationally, computer science can be defined as a branch of knowledge concerned with technological information processes, structures and procedures and representing these processes, and their implementation in information-processing systems. Alberta Learning (2000) defines information technology as the board subject concerned with the processes and tools used to send, retrieve, store, manipulate, and manage information. These terms will be used throughout the current discussions.

Alarmingly, when comparing statistics from the 1980s, fewer women are entering these fields today despite advancements in many traditionally masculine areas (Henwood, 1993). Almost every academic area of science and engineering has experienced substantial increases in the enrollment of female students over the last few years (AAUW, 2000). Unfortunately, this trend does not spread to Computer Science and Information Technology (IT).

The percentage of female undergraduate majors in computer science, at Canadian Universities, has declined from 30-40% in the 1980's to 15-20% today (Chan, Stafford, Klawe & Chen, 2000). Statistics from the United States indicate the same trend. Women represent 17% of the computer science test takers and accounted for less than 1 in 10 of the higher level computer science students (AAUW, 2000). Statistics from American universities reveal that women receive less than 28% of the computer science bachelor's degrees, which is down from a high of 37% in 1984. While the research has cemented these facts, few explanations have been given for the enormous gender disproportion seen in the fields of computer science and information technology. Strikingly, these fields, which have become the fastest growing and most profitable sectors within the business world, are utilizing less than one-third of the able population. By disallowing a feminist perspective within the computer-related sectors these industries are limiting the potential for a more collaborative form of work. Hoffman (1996) found that women are more likely to bring a communication oriented framework to industries that currently are more independently organized. Inkpen, et al. (1993) have suggested that professions, such as technology related sectors, will only experience a transformation if more women choose to enter these professions. This transformation will occur not by women working twice as hard and developing a thick skin to acclimatize to a masculine profession, but rather by dealing with the issues of equity and discrimination in ways that allow individuals and systems to change.

A recent Statistics Canada report (Wong, 1995) indicated that information technology is a significant part of the Canadian economy accounting for 7.6% of Canada's Gross Domestic Product in 1995 (this number was up from 5.5 in 1990). Data on trade suggest that exports of software and computer services have almost tripled from $515 million in 1990 to $1.5 billion in 1995.

With the increase in the number of technology based corporations comes the increased demand for skilled and trained workers to manipulate and develop the latest in cutting-edge computer systems (Chan, Stafford, Klawe, & Chen, 2000). However, the research has shown that women are far less likely to hold Information Technology (IT) and Computer Science degrees than their male peers (Chan, Stafford, Klawe, & Chen, 2000). Indeed, it has been shown that female enrollment in computer science and information technology programs has steadily decreased over the last number of years.

In contemporary culture, the computer is no longer an isolated machine. It is a centerpiece of science, the arts, media, literacy, commerce, and civic life. According to Klawe, Carvers, Popowich, and Chen (2000), Canada is experiencing a shortage in skilled IT professionals. The demand for such workers, is growing more rapidly than any other profession, yet the percentage of women holding these higher level jobs has actually decreased (Henwood, 1993). The AAUW (2000) states that this discrepancy is due to the lack of sophistication that women have in their advanced computer skills. In order to be technological fluent three things are required: 1) having skills necessary for job preparedness, productivity, and employing the skills to change as the technology advances; 2) having the concepts of how and why technology works and; 3) having capabilities for essential problem solving, and managing complex systems as well as testing solutions. According to Groundwater-Smith (1994) computer skills and information technology can now be thought of in terms of currency:

> We have the information rich
> and the information poor. Those who have access
> not only to information, but to the sophisticated
> tools which enable information to be juxtaposed in
> creative and innovative ways are significantly empowered
> in our late twentieth-century, trans-national society.
> An information literate person is not only knowledgeable
> about information representations but is also literate
> about the most significant information management
> mediums, that is the computer. To be computer literate
> is to be understanding of how the computer manages
> information, or to put it another way to grasp
> the functions of the most powerful of the late
> twentieth century talismans (p.2).

Unfortunately, reviews of the statistics regarding females' computer use and skill level repeatedly indicate that women are more superficial users of computers than their male peers (Nelson & Watson, 1995; Uptis, 1995). Women tend to use the computer more for word-processing, spreadsheets, and communication, all of which are considered basic level operations. Overwhelmingly, women who enter the fields of IT and computer science are still being defined, by their male employers, as clerical and often have lower salaries than their male co-workers (Pain, Owen, Franklin, & Green, 1993).

In addition to being less visible in the technology related sectors, women have had little input into the programs they are expected to use (AAUW, 2000; Henwood, 1993).

Women are not designing the tools, they are not manipulating the internal components, and they are not contributing to the system development. Notably, this trend has continued from the early 1980s with little improvement. Women accounted for 92% of data entry workers in the United States in the 1980s and only decreased to 87% for the 1990's (Henwood, 1993). When examining the percentage of women who are programmers and systems analysts the gap widens. In 1990, women accounted for only 32% of computer scientists and engineers in the United States (Henwood, 1993). Statistics Canada's (2001) labour rate report on the Natural and Applied Science and Related Occupations revealed significant disproportionate representation of males and females. In 1996, the total number of individuals employed in mathematics, science, technology, and other related fields was 712,495. The gender disparity among this number is alarming: 82% were male, and 18% were female. Breaking down these occupations even further, data pertaining to Systems Analysis and Computer Programming, indicated that 72% were male and 28% were female.

The above discussion makes it clear that computer related academic courses and careers are experiencing the same gender discrepancies that mathematics and science have witnessed. Discouragingly, numerous researchers have shown that these trends seem to begin at an early age and these unfortunate gender differences can be seen as early as adolescence (Chen, 1986; Kiesler, Sproull, & Eccles, 1985; Crombie & Armstrong, 1998; Schumacher & Martin, 2001).

Thus far, research has consistently indicated that women are not equally represented with respect to the technology fields. However, the facets that account for such gender disproportion have not been as clearly defined. The reasons for examining this phenomenon are very clear. The research has shown that women are not equally pursuing higher functioning computer courses and tend to be in the lower status, lower paying areas of mathematics, science, and computer employment (Henwood, 1993). What is unfortunate, is that mathematics is an academic subject that can act as a filter for future academic and occupational plans: adolescents who do not study advanced mathematics are limiting their future options (Crombie & Armstrong, 1998). Accordingly, Comber, Colley, Hargreaves, and Dorn (1997) stated that math does act as a gateway for future academic and occupational plans. They also declared that education in computer technology is emerging as an additional filter which can also influence future career plans and options.

Evidence from numerous studies indicates that few girls are taking advanced level computer courses, they are not showing as much of an interest, and have higher levels of computer anxiety (AAUW, 2000; Koch, 1994; McIlroy, Bunting, Tierney, & Gordon, 2001; Schumacher & Martin, 2001; Silverman & Pritchard, 1996; Teo & Lim; 2000; Whitley, 1996). Many academically capable high school students, particularly females, limit their future occupational choices by not enrolling in computer and technology courses (Nelson & Watson, 1995; Whitley, 1996). This gender imbalance must be addressed to ensure that all able minds can contribute to Canada's e-global economy. As North American culture enters the new millennium, the demand for software engineers and computer scientists grows (AAUW, 2000; Wong, 1995). Yet universities and high schools are still seeing few girls entering these courses. This detrimental discrepancy needs to be examined and ratified. Hesse-Biber and Gilbert (1994) claim that:

> by debunking the masculinization of computer technology

> early on in women's education, we begin to ensure that
> women will use these tools to their fullest capacity,
> creating technological equity both in the classroom
> and the workforce (p.23)

While the literature has provided many disheartening examples of how young women are not choosing to explore technology-related options, little research has been done to examine their experiences with computers and how these experiences pertain to their future career decisions. In order to prevent the gender gap in computer science from widening into a crevasse early interventions must be addressed. The literature has consistently shown that children are now using computers more readily within the home and school than previously believed (AAUW, 2000; Kiesler, Sproull, Eccles, 1985). Despite the increased exposure and early introduction to these technological machines, gender differences in the computer culture are still readily witnessed. In order to debunk this trend from continuing close examination of adolescent perceptions of and experiences with computers needs to be examined.

The current study addresses the gaps within the relevant research and examines some possible explanations as to why young girls tend to shy away from computers. Another goal of this research project was to examine the computer usage patterns of adolescents and their future career plans, particularly as they relate to computer science. More specifically, the age at which adolescents begin their computer experiences, the amount of time they spend on computers, and what activities they are use the computer for were examined. This examination also dissected any gender differences in responses to these questions and examined whether gender has a direct effect on these types of experiences. A subsequent goal of this study was to provide information as to how these adolescents feel about computers and if they see themselves as computer users. Ultimately, this research project aimed to provide evidence of how students' computer attitudes, experiences, and affects contribute to their technology choices and future career ideations.

Chapter II

Review of the Relevant Literature

What is evidently clear within the fields of computer science and information technology is that the increasingly low percentage of women who either study or work within these spheres does not seem to be changing (AAUW, 2000; Bain, Hess, Jones & Berelowitz, 1999; Chan, Stafford, Klawe & Chen, 2000;Groundwater-Smith, 1994; Groundwater-Smith & Crawford, 1990; Kiesler, Sproull & Eccles, 1985; Statistics Canada, 2000; Wong, 1995). Researchers have been challenged to examine some possible explanations as to why girls are not entering higher-level computer courses by examining their computer-related behaviours in adolescence. In order to uncover these facets it is important to understand why students make the academic choices that they do and what factors lead to these life-altering decisions.

Historically, very few female students, both adolescent and young adult, have chosen to work or study within the fields of science and or engineering (Blair & Lupart; 1996; Eccles, Roeser, Wigfield, Freedman, & Doan, 1999; Greene, Debacker, Ravindran, & Krows, 1999; Jacobs & Eccles, 1985; Lupart & Barva, 1998; Muller, 1998). The fields of information technology and computer science are not immune to this trend (AAUW, 2000; Kiesler, Sproull & Eccles, 1985; Schumacher & Martin, 2001; Zeldin, Am & Parjare, 2000). Currently, however, almost all university programs within the area of science, engineering, and mathematics are experiencing substantial increases in the enrollment of female students except for computer science (AAUW, 2000; Chan, Stafford, Klawe & Chen, 2000). The question that remains is why do so few girls pursue advanced level computer related courses and/or careers in this field and what factors prevent them from making this choice?

These blatant gender inequalities have been the focus of extensive debate. There are ample theoretical explanations that attempt to explain why boys tend to choose computers and math more so than their female peers. From biological sex differences theory to influences on student choice theory, researchers from several schools of thought have attempted to explain this phenomena. Several of these theories and their implications will be discussed.

Biological Sex Differences Theory

Previously in educational research, the gender differences that were noted between male and female students within the education system were attributed to physiology. Girls were seen as the weaker, less intelligent sex due to their biological makeup (Stewart, 2001). Historically, male educators primarily cited biological explanations, such as lack or interest, a weaker constitution, and unsuitability for intellectual endeavors, to explain the inferior performance among their female students (Tittle, 1968). While this theory is not widely supported, several researchers still use the biological predisposition theory to explain gender differences in students performance in the sciences (Benbow & Stanley, 1980; Raymond & Benbow, 1989, Taylor, Leder, Pollard, & Atkins, 1996).

Perhaps the most controversial research article to come out of the early 1980s is that of Benbow and Stanley (1980). Arguing for the nature side of the debate, Camilla Benbow and Julian Stanley reported the findings of their research on academic achievement of junior high school students. They found that on average, boys scored higher than girls did on the Scholastic Aptitude Test's (SATs) mathematical portion. From these results, Benbow and Stanley concluded that:

> We favor the hypothesis that sex differences in achievement and attitudes toward mathematics result from superior male mathematical ability, which may in turn be related to greater male ability in spatial tasks (p.1264).

They claimed support for this theory by stating that the differences exist even though the girls and boys had received essentially identical formal education experiences.

Maccoby and Jacklin (1974) have also supported biological underpinnings as an explanation for gender differences. On the basis of their research on children's development, they concluded that the sexes differ in several aspects of intellectual abilities, including quantitative and spatial abilities.

Another researcher who found evidence for the innate differences argument was D. McGuinness (1975). She stated that there is a biologically innate difference in the way females and males process and interact with the world. McGuinness also claimed that males gain information hands-on, that contributes to their superior mechanical and visual-spatial skills, which are important in abstract mathematical thinking. Females tend to learn about the environment largely via communication with others and not through physical manipulation of the environment. However, similar to Benbow and Stanley (1980), and Maccoby and Jacklin (1974), the work of McGuiness has come under heavy scrutiny.

Numerous researchers contested the findings that suggested that boys are naturally better at math than girls (Bornholt, Goodnow & Cooney, 1994; Eagly, 1995; Eccles & Jacobs, 1986, 1985; Jacobs & Eccles, 1985). These researchers have argued that the results of Benbow and Stanley's 1980 report were misconstrued not only by the researchers themselves but also by mainstream media. Publications in popular magazines such as *Time* and *Newsweek* swept through North American culture, portraying that girls are naturally not as proficient at math as boys (Eccles & Jacobs, 1985).

The consequence of the popularization of this theory not only created major effects in the educational practices surrounding math, science, and computer technology it also promoted the stereotype that boys naturally excel at math (Bornholt, Goodnow, Cooney, 1994). In fact, Eccles and Jacobs (1986) found that parents who were exposed to Benbow and Stanley's 1980 article indicated that they felt their daughters had less math ability, less success for future math endeavors, and found math more difficult than boys. Their results suggested that parents' gender stereotyped beliefs were a key cause of sex differences in students' attitudes towards math. Mothers in this study endorsed the idea that boys do better in math and that math was more challenging for their daughters. Even though there was widespread cementing of the societal stereotype that math, science, and computers are easier for boys, this biological explanation has, for the most part, been rejected by researchers working in this area.

Eccles' Model

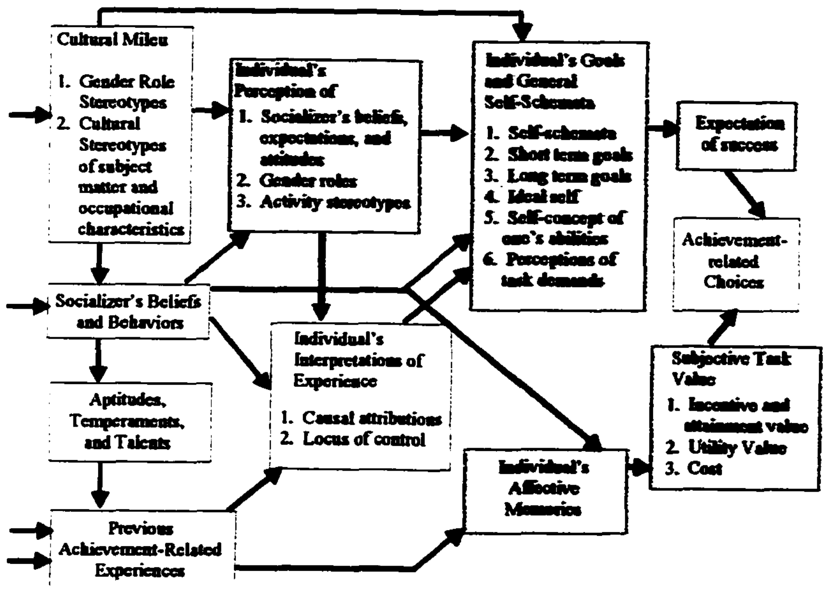
Not willing to accept a biology based theoretical explanation for gender differences in students academic achievement, Jacqueline Eccles and colleagues set out to develop an alternative, comprehensive model of students' achievement factors (Eccles, 1983; Eccles, Alder, Futterman, Goff, Kaczala, Meece, & Midgley, 1983; Eccles, Barber, Updegraff, O'Brien, 1995). Eccles and her colleagues at the University of Michigan have spent the last three decades developing and testing a model that explains some of the psychological and developmental factors that contribute to students' academic choices and achievement. This Expectancy-Value Model (See Figure 1), provides a theoretical framework of the connections between attitudes, experiences, and the influence of socializers, that may contribute to the gender differences in computer-related attitudes and behaviours. It incorporates the perceptions of the individual in their interpretation of their environment, their experiences, and expectations for future success. Collectively, these factors influence achievement-related behaviours and choices. The model consists of two major constructs; the psychological and the developmental. The psychological construct details the interactions of various cognitive facets at any point in time. Task choice, persistence, expectations of success, and the value placed on success are included in this construct. These values are determined by factors such as self-concept, goals, perceptions of socializers expectations, and perceived task difficulty. The developmental constructs constitute the basis of the individual differences in these psychological factors (Eccles et al., 1983; Eccles, 1994; Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999).

Eccles model frames the bulk of factors that have been shown to contribute to achievement choices in math, science, and computer science (Eccles, 1985,1987, 1994, Eccles & Jacobs, 1986, 1985; Eccles, Jacobs & Harold, 1990; Jacobs & Eccles, 1985;). This model:

> links achievement-related beliefs, outcomes, and goals
> to interpretive systems like causal attributions, to the

Figure 1

Eccles' Expectancy-Value Model.



> input of socializers (primarily parents and teachers),
> to gender-role beliefs, to self perception and self-concept,
> and to one's perceptions and self concept of the task itself
> (Eccles, 1994, p. 587).

Eccles and colleagues (1983) reported that their theory is based upon the assumption that it is the interpretation of reality which most directly determines children's expectancies, values, and behaviours. Thus, one of the facets which will help a child grow to believe that they are successful or not, is how they perceive past experiences. Children will make causal attributions for these successes or failures, based on a variety of influences. Each of the influences impacts the determination of the child about the task value, and the expectancy for success. These factors then influence achievement related behaviours.

Figure 1 illustrates the ten main constructs in Eccles' Expectancy-Value model that are thought to influence the achievement-related choices that students make regarding math and science. These constructs are: 1) the cultural milieu, 2) the socializers beliefs and behaviours, 3) the individual's aptitudes, temperaments and talents, 4) the individual's previous achievement-related experiences, 5) the individual's perception of the socializers beliefs, expectations and attitudes, gender roles and activity stereotypes, 6) the individual's interpretations of the experiences, 7) the individual's goals and general self-schemata, 8) the individual's expectation for success, 9) the individual's affective memories, and 10) the individual's subjective task value (Eccles et al., 1983; Eccles, Wigfield, & Schiefle, 1998).

Overall, Eccles theory provides the most comprehensive explanation of the many intertwining components that effect a child's achievement and their academic choices. While the current study does not attempt to test Eccles' model, it does find this contextual framework beneficial for organizational purposes. From Eccles model three dominant themes are salient to the explanation of gender differences in students' technology achievement. The relevant literature pertaining to these themes: student's attitudinal patterns towards computers, their experiences with technology, and the link to their future career ideations, will be addressed.

Attitudinal Patterns

Extensive amounts of empirically supported studies have found that attitudinal patterns and styles, which are a major facet of individual personality, greatly effect the choices that humans make everyday (Eccles, 1983; 1987; 1994). This is especially true when examining the attitudes of adolescents. The development of these attitudes is influenced, in large part, by perceptions of prior experiences and behavioural expectations of the socialization process (Blair, 1991). These attitudes then in turn effect students' choices and cognitions towards many different elements of daily life, academic subjects being one.

Recent research suggests that female under participation in the area of computer science and information technology can, in some part, be attributed to attitudinal patterns towards these subjects (Nelson & Watson, 1995). These researchers claim that the historical link between computers and mathematics has reinforced the alienation of girls from computers. Eccles (1987; 1994) has proposed that females often reject these subjects because they do not perceive themselves as being effective within these areas of academia and that they hold lower self-efficacy surrounding these topics. Similarly, following a vast meta-analysis of the relevant literature, Koch (1995) concluded that females' feelings of incompetence and alienation from technology start, or are reinforced, in schools. Summers (1990) also presented similar findings. She surveyed students at a popular university in the United States and found that 58% of the undergraduates and 49% of the graduate students had little or no computer experience. Consequently, Summers (1990) confirms a direct correlation between the lack of experience and the students' negative attitudes towards computers.

Based on their collective findings, Eccles (1994) suggested that many females do not perceive these subjects (math, science, computer technology) as helpful to their future education and career plans. Overwhelmingly, females tend to view these subjects as difficult and not worth the effort. Eccles concluded that a student's perceived self-ability for success in an academic area greatly influences the choices that student makes pertaining to that subject.

Academic competence is an important factor in the overall portrait of positive adjustment and interpersonal competency during adolescence (Eccles & Midgley, 1989). Students who see themselves as successful or having the ability to become successful within a subject area tend to have more adjustment within their lives than students with negative attitudes do. In a similar vein, Eccles, Barber, Jozefowicz, Malenchuk, and Vida (1999) found that low self-confidence and low perceived ability in academic subject areas has a direct link to the performance of this student. What is discouraging is that females consistently tend to report that they are more competent in English and Humanities than they are in math, science, and computer technology.

Janet Shibley-Hyde (1993) completed a meta-analysis of over 70 research-based articles that looked at gender differences in regards to math and science attitudinal patterns. She reported that of the 63,339 subjects participating in these studies, female students reported significantly less self-confidence in math and science ability. Greene, Debacker, Ravindran, & Krows (1999) reported similar findings. They found that girls were less motivated to take math classes as electives and for the majority, these girls only took math courses that were required. The researchers also uncovered a negative relationship between perceived difficulty of mathematics and mathematics achievement. Numerous other researchers (Ayersman, 1996; Levine & Donitsa-Schmidt, 1998; Schumacher & Martin, 2001; Sussman & Tyson, 2000; Zeldin, Am & Parjare, 2000) have found similar results in regards to computer related courses.

Overwhelmingly, female students have been found to report themselves as having less ability for computers than their male peers. Schumacher and Martin (2001) surveyed 619 undergraduate students and found that females reported less competency and comfort for both computers and Internet use. Similar to this study, Canadian researchers found that of the over 7000 students surveyed, males rated their own skills higher in all areas than their female peers (Chan, Stafford, Klawe, & Chen, 2000). Comparably, Debacker and Nelson (2000, 1999) reported that male students had significantly higher scores on perceived ability and stereotyped views of science. They found that students who valued science had higher perceived ability in that area and those who did not hold gender stereotyped views of science were more likely to pursue learning goals in science class. However, these researchers did not examine the link between student self-esteem and achievement.

In an American-wide research project, the American Association of University Women (AAUW) (1998) surveyed over 3000 children, aged 9 to 15, on issues of self-esteem and academic achievement. Unfortunately, they consistently found that girls had significantly lower self-esteem and lower perceptions of their abilities for mathematics and science. In another portion of this study, the AAUW examined over 2300 research reports and found that girls were more likely to rate themselves significantly lower than boys on computer ability. Boys also exhibited higher self-esteem and more positive attitudes about computers than their female peers did. These findings are consistent with those of Whitley (1996) and Chen (1986).

Some interesting trends have emerged from the recent works of Nelson and Cooper (1997). These researchers conducted a study with the purpose of examining students' attributions for success and failure with computers as an explanation for gender differences in computer usage and attitudes towards computers. One hundred and twenty-seven grade 5 students, from lower to middle socioeconomic backgrounds, were surveyed and interviewed. The researchers noted that the majority of the girls within the study reported feeling significantly less competent with computers than their male peers did. In contrast, the male students reported using the computers more often and had significantly higher levels of perceived self-ability in regards to computers. They also consistently felt more positive about their computer performance than their female classmates did. Nelson and Cooper also noted significant gender differences in attributions for performance on the computer program. Females consistently attributed poor performance internally (lack of skills, intelligence) whereas males attributed their poor performance externally (difficulty of program, unfairness). In turn, these attributions predicted reactions to success and failures with the computer experiences.

Of particular interest are the findings presented by Zeldin, Am, and Parjare (2000). These researchers interviewed women who were working within the fields of science, math, or technology about their personality styles. Overall, the women in this study tended to have stronger self-efficacy and were more resilient to obstacles than females in the control group, who did not work within traditionally masculine sectors.

The above studies come from solely a North American perspective. Interestingly, a review of the relevant literature has uncovered several foreign studies that have found similar results.

Bannert and Arbinger (1996) conducted a study that examined the computer attitudes, usage, and skills of over 1000 students within Germany's public school system. These students, from grades 5 to 10, were asked several questions in regards to their attitudinal patterns for computers, their computer knowledge, and their expectations for success with computers. Overall, the boys in this study scored significantly higher mean scores on questions that asked if they expected success with computers whereas, the girls in the study showed higher expectations for failures with computers. A previous study conducted in Costa Rica found similar results (Huber & Schofield, 1998). These studies give evidence to the argument that universally, female students have lower perceived ability for computers then their male peers do. Paxton and Turner (1984) noted that negative attitudes towards computers are more likely to lead to slower learning of computer tasks and more errors. They also found that negative attitudes towards computers are associated with high computer anxiety.

Overall, the literature pertaining to students' perceived ability for computer success has not painted a very promising picture. The research indicated that women tend to feel less confident in their own abilities regarding technology which, ultimately, hinders their computer skill development (Chen, 1986; Nelson & Cooper, 1997; Whitley, 1996). Females are not feeling as good about their technology abilities as their male counterparts. With poor perceived self-ability girls attempt their technological experiences with an arduous disadvantage. While the evidence points to the fact that females do not see themselves as good computer users, few of these research endeavors have looked solely at the perceived ability of adolescents. Fewer still have examined the relation between perceived ability and future career ideations. The vast majority of the literature pertaining to this issue has come either from the United States or from Europe. Little empirical evidence has been found regarding Canadian students' perceptions of ability. The present study proposes to ratify these gaps in the information regarding students' perceived ability for technology.

Having poor perceived self-ability for technology can increase a student's trepidation toward this subject. Anxiety and feelings of nervousness in regards to a particular subject can often promote avoidance of the subject and increased negative attitudes (American Psychological Association {APA}, 1994). Students of all ages have previously reported feelings of anxiety in relation to mathematics and science content (Eccles & Jacobs, 1986; Jones & Wheatley, 1988; Shibley-Hyde, 1993; Tocci & Engelhard, 1991; Wigfield & Meece, 1988).

Rosen and Weil (1992) coined the term *technophobia* to describe anxiety felt about the present or future interactions with computers or computer related technology. This term also alludes to negative global attitudes about computers, their operations or their societal impact; and/or specific negative cognitions or self-critical internal dialogues during actual computer interaction or when contemplating future computer interaction. Relevant research on *technophobia* consistently points to the fact that female students are experiencing much higher levels of this condition than their male classmates. McIlroy, Bunting, Tierney, and Gordon (2001) conducted a research study to examine the relation of gender and background experiences to self-reported computing anxieties and cognitions. Subjects in this study completed a questionnaire and the Computer Anxiety Scale. These results indicated that computer anxiety was more commonly found among female students. However, it was noted that when regularity of access to computing facilities was controlled, there was an association with more positive cognitions surrounding computers. For males and females, their findings further indicated that computer anxiety was more likely to lead to slower learning, more errors, and more avoidance of computers.

One Canadian study (Inkpen, 1993) examined the computer anxiety of school aged children. These researchers observed children while they played with electronic games at the Science World in Vancouver, British Columbia. They noted that the girls appeared to be very hesitant about approaching a station that was filled with boys and that the girls reported higher levels of anxiety when they were working on the computers with a group that was mainly male. Similar findings have been found among older women. Gattiker (1988) noted that women appeared more afraid of computers than men and they were more likely to express concerns about how computers would effect the quality of their work. Whitley (1996) has conducted several investigations concerning the computer anxiety phenomena. Whitley carried out an extensive analysis of studies that dealt with computer anxiety and nervousness in the reference guides, PsychLIT and ERIC (Educational Resources Information Service). On average, he found that women reported significantly higher levels of anxiety than men did when dealing with computers. Overall, Whitley concluded that computer anxiety might cause women to take fewer technology courses or use computers less. He concluded that one way to overcome this fear would be through structured positive experiences with computers as a way to reduce anxiety for both men and women.

Several international studies have also examined the issue of computer anxiety (Brosnan & Lee, 1998; Huber & Schofield, 1998). Of particular interest is the cross cultural comparison study completed by Brosnan and Lee (1998). These researchers surveyed and interviewed 207 individuals from the United Kingdom and 286 subjects from Hong Kong. They found that the UK sample reported more computer-related experiences, less anxiety, and more positive attitudes. Consistent with research in North America, males in the UK held more positive computer attitudes than the UK females. However, a find that was noteworthy was that the males from Hong Kong reported more computer anxiety than their female peers did. Unfortunately, Brosnan and Lee did not account for the differences between Asian and European cultures, and has left the academic audience to speculate about the surprising gender reversal in computer anxiety trends.

In conclusion, the evidence in support of actual computer anxiety as a proponent of women's avoidance of computers has not only been well documented, it has links to anxiety research that dates backs several decades. Several researchers (Brosnan & Lee, 1998; Whitley, 1996) have suggested that to help reduce computer anxiety, instructors educators, and parents can provide support and ensure structured experiences, thereby increasing the students' affinity for computers and allowing them to see how useful these machines can be. Despite the volumes of research that point to the notion of computer anxiety it would be beneficial for future researchers to re-examine this phenomena. In light of the huge increase in computer technology developments over the last few years, it is hypothesized that as computer tools become less complex and more user friendly computer anxiety may actual diminish. This area needs further examination and extrapolation over the next few years.

Motivation to learn a new subject or to master an art is crucial in the learning process. Many research studies have found that the more a student is interested, and the more positive the reports of liking a particular subject are, the more likely that student will do well in regards to the material (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999; Eccles, Roeser, Wigfield, & Freedman-Doan, 1999; Huber & Schofield, 1988; Miller, Chaika, & Groppe, 1996). Moreover, by increasing a student's affinity towards a subject matter, educators and parents have found that they often increase the child's achievement as well. Clewell, Anderson, and Thorpe (1992) found, in their meta-analytical review of the relevant literature, that the majority of intervention programs aimed at increasing female participation and achievement in the science, began with increasing their affinity for this subject. Nevertheless, despite numerous intervention programs girls are still reporting that they like math and science less than the reports of their male peers (Muller, 1998; Tocci & Engelhard, 1991). These findings have been well supported through the results of numerous other researchers (Catsambis, 1994; Sadker & Sadker, 1994; Sadker, Sadker, Fox, & Salat, 1993).

Similarly, Catsambis (1994) reported that grade ten girls in her study overwhelmingly reported that they did not like mathematics and that they did not feel comfortable in math class. Sadker and Sadker (1994) support these results through their extensive report of how American schools are short changing female students. They concluded that female students' consistently reported that they did not like math, felt that the math content was too hard, and has little reward. The girls in their investigation consistently reported viewing advanced level mathematics as not pertaining to their future career ideations.

Unfortunately, it appears that this trend carries over to the fields of computer science and information technology. Students are continually short-changing their futures by limiting their computer skill development by not taking advanced technology courses. Campbell (1992) has indicated the best predictor of future computer course enrollment by college students is the perceived usefulness for future educational and occupational plans. This is disheartening when considering the commonly held beliefs that females tend to have concerning computers. Overall, the research has shown that girls do not see computer skills as useful towards their future career ideations. What is disparaging about this fact is that technical skills have become one of the most marketable factors in the world economy today. As previously mentioned, having well developed computer skills puts a person at an advantage within the employment sector. It is of interest to note that females tend to report that computer skills and knowledge are less useful than the reports of their male peers. In fact, Kaplan (1994) found that females were more likely to report computers as being "fun", whereas males tended to have a more logistical view of computers and saw them as more useful. Unfortunately, research has shown the same trends for affinity towards computers. Numerous studies have indicated that consistently, females reported liking computers less (Brosnan, 1998; Crombie & Armstrong, 1998).

For example, in a recent study carried out in Houston, Miller, Chaika, and Groppe (1996) recruited 30 girls from grades 6-12, and asked them what they would like technology to do in their wildest dreams. The authors indicated that the same type of study was previously done with male students to which the results were starkly different. The girls in this study consistently reported that they would like the technology to be used for increased social communication and domestic chores. The themes that emerged from the boys reports included more practical ideations such as "make games more fun", "help businesses" and "increase wealth". The girls in the study also chose computer activities that were more challenging than competitive. Challenging games were consistently ones that required intellectual knowledge and problem solving strategies where working collaboratively resulted in higher scores. In contrast, competitive games required one on one contest with no reward for collaborating. The male students consistently reported preferring the competitive games more so than their female peers did.

In a slightly different vein, Bannert and Arbinger (1996) noted that females' attitudes towards computers are determined by practical and social aspects to a much greater degree than males' attitudes. Females are more interested in the computer's usefulness and social consequences of its implementation than in purely technological aspects. This finding supports the notion that young girls tend to prefer activities that have to do with connectedness, collaboration, and relationships (Taylor, Gilligan, & Sullivan, 1995). This knowledge could be used to create supportive and enticing computer learning environments for all students. By allowing, collaborations during the learning process, educators can increase the affinity for a subject as well as the productivity. In fact, Inkpen, Booth, Klawe, and Uptis (1995) found that allowing children to work collaboratively when learning new computer applications was more beneficial and resulted in better learning than when the children worked alone. Thus, educators and curriculum developers would be well served to use Taylor, Gilligan, and Sullivan's (1995) findings and incorporate these ways of learning into new computer education planning.

In summary, the research has consistently provided some disparaging results. Overall, females tend to view computers as less useful for their future career development than their male peers. Overwhelmingly, females report liking computers less and feeling less comfortable using the computer. This places these girls at an increased disadvantage when entering the workforce because as a result of having these negative views they are less likely to take advanced level computer science courses. Like so many other professions, such as advanced mathematics and engineering, men enter these fields with more knowledge, and or, skill development because their attitudes and experiences, regarding these subjects, were encouraged and cultivated. Paradigmatically, psychologists and educators know that positive and negative experiences in regards to academic subject areas can have polarized effects.

Experiences

The early forefathers of psychology, such as Wundt, Külpe, Ebbinghaus, and Kraepelin, all stated that the human experience is what sets the human species apart from those of the animal kingdom (Brunswick, 1956). What is even more interesting is that even in the earliest of psychology laboratories, human experiences and their effects on human behaviour have been a keen focus of study (Ross, 1967). Social learning theorist, Albert Bandura, attributed a person's experiences in relation to teaching another the elements of the same behaviour (1969, 1977). Historically, experiences were used to explain everything from depression to the absorption of new information. While psychologists today have come a long way in their research methods and understanding the factors of human experience, the basic paradigms of the human experience has not changed over the last few centuries. Essentially, what a person experiences in their daily life in effect will contribute to the decisions they make and how they form judgments and stereotypes. On the basis of her extensive research in this area Eccles (1994, 1987) confirmed that the experiences a student has in their academic career greatly effect the cognitions they hold for the subject matter and their behaviours surrounding these topics. This applies to computer science as well. An important factor when inquiring about the computer experiences of boys and girls is to examine the differences in how these children are using the computer.

The AAUW commissioned on-line surveys of 900 teachers and later conducted qualitative focus groups with 70 female students across the United States. The result of this in-depth inquiry revealed that women are at a disadvantage when it comes to computer skills and knowledge. Not only did they find that on average, females tended to have higher reservations about the computer culture, they also uncovered that females only use the computer tools and tend not to be computer fluent. Females tend to take more computer "tool" courses that teach skills such as page layout, spreadsheet use, PowerPoint, or word processing than actual programming and software design courses. The commission concluded that while using these tools may be useful, it is not the same thing as being technologically literate. Essentially, it would be beneficial for all learners to have computer technology taught across all disciplines so that students could become more aware of the practicality of such applications. Current plans, such as Alberta Learning's ICT Program of Studies (2000), encourage computer integration across all subjects rather than keeping these technological machines to a separate class. Hopefully, this will help to encourage girls to pursue computer related topics more readily and to help them become more computer-literate.

Technological fluency or computer literacy requires a set of skills and concepts that permit full citizenship in the e-culture. The new standard of fluency assumes an ability to use abstract reasoning, to apply information technology in innovative ways to problem solve across disciplines, to interpret vast amounts of information, and to understand basic principles of programming and other computer fundamentals (AAUW, 2000). This study and several others (Chan, Stafford, Klawe & Chen, 2000; Nelson & Watson, 1995) indicate that females tend not to engage in programming or system development while using computers. Uptis (1995) found that boys are more likely to be game creators, hackers, and get into the internal components of the computer. What the research in this area appears to suggest is that boys are experiencing these advances in their computer knowledge due to their increased prior experiences with these technological machines. However, there is still little understanding as to why girls do not have as much prior practice in this area. Why do females have less prior experience, and how does this translate into later career expectancies?

Perceptions of one's ability and affinity towards an academic subject can be directly related to prior experiences. Eccles' (1985) model postulates that a student's interpretation of his/her experiences produces affect and cognition about a particular subject matter. Therefore, a student who experiences repeated successes and intensive exposure to a subject matter is more likely to have positive intentions and cognitions in regard to this area of study than a student who has had more negative experiences in this area. Indeed, researchers have reported findings to support this theory in regards to adolescent experiences with mathematics and their future intentions for this subject (Comber, Colley, Hargreaves, & Dorn, 1998). Thus, it would appear that even the simplest factor such as having higher levels of prior experiences with a subject can greatly increase the positive attitudes a student has for a subject (Schumacher & Martin, 2001).

Increased prior experience with computers has been found to put male students at an increased advantage over their female peers in regards to computer achievement and positive attitudes surrounding this topic (Kiesler, Sproull, & Eccles, 1985). Bannert and Arbinger (1996) found that the majority of the boys in their sample had more experiences with computers. They also stated that boys had previously gathered more experience with computers and that a majority of the boys (grades 5 to 10) indicated that they had been using a computer for more than 2 years. What is discouraging about these results is that when examining the girls' responses, 44% indicated that they had been using the computer for less than 1 year. Similar results have been found by other researchers (Chan, Stafford, Klawe, & Chen, 2000). Boys are not only showing increased prior school computer experience, they have also shown higher attendance rates at computer camps, workshops, and clubs (Nelson & Watson, 1995).

In their 2000 report, *Tech-Savvy: Educating Girls in the New Computer Age*, the American Association of University Women found that, girls are not well represented in computer labs, clubs, and have taken dramatically fewer programming courses both at the high school and post-secondary level. Besides this under-representation in extra-curricular computer activities, girls are also less likely to be computer owners (Schumacher & Martin, 2001).

Groundwater-Smith (1994) found that fewer girls had access to a computer at home than their male peers. She claims that essentially what this does is put girls on a lower rung of the proverbial computer skill ladder, and at the same time also places boys several steps ahead. Kiesler, Sproull, Eccles (1985) claim that the discrepancy between the genders ownership and prior experiences with computers can be blamed, to some extent, on the software and gaming industry. They claim that student's of all ages have grown up in a social environment in which arcade games and educational software have been designed to appeal to boys more than girls. Nelson and Watson (1995) concur that computer software tends to have male-dominated themes, characters, and story lines which can discourage females from using these tools. Moreover, educational software often reflects male interests (war, science fiction, adventure, and technology) which not only puts females at a disadvantage within the home but also at school (AAUW, 1992, 1998). Basically, female inferiority in regards to computers has been reinforced from grade school to graduate school through the use of textbooks, materials, and course content that is masculine in nature (Henwood, 1993). Therefore, boys have yet another advantage over their female peers in the sense that not only are they more experienced, they are often the target audience for software manufacturers.

In summary, not only have researchers uncovered that boys have more prior experience with computers, studies have also determined that on average boys are spending more time using the computer (Chan, Stafford, Klawe, & Chen, 2000; Klawe, Carvers, Popowich, & Chen, 2000; Whitley, 1996). Consequently, females are placed on an arduous journey to claim citizenship within the e-culture.

Yet again, the research has shown that females are at an increased disadvantage within the technological revolution. While the research pin points serious discrepancies between the genders computer experiences it is important to remember that some of the investigations were completed several years ago. Hopefully, re-examination of computer experiences, attitudes, and anxiety in years to come will show an improvement in the gender distortions as a result of some major initiatives that are presently underway. Technology has become more accessible and less complicated for users over the last number of years. This trend combined with increased integration of technology within the school systems provides an optimistic outlook for the future of women and girls and information technology. However, serious investigations will need to be performed within the next few years to determine if these advances are actuality or still just theory.

The relevant literature has shown some serious gaps in information. Little research has been done on Canadian students, thus leaving the Canadian educator and researcher to speculate that the trends that are readily seen around the world would be the same within their educational systems. How much time are Canadian students' spending on the computer and are the blatant gender differences visible within this culture?

One Canadian study is of particular interest (Chan, Stafford, Klawe & Chen, 2000) in that it was found that on average boys spend significantly more time using computers on a daily basis. By spending more time using the computer than girls, boys are increasing their knowledge, their skill level, and their computer competence which puts them at an advantage for pursuing higher level technology courses and careers. Kiesler, Sproull, and Eccles (1985) reported that the ability to compute and have well defined technological skills is perceived as a marketable skill. Furthermore, they suggested that true computer efficacy requires both knowledge of social awareness of computer culture and the technical knowledge of computers as machines. All of which boys are experiencing and absorbing more of every time they turn on a computer monitor.

Girls in many other cultures around the globe have also reported spending less time, than their male peers, using and developing their computer expertise. In their 1996 report on German public school children, Bannert and Arbinger determined that 20% of male and only 7% of female middle school subjects reported using a computer for more than 2 hours per day. In contrast, over half of the girls surveyed indicated that they, on average, spent less than one hour on the computer each day. Several other research reports have indicated the gender difference in computer usage at home is just as prevalent as the discrepancy at school (AAUW, 2000; Whitley, 1996).

Nelson and Cooper (1997) and Nelson and Watson (1995) not only found that on average boys have more access to computers at home and are spending more time on the computer, they found that parents inadvertently reinforce the notion that computers are for boys. These researchers report that on average, parents are less likely to purchase computer related paraphernalia (magazines, games, accessories) for their daughters. Mothers are less likely to spend as much time on the computer as fathers, and both parents have indicated more often that they believe that girls enjoy computers less (Bannert & Arbinger, 1996).

Thus far, the research paints a picture of the computer culture and the e-global citizenship as an unequal playing field for boys and girls. Girls have reportedly less experience with computers, spend less time using computers, and do not feel as connected within the technological revolution as their same aged male peers. Unfortunately, many researchers have reported that even the activities that females overwhelmingly use the computer for puts them at another disadvantage (AAUW, 2000, 1998; Teo & Lim, 2000; Uptis, 1995).

Improved access to technology is a pivotal factor in improving one's computer skill level and knowledge about the information revolution. However, merely using a computer does not always increase the wealth of sophisticated knowledge that is required to have full citizenship within the electronic culture. Once again, this is an area where researchers have uncovered some disparaging gender differences.

The development of the Internet in the early 1960's unwittingly changed the face of global history. Despite the delay of its popularity until the 1990's, the Internet, or the World Wide Web, has basically become an omnipotent power of knowledge and information. The Internet is now composed of over one billion websites with a countless number being added daily. Internet developing companies have gone from small-time, single digit employers to some of the largest grossing industries today (Adam & Bruce, 1993; LaMorte & Lilly, 2001). However, it is only those individuals who posses the elite and sophisticated skills that know the inner workings of the Internet that experience these successes. The mere "tool users" will not. Unfortunately, these less-refined skill holders tend to be female.

Research has repeatedly indicated that while girls spend almost as much or just as much time on the Internet than their same aged male peers, their knowledge of the Information Super High-Way tends to be more superficial (AAUW, 2000; Uptis, 1995). Hoffman (1996) found that women are more likely to use the Internet for communication with social purposes more so than their male counterparts. He suggested that females have a greater need to form social networks and to exchange information and opinions about a wide variety of work and non-work related topics. This resonates with the ideas of Gilligan and colleagues who suggest that young girls prefer to work on topics of collaborations and connectedness (Taylor, Gilligan, & Sullivan, 1995). It is the ability to take computer skills to the next level and understand e-language, through programming, that puts males ahead of females in this technological revolution. Teo and Lim (2001) found that internationally, boys spend more time using and creating sites on the Internet than their same aged female peers. They also found that girls tend to use the Internet more for messaging and email purposes. These results have been confirmed by other investigators (Bannert & Arbinger, 1996).

Because the knowledge of programming and the ability to manipulate computer components sets individuals ahead on the proverbial computer success ladder, it is worthwhile to examine who is responsible for these advancements. Historically, development of the worlds leading software and technological advancements have predominately come from men (LaMorte & Lilly, 2001). What is interesting to note is that this gender difference in programming abilities begins in childhood. Numerous researchers (Chan, Stafford, Klawe, & Chen, 2000; Lupart & Cannon, 2000; Schumacher & Martin, 2001; Teo & Lim, 2000; Uptis, 1995) have found that on average, boys report spending more time on programming activities than females do. Schumacher and Martin (2001) claim that greater experience with programming and games may all enhance the technical sophistication of males with computers and account for the greater degree of competency and comfort with both the Internet and technology in general.

Several investigators have reported that some females have indicated that they are more likely to ask a boy in their class for help when they encounter a computer problem than to try and fix it themselves (Brosnan, 1998). Despite all of the evidence that points towards males being better at sophisticated computer applications, this advantage appears to stem purely from environmental factors.

For example, several researchers have found that when environmental variables were controlled (such as time on computer, prior knowledge, and instruction) gender differences disappeared (Bain, Hess, Jones, & Berelowitz, 1999; Levine, & Donitsa-Schmidt, 1998; Lichtman, 1998; Nelson & Cooper, 1997; Zehr, 1998). According to Hesse-Biber and Gilbert (1994) by applying a female pedagogy in the computer assisted college classroom, they demystified and promoted technological equity for the females in the class. They incorporated into the classroom cooperative learning groups, added a feminist perspective, and used female identified content within the curriculum. Moreover, they found that by the end of the semester, the females within the class were performing as well as or better than their male counterparts, even on advanced level computing.

Thus far the research has provided overwhelming evidence to the fact that boys are spending more time on the computer, they are playing more games, are doing more programming, and they are more likely to have more experiences with technology. What is even more disparaging is that several other studies have proven that given the right types of factors and the necessary support, females can do as well as their male peers. So why is this occurring? Are boys and girls experiencing technology instruction differently at the grade school level? The evidence has consistently indicated that the gender differences within the computer classroom are not encouraging.

The AAUW (1992, 1998) commissioned several extensive reports on the status of girls in American public school systems. According to their collective findings, female students often do not receive the same instruction as male students, and they receive less one-on-one support from their teachers. Several other researchers (Sadker & Sadker, 1994; Sadker, Sadker, Fox, & Salat, 1993) have supported these findings. This trend did not exclude technology. The AAUW also claim that aside from technology-magnet schools, the public school systems with the United States have limited offerings in computer science, programming and applications. They also report that course enrollment in computer sciences warn of the emerging gender gap in the "boom" industries of the future. This is not only limited to schools within America.

Researchers in Costa Rica examined the behaviours and attitudes of boys and girls in elementary school (Huber & Schofield, 1998). They found clear and consistent differences in the teaching practices directed at boys and girls. Girls within the computer class were given less opportunity to manipulate the tools and often received less teacher assistance. It is not surprising that the boys in the class often stayed after class and reported liking computers more than their female peers. Other researchers have claimed that in addition to less attention in the computer class, girls are sometimes the brunt of sexual harassment, bullying, and intimidation by their male peers (Silverman & Pritchard, 1996).

In a disturbing report on her observations within a high school technology course, Schofield (1995) reported numerous indications of sexual harassment and emotional abuse directed at several female students by their male peers. Moreover, on several occasions the male teacher of the class actually heard the disgusting and blatantly inappropriate comments and did nothing to deter the behaviour. While Schofield notes that these incidents were not the norm, the messages that were being sent to the female population within the computer class would certainly tend to discourage these students from pursuing an interest in this subject. In another study, female junior high school students were asked why did they not use the computers during their free time (Koch, 1995). The girls reported that they felt that the boys in their class dominated the computer lab and they felt excluded from the computer culture within their school. Australian researchers have obtained similar findings (Groundwater-Smith & Crawford, 1990). It was found that not only were the teachers responsible for technology mostly male (3:1), they also discovered that female students were practically non-existent within computer clubs and extra curricular activities.

Overall, the evidence regarding females and technology has not been promising (Bain, Hess, Jones, & Berelowitz, 1999; Brosnan, 1998; Chan, Stafford, Klawe, & Chen, 2000; Klawe, Carvers, Popowich, & Chen, 2000; Huber & Schofield, 1998; McIlroy, Bunting, Tierney, & Gordon, 2001; Silverman & Pritchard, 1996; Whitley, 1996). However, a number of researchers have given some practical and useful strategies to help include female students within the technology classroom.

Through collective endeavors, Eccles (1994, 1987, 1985) determined that increasing a student's motivation and affinity towards a subject educators can in turn increase achievement levels. According to several researchers (Hesse-Biber & Gilbert, 1994; Lichtman, 1998; Zehr, 1998) technology instructors can increase female achievement and participation in this area by implementing a few simple steps. While some researchers have proposed that providing female-only technology classes has multiple benefits, this strategy is not always possible (Bennett, 1997; Lichtman, 1998; Rand & Gibb, 1989; Singh, J, 1990; Stables, 1990; Stretmatter, J; 1997). Acker and Oatley (1992) suggest that by having highly motivated teachers and having an appreciation of the social context into which technology is being introduced, female achievement can increase. Koch (1994) tested and reviewed several strategies and listed the most effectual. These included exposing girls to computers during early to middle school years and providing different types of technology related activities. When these strategies were implemented female interest in technology increased significantly. Koch also noted that simply setting up the classroom to promote collaborations and making gender equity a priority also had beneficial implications. Perhaps the most important recommendation made by Koch was that teachers should choose software that is free of gender bias and encourage girls to participate in after school and summer computer camps.

Zehr (1998) tested the above mentioned strategies and found that girls participation in computer elective courses increased to equal the percentage of boys registered. She designed and implemented a computer program in which girls were instructed about technology during their all-female health classes. The girls were taught computer skills as they learned about other issues relevant to adolescent girls (i.e. eating disorders, careers, and self-defense). Not only did this result in increased enrollment in computer classes, teachers also observed heightened self-confidence and more interest in computer careers amongst girls who had participated in the program. These findings encourage the tenet that female enrollment and participation within the technology industry can increase if they are given the befitting supports throughout their education careers.

In summary, the literature has painted a very clear picture that females are not having the same valuable and skill developing computer experiences as their male counterparts. However, the majority of the research has examined the computer patterns and experiences of young adults with little insight into the patterns of the adolescent. By examining the computer experiences of the adolescent the researcher can in turn help to prevent negative cognitions and affects from being formed towards computers. Importantly, researchers have determined that many attitudes and beliefs that individuals hold throughout their lifetimes actually have roots in adolescence (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999; Eccles, Buchanan, Flanagan, Fuligni, Midgley, & Yee, 1991). If a child develops a negative attitude towards a particular subject area the chances are overwhelming that this child will shy away from this area of study and employment. Moreover, it is important for researchers to examine how the technological experiences of adolescents' translate into their future career development.

Career Development

The under-representation of women in the fields of technology, applied mathematics, and engineering is widely recognized. The research has suggested some of the facets of this trend begin in the middle and high school years of education. Students form some of their most stagnant and influential attitudes at this stage of development (Bornholt, Goodnow, & Cooney, 1994). Unfortunately, there is overwhelming evidence to show that female students often develop negative attitudes concerning mathematics, technology, and applied sciences (Chen, 1986; Clarke, 1991; Clewell, Anderson, & Thorpe, 1992; Crombie & Anderson, 1999; Debacker & Nelson, 2000; 1999; Eccles, 1987; Eccles et al., 1999; Eccles et al., 1995; Eccles, Buchanan, Flanagan, Fuligni, Midgley, & Yee, 1991; Eccles, Jacobs, & Harold, 1990; Eccles & Jacobs, 1986, 1985; Eccles, Lord, & Midgley, 1991; Eccles, Midgley, Wigfield, Buchanan, Reuman, Flanagan, & MacIver, 1993). Eccles (1994) found that many females do not perceive these subjects as helpful to their future educational and career ideations. She also states that girls view these subjects as difficult and the amount of work necessary to do well as just not worthwhile.

Not only do females often have negative attitudes towards technology, they also tend to be unaware of the realties concerning careers in this area. Silverman and Pritchard (1996) found that girls were uninformed about economic realities within the work world. They often lacked basic information about technology careers, including any sense of salaries, promotion prospects, or the amount of education and training needed to pursue this occupation. Pain, Owen, Franklin, and Green (1993) have also claimed that women who do enter the IT professions tend to be defined as clerical, many of whom are unaware of the possibilities for advancement.

Other researchers claim that it is not only a lack of knowledge but a misinformation of facts that prevents many females from entering into the IT world.

Women who hold stereotypical views regarding technology as a male domain overwhelming avoid this area of employment (Dick & Rallis, 1991). Clewell, Anderson, and Thorpe (1992) confirmed that women often have a limited or misunderstanding of knowledge of the applications of science, mathematics, and technology to everyday life. They also reported that women who hold negative attitudes towards technology see these careers as not being part of the solution of the world's problems, which is an area of significant interest in female adult life role decision making.

What is disparaging is that females often hold these negative beliefs at a young age, which not only impedes their entering these fields, these attitudes can limit their access to technology in the future. Campbell (1992) claims that the best predictor of future technology careers is the student's perceived usefulness and their enrollment in advanced level courses in high school. This is disheartening as the research has consistently shown that females are not enrolling in these courses. In fact, girls in high school are limiting their futures options by not taking the proper courses during their final school years and within university (Jones & Wheatley, 1988). In a more positive vein, several researchers have noted the beneficial strategies that can combat these negative tendencies (Lichtman, 1998; Zehr, 1998).

In order to increase female awareness of the fields of information technology and computer science educators, counsellors, and parents need to inform themselves first. Teachers can also encourage their female students to learn more about the potential for these careers by arranging for mentorships with women who are currently working in the industry. School job fairs, information sessions, and job-shadowing have all been proven to be successful in increasing female awareness and interest in the stereotypical male domains (Clewell, Anderson, & Thorpe, 1992). The important thing is that regardless of the strategy used, educators, teachers, and parents must do something to prevent this gender gap from widening into a massive crevasse.

Summary

The review of the relevant literature has revealed some significant gaps in the gender differences in computer science and information technology literature. Research has shown that females are under represented within the technology sector both in the actual industry and in the classroom. Women are also not as sophisticated in their development of computer skills and technological knowledge. What the literature has failed to provide is information regarding the age of onset of computer usage and where children begin their computer experiences. Currently, Alberta Learning has initiated a major computer curriculum for all ages and across core subject areas (Alberta Learning, 2000). This ICT Program of Studies suggests that children as early as Kindergarten are beginning to learn computer skills across the subject areas. However, as with any new curriculum mandate, it is important to note that this initiative is only in the preliminary stages. In depth investigation is needed to determine if this program is actually being used and if it is having the desired effects.

The majority of the research, completed to date, has primarily examined American statistics and research efforts. This does not translate well over to Canadian children, as it is known that education systems are not comparable. The current study attempts to address these information gaps by examining the computer usage patterns and attitudes of Canadian adolescents. The study also maintains that Calgary, Alberta is perhaps one of the more prime locations to examine these issues because it has the highest level of computer usage in Canada (Lupart & Cannon, 2000). Specifically, the research questions used for this study were:

1. Are there gender differences in ownership of computers?
2. Do boys and girls begin using computers at different ages?
3. Is there a gender difference as to the location where boys and girls first used a computer?
4. Is there an interaction effect between males and females, grade 7 and grade 10 student's affinity towards computers?
5. Is there an interaction effect between males and females, grade 7 and grade 10 students' perceived self-ability for computers?
6. Is there an interaction effect between males and females, grade 7 and grade 10 students' time spent daily using computers?
7. Is there an interaction effect between males and females, grade 7 and grade 10 students' responses to what activities they perform on the computer?
8. Is there an interaction effect between males and females, grade 7 and grade 10 students' future career plans regarding Information Technology?

CHAPTER III
METHOD

OVERVIEW OF THE CURRENT STUDY

The current study examined a selection of data from stage one of a larger three-part study, which was funded by Social Sciences and Humanities Research Council of Canada (SSHRC). This study, entitled Gender Differences in Student Participation and Achievement in the Sciences: Choice or Chance, focused on examination of junior and senior school students academic choices and achievement. Lupart, Cannon, and Rose's Cannon's (1998) goals for this study were:

"1. Investigate the key personal and educational factors that contribute to junior and senior high school participation and high achievement in the sciences for males and females.

2. To identify the factors that most directly contribute to decisions on the part of males and particularly females to pursue programs and careers in science and related disciplines.

3. To explore roots of differences and similarities for males and females in early decisions about adult life role and career choices.

4. To investigate parent/teacher/counsellor influence on student participation in the sciences.

5. The employment and assessment of the value of Eccles' Achievement-Choice Model."

This three stage project, included: 1) questionnaire administration to approximately 1500 grade 7 and grade 10 students from Calgary and surrounding rural communities. 2) in-depth telephone interviews of sub-sample of approximately 250 students from the first sample, in-depth telephone interviews with parents of this sub-sample as well as questionnaire administration of the parents. 3) questionnaire administration to science teachers and school counsellors from the cooperating school districts.

Phase I of the study involved the development of the "Academic Choices and Achievement Survey" (Lupart, Cannon, & Rose, 1999) (Appendix A). This 209 item survey was based primarily on The Michigan Study of Adolescent Life Transitions Questionnaire (MSALTQ). The MSALTQ has been thoroughly examined and statistically validated over the last several decades by Jacqueline Eccles and her colleagues (Eccles, 1994; Eccles, 1987; Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999; Eccles & Jacobs, 1986; Eccles, Wigfield, Flanagan, Miller, et al., 1989; Eccles, Wigfield, Midgley, Reuman et al., 1993; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Eccles, Wigfield, & Schiefele, 1998).

Phase I of this project was completed from September 1999 until December 2000. During this Phase, over 1400 participating students in grades 7 and 10 were surveyed using an adapted version of Eccles' MSALTQ.

Sampling

The current study consisted of questionnaire responses from a sample of 1416 students (868 girls and 548 boys) who participated in Phase I of the current study. This introductory phase involved a major information letter/consent form mailout for approximately 6000 students in grades 7 and 10 from Calgary and surrounding communities. Students participating in Phase I of this SSHRC study were enrolled in either grade 7 or 10 at one of the 39 cooperating schools. The schools were selected to give representation of all socioeconomic and geographical characteristics of the city.

School selection began with a representative sample of senior high schools, from the geographical areas of Calgary, followed by selection of the associated feeder junior high schools. School principals and science coordinators were advised about the study and provided with sufficient information concerning the survey and time requirements, which they were to share with their teaching staff. Information letters where given to school principals and parents regarding Informed Consent and adherence to the School Act-Freedom of Information and Protection of Privacy (FOIPP) (Lupart, Cannon & Rose, 1999) (Appendix B).

The participating schools sent all grade 7 and 10 students an invitational letter and consent forms provided by the University of Calgary research team. The letter contained a brief description of the study and requests for parental permission for voluntary participation and access to school awarded and provincially awarded achievement marks. Duplicate parental consent letters were provided in the packages for the parents to keep for their own personal records (See Appendix C). This duplicate reiterated the information contained in the above-mentioned letter. The letter requested that parents return the consent form whether or not they had agreed to allow their child to participate.

INSTRUMENTATION

The questionnaire developed for this study, Academic Choices and Achievement Survey (Lupart, Cannon & Rose, 1999), was adapted from the previous work of Eccles and her colleagues. The Michigan Study of Adolescent Life Transitions Questionnaire

(MSALTQ) is the result of a 15 year longitudinal study of approximately 1000 adolescents from southeast Michigan (Eccles, 1994).

The focus of Eccles' project was to study adolescent psychosocial development across three life stages: 1. transitions from middle school to junior high school, 2. transition from junior high through to high school, and 3. transition from high school to post-secondary/college. The results of this project have provided strong support of the reliability and validity of the MSALTQ questionnaire. Results from the last several decades have indicated that Eccles' MSALTQ is a valid measurement tool for examining achievement related choices and activities (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999). Consistently, researchers have used Eccles' MSALTQ in accordance with the Expectancy-Value Model (See Figure 1) to investigate the multitude of factors that influence a student's academic choices and their achievement related behaviour (Eccles-Parsons, 1983; Eccles, 1985, 1994; Eccles, Barber, Updegraff, & O'Brien, 1995).

The primary change in the adapted Lupart, Cannon, and Rose (1999) version employed in the current study was to eliminate questions irrelevant to the subject age groups and/or specific research interests of the investigators. These adaptations resulted in a 209 item questionnaire with several sections.

The sections included in the questionnaire used for the current survey are as follows: (i) background Information (e.g. gender, family status, level of parental education, language spoken at home), (ii) interest and value of math, language arts, science, and computers, and (iii) future plans and career choices. The majority of the questions had responses on a five point Likert scale, with responses consisting of

Strongly Disagree, Disagree, Neither Agree nor Disagree, Agree, and Strongly Agree. See Appendix A)

Procedure

Approval for student participation was granted from 4 different school boards: the Calgary Board of Education, the Calgary Roman Catholic School District, Rockyview School District, and Foothills School District. Officials responsible for research for each of the school boards were approached and provided with samples of the information and consent letters. These officials recommended which schools would best serve the needs of the researchers. Permission and information packages were sent to the to the participating schools' principals for distribution to the grade 7 and 10 students enrolled in science. Each package contained an Information letter (Appendix B) for the parents, two consent forms (Appendix C) and a stamped, University of Calgary addressed envelope, which were all located in a sealed envelope. The estimated positive response rate was approximately 40%, with a relative balance between males and females.

Two sessions were carried out in December 1999 to determine survey completion time and develop standardized administration procedures. All of the team members were graduate students from the Division of Applied Psychology.

Administration of the questionnaires took place from December 1999 until June 2000. All of the research members used standardized practices for instructing the students about the nature of the study, which included a brief history of the project and the necessity of such research. Student participants completed the surveys during scheduled science classes, which lasted approximately 30 to 45 minutes. While the students were completing their questionnaires, the research teams answered any questions that the students had on an individual basis. Once the students completed the questionnaires the research team collected them. The questionnaires were then returned to the University of Calgary where they were analyzed.

Data Analysis

Appendix D contains a complete list of the questionnaire items analyzed in the current study. The current study involves the initial quantitative data from the grade 7 and grade 10 student surveys. From the 209 survey items 8 survey questions were selected as they related to the present study of individual's experiences, attitudes, and perceptions of computers.

Dependent variables were the five response choices on the Likert scale (1= Strongly Disagree, 2= Disagree, 3= Neither Agree nor Disagree, 4= Agree, 5= Strongly Agree). Chi-square analysis were performed for three questions (Q128, Q129, Q130) due to the nature of their categorical data. Multivariate analysis of variance were performed on several of the questions to determine if there were any gender differences, grade differences, or interaction effects. Due the large sample size the significance level was set at .$\geq$001 (Krathwohl, 1998).

Several of the research questions were further analyzed using frequency and response distributions. This was carried out to demonstrate the significance of the gender differences found on several questions. Appendix E lists the questionnaire items that were analyzed for response frequency distribution.

Summary

In summary, the Gender Differences and Student Participation and Achievement in the Sciences: Choice or Chance? questionnaire provided the contextual framework for the current study. Dominant areas of interest included analysis of student computer related experiences, attitudes, later career choices and whether or not gender has a direct effect on these variables. Procedures to adhere to the School Act of the Freedom of Information and Protection of Privacy information were implemented to ensure confidentiality of the students' responses. Data collection procedures were completed through the use of 209 item questionnaire. Data analysis was performed on 8 questions that dealt with computers. Data analysis consisted of chi-square analysis and response frequency distribution. Higher order multivariate analysis of variance were also performed to determine interaction effects for Grade and Gender.

CHAPTER IV
RESULTS

Items Analyzed

This study examined grade 7 and grade 10 students' responses to questions dealing with their computer ownership, attitudes, experiences, and future career ideations. For the purposes of this research, information relating specifically to the area of students' computer attitudes, experiences, and future career aspirations were used. The constructs included in the data analysis consisted of grade, gender, ownership of computers, age of computer use onset, affinity for computers, perceived self-ability for computers, time spent on computer, what activities computer is used for, and likelihood of computer related career. Appendix G contains a list of the 8 specific survey items analyzed through chi-square and multivariate statistics.

Research Questions and Analysis

Chi-square analyses were performed on the first three questions of this study because this data was categorical. When dealing with categorical data, the data consists of frequencies of observations that fall into each of two or more categories (Yes or no questions, Location of first computer use, Age of first computer use) therefore requiring a chi-square test to determine significance (Howell, 1995).

1. Are there gender differences in ownership of computers?

For this question students were given two possible answers to choose from (1=Yes, 2=No). Pearson's chi-square analysis revealed no gender differences for computer ownership (PCS{1, 1416}=3.78, p=0.52). These results indicate that there is no difference between girls and boys as to who owns a computer.

2. **Do boys and girls begin using computers at different ages?**

For this question students were given four possible answers to choose from (1=5 or under, 2=6-10, 3=11-13, and 4=14 and over). Pearson's chi-square analysis was used to determine if there are gender differences for age of computer use onset. The results of this analysis indicated there was no gender difference as to the age of onset of computer usage (Pearson's Chi-Square{1, 1416}=10.23, p>.02).

3. **Is there a gender difference as to the location where boys and girls first used a computer?**

For this question 4 possible answers were given (1=At a friend's house, 2=at school, 3=at a relative's house, 4=at home, 5=at work/other). Pearson's Chi-Square analysis was used to determine if there was a gender difference as to where males and females first used a computer. This analysis revealed no significant gender differences. However, a significant difference was found among location (Pearson's Chi-Square(1, 1409)=32.22, p>.001). Overall, more students (both males and females) reported first computer experiences either at home or at school. Over 45% of the total sample indicated that they first used a computer at home (43.6% of females and 49.4% of males). Similarly, 39.4% of respondents indicated that they first used a computer at school (45.7% of females and 32.7% and males).

Multivariate Analysis of Variance and Univariate Analysis of Variance

Multivariate statistics were used to examine the remaining survey items through a 2(Grade) by 2(Gender) multivariate analysis of variance (MANOVA). There was no overall significant interaction effect gender by grade (Wilks Lambda =0.978, F(12, 1357)=2.49, p=0.003). This 2X2 MANOVA revealed effects for both gender (Wilks

Lambda=0.738, F(12, 1357)=40.14, p<0.001) and grade (Wilks Lambda=0.819, F(12, 1357)=25.04, p>0.001. Table 1 shows the multivariate analysis of variance for gender by each question, with significant difference level set at .≥001. Table 2 shows the MANOVA for grade by each question, with significant difference level set at .001.

4. Will there be an interaction affect between males and females, grade 7and grade 10 student's affinity towards computers?

In regards to gender, a multivariate analysis of variance revealed a mean score of 4.21(SD=0.86) for females and 4.53 (SD=0.81) for males, which was statistically significant (F{1, 1413}=45.38, p>0.001). Generally, males were more likely to report liking computers than females. This is especially noticeable when examining the frequencies of responses to this question. Figure 2 shows the response rate of both females and males in regards to this question. What is striking about these frequencies is that 67.3% of males indicated that they strongly agreed with the statement "I like computers" whereas only 41.1% of females indicated the same response. Overall, results have shown that males have higher affinity for computers than females.

Significant differences were also found between the mean scores for grade 7 (4.49, SD=0.81) and grade 10 (4.15, SD=0.89), (F{1, 1413}=50.83, p>0.001). Grade 7 students' reported higher affinity for computers than Grade 10 students. Examination of

Table 1

Multivariate Analysis of Variance for Gender by Selected Survey Items.

	Females	Males	
	Mean (SD)	Mean (SD)	F-Value
Q131(affinity for computers)	4.21(0.86)	4.53(0.82)	45.38*
Q132(ability for computers)	3.96(0.95)	4.29(0.93)	40.70*
Q133(time spent daily on computer)	2.81(1.45)	3.38(1.48)	43.05*
Q134a(time spent on email)	2.48(1.10)	2.02(0.97)	67.50*
Q134b(time spent on Internet)	2.50(1.07)	2.77(1.14)	21.64*
Q134c(time spent on assignments)	2.85(1.01)	2.60(1.01)	21.22*
Q134d(time spent programming)	1.39(0.76)	1.92(1.08)	95.41*
Q134e(time spent on games)	2.70(1.17)	3.51(1.22)	160.57*
Q158(likelihood of computer career)	2.38(1.22)	3.34(1.41)	174.01*

* indicates significance at 0.001.

Table 2

Multivariate Analysis of Variance for Grade by Selected Survey Items.

	Grade 7	Grade10	
	Mean (SD)	Mean (SD)	F-Value
Q131(affinity for computers)	4.49(0.81)	4.15(0.90)	50.83*
Q132(ability for computers)	4.21(0.95)	3.97(0.94)	22.01*
Q133(time spent daily on computer)	3.12(1.48)	3.05(1.50)	0.582
Q134a(time spent on email)	2.23(1.10)	2.33(1.01)	2.00
Q134b(time spent on Internet)	2.71(1.17)	2.48(0.98)	12.81*
Q134c(time spent on assignments)	2.78(1.05)	2.65(0.95)	5.50
Q134d(time spent programming)	1.78(1.06)	1.41(0.72)	54.84*
Q134e(time spent on games)	3.37(1.22)	2.63(1.20)	127.93*
Q158(likelihood of computer career)	2.92(1.43)	2.70(1.38)	7.91

* indicates significance at 0.001.

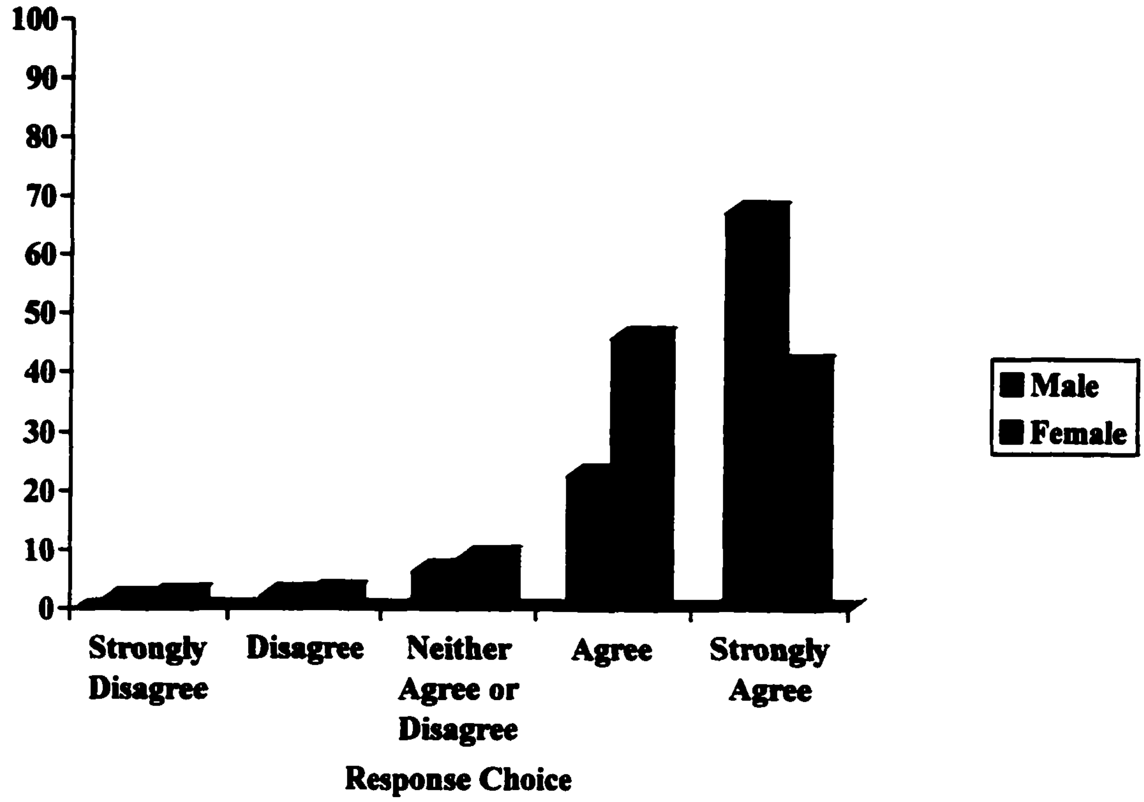
the frequencies of responses shows that overall, 91.% of Grade 7 students indicated that they agreed or strongly agreed with the statement "I like computers" whereas only 83.9% of Grade 10 students indicated the same responses. Overall, the results for Q131 were consist with the hypothesized outcome that no interaction effect would be found for grade and gender. The results of the MANOVA were consist with the hypothesis that boys would indicate that they liked computers more so than their female peers.

4. **Will there be an interaction effect between males and females, grade 7 and grade 10 student's perceived self-ability for computers?**

There was no significant gender by grade interaction effect . Results from an MANOVA revealed two areas of significant differences, gender and grade. The means scores were 4.29 (SD=0.93) for boys and 3.96 (SD=0.95) for girls. This indicates that more often boys perceived that they were good at computers than the reports of the girls (F{1, 1413}=40.69, p>.001). Examination of the frequencies of responses to this question show some interesting findings. Figure 3 shows the frequency of responses for males and females for Q131. This shows that, more than half (52.3%) of males reported that they strongly agreed with the statement "I am good at doing things on the computer", whereas only 30% of females indicated the same response. Overall, examination of the MANOVA and the frequencies for this item indicate that boys have significantly higher perceived ability for computers than girls. Analysis also revealed significant means score differences for grade. The means scores were 4.21 (SD=0.95) for grade 7 and 3.97 (SD=0.94) for grade 10, indicating that grade 7 students reported higher perceived ability for computers than grade 10 students (F{1, 1413}=22.01, p>.001).

Figure 2

Frequency of Students' Responses to Q131 (I like computers) for Gender.



The results for this question were consistent with the hypothesized outcome that boys have higher perceived ability for computers than their female peers.

6. Will there be an interaction affect between males and females, grade 7 and grade 10 student's daily time spent on the computer?

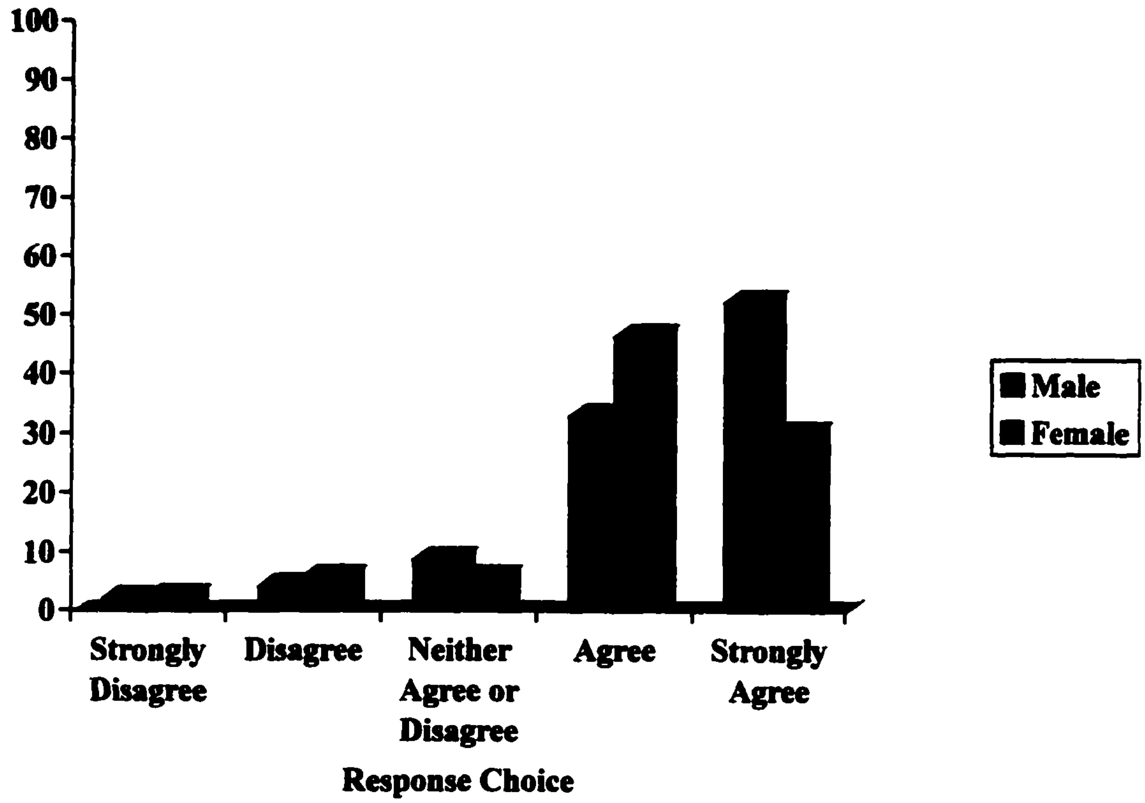
For this question 5 possible answers were given (1=less than 15 minutes, 2=about 30 minutes,3= about 45 minutes, 4= about an hour, 5=more than one hour). Results from an MANOVA revealed no significant gender by grade interaction effect. However a significant difference was found for gender ($F\{1, 1, 1410\}=43.05$, $p>.001$). The mean scores were 2.84(SD=1.45) for females and 3.38(SD=1.48) for males, thus showing that per day, boys spend more time on the computer. Frequencies of responses for this survey item are shown in Figure 4. Alarmingly, over 20% (22.7%) of females responded that they spend less than 15 minutes on the computer daily. In contrast, only 14.2% of males indicated the same response. These results were consistent with the hypothesized outcome that boys spend more time per day on the computer than girls

7. Will there be an interaction affect between males and females, grade 7 and grade 10 student's responses to what activities they perform on the computer?

For this question students were asked to indicated how much time they spent on the following activities: email, surfing the net, assignments/work on the computer, programming, and playing games. They were given 5 possible answers for these items (1=none of the time, 2=less than half the time, 3=half the time, 4=more than half of the time, 5=all of the time) and MANOVA analysis indicated several significant differences. In regards to time spent on email a significant difference was found for gender ($F[1,1414\}=67.50$, $p>.001$). Girls indicated that they spent more time on email when on

Figure 3

Frequency of Student's Responses to Q132 "I am good at doing things on the computer" for Gender.

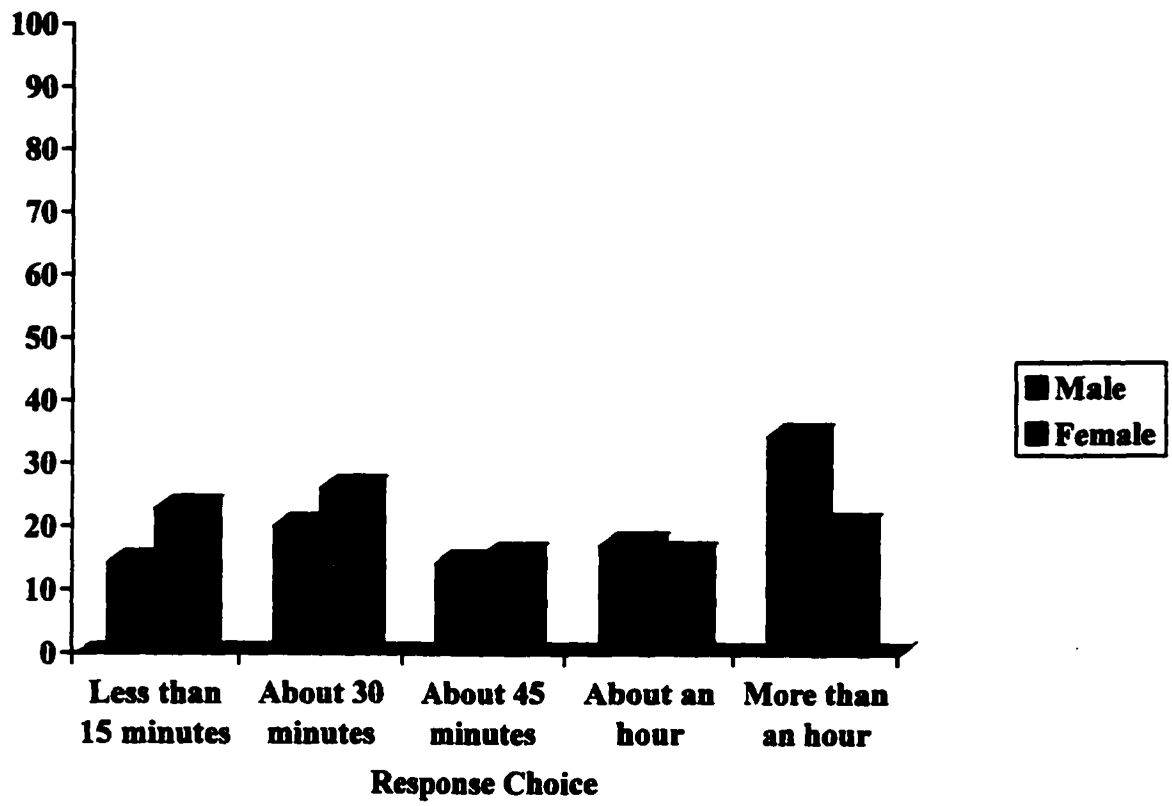


the computer. The mean scores were 2.48(SD=1.10) for girls and 2.02(SD=0.97) for boys. These results support the hypothesized outcome that girls spend more time on email than boys do. No significant difference was found between grade 7 and grade 10 students' responses to this question (F{1, 1414}=2.00, p=.158).

In regards to time spent surfing the Internet, multivariate analyses of variance revealed significant differences for gender and grade. For gender the mean scores were 2.50(SD=1.07) for girls and 2.77(SD=1.14) for boys. This difference was statistically significant indicating that boys spend more time on the surfing the Internet than girls (F{1, 1404}=21.64, p>.001). These results were similar to the hypothesized outcome that boys spend more time on the Internet than their female peers. In reference to grade, significant differences were found between the grade 7 and grade 10 means, which can be seen in Table 2 (F{1, 1404}=12.81, p>.001). Grade 7 students reported spending more time on the Internet than Grade 10 students. Students were asked to indicate how time they spent completing assignments or doing work on the computer. The mean scores for this question (Q134c) can be seen in Table 1. The difference between female and male mean scores for this answer was significant (F{1, 1412}=21.22, p>.001). Overall, females indicated that they spent more time on completing assignments and doing work on the computer than their male peers. Examination of the response frequencies (See Figure 5) show some interesting findings. Over 25% of females (27.2%) indicated that they spend more than half to all of the time on the computer doing assignments, in contrast to less than 20% (19.3%) of males. Overall, girls reported spending more time using the computer for assignments.

Figure 4

Frequency of Student's Responses to Q133 " In a typical day, how much time do you spend on the computer for gender.



No significant differences were found between grades on amount of time spent using the computer for assignments.

In regards to time spent on programming, the MANOVA results indicated significant differences for both gender and grade. For gender, the mean score for females was 1.39(SD=0.76) and 1.92(SD=1.07) for male ($F\{1, 1408\}=95.41$, $p>.001$). What is especially interesting is the results that emerge from the response frequencies for this question (see Figure 6). Alarmingly, over 70% (73.3%) of females indicated they spent none of their computer time programming. This was significantly different from the 45.5% of males who indicated the same response. Overall, the results indicate that boys are spending significantly more time programming then their female peers. For grade, a significant difference was found between grade 7 and grade 10 mean scores ($F\{1, 1408\}=54.84$, $p<.001$). The mean scores for grade 7 was 1.78(SD=1.06) and 1.41(SD=0.72) for grade 10. These results indicate that grade 7 students spend more time programming than students in grade 10.

8. Is there an interaction affect between males and females, grade 7 and grade 10 students' future career plans regarding Information Technology?

For this question students were asked to indicate were asked, as it stands now, if they would likely enter a career in Information Technology. Results of a multivariate analysis of variance indicated significant differences for both gender and grade ($F\{1, 1372\}=174.10$, $p>.001$). In regards to gender, the mean score was 3.34(SD=1.44) for males and 2.39(SD=1.22) for females.

Figure 5

Frequency of Student's Responses to Q134c "When you are on the computer how much time do spend on (assignments/work on the computer)?"for gender.

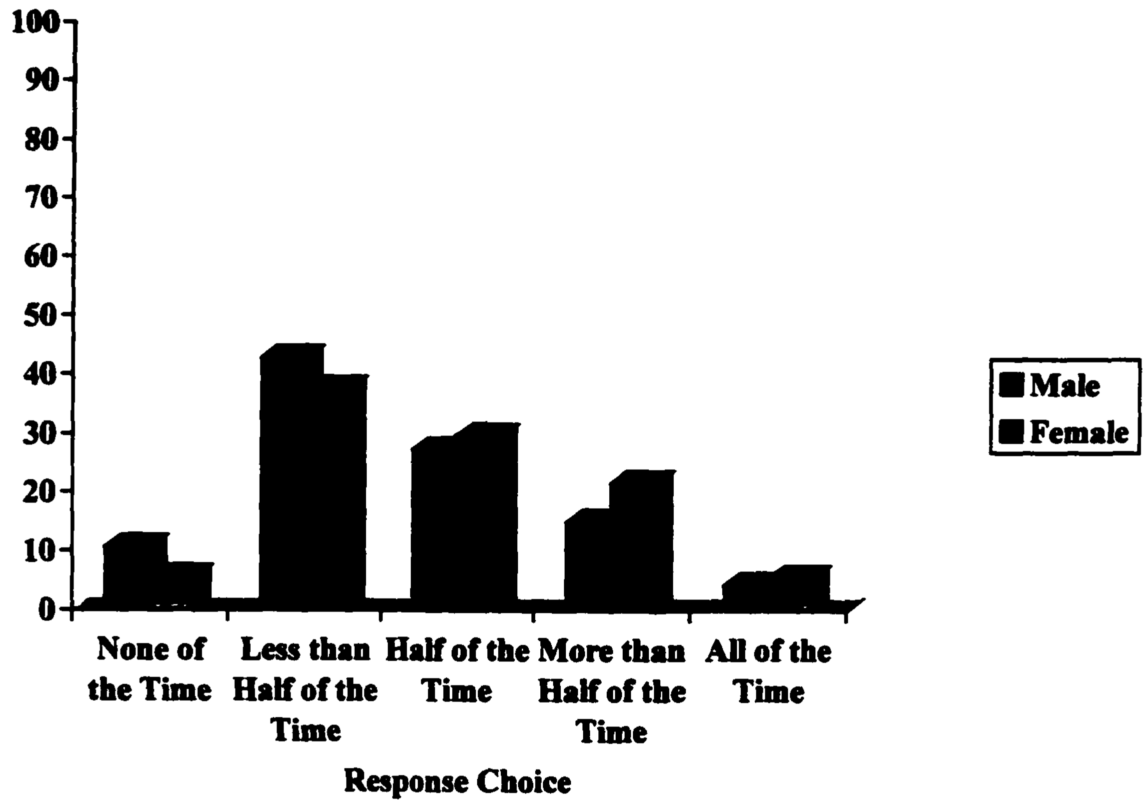
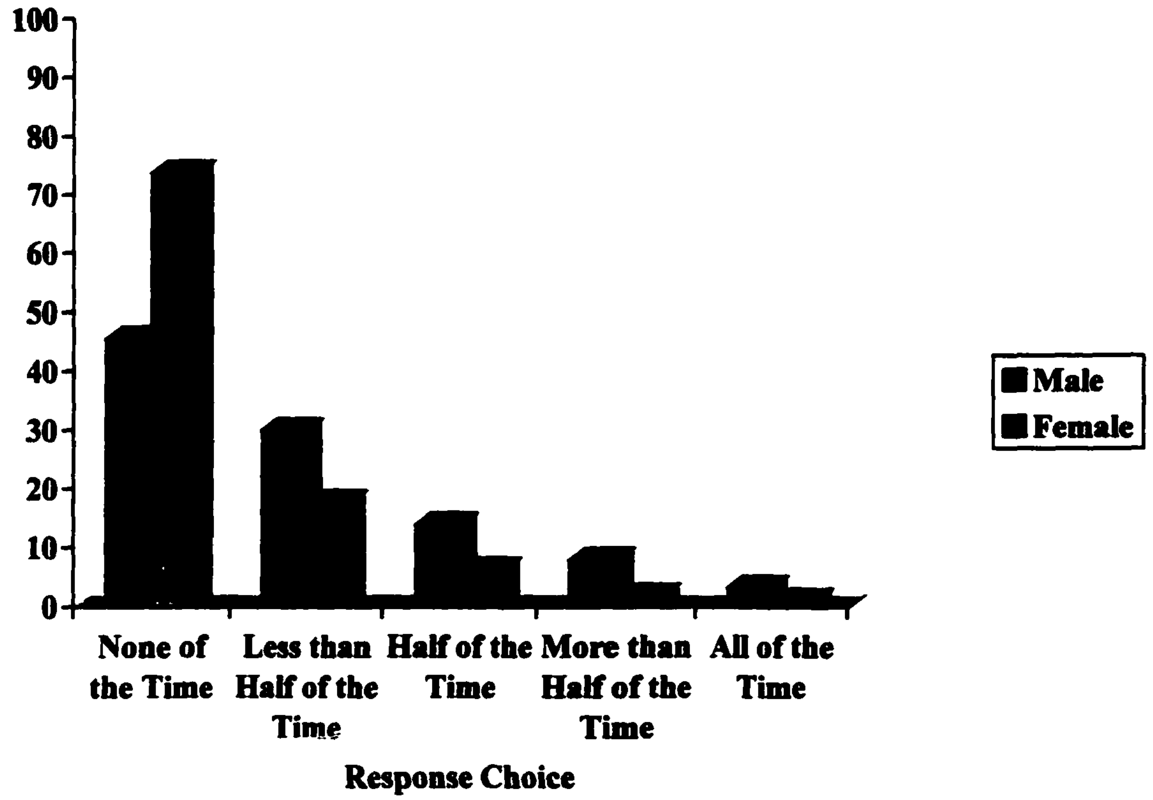


Figure 6

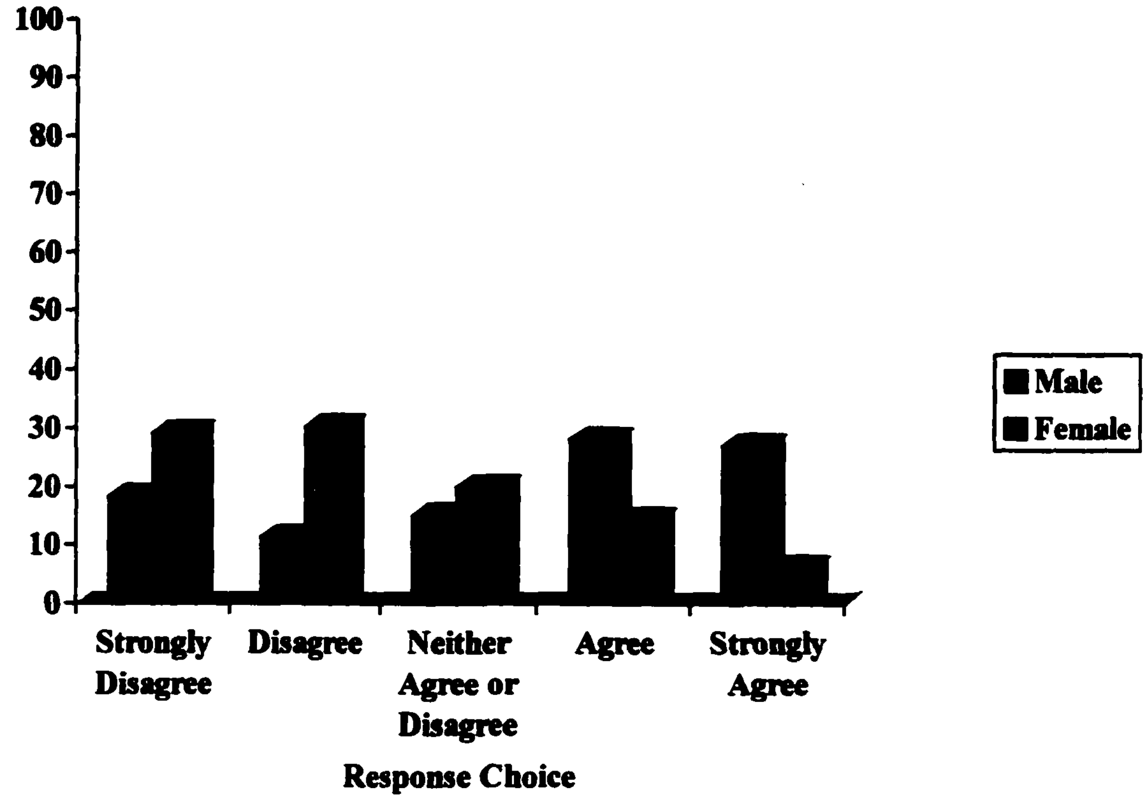
Frequency of Student's Responses to Q134d "When you are on the computer how much time do you spend on (programming)?" for gender



These results indicate that males were more likely to have future career aspirations for information technology and/or computer science. Strikingly, examination of the response frequencies for this question indicated that over half of the girls surveyed (59.5%) either strongly disagreed or agreed with the statement "As it stands now, I will likely choose Information Technology as a career option". In contrast, less than a third (29.6%) of the boys gave similar responses. Over 50% of the boys surveyed (55.3%) either agreed or strongly agreed that they would choose IT as a future profession. Disparagingly, only 20.6% of the girls surveyed indicated that they would choose computers as a career. Figure 6 shows the percentage of both male and female responses for this question.

Figure 7

Frequency of Students' Responses to Q158 "It is likely that I will choose Information Technology as a career option." for Gender.



Chapter V

Discussion and Implications

Overall, the literature pertaining to the topic of girls and computers has not portrayed a positive picture (AAUW, 2000; Chan, Stafford, Klawe, & Chen, 2000; DeBacker & Nelson, 2000; Schumacher & Martin, 2001). Girls are reporting significantly less sophistication in their computer applications, less positive attitudes, and more computer reticence than their male counterparts (Kiesler, Sproull, & Eccles, 1985; McIlroy, Bunting, Tierney, & Gordon, 2001; Turkle, 1988). What is disparaging about this fact is that several major initiatives have been adopted by educational institutions to address computer literacy and competency across curriculums.

In Alberta, the education minister along with Alberta Learning has implemented their *ICT Program of Studies* (Summary available at http://ednet.edu.gov.ab.ca/ict/) The philosophy of this program states that students across all ages will be encouraged to grapple with the advantages and disadvantages of technology in our lives and places of work. Instruction and exploration of the technological world will be infused within the core courses rather than stand alone. The rationale for this addition to the Alberta curriculum points to the fact that technology has an enormous impact on human lives today and students need to be ready and capable for the technological challenges (Alberta Learning, 2000). With this massive initiative to ensure that all students receive quality and progressive technology skills it is interesting to examine if this theory has been put into practice. The current study examined several computer-related issues to which this ICT Program of Studies claims to foster.

The current study investigated the computer attitudes, experiences, and future career ideations of males and females in grades 7 and 10. Questions were asked to determine if gender differences exist between girls and boys in relation to these technology related areas. Discussion of the results will include the following sections: gender differences in computer experiences; gender differences in computer attitudes, and gender differences for future career ideations. Education implications will be addressed, followed by discussion of the study's limitations and ideations for future research directions.

Gender Differences in Computer Experiences

The current study asked students several questions concerning their computer experiences. Interestingly, the present study found no gender differences in relation to the age of computer use onset, ownership of computers, and where students first used a computer. This gives promising indications that the gender gap that was once witnessed in these areas is now closing. Previously, researchers found that boys were more likely to report owning a computer and using a computer at an earlier age than their female peers (Groundwater-Smith, 1994; Bannert & Arbinger, 1996, Schumacher & Martin, 2001). The discrepancy in the current findings, however, may be the result of time. Significant changes in the information and computer technology world have occurred within the last five years (LaMorte & Lilly, 2001). Statistics Canada (2000) identified Calgary and Ottawa as the two most Internet ready, computer wired, cities across Canada. This combined with the introduction of provincially mandated computer technology curriculum and the enormous growth of the World Wide Web have increased the computer access for many children and young adults (Alberta Learning, 2000; Chan, Stafford, Klawe, & Chen, 2000; Schumacher & Martin, 2001). Suggestively, these factors have helped to contribute to the gender neutrality among computer ownership and age of first computer usage.

Students in the present study were asked to indicate how much time they spend, per day, using the computer. Reportedly, boys are spending significantly more time daily on the computer than their female peers. Strikingly, over 50% of the surveyed boys indicated that they spend an hour or more than one hour on the computer daily. In contrast, less than 35% of females surveyed indicated similar responses. In fact, 48% of the females surveyed indicated that they spend less than 30 minutes per day on the computer. These reports are disparaging in light of what is known about the philosophies and mandates of Alberta Leaning in regards to computer instruction (2000). Students are supposed to be receiving comprehensive computer training across the curriculum in Alberta's public school systems, yet how can this be possible with the glaring gender differences in regards to time spent on the computer? While this program is still in the preliminary stages of implementation, it would be very interesting to re-investigate these questions 5 years from now and determine if the ICT Program of Studies has made an impact on students' computer experiences. Crucially, this is an area that needs to be addressed and ratified.

The current study was also interested in examining the computer activities that students are performing when they are using technology. Students were asked to indicate what activities they completed on the computer and proportionally how much of their computer time they spent on each of these activities. Overall, gender differences were found for all of the activities listed. In regards to email, girls reported significantly more time spent on emailing than the surveyed boys. This is not surprising and has been supported by many researchers (Bannert & Arbinger, 1996; Chan, Stafford, Klawe, & Chen, 2000). Taylor, Gilligan, and Sullivan (1995) state that females are more likely to choose activities which increase opportunities for collaborations, connectedness, and communication. Thus, it is not surprising that female students report using the technological communication medium that is email. This area needs further examination of how to incorporate email to increase knowledge and information collection. This idea will be further discussed in a later section.

It is not surprising that more students today are using the Internet more than ever before. With over 1 billion web-sites now available to Internet users, the World Wide Web has become a Mecca of digital information. Students in the present study were asked to indicate how much of their computer time they devoted to surfing the Internet. Unfortunately, a significant gender difference was found favoring males. Boys significantly spent more time surfing the Internet than the girls in this study. Interestingly, a significant difference was also found for grade, favoring grade 7 students. This finding may be the result of the increased exposure young children are having to computers, more so than even 5 years ago (Chan, Stafford, Klawe, & Chen, 2000).

Importantly, Internet expertise and experiences have been found to have important educational and economic benefits (Schumacher & Martin, 2001). These researchers claim that educational institutions increasingly use the Internet for courses, research, and virtual education, making Internet access and skills critical for students. Krueger (1993; as cited in Schumacher & Martin, 2001) found that individuals who used the Internet had more efficient access to information and 77% surveyed reported that being on-line helped them to be more productive.

Access to the Internet has been found to be correlated with higher rates of pay and leveling salaries (Avon Products, 1997; as cited in Schumacher & Martin, 2001). Unfortunately, the current study did not ask surveyed students about their access to Internet. This information would be beneficial to help researchers and educators develop adequate technology related curriculum for both in school use and through virtual education programs. Interestingly, Goldman-Segall (1998) states through high-tech tools, children can learn by sharing information with one another, similar to the style of education seen before the days of institutionalized schooling. In fact, Goldman-Segall indicates that children can be extremely influential in the education of other children due to the increased level of trust and similarities. Thus, the research has shown that having defined Internet skills as well as access to this information tool, has both educational and economic benefits.

Students in the current study were also asked to indicate how much time they used the computer for work (school assignments). A significant difference was found for gender favoring females. Overall, girls reported spending more time using the computer for homework and school assignments than the boys in this study. Several researcher have found similar results (Chan, Stafford, Klawe, & Chen, 2000; Leong & Hawamdeh, 1999; Bannert & Arbinger, 1996).

As previously discussed, technological fluency requires sophistication of computer skills, which are more advanced than just using the "tools". Programming has been identified as an extremely important aspect of tech fluency and is thought to be a higher order process of computer use. Students in the current study were asked how much of their time do they spend programming on the computer. Unfortunately, a significant difference was found for gender, favoring the surveyed boys. Over 70% of the girls surveyed indicated that they spend none of their computer time programming. In contrast, over 50% of the surveyed boys reported that they spend at least some of their computer time on programming. These findings suggest that girls are not as sophisticated in their computer use as their male peers. Similar findings have been found by numerous researchers (AAUW, 2000; Brosnan & Lee, 1998; Chan, Stafford, Klawe, & Chen, 2000; Schumacher & Martin, 2000). What is interesting is that the above mentioned research projects have been conducted within the last few years and provide some of the most up-to-date information regarding this topic. However, it is important to remember that new initiatives, like the Alberta Learning ICT Program of Studies, provide implications for a more promising, gender neutral future. Vitally, the research questions used for the current study should be reexamined in the few years to determine if changes are readily witnessed.

The last activity that students in the present study were queried on was the amount of time they spend playing computer games. Consistent with the hypothesized outcome, the results indicate that boys spend significantly more time playing games on the computer than their female peers. In fact, over 55% of the boys surveyed indicated that they spend more than half, to all of the time, playing games on the computer. In contrast, only 27% of the girls indicated similar responses. This is not surprising as many researchers have documented that the majority of the computer games software available on the market today is targeted at boys aged 12-25 (Huber & Schofield, 1998; Miller, Chaika, & Groppe, 1996). Similarly, Inkpen, Booth, Klawe, and Uptis (1995) found that girls liked games that were required more collaborating than competition. Unfortunately, the majority of computer games deal with topics of violence and competition (Inkpen, Uptis, Klawe, Lawry, et al., 1993). As Provenzo (1992) has shown, gender stereotyping in video games is a common occurrence, where women are often portrayed as prizes or victims. With what is available in terms of computer games it is not surprising that girls spend less time on these activities. The present study also examined students' attitudes towards computers. This topic will be addressed in the next section.

Gender Differences in Attitudes towards Computers

Students in the present study were asked to respond to "I like computers". As hypothesized, boys reported liking computers significantly more than the surveyed females. Similar results have been found by other researchers (Chen, 1986; Kiesler, Sproull, & Eccles, 1985; AAUW, 1998, 2000; Schumacher & Martin, 2001). Interestingly, examination of the research of the last few decades has not revealed much of a change in this pattern. Similar results for computer affinity were found in the early 1980s and are still readily witnessed today. Repeatedly, girls report less affinity for computers than their male peers. This lack of affinity places females at an increased disadvantage within the technology sphere as numerous researchers have suggested that with affinity for a subject comes increased achievement and advancement (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999; Eccles, Roeser, Wigfield, & Freedman-Doan, 1999; Huber & Schofield , 1988; Miller, Chaika, & Groppe, 1996).

The current study also examined student's perceived ability for computers. Dishearteningly, boys reported significantly more perceived ability for computers than the surveyed girls. In fact, over 85% of the boys, in the current study, indicated that they either agreed or strongly agreed with the statement "I am good at doing things on the computer". In contrast, over 20% of females responded that they had no opinion or that they disagreed or strongly disagreed with this statement. These results are similar to those previously found by several researchers (Ayersman, 1996; Levine & Donitsa-Schmidt, 1998; Schumacher & Martin, 2001; Sussman & Tyson, 2000; Zeldin, Am & Parjare, 2000). Eccles, Barber, Jozefowicz, Malenchuk, and Vida (1999) stated that low perceived ability in academic subject areas has a direct link to the performance of this student.

With all that is known about the importance of the adolescent development of attitudes and experiences where does this leave females in their future ideations for technology related careers? According to Eccles and her colleagues, attitudes and perceptions that are formed in adolescence are often stagnant over time (Eccles, 1983, 1987, 1994; Eccles & Midgley, 1989). This knowledge should then be used to help foster positive attitudes and experiences among adolescents to encourage their full potential for the computer sciences and information technology.

Gender Differences in Future Career Ideations

Students in the current study were also asked to indicate the likelihood that they would choose Information Technology (computer scientist/computer engineer) as a future career option. The results from this item were consistent with the hypothesized outcome, that boys would report significantly more agreement that they would choose this area as a career. Remarkably, over 55% of the boys surveyed indicated that they either agreed or strongly agreed that they would choose information technology as a future career. In contrast, only 20% of females indicated similar patterns of responses. What is disparaging about this statistic is that the trends of women staying out of the computer related spheres appears to be continuing with the next generation of girls. Despite the fact that girls are just as likely to begin their computer experiences at the same age as boys, somewhere along the way they lose their interest for this genre. The proverbial computer technology playing field does not remain level for the genders.

Significance of the Results

The results found within the current study are startling and puzzling at the same time. Consistently, the reports from students have indicated that boys and girls are just as likely to own computers and use computers at the same early age thus starting them off relatively equal for background computer demographics. However, within a few short years the attitudinal patterns, experiences, and future career ideations begin to separate for the genders. Boys are reportedly spending more time on the computer, they have more positive attitudes towards computers, they are using the computer for more sophisticated applications, and are more likely to consider information technology as a career. Strikingly, these results are still being seen despite advantageous initiatives like those of Alberta Learning's ICT Program of Studies. Is this due to stereotypes about computers? Is this due to negative experiences with computers? Can familial attributes account for some of the witnessed differences? All of these questions need to be addressed in the future.

To be fair, the mandate set out by Alberta Learning is relatively new and will need appropriate time and course to develop and mature. Nevertheless, the research can provide educators and curriculum developers with some keen strategies to encourage the technological development of all learners. Several researchers' strategies are recommended for those interested in applying them into computer-related learning centers (Please see Koch, 1996; AAUW, 2000; Chan, Stafford, Klawe, & Chen, 2000).

Educational Implications and Recommendations

Three main educational implications emerge from the current study's findings. First and foremost, there is confirmation of the influential impact that experiences and attitudes have on computer related choices and achievement. The findings of the current study, along with some previous research, indicates that these factors greatly influence children's decisions about computers. Therefore, it is necessary to educate and encourage educators and parents to provide supportive, encouraging opportunities for their children to be successful with computers. By doing so, they greatly increase the likelihood that these children will form positive attitudes and affects towards technology thereby keeping yet another career option open. In sum, by helping students' to develop positive attitudes and to have positive experiences with computers, teachers and parents can help to prevent the gender gap from widening.

Secondly, this study reveals that the current practices are not disinhibiting these gender differences form occurring. All students must have equal opportunity to learn with and about computers to ensure equity. While many schools and educational authorities aggressively pursue strategies to improve access to technology, there is little experimental research to confirm or counter such an approach (Bain, Hess, Jones & Berelowitz, 1999). Several researchers have addressed the issue of including girls equally within the computer spheres and have made some progressive and effective recommendations for such programs (AAUW, 2000; Kiesler, Sproull, & Eccles, 1985;

Koch, 1996). Collectively, recommendations for curriculum development within the information technology domains can include providing successful mentoring relationships and to ensure that computers are used across all subject areas. Regardless of the strategy, the important factor for educators and teachers to ensure is that all learners develop their technology skills to the best of their abilities.

The third educational implication to emerge is the necessity to foster positive computer development (increased sophistication of applications, positive attitudes and experiences) and career awareness of information technology and computer science. The research has shown that females tend to be unaware of the potential for computer-related careers (Silverman & Pritchard, 1996; Pain, Owen, Franklin, & Green, 1993). By giving girls the knowledge of what careers are available within information technology and computer science this would encourage these girls to consider these options for later employment. Particularly beneficial are mentoring and job-shadowing programs which encourage children to find out exactly what people who currently work in the technology sectors do. Whether it is in the form of job-fairs, job-shadowing or mentoring these programs allow girls to witness firsthand, the number of potential future occupations that are available to them. Children need to see multiple role-models who are successful in their careers, particularly those in computer science and information technology, rather than only seeing a limited, stereotyped picture of their opportunities.

Limitations of the Current Study

The current study encountered some limitations that were difficult to avoid and require some discussion. The following section discusses the implications of these limitations in regards to the present research.

First, the current study examined only the responses of adolescents. A parallel survey of younger children (elementary aged) is required to understand at what age these gender differences emerge. Eccles , Buchanan, Flanagan, Fuligni, Midgley, and Yee (1991) state that adolescent development is quite different from that of elementary aged children, therefore their experiences are often different as well as their attitudes.

Second, the current project did not ask students about their access to the Internet, rather it only asked them about their Internet experiences. It would be interesting to see how many students had access to Internet at home and at school, how much time they spend on the Internet per day and what kinds of things (besides email and surfing) they use the Internet for. As previously stated, Lupart and Cannon (2000) reported that Calgary, Alberta is one of the most Internet-wired cities in Canada. Consequently, the predicted percentage of students with Internet access would be quite high. The current study did not query students about their Internet access at home and at school. Further investigation is required. However, without actually gathering this information the researchers are left to speculation.

It is difficult to generalize the findings of the current project to other areas given the extensive diversity of Canada, and therefore similar studies in other regions of the country are recommended. In January and February of 1999, more than 9 out of every 10 students at the elementary, intermediate and secondary levels in Canada attended schools that had access to the Internet for educational purposes (Perrier, 2000). Perrier also states that provinces such as Nova Scotia, who have a student to computer ratio of 15-to-1 may not have as equal access to the Internet as their Alberta peers. Alberta was ranked number 1 in terms of student to computer ratio (6 students per computer) (Perrier, 2000).

It would also be interesting to tease out the difference, if any, between urban and rural Internet access.

Overall, the current study has few limitations but does lead the researchers to ideas for future studies.

Future Studies

The larger study, which provided the current project with data, qualitatively asked more in-depth questions concerning students' computer beliefs, expectations, and experiences. However, this data was not used for the current study. It would be beneficial for future examinations to investigate these computer related topics.

The review of the relevant literature provided some excellent theoretical ideas for computer curriculum development to favor both genders equally. Future research endeavors should examine the effects of these initiatives to examine their effectiveness and their ease of implications within the school systems. Alberta Learning's ICT Program of Studies would benefit from independent examination to determine the effectiveness of the program as well as to help pin-point areas of potential refinement.

Future researchers interested in the study of gender differences in relation to computer experiences and attitudes may want to examine the effect of job-shadowing, mentoring, and career awareness on adolescent girls. The literature has shown that girls tend to be less informed and more unaware of the future computer related career options that are available to them. Mentoring programs, where an adolescent girl would be matched with a successful women who is working in the information technology sectors, may be beneficial to changing some to the gender differences so readily witnessed today.

In conclusion, the literature and the research has shown an increased need for more investigation in tot the gender differences that are witnessed within the computer technology related industries. It is important that all children be allowed to learn freely and equally and that all educators and parents ensure that all learners are valued.

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Appendix A

Academic Choices and Achievement Survey

Academic Choices and Achievement Survey (Lupart, Cannon, & Rose, 1999)

Name: ____________

School: ____________

Grade: ______

We appreciate you participating in this study with us, and hope you will find this questionnaire both interesting and fun! The following pages contain a variety of questions about your activities, interests, likes, abilities, future plans, etc. We are interested in your opinion about these matters. Please read and answer each item carefully, and remember, there are no right or wrong answers. If you don't understand a question, don't spend a lot of time on it. Just go on to the next question.

All your answers will be kept confidential. Only those working on this research project will see your answers.

Part 1 Background Information

1. What is your date of birth? Month______ Day______ Year______

2. Are you a ______1) Female ______2) Male

3. Who do you live with?
   _____Mother and father together
   _____Mother only
   _____Father only
   _____Mother + other adult
   _____Father + other adult
   _____Part of the time with each parent
   _____Other (specify) ____________________

	None	One	Two	Three	Four or more
4. How many brothers do you have?	❑	❑	❑	❑	❑

	None	One	Two	Three	Four or more
5. How many sisters do you have?	❑	❑	❑	❑	❑

6. What is the highest level of education your parent(s) received?

Mother

some grade school	some high school	high school graduate	university, technical school or college
❑	❑	❑	❑

Father

some grade school	some high school	high school graduate	university, technical school or college
❑	❑	❑	❑

		English	Other
7.	What language is most often spoken at home?	❑	❑

		Language Arts/ English	Math	Science
8.	Which of the following courses are you taking at this time?	❑	❑	❑

Part 2 General Questions About Yourself

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
9.	I do my schoolwork because I want to learn new things.	❑	❑	❑	❑	❑
10.	I do my schoolwork because it's fun or interesting.	❑	❑	❑	❑	❑
11.	I do my schoolwork because I feel bad if it's not done.	❑	❑	❑	❑	❑
12.	I do my schoolwork because the teacher says I have to.	❑	❑	❑	❑	❑
13.	I do my schoolwork because it makes my parent(s) happy.	❑	❑	❑	❑	❑
14.	If I get stuck on a problem or make a mistake, I try and figure it out by myself, rather than asking the teacher for help.	❑	❑	❑	❑	❑
15.	When a group I belong to plans an activity, I would rather organize it myself than have someone else organize it.	❑	❑	❑	❑	❑
16.	I feel that winning is important.	❑	❑	❑	❑	❑
17.	I like myself.	❑	❑	❑	❑	❑

Part 3 Questions About Your Dad

The following questions are about your dad or the person who is most like a dad to you. If this doesn't apply to you, go on to Part 4 - Questions About Your Mom

		Works full-time	Works part-time	Currently unemployed	Stay-at-home dad
18.	What is your dad's main job?	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
19.	My dad is happy with his main job.	❑	❑	❑	❑	❑
20.	I want to be like my dad.	❑	❑	❑	❑	❑
21.	No matter how well I do in school, my dad doesn't think it's good enough.	❑	❑	❑	❑	❑
22.	My dad takes an interest in my activities.	❑	❑	❑	❑	❑
23.	I worry about what my dad will say if I don't do well at school.	❑	❑	❑	❑	❑
24.	I like being with my dad.	❑	❑	❑	❑	❑
25.	If I need help with my homework, I can count on my dad.	❑	❑	❑	❑	❑

Part 4 - Questions About Your Mom

The following questions are about your mom or the person who is most like a mom to you. If this doesn't apply to you, go on to Part 5 - General Questions About Your Parent(s)

		Works full-time	Works part-time	Currently unemployed	Stay-at-home mom
26.	What is your mom's main job?	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
27.	My mom is happy with her main job.	❑	❑	❑	❑	❑
28.	I want to be like my mom.	❑	❑	❑	❑	❑
29.	No matter how well I do in school, my mom doesn't think it's good enough.	❑	❑	❑	❑	❑
30.	My mom takes an interest in my activities.	❑	❑	❑	❑	❑
31.	I worry what my mom will say if I don't do well at school.	❑	❑	❑	❑	❑
32.	I like being with my mom.	❑	❑	❑	❑	❑
33.	If I need help with my homework, I can count on my mom.	❑	❑	❑	❑	❑

Part 5 - General Questions About Your Parent(s)

The following questions are about your parent, parents or guardian.

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
34.	It is important to my parent(s) that I do things for myself.	❑	❑	❑	❑	❑
35.	I worry about letting my parent(s) down when I do my schoolwork.	❑	❑	❑	❑	❑
36.	It is important to my parent(s) that I stick to a job until it is done.	❑	❑	❑	❑	❑
37.	It is important to my parent(s) that I will be able to support myself and a family.	❑	❑	❑	❑	❑
38.	It is important to my parent(s) that I am employed regularly when I finish high school.	❑	❑	❑	❑	❑

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
39. It is important to my parent(s) that I go on to University or college after high school.	❑	❑	❑	❑	❑
40. It is important to my parent(s) that I do well in school.	❑	❑	❑	❑	❑
41. It is important to my parent(s) that I have a successful career.	❑	❑	❑	❑	❑
42. My parent(s) and I talk about what courses/options I should take in school.	❑	❑	❑	❑	❑
43. My parent(s) and I talk about the future jobs that I might have.	❑	❑	❑	❑	❑
44. My parent(s) praise me for doing well.	❑	❑	❑	❑	❑
45. My parent(s) encourage me to do the best on everything that I do.	❑	❑	❑	❑	❑

Part 6 - Questions About Math

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
46. I think the math that I will learn this year will be useful for my future.	❑	❑	❑	❑	❑
47. It is important to me to do well in math.	❑	❑	❑	❑	❑
48. I try to do the best I can in math.	❑	❑	❑	❑	❑
49. I find working on math assignments interesting.	❑	❑	❑	❑	❑
50. Compared to other subjects, math is useful.	❑	❑	❑	❑	❑
51. I like math.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
52.	I like math compared to other subjects.	❑	❑	❑	❑	❑
53.	I feel excited and challenged while doing math.	❑	❑	❑	❑	❑
54.	I would take more math courses even if I didn't have to.	❑	❑	❑	❑	❑
55.	I feel that a more advanced math course would be too difficult for me.	❑	❑	❑	❑	❑
56.	I have to work hard to get good grades in math.	❑	❑	❑	❑	❑
57.	I am going to do well in math this year.	❑	❑	❑	❑	❑
58.	I am going to do as well in math this year as my teacher wants me to.	❑	❑	❑	❑	❑
59.	I am going to do as well in math this year as my parent(s) want me to do.	❑	❑	❑	❑	❑
60.	If I were to rank all the students in a math class, from the lowest to the highest, I would put myself in the highest group.	❑	❑	❑	❑	❑
61.	I am good at math.	❑	❑	❑	❑	❑
62.	I am good at learning something new in math.	❑	❑	❑	❑	❑
63.	I would be successful in a career that required mathematical ability.	❑	❑	❑	❑	❑
64.	I get nervous when taking a test in math.	❑	❑	❑	❑	❑
65.	My heart beats faster when I take a math test.	❑	❑	❑	❑	❑
66.	No matter how hard I try, I feel I just cannot understand math.	❑	❑	❑	❑	❑

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
67. I get nervous if I have to explain my answer in front of a math class.	❑	❑	❑	❑	❑
68. In general, I feel comfortable or okay asking a math teacher for help.	❑	❑	❑	❑	❑
69. It is important to my parent(s) that I do well in math.	❑	❑	❑	❑	❑

	Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
70. In general, how much time do you spend on math homework most days?	❑	❑	❑	❑	❑

Part 7 - Questions About Language Arts/English

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
71. I think the Language Arts/English that I will learn this year will be useful for my future.	❑	❑	❑	❑	❑
72. It is important to me to do well in Language Arts/English.	❑	❑	❑	❑	❑
73. I try to do the best I can in Language Arts/English.	❑	❑	❑	❑	❑
74. Compared to other subjects, Language Arts/English is useful.	❑	❑	❑	❑	❑
75. I find working on Language Arts/English assignments interesting.	❑	❑	❑	❑	❑
76. I like Language Arts/English.	❑	❑	❑	❑	❑
77. I like Language Arts/English compared to other subjects.	❑	❑	❑	❑	❑

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
78. I feel excited and challenged while doing Language Arts/English.	❑	❑	❑	❑	❑
79. I would take more Language Arts/English courses even if I didn't have to.	❑	❑	❑	❑	❑
80. I feel that a more advanced Language Arts/English course would be too difficult for me.	❑	❑	❑	❑	❑
81. I have to work hard to get good grades in Language Arts/English.	❑	❑	❑	❑	❑
82. I am going to do well in Language Arts/English this year.	❑	❑	❑	❑	❑
83. I am going to do as well in Language Arts/English this year as my parent(s) want me to do.	❑	❑	❑	❑	❑
84. I am going to do as well in Language Arts/English this year as my teacher wants me to.	❑	❑	❑	❑	❑
85. If I were to rank all the students in a Language Arts/English class, from the lowest to the highest, I would put myself in the highest group.	❑	❑	❑	❑	❑
86 I am good at Language Arts/English.	❑	❑	❑	❑	❑
87. I am good at learning something new in Language Arts/English.	❑	❑	❑	❑	❑
88. I would be successful in a career that required writing and speaking ability.	❑	❑	❑	❑	❑
89. While I am taking a test in Language Arts/English I get nervous.	❑	❑	❑	❑	❑

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
90. My heart beats faster when I take a Language Arts/English test.	❑	❑	❑	❑	❑
91. No matter how hard I try, I feel I just cannot understand Language Arts/English.	❑	❑	❑	❑	❑
92. I get nervous if I have to explain my answer in front of a Language Arts/English class.	❑	❑	❑	❑	❑
93. I feel comfortable or okay asking a Language Arts/English teacher for help.	❑	❑	❑	❑	❑
94. It is very important to my parent(s) that I do well in Language Arts/English.	❑	❑	❑	❑	❑

	Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
95. In a typical day, how much spare time do you spend reading books, comic books, or magazines?	❑	❑	❑	❑	❑

	Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
96. In general, how much time do you spend on Language Arts/English homework most days?	❑	❑	❑	❑	❑

Part 8 - Questions About Science

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
97. I think the science I am learning now will be useful for my future.	❑	❑	❑	❑	❑
98. It is important to me to do well in science.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
99.	I try to do the best I can in science.	❑	❑	❑	❑	❑
100.	Compared to other subjects science is useful.	❑	❑	❑	❑	❑
101.	I find working on science assignments interesting.	❑	❑	❑	❑	❑
102.	I like science.	❑	❑	❑	❑	❑
103.	I like science compared to other subjects.	❑	❑	❑	❑	❑
104.	I feel excited and challenged while doing science.	❑	❑	❑	❑	❑
105.	I would take more science courses even if I didn't have to.	❑	❑	❑	❑	❑
106.	I feel that a more advanced science course would be too difficult for me.	❑	❑	❑	❑	❑
107.	I have to work hard to get good grades in science.	❑	❑	❑	❑	❑
108	I am good at science.	❑	❑	❑	❑	❑
109.	I am going to do well in science this year.	❑	❑	❑	❑	❑
110.	I am going to do as well in science this year as my parent(s) want me to do.	❑	❑	❑	❑	❑
111.	I am going to do as well in science this year as my teacher wants me to do.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
112.	If I were to rank all the students in science class from the lowest to the highest, I would put myself in the highest group.	❑	❑	❑	❑	❑
113.	I am good at learning something new in science.	❑	❑	❑	❑	❑
114.	I would be successful in a career that required scientific ability.	❑	❑	❑	❑	❑
115	When taking a test in science, I get nervous.	❑	❑	❑	❑	❑
116.	My heart beats faster when I take a science test.	❑	❑	❑	❑	❑
117.	No matter how hard I try, I feel I just cannot understand science.	❑	❑	❑	❑	❑
118.	I get nervous if I have to explain my answer in front of the science class.	❑	❑	❑	❑	❑
119.	Students seem to like the science class.	❑	❑	❑	❑	❑
120.	The science teacher is friendly to us.	❑	❑	❑	❑	❑
121.	The teacher makes science interesting in this class.	❑	❑	❑	❑	❑
122.	I feel comfortable or okay asking a science teacher for help.	❑	❑	❑	❑	❑
123.	My science teacher is more interested in smart kids than other kids.	❑	❑	❑	❑	❑
124.	My science teacher shows more interest in the progress of boys than of girls.	❑	❑	❑	❑	❑
125.	It is important to my parent(s) that I do well in science.	❑	❑	❑	❑	❑

	Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
126. In a typical day, how much spare time do you spend doing science activities like collecting rocks, collecting insects, or doing experiments?	❑	❑	❑	❑	❑

	Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
127. In general, how much time do you spend on science homework most days?	❑	❑	❑	❑	❑

Part 9 - Questions About Computers

	Yes	No
128. Do you (or your family) own a computer?	❑	❑

	5 or under	6-10	11-13	14 or over
129. At what age did you first use a computer?	❑	❑	❑	❑

	At a friend's house	At school	At a relative's house	At home	At work/ other
130. Where did you first use a computer?	❑	❑	❑	❑	❑

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
131. I like computers.	❑	❑	❑	❑	❑
132. I am good at doing things on the computer.	❑	❑	❑	❑	❑

		Less than 15 min.	About 30 min.	About 45 min.	About an hour	More than an hour
133.	In a typical day, how much time do you spend on the computer?	❑	❑	❑	❑	❑

134. **When you are on a computer, how much of the time do you spend doing each of the following activities?**

	None of the time	Less than half the time	Half of the time	More than half of the time	All of the time
Email	❑	❑	❑	❑	❑
Surfing the 'net	❑	❑	❑	❑	❑
Assignments/work on the computer.	❑	❑	❑	❑	❑
Programming	❑	❑	❑	❑	❑
Playing Games	❑	❑	❑	❑	❑

Part 10 - Questions About Your Future and Career Choices

In the future, I would like a job that . . .

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
135.	Allows me to earn a great deal of money.	❑	❑	❑	❑	❑
136.	Has high status in society.	❑	❑	❑	❑	❑
137.	Provides enough money to support me and my family.	❑	❑	❑	❑	❑
138.	Gives me a chance to work on challenging projects.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
139.	Allows me to be my own boss most of the time.	❑	❑	❑	❑	❑
140	Gives me a chance to learn new skills and new things.	❑	❑	❑	❑	❑
141.	Gives me an opportunity to make the world a better place.	❑	❑	❑	❑	❑
142.	Gives me the ability to combine career and family.	❑	❑	❑	❑	❑

As things stand now, it is likely that I will:

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
143.	Finish high school, then go on to University or College.	❑	❑	❑	❑	❑
144.	Do more than one University degree (e.g. Master's, PhD, become a medical doctor, lawyer).	❑	❑	❑	❑	❑
145.	Get married.	❑	❑	❑	❑	❑
146.	Have children.	❑	❑	❑	❑	❑

It is likely that I will choose the following as a career option:

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
147.	Service/clerical (like childcare worker, beautician, secretary).	❑	❑	❑	❑	❑
148.	Trade (like welder, carpenter, plumber).	❑	❑	❑	❑	❑
149.	Protective or military service (like police, officer, firefighter, military).	❑	❑	❑	❑	❑
150.	Full-time homemaker.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
151.	Farmer.	❑	❑	❑	❑	❑
152.	Artist (like designer, interior decorator musician, actor).	❑	❑	❑	❑	❑
153.	Healthcare worker (like registered nurse physical therapist, pharmacist).	❑	❑	❑	❑	❑
154.	Health professional (like doctor, dentist, veterinarian).	❑	❑	❑	❑	❑
155.	Science or math-related professional (like engineer, architect, geologist).	❑	❑	❑	❑	❑
156.	Human services (like teacher, social worker, counsellor).	❑	❑	❑	❑	❑
157.	Environment-related (like forestry, marine biologist, environmental engineer).	❑	❑	❑	❑	❑
158.	Information Technology (like computer scientist, computer engineer).	❑	❑	❑	❑	❑
159.	Other professions (like lawyer, accountant, architect, stock broker).	❑	❑	❑	❑	❑

Part 11 - Questions About Adult Roles in Society

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
160.	Men and women should contribute equally to the family income.	❑	❑	❑	❑	❑
161.	It is difficult for women to have successful careers and raise a family.	❑	❑	❑	❑	❑
162.	It is difficult for men to have successful careers and raise a family.	❑	❑	❑	❑	❑

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
163.	In general, men are better than women in science and engineering.	❑	❑	❑	❑	❑
164.	In general, women are better than men in math.	❑	❑	❑	❑	❑
165.	Women have better social skills than men do.	❑	❑	❑	❑	❑
166.	All in all, it is better for the family if the husband provides most of the family's income and the wife takes care of the home and family.	❑	❑	❑	❑	❑
167.	Babies and young children need to have their mothers around most of the time.	❑	❑	❑	❑	❑
168	It is okay for mothers of babies and young children to have a full-time job.	❑	❑	❑	❑	❑
169	Women are better wives and mothers if they also have a paid job outside the home.	❑	❑	❑	❑	❑
170.	If a husband and a wife both work full-time, the husband and wife should share the housework and childcare equally.	❑	❑	❑	❑	❑
171.	A working mother can establish just as warm and secure a relationship with her children as a mother who does not work.	❑	❑	❑	❑	❑
172.	Women can handle the pressure just as well as men when making an important decision on the job.	❑	❑	❑	❑	❑
173.	Having a job gives a wife a better chance to develop herself as a person than staying at home.	❑	❑	❑	❑	❑

Part 12 - Questions About Your Friends

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
174.	My friends influence the courses I will take in school.	❑	❑	❑	❑	❑
175.	My friends influence my future job plans.	❑	❑	❑	❑	❑
176.	In general, I prefer to do things with one or two friends, rather than with a large group.	❑	❑	❑	❑	❑
177.	For me, being popular with girls is important.	❑	❑	❑	❑	❑
178	I am popular with girls.	❑	❑	❑	❑	❑
179.	For me, being popular with boys is important.	❑	❑	❑	❑	❑
180.	I am popular with boys.	❑	❑	❑	❑	❑
181.	I am good at making new friends.	❑	❑	❑	❑	❑
182.	All of my friends are concerned about being popular.	❑	❑	❑	❑	❑
183.	My friends are very concerned with status in social situations.	❑	❑	❑	❑	❑
184.	All of my friends try hard at their studies.	❑	❑	❑	❑	❑
185.	All of my friends get along well with their parent(s).	❑	❑	❑	❑	❑
186.	Friends encourage me to do my best in school.	❑	❑	❑	❑	❑

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
187.	I would act dumber than I really am to be popular with my friends.	❑	❑	❑	❑	❑
188.	It's ok to let your schoolwork slip or get a lower grade in order to be popular with your friends.	❑	❑	❑	❑	❑
189.	To be popular with my friends I sometimes don't try as hard as I could in school.	❑	❑	❑	❑	❑

Part 13 - Questions About Who Raised You

190. Who is the person in your life who raised you – that is, the person who mostly took care of you from the time you were born until age 5. (circle the correct answer):

1. Mother
2. Father
3. Other - ________________ (describe the relationship - adoptive mother, grandmother, etc.)

Do you live with this person now? Yes / No

The following statements are about your relationship with that person.

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
191.	My parent only seems to notice me when I am angry.	❑	❑	❑	❑	❑
192.	I often feel angry with my parent without knowing why.	❑	❑	❑	❑	❑
193.	I get annoyed at my parent because it seems I have to demand his/her caring and support	❑	❑	❑	❑	❑
194.	I'm confident that my parent will listen to me.	❑	❑	❑	❑	❑
195.	I'm confident that my parent will try to understand my feelings.	❑	❑	❑	❑	❑
196.	I talk things over with my parent.	❑	❑	❑	❑	❑
197.	I enjoy helping my parent whenever I can.	❑	❑	❑	❑	❑
198.	I feel for my parent when he/she is upset.	❑	❑	❑	❑	❑

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
199.	It makes me feel good to be able to do things for my parent.	❑	❑	❑	❑	❑
200.	When I'm upset, I am sure that my parent will be there to listen to me.	❑	❑	❑	❑	❑
201.	I can count on my parent to be there for me when I need him/her.	❑	❑	❑	❑	❑
202.	My parent is always disappointing me.	❑	❑	❑	❑	❑
203.	I never expect my parent to take my worries seriously.	❑	❑	❑	❑	❑
204.	I think it is unfair to always have to handle problems by myself.	❑	❑	❑	❑	❑
205.	I get really angry because I never get enough help from my parent.	❑	❑	❑	❑	❑
206.	I get really angry at my parent because I think he/she could make more time for me.	❑	❑	❑	❑	❑
207.	I'm afraid that I will lose my parent's love.	❑	❑	❑	❑	❑
208.	I have a terrible fear that my relationship with my parent will end.	❑	❑	❑	❑	❑
209.	I'm certain that my parent will always love me.	❑	❑	❑	❑	❑

Appendix B

February 8, 2000

Dear Parent/Guardian:

My name is Dr. Judy Lupart. I am a professor in the Department of Educational Psychology at the University of Calgary, conducting a research project along with two co-investigators, Dr. Sarah Rose from the Community Health Department and Dr. Elizabeth Cannon from the Department of Geomatics Engineering. We have received approval from Calgary Roman Catholic Separate School District to carry out this research and we would like to invite your child to participate in our study "Gender Differences in Student Participation and Achievement in the Sciences: Choice or Chance?"

This letter is to provide information regarding our research project, so that you can make an informed decision regarding your child's participation. The purpose of this study is to investigate the key influences on junior and senior high school students' choices for various activities, courses and careers, particularly in the sciences. Overall there will be approximately 3,000 students participating in this part of the study and since we need to keep track of letters from four school districts and numerous schools **we would ask that you fill out and return the enclosed consent form whether or not you wish your child to participate.**

If you agree to have your child participate, he/she will be asked to complete a questionnaire designed to investigate achievement-related decisions and participation in academic activities and careers. In addition, we will require access to school awarded grades, provincial achievement data, and your child's provincial identification number acquired either through Calgary Roman Catholic Separate School District or Alberta Learning. The data collection will be carried out during school hours at your child's school, and it will require approximately 45 minutes to complete.

Participation in this study will involve no greater risks than those ordinarily experienced in daily life. You should be aware that even if you give your permission for participation your child is free to withdraw at any time for any reason without penalty. This includes your child's own decision not to answer a question. Results, which we will be reporting in published articles or graduate student theses, will ensure your child's complete anonymity, and no identifying data will be released to teachers. All information gathered from the questionnaires will be securely stored and will only be accessible to those who are directly involved with this research project.

If you have any questions, please feel free to contact me at 220-6280, or Andrea Lynch at the Office of the Vice-President (Research) at 220-7114. Two copies of the consent form are provided. Please return a signed copy, which indicates your decision concerning your child's participation in this research using the stamped envelope provided. The other copy can be retained for your records.

Thank you for your cooperation.

Sincerely,
Judy L.Lupart, Ph.D.

[redacted]

The information requested on this form is being collected pursuant to the *School Act – Freedom of Information and Protection of Privacy.* Information acquired through this form has been approved by the Calgary Roman Catholic Separate School District and will be kept secure and access to the information restricted to the researchers and their research assistants.

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your child's participation will involve. If you would like more detail about something mentioned here, please ask. Please take the time to read this information form carefully and to understand any accompanying information.

I/We understand that such consent allows the release of my child's school awarded course grades, provincial achievement test results, and provincial student ID number which would be obtained from either Calgary Roman Catholic Separate School District or Alberta Learning.

My/Our child will also be completing a student questionnaire, during a regularly scheduled science class, which will take approximately forty-five minutes to complete. The investigator will, as appropriate, explain to your child the research and his or her involvement, and will seek his or her ongoing cooperation throughout the project. (Parents or guardians must sign/co-sign for children).

I/We understand that participation in this study may be terminated at any time by my/our request or of the investigators. Participating in this project and/or withdrawal from this project will not affect my/our request or receipt of services from the school board or the university.

PLEASE TURN PAGE OVER

I/We understand that this study will not involve any greater risk than those ordinarily occurring in daily life.

I/We understand that all responses will be recorded with names being coded to ensure participant anonymity.

I/We understand that no personally identifying information will be released to teachers or used to report the data in any published reports.

I/We understand that all data, will be kept in a locked file cabinet in a locked office at the University of Calgary and destroyed five years after publication of the study results.

Your signature on this form indicates that you have understood to your satisfaction the information regarding your child's participation in the research project and that you agree or disagree to have your child participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. Your child is free to withdraw at any time. His or her continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your child's participation. If you should have further questions concerning matters related to this research, please contact:

Dr. Judy Lupart	220-6280
Dr. Elizabeth Cannon	220-3593
Dr. Sarah Rose	220-4297

If you have any questions concerning the ethics review of this project, or the way you have been treated, you may also contact the Office of the Vice-President (Research) and ask for Andrea Lynch, 220-2145. If you have concerns about the project itself, please contact the researchers.

THANK YOU FOR YOUR CONSIDERATION.

PLEASE INDICATE YOUR DECISION CHOICE BELOW:

I hereby give my consent for my child:

______________________________________to participate in this study:
(Please Print Full Legal Name of Child)

YES _____ **If YES, please provide student birth date:**

Month _____/Day__________ / Year ________

NO _____

***Since we need to keep track of approximately 5,000 replies from four school districts, we ask that ALL PARENTS/GUARDIANS please sign on the space below, and return this form in the enclosed, stamped envelope.**

_______________________________ _______________________

Signature of Parent/Guardian **Date**

*A copy of this consent form has been given to you to keep for your records and reference.

Appendix D

8 Survey Items Analyzed Through Chi-Square Analysis and Multivariate Analysis of Variance(MANOVA)

Q128. Do you (or your family own a computer? (chi-square)

Q129. At what age did you first use a computer? (chi-square)

Q130. Where did you first use a computer? (chi-square)

Q131. I like computers. (MANOVA)

Q132. I am good at doing things on the computer. (MANOVA)

Q133. In a typical day, how much time do you spend on the computer? (MANOVA)

Q134. When you are on the computer how much of the time do you spend on each of the following: (MANOVA)

a. Email

b. Surfing the net

c. Assignments/work on the computer

d. Programming

e. Playing Games

Q156. It is likely that I will choose the following as a career plan: Information Technology (like computer scientist, computer engineer). (MANOVA)

APPENDIX E.

<u>Response Frequency Distributions for 7 Selected Survey Items</u>

Q131 (I like computers)

Q132 (I am good at doing things on the computer)

Q133 (In a typical day, how much time do you spend on the computer)

Q134c (When you are on the computer how much time do spend on assignments/work on the computer.)

Q134d (When you are on the computer how much time do you spend on programming?)

Q158 (It is likely that I will choose Information Technology as a career option.)