The impact of technological experience and software experience on student attitudes.

Karen Barbara Pluard

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THE IMPACT OF TECHNOLOGICAL EXPERIENCE
AND SOFTWARE EXPERIENCE ON STUDENT ATTITUDES

by
Karen Pluard

A Thesis
Submitted to the Faculty of Graduate Studies and Research
through the Faculty of Education
in Partial Fulfilment of the Requirements for
the Degree of Master of Education at the
University of Windsor

Windsor, Ontario, Canada
1996
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Abstract

In this study the effects of gender, grade and experience, defined as technological experience on one hand, and software experience on the other, upon various attitudes were examined. Specifically, three sets of attitudes were examined: (1) the usefulness of technology to curriculum, career awareness, self and society, (2) anxiety, confidence, liking and usefulness, and (3) affective and cognitive domains. Three instruments were administered: the Vosburg Survey (1993, modified), the Computer Attitude Scale (Gressard & Loyd, 1986), and the Cognitive and Affective Attitude Scales (Bannon, Marshall, & Fluegal, 1985). The experimental group included 80 grade 10 and 11 students, who were surveyed after two years of intensive work with modern technological applications in their elementary school. The control group consisted of 78 students from the same high school who were of similar age and gender, but who did not have the same intensive elementary school background in the use of technology. Data showed that students with more technological experience had a more positive attitude with regard to liking technology. In addition, greater software experience was related to reduced anxiety and more positive ratings for curriculum, career awareness, self, society, and the cognitive domain. Moreover, greater software experience was related to more positive attitudes for males in the areas of confidence and liking.
Acknowledgements

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With gratitude the researcher thanks Dr. Larry Morton, the author’s advisor at the University of Windsor. The author recognizes the magnitude of the task of making this researcher competent in statistical analysis. Also, thank you, Drs. David Kellenberger and Joan Morrissey whose time and advice were greatly appreciated.

The final thanks are for my daughters Catherine and Andrea who always encourage their mother in all her endeavours. They never once questioned the fact that they had to lift me up when my load became too heavy.
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CHAPTER 1
INTRODUCTION

Since the onset of the information age, the necessity and relevance of technology has been promoted by all levels of government, business and education. Technology, in this study, referred to the most recent methods of computer application, including telecommunications, audio and video editing, laser disks, technological design and computer software. A recent document issued by the Ministry of Education and Training, The Royal Commission on Learning, January, 1995, recommended that Boards of Education develop a plan of action in conjunction with the Ministry, the private sector, and the universities and colleges to initiate a number of high profile and diverse projects on school computers and learning. These projects were to include a major infusion of computer software and hardware. The commission also recommended that students develop expertise in broad-based technology and that Boards of Education make these skills accessible to all students. Broad-based Technology referred to the use of all of the above technologies, plus, the technology used in courses related to design and graphics, auto-technology, food-management classes, and cosmetology.

Students introduced to modern technology have shown very positive attitudes toward the use of the new technology and learning using the
technology. Studies have shown that students exhibited increased self-esteem when they experienced better results in reading and writing following increased use of the technology (Dwyer, 1990; Kell & Gadzuk, 1990; Reece, 1986; Smith, 1982).

The Apple Classrooms of Tomorrow (ACOT) project gave each student and teacher the use of a computer at home and at school (Dwyer, 1990). This helped ensure that the student had adequate computer time to complete an assignment. The ACOT project demonstrated that students reported a higher degree of confidence in their ability to complete the assignment accurately following the increased use of the computer to complete their studies.

Yet, a problem reported in recent studies was that as students advanced into high school their level of enjoyment and perceived value of the use of technology decreased (Krendl & Brothier, 1991; Reece, 1986). These studies also found that the level of enjoyment decreased more for females than for males.

Since the infusion of more computer technology into the schools, researchers have been interested in a number of questions related to the attitudes of students toward the technology. For example, was the computer a useful tool and was it considered an asset in future employment (Gressard & Loyd, 1986; Vosburg, 1993)? Do students feel
anxious about using the technology and do they enjoy working with the technology (Gressard & Loyd, 1984)? Do students feel more confident about the use of the technology with more experience and do students feel that their work is of a higher calibre when technology is used to complete assignments (Dwyer, 1990; Dwyer, 1991). Bannon, Marshall, and Fluegal (1985) suggested positive affective and cognitive attitudes toward the use of the computer. Finally, of what significance are age/grade on the above attitudes about the computer (Chen, 1986)?

**Significance**

The Ministry of Education and Training in its newly released curriculum document *Broad-based Technological Education for grades 10, 11, and 12* (1995), indicated that all courses be integrated, student centred, and activity based. Moreover, these courses must use projects as the primary vehicle for learning, emphasize open-ended problem solving, and focus on the process as well as the product or solution. They must include three major areas (physical products, human process, and environmental systems) and the ten concepts used in technological education: structure, material, fabrication mechanism, power and energy, controls, systems, function, aesthetics, and ergonomics. The broad-based programs include communication technology, construction technology,
hospitality services, manufacturing technology, personal services, technological design, and transportation technology.

Many students who enter high school work at a high level of competency with the use of technology. They have been exposed to the relevance of technology to their studies in all disciplines at the elementary level. Yet some questions remain unanswered. Do students who have been exposed to educational technology continue to:

1. sustain an interest in the use of technology in their studies;
2. show that the use of technology is advancing them in their studies; and
3. show an enthusiasm for technological studies independent of grade or gender?

**Identification of the Problem**

An enormous amount of research has been compiled on the use of the computer to increase the competency of students especially in the areas of mathematics and reading skills (Burns & Bozeman, 1981; Menis, Snyder, & Ben Kohav, 1980; Teale, 1988; Valencia, Pearson, Peters, & Wilson, 1989; Weir, 1989). These studies focused on the improvement or lack of improvement in these disciplines and reported that students felt there was significant improvement in their mathematics and reading
skills.

Recent studies have measured the attitudes of students with regard to the use of technology in their studies after a few years of computer use (Koohang, 1986; Gressard & Loyd, 1984). Prior computer experience and the nature of that experience made a significant difference with regard to computer anxiety and confidence in use; more experience with the computer and software generated less anxiety and more confidence.

This study evaluated the attitudes of students who were surveyed in the fall of 1992. At that time these students were in grades seven and eight. These same students are now in grades ten and eleven, respectively. When first surveyed, students expressed a very positive attitude toward the use of modern technology (Vosburg, 1993). They also indicated that the use of the technology had enhanced their ability to succeed in the accurate presentation of the content of their assignments. When these students entered high school they had access to many forms of technology, including the computer, on a daily basis. They were able to apply technological skills to the resolution of most assignment problems in all subject areas.

One of the recommendations of the original researcher was to reevaluate students' attitudes at a later date to eliminate the influence of the "novelty" variable in the study (Vosburg, 1993). Vosburg felt that,
perhaps the reason the results were so positive was that the use of the equipment was new and exciting. Yet, would these students have the same attitude after the “novelty” of the program wore off?

The following questions were investigated:

1. Is there a difference in the affective and cognitive attitudes towards technology of the students who have had more experience in the use of the technology compared to those students with less experience?

2. Is an increased use of the technology related to a greater confidence and liking of technology?

3. Are differences in students' attitudes towards the use of technology related to differences in gender and grade level?
CHAPTER II
LITERATURE REVIEW

Yeaman (1991), stated that where the quality of education was once rated on the ratio of teachers to students, it is now rated on the ratio of computers to students. The development of the use of technology has expanded to include, not only the microcomputer, but, also several other forms of technology such as CD-Rom, audio-editing, video filming and editing, laser disks, lego, and robotics. Students have developed skills in the use of this technology at the elementary school level. Often, students have expressed pleasure in working with the new equipment and have the attitude that such technology has improved their ability to achieve better grades in their academic work (Vosburg, 1993).

Usefulness Attitude

Yet, is the knowledge of the technology made available to students usefully applied in their daily lives? Do these students perceive a need for this expertise in order to be proficient in their career choices? To answer these questions, researchers such as Vosburg (1993) and Gressard and Loyd (1986) researched the attitudes of students about the usefulness of computer technology to their lives.
In order to determine if technology was useful to students, Shell Oil partnered with an elementary school to build a three-lab technology centre in a particular school. In the fall of the second year, a study was completed using all participants in the program. All students from grades K-8, all teachers, parents, support staff, administrators, board members, and Shell resource partners were surveyed about their attitudes regarding the project. Vosburg (1993) surveyed the 106 students in grades 7 and 8 to evaluate their attitudes. The following questions were addressed:

1. Do students have a positive attitude toward technology?
2. Do students have a positive attitude toward learning when utilizing technology?
3. Is there a correlation between students’ attitudes toward technology and their attitudes toward learning when utilizing technology?
4. Do gender or grade level affect students' attitudes toward technology or their attitudes toward learning when utilizing technology?

The questions about students’ attitudes toward technology and learning when utilizing technology were dealt with in part A and B of the survey. The mean scores from part A and B were calculated for each of the 106 students and an overall mean score was tabulated for the whole
group. The survey used a four-point Likert-type scale. The responses ranged from "strongly agree" to "strongly disagree", with the absence of the middle neutral response. Any score less than 2.5 was considered to be an indication of a positive response to a question; conversely, any score above 2.5 was considered to be a negative response. The mean score for part A was 1.70, with a standard deviation of .46. The mean score for part B was 1.74 with a standard deviation of .49. The overall mean score was 1.70. Thus, the mean scores in both part A and B supported the hypothesis that students enjoyed working with the technology and enjoyed learning using the technology.

Vosburg (1993) also reported the correlation between the use of the computer and the enjoyment of learning. The Pearson product-moment correlation coefficient ($r = .86, p < .05$) indicated a strong relationship between positive attitudes toward the technology and the attitudes toward learning when utilizing the technology.

In order to determine if gender had any effect on attitudes, Vosburg (1993) used a one-way analysis of variance (ANOVA) on each part of the survey. The results were not significant for gender [$F(1,106) = .46; p < .1$ (Part A) and $F(1,106) = .57; p < .1$ (Part B)], that is there was no statistical evidence to support gender differences in attitudes toward using technology and using technology in learning. The F-scores based on
grade level were .12 for Part A and .07 for Part B indicating that grade level had no effect on students' attitudes toward technology and toward learning at the .05 significance level. However, Vosburg's (1993) study showed that the students found the computers useful in the completion of their assignments and for their future career choices.

In addition to Vosburg, other researchers have developed computer attitude scales. The Computer Attitude Scale (CAS) was a Likert-type instrument developed by Gressard and Loyd (1984). It measured the attitudes of anxiety, liking and confidence when using computer technology. In order to discover whether computer users felt that computers were useful, Gressard and Loyd (1986) later added another scale to their Computer Attitude Scale. This subscale was entitled Computer Usefulness and consisted of ten items with both positively and negatively worded statements, such as, "I will use computers many ways in my life." and "Learning about computers is a waste of time."

The complete Computer Attitude Scale was administered to 112 elementary, junior high, and high school teachers from three school systems in Virginia. These teachers were enrolled in one of six staff development courses in computers. Each respondent provided information regarding gender and the amount of previous computer experience. Computer experience was divided into four levels: none, less than six
months, six months to one year, and more than one year. Scores on all subscales were obtained by summing the items (which ranged from 10 to 40) with a larger score indicating a more positive attitude.

Analyses of variance (ANOVA) were computed to assess each of the subscales for the impact of gender and the amount of computer experience on computer attitudes. There was no statistically significant interaction effect or main effect for gender for the subscale usefulness. Teachers with more than one year of computer experience perceived computers to be more useful than the teachers with less experience. The main effect for computer experience was statistically significant ($F(1, 112) = 3.1, p < .05$) showing that the more experience a respondent had, the more useful they thought the computer to be. The coefficient alpha reliability for the subscale Usefulness was .82.

The results of the study showed that most respondents believed that the computer was an important tool. The researchers believed that the fact that most of the teachers were taking a non-required course in computer technology may have been an indication that the teachers were aware of the trend toward the increased use of the technology. Researchers continued to develop instruments to evaluate the usefulness of computer technology.

Koohang (1989) developed a survey to study the attitudes of
students toward perceived usefulness of computers. The instrument was a Likert-type scale that consisted of 12 items which were positively and negatively worded statements (e.g., "Using a computer results in an increase in my productivity" and "I don't ever want to see a computer"). All "strongly agree" responses were recorded as a 4 and the "strongly disagree" as a 1. The scoring strategy resulted in a higher score on attitudes toward computer usefulness corresponding to more positive attitudes toward computer usefulness. The internal consistency (alpha coefficient) was obtained from 46 undergraduate college students who were using computers. The calculated coefficient alpha reliability for the instrument was .86. The Computer Attitude Scale of Gressard and Loyd (1986) was also used.

Koohang's (1989) subjects were 81 undergraduate college students who were enrolled in different computer-based education courses (e.g., introduction to computer based education, advanced instructional applications of microcomputers, introduction to data processing, etc.). Multivariate analyses of variance (MANOVA), univariate analysis of variance, and the Scheffe's multiple comparison technique were used.

Koohang (1989) found that gender was a significant variable. Males perceived computers to be more useful than females ( \( F(1,79) = 4.12, p< .05 \)). The researcher suggested that there was a need for further
research in order to find out why female students have less positive attitudes about the usefulness of computers than male students.

Peck and Dorricott (1994) provided the following 10 reasons why the technology available to students might be useful in their academic and vocational careers:

1. Students learn and develop at different rates.
2. Graduates must be proficient at accessing, evaluating, and communicating information.
3. Technology can foster an increase in the quantity and quality of students' thinking and writing.
4. Graduates must solve complex problems.
5. Technology can nurture artistic expression.
6. Graduates must be globally aware and be able to use resources that exist outside the school.
7. Technology creates opportunities for students to do meaningful work.
8. All students need access to high-level and high-interest courses.
9. Students must feel comfortable with the tools of the Information Age.
10. Schools must increase their productivity and efficiency.

The favourable attitudes toward computers are often linked to the
system that is developed in a school for computer use. Smith (1982) implied that the structure of most classrooms would not promote the initiative for creative learning so students may expand their interest and experience in an area for which there is a particular talent. Smith (1982) further stated that computers now offer educators a way of overcoming this obstacle by removing the need to teach all students the same material, in the same way, at the same time.

Smith (1982) attributed this positive attitude of computer users to the assumptions that the computer:

1. has infinite patience;
2. can repeat, redraft, and replay material for the student;
3. can pick up and feed back information regarding errors;
4. can present material in the manner most suited to an individual student;
5. eliminates the intimidation experienced by the need to ask questions in front of other students; and
6. can eliminate boredom and restlessness in students, who quickly understand ideas.

In order to further determine the attitudes of children toward the computer Lawton and Greschner (1982) compiled a sample of ERIC references written between 1976 and 1982. A manual review of the
literature, suggestions from colleagues, and references from bibliographies of similar studies were also used. All articles were then condensed and compiled into an overall review of the literature on attitudes towards computers and computerized instruction. An earlier review of literature, titled *Effects of Educational Technology: A Review of Literature* was used as the pivotal point for the review to assess the status of computerized instruction prior to 1976. The compilation of all of these articles showed that children found computers to:

1. never get tired;
2. never get frustrated or angry;
3. never forget to correct or praise; and
4. individualize learning.

**Anxiety, Liking, Confidence Attitudes**

The attitudes about the usefulness of the technology were only one of the many attitudes that Gressard and Loyd (1986) studied. The Computer Attitude Scale (CAS) was a Likert-type instrument developed by Gressard and Loyd (1984). It measured the attitudes of anxiety, liking, and confidence when using computer technology. It consisted of 30 items that were both positively and negatively worded statements of attitudes toward computers and the use of computers. The authors completed
three validation studies on the CAS to determine:

1. the reliability and factorial validity of the CAS and its subscales;
2. the convergent validity of the correlation of the CAS subscales with a self-descriptive response scale; and
3. the effectiveness of the CAS in reflecting change in computer attitudes as a result of computer instruction and experience.

The first study was conducted by Gressard and Loyd (1985). In the validity study of the survey, 186 high school students in language arts courses, 89 community college students in mathematics courses, and 79 students in a small liberal arts college participated. The students represented a broad spectrum of backgrounds and academic interests. Students indicated age, gender, and amount of computer experience. The amount of experience was divided into three levels:

1. no experience;
2. introductory experience with a home computer; and
3. enrolment in more than one computer course past the introduction and a home computer.

The scale has 30 questions divided into 3 subscales of 10 items under the headings: Computer Anxiety, Computer Confidence, and Computer Liking. Students responded to each of the statements by selecting one of four responses ranging from “strongly agree” to
"strongly disagree". Alpha reliability coefficients were .87, .91, and .91 for each subscale, respectively.

Three scores were computed for each student, one for each of the subscales. Means and standard deviations were computed for each of the three scores to examine the nature of the computer attitudes. Analysis of variance procedures were used to assess the effects of age, gender, and computer experience on computer attitudes.

Three analysis of variance procedures were completed, which corresponded to the three subscales of the Computer Attitude Scale that were administered. In the first procedure computer anxiety was the dependent variable; in the second procedure computer confidence was the dependent variable; and in the third procedure computer liking was the dependent variable.

The raw scores for the total group of students and of the subgroups specified by age and computer experience ranged from 10 to 40. The mean for the entire group was 31.9 and the standard deviation was 6.3 for the Computer Anxiety subscale. For the Computer Confidence subscale, the mean for the entire group was 30.0 and the standard deviation was 6.8. The mean for the entire group, for the Computer Liking scale, was 30.7 and the standard deviation was 7.1.

The results of the three analyses of variance procedures, using the
subscale computer anxiety ($F(1,354) = 16.5, p< .05$), computer confidence ($F(1,354) = 22.24, p< .05$), and computer liking ($F(1,354) = 13.27, p< .05$) indicated significant main effects for computer experience for all three dependent variables. Also the main effect for age was statistically significant ($F(1,354) = 3.11, p< .05$) but only for computer liking. The older the students were, the less they liked the computer. The main effect for gender was not statistically significant ($p>.05$) in any of the three analyses. The main effect for computer experience for confidence and liking were qualified by interactions with age. This interaction with age and computer experience was statistically significant for computer confidence ($F(1,354) = 2.34, p< .05$) and computer liking ($F(1,354) =3.57, p< .05$), but, not for computer anxiety. Computer experience did not lead to the students having greater confidence or liking in the older groups.

The results of the second analysis of variance procedure, using computer confidence as the dependent variable and the follow-up procedures for the main effect, showed that students with more computer experience were significantly ($F(1,354) = 16.5, p< .05$) more confident than those with less experience with computers. There were no statistically significant effects (main or interaction effects) for gender.

In 1985, Gressard and Loyd conducted another study to further
validate their Computer Attitude Scale. The population of the first part of this study was 193 elementary, middle school, and secondary teachers. There were 41 males and 152 females ranging in age from 22 to 51. Seventy-two percent had less than one month experience with computers and 13% had less than six months experience. Some of the participants were surveyed at the beginning of their computer program, some in the middle, and others at the end of the program.

Means, standard deviations, and estimates of internal consistency (alpha coefficients) were calculated for each of the three subscales. The reliability of the three subscales and the findings of the factor analysis indicated that the scores of the three subscales were sufficiently stable to be used as separate scores. This study supported the findings of their earlier study (1984) in which the Computer Attitude Scale was administered to 155 students in grades 8 through 12.

The second study (Gressard & Loyd, 1985) used 118 of the participants of the first study. The ages of the subgroup were from 22 years to 51 years and over; 29 were males and 98 were females. In addition to the CAS the participants were given another instrument with two statements regarding their general attitude toward computers. The first statement was, "I think the learning about and working with computers is (would be) ________" was completed by selecting a word
or phrase from a list of 14 responses (e.g., difficult or a waste of time). The second statement was, "In general, I would describe myself as ________ about the learning about and working with computers". Teachers selected one of four responses ranging from "very anxious" to "very comfortable".

Gressard and Loyd (1985) found a significant relationship between the Computer Attitude Scale and the selected responses to the two statements about the teachers' general attitude toward computers. The results indicated that the Computer Attitude subscales were significant \( p < .01 \) but low \( r = .22 \) to moderately \( r = .54 \) related to the six selected response words. If teachers did not use the words "difficult" or "nerve-wracking" to complete the first statement, they tended to have less anxiety and more computer confidence and liking. The mean \( M = 2.83 \) and the standard deviation \( SD = .87 \) calculated for the second response statement indicated that the Computer Attitude Subscales were significantly \( p < .001 \) and moderately positively correlated with the response. For example, the word "enjoyable" correlated most highly with the "Liking" subscale \( r = .54 \); the word "nerve-wracking" correlated most highly with the "Anxiety" subscale \( r = .39 \).

Generally there was a higher correlation between selected responses and the subscale with which the response was most closely associated.
Even though the relationships were not high, the strength of the correlations indicated reasonable evidence for assuming there was a relationship between the two indicators, the Computer Attitude Scale and the selected responses.

The third study (Gressard & Loyd, 1985) assessed the effectiveness in reflecting change in computer attitude as a result of computer instruction and experience. The population was 70 of the 192 teachers in the first study. The ages of this subgroup were 22 years to 51 years and over; 10 were males and 60 were females. The teachers were administered the Computer Attitude Scale at the end of a teacher in service program. In the course teachers designed, implemented, and evaluated a classroom lesson that included integrating a computer skill (e.g., providing an introduction to computer technology or computer processing) into the lesson.

Reliability coefficients were calculated for the three subscales, both before and after the in-service program. An independent t-test was used to analyze the data. The independent variable was experience (before and after in-service) while the dependent variable was attitude measured by a particular subscale. Alpha coefficients were calculated for the three subscales of the CAS for both the preprogram and the post program administration. The alpha coefficients for the Computer Anxiety,
Computer Confidence, and Computer Liking subscales at preprogram were .95, .88, and .83, respectively. The alpha coefficients for the Computer Anxiety, Computer Confidence, and the Computer Liking subscales at post program were .88, .89, and .91. Means and standard deviations were calculated for each dependent variable (Computer Anxiety, Computer Confidence, and Computer Liking). The mean for computer anxiety was 29.83 at preprogram and 33.36 at post program. The difference between these means was significant ($t = 5.48, p < .001$). This indicated that teachers were significantly less anxious after the program. The mean for the computer confidence subscale was 29.83 at preprogram and 31.54 at post program. Again, the difference was significant ($t = 3.29, p < .001$). This suggested that teachers were significantly more confident after the program. The third subscale, computer liking, had a mean of 32.84 at preprogram and 33.41 at post program. The difference in means was not statistically significant at the .05 level. Since the level of computer liking was high previous to the program, it was assumed that the teachers' liking for the computer would not increase significantly after the program since it was largely positive at the beginning. The results of the studies of Gressard and Loyd, (1985) showed that the Computer Attitude Scale is a reliable and valid measure of computer attitudes, and that it can be used confidently and effectively in research and program
evaluation.

The major extent of research studies has been with elementary school students. Yet, there are few longitudinal studies which studied whether this positive attitude is sustained throughout high school. Two studies, one by Dwyer (1990) and the other by Apple Computer Incorporated (1991) described the project called Apple Classrooms of Tomorrow (ACOT). This was a long-term project sponsored by Apple Computer Incorporated to explore how learning and teaching change when teachers and students have access to interactive computer technologies. The ACOT project was a consortium of researchers, educators, students, and parents who work collaboratively to create and study innovative learning environments and to implement educational change. Their philosophy was that instruction should be learner controlled: that is, students take responsibility for their own learning and the teacher's role changes to that of being a mentor or coach who guides them in the building of their own knowledge of subjects. The question that the project wanted answered was, “What happens when teachers and students have constant access to computer technology?”. To that end, teachers and students in the project were given two computers, one for school use and one for home use.

The findings of these studies showed that ACOT students had:
1. more effective communication skills than those students who did not have unlimited access to computers;

2. a higher degree of social awareness, confidence, and independence; and

3. had a more positive attitude about learning and themselves.

It was also noted that the students showed skills that were not representative of the learning which took place and could not be measured by traditional or standard testing instruments.

Dwyer (1994) summarized the results of the ACOT project after eight years of studying the effects of computers on the classroom as follows:

1. Children did not become social isolates.

2. Children's interest in and engagement with the technology did not decline with routine use.

3. Children, even young ones, did not find the keyboard a barrier to fluid use of the computer.

Dwyer (1994) concluded that technology:

1. encourages fundamentally different forms of interactions among students and between students and teachers;

2. engages students systematically in higher-order cognitive tasks.

Yet, one might question the integrity of a study conducted by a
company that built and marketed computers for the purpose of educational use if it were not for the other stakeholders in the experiment. Each of the partners in the project held a different urgency for this study. Teachers wanted an effective tool to enhance their pedagogy; parental interest reflected a need to have their child experience success; students wanted an improvement in their marks; and finally, the ACOT researchers wanted to prove that their product would be viable in the educational market.

Another study by Chen (1986) indicated that the amount of computer use by students increased their confidence. A survey instrument was designed, pretested, and then administered to a sample of 1,138 students from five area schools in the San Francisco Bay area where a high percentage of the jobs were in computer-related industries. A factor analysis was performed on thirty-two items that established five dimensions of computer attitudes:

1. computer interest
2. gender equity in computer use
3. computer confidence
4. computer anxiety
5. respect through computers.

Male students, who had the most experience, responded with more
confidence about their abilities with computers than female students with similarly high levels of experience. Male and female students at lower levels of experience showed smaller differences in confidence and greater discomfort with computers. Chen (1986) believed that a gender difference in confidence with computers may present a significant attitudinal problem.

The general conclusions that Chen (1986) reported were:

1. gender differences in computer use favoured males;
2. adolescent boys were more likely to have taken a computer programming course before or during high school;
3. computers were more frequently found in males' homes and were more frequently used at home by males than females;
4. gender differences were not significant in high school courses offering non-programming applications.
5. males with the most experience report greater self-confidence and less anxiety with computers than females with similar experience.

Children have expressed a growing confidence in the use of the computer and its unbiased approach. Some of the previous studies showed that children enjoyed working alone with the computer. Yet, do students prefer to work in isolation when confronted with problem-solving? Diem
(1984) observed students in a summer computer camp program. As they worked with the computer, they were asked to complete a questionnaire about the social dilemmas that arose in a technological environment such as copying another's program or altering a password.

Diem (1984) formed a computer camp with 151 children aged 8 through 12 as participants; 116 of whom were males and 35 were females. The camp was held, on-site, at a mid-sized southwestern state university in June and July. The students' sessions included hands-on instructional lessons, field trips to locations on campus and in the community where different types of computer resources were used, and demonstrations of programmable robots.

The first method of data collection was non-participant behaviour observation. Groups of two or more students were observed as they worked on independent instructional activities. The observer did not intervene in the activity. The computer lab and study area were not included in the observations. The observer recorded the kinds of ethical or socially related issues that were discussed and resolved. The author, single-handedly, compiled the data and compared the responses to the surveys for similarities, differences, or points of interest. The second method of evaluation was a questionnaire which included three sections: background questions (e.g., age, gender); technological familiarity; and
social dilemmas (e.g., Is it acceptable to copy someone else's computer program?).

Diem (1984) discovered from observations that even though these students were exposed to a variety of technology, both in and out of school, they had not considered the social implications of using another student's information. They had not considered the right to privacy that might be violated by the misuse of information technology. When an infringement of their right to privacy took place, the students demanded harsh penalties for the offender. Students engaged in group type problem solving strategies while solving technologically related problems. This was in contrast to the traditional type of learning where each student solved the problem individually. Finally, the reader found that student behaviour patterns, while working with information technology systems, appeared to be directly related to previous experiences with computer games and other popularised forms of information technology.

Diem (1984) found that the apparent approval of sharing of information was reinforced by the answers to the questionnaire he administered. Copying another's material was approved by 82% of the students; however, students did not approve of having their data copied and demanded severe penalties for the offender.

A further outcome of Diem's (1984) study showed that students
preferred to work together to solve problems. Rather than trying to solve a problem or write a program alone, one or more of the students would gather together as sounding boards and share resources during the process. Individual success seemed to be deferred or even forgotten as group goals took over.

Vosburg (1993) and Dwyer (1990) showed that students exhibited increased confidence when they experience success with the increased use of computers. Kell, Harvey and Gadzuk-Drexler (1990) reported on their findings of the impact of computers in primary grades for both teachers and students. This study showed that an increased use of the computer was related to a greater achievement in reading, writing, and computer literacy. The increase in achievement boosted the confidence of the students. The study was based on a computer based language arts instructional program developed by Apple: Apple Learning Series: Early Language (ALS-EL). The study explored the literary-based outcomes for students in the areas of reading, writing, and computer literacy as well as non-literary outcomes such as: increased self-esteem, student motivation, positive attitudes toward school, and the experiences of success. The study was developed throughout one school year and involved 1000 students, 57 teachers, 62 classes in 12 schools geographically dispersed in the western, Midwestern, and southern parts of the United
States. A field team visited each of the six districts in October, January, March, and May of the school year. The visits lasted four to five days with a two-person field team. The teachers completed the DeFord Theoretical Orientation to Reading Profile in October, January, and May. This instrument assessed teachers' orientations to early reading instruction along a continuum from phonics to whole language. In January and May, they completed the Stages of Concern and the Concerns-Based Adoption Model Surveys. Site-level analytic memos written by the field researchers were also used. From a combination of the surveys and the memos, teachers reported the following outcomes as a result of the project:

1. ALS-EL appeared to have a positive impact on students' development as writers.

2. Students using ALS-EL showed increased self-esteem and self-confidence.

The researchers also note that the time limit on their study presented major problems with the evaluation of the data. They recommended that a longitudinal study be developed to verify the results.

**Gender and Grade**

Another question that arose was whether or not females have the
same positive attitudes toward the use of the computer as males. Reece (1986) conducted a study to investigate whether parents were more likely to purchase a computer for sons rather than daughters; and whether elementary and secondary students reflected gender differences with respect to attitudes toward computer use. Reece (1986) provided a survey to students in four groups: a private school fifth grade, a county school fifth grade, a suburban seventh grade, and a city high school class of computer programming students.

Chi-squared analysis confirmed that there was no statistically significant relationship between gender and ownership of a computer. The ratio of students who owned their own computer was significantly higher in the students from a higher socioeconomic background. Consistent with the literature, there were positive attitudes about the use of computers exhibited by the elementary students. Yet, the reasons given by the high school students in the anecdotal responses about computer use were stereotypical answers:

1. boys are more interested in computers;
2. boys are businessmen;
3. boys work with male friends;
4. a man invented the computer;
5. girls like other things.
Reece (1986) concluded that there must be changes in the approaches to school curricula and to the methods that counsellors use in guiding females in their career choices. Since this study, there has been a drive by educators and government to make access equitable for all students.

The study by Chen (1986) indicated that computers were more frequently found in male homes. This was different from the findings of Reece (1986), who found no significant relationship between ownership of a computer and gender.

Other literature has also indicated a relationship among computer attitudes, computer knowledge, grade (age), and gender. In a study by Bannon and Marshall (1986), 2,302 students from grades seven through university, 537 teachers, 81 administrators and 95 library/media specialists were surveyed. The sample came from rural and urban districts in Missouri and Southern Illinois regions. Each subject was administered the "Survey of Computer Attitudes and Knowledge" designed by the authors. The first section contained 18 items reflecting both cognitive and affective attitudes. The items were scored on a five-point Likert-type scale ranging from 0 for strongly agree to 4 for strongly disagree.

The results of the study of the students were:
1. the older the student the more positive the cognitive attitude toward computers;
2. students with greater knowledge of computers or home computers had a more positive attitude;
3. male students had a more positive attitude about the use of computers and expressed less anxiety with computer use than did females students.

The question of whether experience in the use of computers fostered positive attitudes about their use was also studied in two Montreal high schools using French-speaking students (Braun, Goupil, Giroux, & Chagnon 1986). The population included 520 females (mean age 15.92 years) and 377 males (mean age 15.93 years). Both schools served low to middle-level socioeconomic members of society. The male and female participants did not differ significantly relative to age, schooling, occupational status of parents, school program, or grades in mathematics and French.

The questionnaire contained 165 questions that covered biographical information and computer-related attitudinal and behavioural variables. The survey asked detailed questions about computer-related activities in the home, at school, and in the video arcades. Only 77 of the 897 students, were enrolled in a computer course at school. Only 107 in the
population had a computer or video game at home. Of this group 15.6% of all female students and 23.4% of all male students owned a computer or video game. Of those asked who would like to have a home computer 80.4% of female students and 88.6% of male students responded positively. The number of students who played video games at the arcade was 417 or 45.3%.

Braun et al. (1986) concluded that the content of the video games was geared more to males than to females. Researchers suggested that there must be greater consciousness developed to cut down on gender bias, violence, and social withdrawal associated with video games. The implication here was, that if female students were as familiar with the video games and their use as males, they would also have shown more positive attitudes towards the use of the computers.

Female students reported a preference for compulsory computer class curriculum that mandated structured exercises and required little creative adaptation to problem solving. They preferred to operate computers in groups. High school females who received as much formal exposure to computers as males were more motivated by these classes and wanted to own computers.

At the time of this study it was determined that students became more computer literate at home than at school. Since this study was
completed in 1986 more access to computers has become available at home and at school.

Krendl and Brothier (1991) conducted a study that examined the evolution of perceptions about computers of fourth grade through tenth grade students. These perceptions about computers included preference, perceived learning, and perceived difficulty with the use of the computer. This was one of the few studies which followed students into the secondary level of education. In most studies conducted at the elementary level (Apple Computer Inc., 1990; Baylor, 1985; Dwyer, 1990; Drexler, 1990; Vosburg, 1993), the results of the surveys of the attitudes of the students had been extremely positive throughout elementary school. This study tracked the students into the high school, finding less positive responses. The researchers attributed the high positive response at the elementary level to the "novelty" factor. The sample population of 339 students was comprised of 53.4% female and 46.6% male participants. The students were tracked over a three year period. Fifty percent of the students at the beginning of the study had used computers, including video games, outside of school. By the end of the study, 65.2% students were using computers outside of school. Students also reported that teachers were their main source of assistance with the use of the computer. The subsequent order of preference for students obtaining help with the use of
the computer were parents, then peers, and finally siblings.

The study also found that the applications of the computer changed during the three year period. Of the students who had previous computer experience, the playing of video games had decreased from 72.5% to 30.8% by the end of the third year. In contrast, students' use of word processing had increased from 32.6% to 53.7% during the same time period.

Krendl and Brothier (1991) used MANOVA repeated measures procedures for longitudinal data to assess the role of gender and grade level over time in determining respondents' assessments of the computer. A group of 339 students were randomly selected from fourth to tenth grade in the public school system in a small town. The students completed self-administered questionnaires at the same time each year for three sequential years.

With the question of computer preference, scores generally declined over time for the group. (See Table 1) The main effect for time was significant for computer enjoyment (\( F(2,232) = 46.87, p < .001 \)). As the academic applications increased, the enjoyment of computers decreased for both male and female students.

Females' assessment of their enjoyment of the use of the computer was lower than that reported by males (See Table 1). The main effect for gender was significant (\( F(1,333) = 51.27, p < .001 \)). These figures
### TABLE 1

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**MEAN SCORES for GENDER and GROUP for ENJOYMENT OVER TIME**
confirmed the hypothesis that male assessment of their enjoyment of the
computer was significantly higher than that of females. MANOVA results
yielded a significant main effect for grade level ($F(2,333) = 14.79,
p < .001$). This indicated that the older the students were, the less they
enjoyed their assignments on the computer.

Krendl and Brothier (1991) also found that students’ perception of
computer difficulty did not decline with greater familiarity and
experience. The test for the main effect of gender yielded significant
results ($F(1,333) = 25.76, p < .001$). Females found computers more
difficult to use in spite of experience. The main effect of grade level
yielded significant results ($F(1,333) = 7.56, p < .001$). Younger students
found the computer less difficult to use as their experience increased.

Tests of the hypotheses related to student assessments of learning
from computers showed a decline as a whole over time. Younger students
were more optimistic and positive about the computer than were high
school students. Female assessment of perceived learning was
significantly lower than male assessment. The results of the tests of
gender effects were significant.

The study by Krendl and Brothier (1991) made the following
conclusions:
1. Students' use of and liking the computer generally declined over the years.

2. Individuals' perception of difficulty did not decline with more experience and familiarity.

3. Students' perception of the technology's instructional effectiveness in general declined significantly over the years.

4. Female enjoyment, perception of difficulty, and perception of learning was significantly lower than that of males each year.

5. Younger students were generally more enthusiastic about the use of computers.

The previously mentioned studies (Bannon et al. 1986; Braun et al. 1986; Chen, 1986; Krendl & Brothler, 1991; Reece, 1986;) indicated that students became less confident and more anxious as they grew older. Males exhibited less negative attitudes toward the technology than did females. Female attitudes about the use of the computer became stronger as they entered adolescence.

**Cognitive and Affective Attitudes**

Another study of the attitudes of students in the cognitive and affective domains was conducted by Bannon, Marshall, and Fleugal (1985). The validity and reliability of the instrument was tested on 2,525
participants from 15 urban and rural school districts and one urban university. The sample contained 1,811 students and 714 educators: 1,041 were females and 1,484 males; 1,532 students under 19 years of age, 411 between 19 and 30 years, and 582 over 30 years.

The attitude survey consisted of 11 items drawn from Ahl's (1976) The Best of Creative Computing survey and 6 items developed by the researcher. Nine of the items were cognitive attitudes and 8 were affective attitudes. A four-point Likert scale was used with responses ranging from strongly agree (1) to strongly disagree (4).

A maximum likelihood factor analysis of item intercorrelations with varimax rotation was computed for the 2,525 subjects. Two factors were identified. Alpha coefficients were calculated to determine the internal consistency estimates of reliability for the two scales.

The first factor was defined by 7 cognitive attitude items with loadings ranging from .34 to .61. All items were positive attitude statements. The alpha coefficient reliability was .93. The second factor was defined by 7 affective attitude items with loadings ranging from .30 to .67. All items were negative attitude statements. The alpha coefficient reliability was .90.

Scoring for the items ranged from 1 (strongly agree) to 4 (strongly disagree). The possible score range for each scale was 0 to 28. The mean
of 8.02 for the first scale suggested that the students and the educators have generally positive cognitive attitudes; the mean of 17.06 on the second scale reflected a tendency toward rejection of negative affective attitudes.

Kay (1993) stated that the affective domain reflects feelings toward the computer; the cognitive domain reflects perceptions of and information about the computer. This study consisted of 647 preservice teachers (27% male, 73% female) ranging in age from 21 to 52 years (mean age 28.2 years) and selected from four universities across the province of Ontario. Of the 647 subjects, 31% intended to teach primary pupils, 67% to teach junior grades, 27% to teach intermediate students, and 4% to teach senior grades.

Kay (1993) modified the original (1989) Computer Attitude Measure. The original measured affective, cognitive, and behavioural subscales. This instrument measured perceived control that described the perceived ease or difficulty of performing a task on the computer. The cognitive scale was modified to incorporate three different contexts: student education, personal use, and general. The behavioural scale was divided into two contexts: using the computer in the class and in the home.

The Computer Attitude Measure, (Kay, 1993) consisted of the following sections: a) demographic information, b) cognitive attitudes,
c) affective attitudes, d) behavioural attitudes, and e) perceived control. Gender, age, computer ownership, and subject area to be taught made up the demographic questions. The cognitive attitude scale was divided into three subscales consisting of five Likert items each (strongly disagree, disagree, slightly disagree, neutral, slightly agree, agree, strongly agree). The affective attitudes were assessed using ten 7-point semantic differential scale items (extremely, moderately, slightly, neither, slightly, moderately, extremely).

The means, standard deviations, and internal reliability coefficients were determined for each of the subscales. Correlations among the subscales were calculated to help determine whether the varimax or oblique rotation would be used to evaluate the scale structure.

The overall mean for the cognitive attitude scale was relatively high at 80.8 (SD = 11.4; possible range 15 to 105). The internal reliability coefficient for the total scale was .86. The alpha coefficient for cognitive attitudes regarding students and computers was moderately high (.73). The alpha coefficient for the personal use subscale was comparable to the student subscale (.77). The alpha coefficient for the general cognitive attitude subscale was .70.

The total scale mean for the affective attitude subscale was 49.0 (SD = 9.5; possible range 7 to 70). The internal reliability estimate for
the subscale was .88. Subjects were more likely to see the experience of using the computer as likable ($M = 5.7$) and less likely to see it as natural ($M = 4.0$). A principal component factor analysis revealed only one factor, accounting for 50% of the total variance. Kay's (1993) study validated the Computer Attitude Measure as reliable for measuring the cognitive and affective attitudes.

To date there has been some research into the attitudes of students about the computer. The amount of research dealing with broad-based technology, however, is limited. The studies outlined in this literature review focus on the use of the computer and the impact on achievement, rather than on the technological applications of computers. The study of the attitudes of students towards the technology is developed in greater detail, but, there are few longitudinal studies on this topic.

The conclusions of the literature review were that younger students enjoyed working with the computer technology. They perceived the computer as a tool that is user friendly, and that assisted them in successfully completing their assignments. Younger students believed that they achieved higher grades and that their work was of a higher calibre because of the technology. There were no significant differences between the elementary male or female students regarding their attitudes toward the computer.
Students in high school did not perceive the technology as a useful tool to the same degree. If there was no experience prior to secondary school, student anxiety was very high. Adolescents who were introduced to the technology, especially those who played video games at an early age, were less anxious and believed that the technology improved their grades. Female adolescents exhibited stronger negative differences in attitudes than males.

**Statements of the Hypotheses**

In previous studies where technology was introduced into the educational setting, the results have been very positive. Technology has motivated students to the point where there has been a positive effect on achievement and increased confidence. However, Krendl and Brothier (1991) showed that interest waned in the higher grades and that females' interest declined as they advanced in high school. Thus, it is predicted that:

> Adolescent students' positive attitude about the usefulness of technology will decrease with more technological experience and females' positive attitudes will decline even more than males.

Gressard and Loyd (1985) found that student anxiety about the use of the computer subsided with increased use. Students suggested that the
more experience they had with technology, the more comfortable they were using the computer and its applications. It is, therefore, predicted that:

There will be a negative correlation between adolescent students' anxiety and experience with technology.

Chen (1986) found that the amount of computer use increased the confidence of students in the use of the computers. With the increased use of technology, students perceived that their work was enhanced by the computer and its many applications. They felt that assignments using the computer were more accurate. It is predicted, therefore, that:

There will be a positive correlation between adolescent students' confidence and experience with technology.

Gressard and Loyd (1984) showed that the older the student was, the more they disliked the computer even though they had experience. This negative response was even more intense for female students who responded to the surveys. Thus, it is predicted that:

There will be a negative correlation between adolescent student liking of technology and experience with technology.

Dwyer (1994) concluded in his review of the ACOT project that technology engages students systematically in higher order cognitive tasks. Students indicated that with more experience with the technology they were able to improve their skills in analyzing, evaluating, and
drawing conclusions. It is, thus, predicted that:

There will be a positive correlation between adolescent students' cognitive attitudes and more experience with technology.

Kay (1993) suggested that students had a positive attitude in the affective domain toward the use of the computer. The more experience students had, the more they felt that the technology would assist them rather than take their place in the work force. They believed that no matter how useful the technology was, the human element would always remain. The computer could not replace the teacher. Thus, it is predicted that:

There is a negative correlation between adolescent students' affective attitudes regarding "threat" and experience with technology.
CHAPTER III

METHODOLOGY

Subjects

This study was conducted in the spring of 1995 at a Southwestern Ontario high school. The total population of the school was over 1,850. The experimental group for this study was composed of 80 students: 33 males (15 in grade 11 and 18 in grade 10) and 47 females (23 in grade 11 and 24 in grade 10). These students were formerly part of a pilot project in their elementary school when they were in grades seven and eight. That project involved the whole elementary school student body. The project at the elementary school consisted of three labs designed to provide students with intensive technological experience. (See Appendix A for the make-up of each lab). A second group, the control group, was established using students from the same high school, but, who had not been exposed to the same amount of in-school high technological experience. The control group was selected to match the experimental group in terms of grade level, age, gender, and number as closely as possible. The high school was renovated prior to the students entering grade nine. This ensured that students who were competent in the use of technology would continue to have access to broad-based technology.
Test Instruments

The first instrument to be used in this study contained sections of the same instrument used in the original study (Vosburg, 1993). (See Appendix B questions 1 to 29). The first four questions gathered information on grade, gender, and the amount of experience the student had with different computer applications (e.g., database, spreadsheet, word processing). The next 20 questions dealt with how useful the student found the computer under the subheadings: curriculum, career awareness, self, and society. These questions were in the form of a Likert-type scale of responses ranging from 1 to 4, with written responses “strongly agree” (at 1) to “strongly disagree” (at 4). Vosburg (1993) decision to use the four-point scale was based on the following arguments made by Williams and Batten (1981):

The standard argument asserts that those answering neutral categories of this kind are a heterogeneous group consisting of those who do not understand the question, those who have no opinion, those who are ambivalent, plus those with low intensity opinions, both positive and negative. The second part of this category inflates the amount of error variance in measures of association between items in ways not entirely predictable. The advantage of a four-point scale is that
students will have to express an opinion, either positively or negatively. (p.29)

The survey (Vosburg, 1993) was modified with word changes and updated to be relevant to the high school situation. The second instrument was the Computer Attitude Scale (CAS) of Gressard and Loyd, (1984). This survey examined attitudes relating to computer anxiety, confidence, and liking. A fourth subscale to determine the perceived usefulness of the computer was added to the CAS (Gressard & Loyd, 1986). The four subscales of the Computer Attitude Scale made up the second part of the survey. (See Appendix B, questions 30 to 69). The questionnaire was set up so that the statements were alternately positive and negative. Every other question was reversed for scoring purposes. As a result the higher the score, the more positive the attitude for confidence, liking, and usefulness. In addition, the higher the score the less anxiety associated with computers.

The third instrument was The Cognitive and Affective Computer Attitude Scales of Bannon et al. (1985). (See Appendix B questions 70 to 83 in).

**Procedure**

Permission to conduct the study was obtained from the Director of


Education and the School Principal. (See Appendices C and D). A letter was sent to the parents requesting permission for the child to participate in the study. (See Appendix E).

The three instruments were composed in the same format as the Vosburg Survey and were numbered 1 to 83 beginning with an adaptation of the Vosburg Survey, followed by the Computer Attitude Scale, and ending with the Cognitive and Affective Computer Attitude Scales. The complete survey used four-point Likert-type scales. Questions from 1 to 4 of the survey dealt with background information (i.e., date of birth, grade, gender, and amount of computer experience).

The principle independent variable used in this study was experience. The experience variable was defined in two different ways. On the one hand was high technological experience (e.g., the intense in-school exposure, to technological applications of the computer, in earlier years) and, on the other hand, software experience (i.e., self-reported use of word processing, spreadsheets, data base, etc.). In addition, gender and grade were considered in the analyses as potentially relevant independent variables. Ten dependent variables were used.

The dependent variables used in this study were: a) the usefulness of technology measured by the Vosburg Survey (1993) with 4 subscales: curriculum, career awareness, self, and society; anxiety, confidence,

**Correlational Analysis**

The Pearson product-moment correlation coefficient was used to determine whether there was a correlation between software experience and the attitudes of the students on (1) the Vosburg Scale (1993) subscales (curriculum, career awareness, self, society); (2) Gressard and Loyd (1985) subscales (anxiety, confidence, liking and usefulness); and (3) Bannon et al. (1985) scales (the affective and cognitive subscales). The correlation coefficient provides an indication of the relationship between the variables.

**Analysis of Variance**

Analyses of variance (ANOVA) were used to determine whether gender, grade level and experience (both technological experience and software experience) were related to the attitudes of students toward curriculum, career awareness, self, society, anxiety, confidence, liking, usefulness, affective and cognitive measures.
CHAPTER IV
RESULTS

For the purpose of this study, two types of analysis were used correlational analyses and two-way analyses of variance (ANOVA). The results are presented in relation to the six hypotheses in Chapter II. Response percentages for all dependent variable items are presented in Appendix F.

Table 2 shows One-Way ANOVA results for grade for all the attitude variables. Preliminary analysis of grade revealed that there were no statistically significant differences between grade 10 and 11 students on all dependent variables ($p > .05$), thus analysis of grade was discontinued.

**Software Experience**

Software experience was defined as familiarity with applications with regard to the use of the computer (i.e., word processing, spreadsheets, database, design, etc.). The student-reported experience rating for each application was summed to provide a composite experience measure ranging from 0 to 32. The mean rating was 15.15 with a standard deviation of 7.85. (Table 3 shows the correlation coefficients for software experience and the ten dependent variables). These Pearson product-moment coefficients indicated that there was a significant
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**Note.** There were no statistically significant differences between grade 10 and 11 students.
TABLE 3
CORRELATIONAL COEFFICIENTS FOR SOFTWARE EXPERIENCE AND
THE DEPENDENT VARIABLES

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Note. *NS* = Not Significant.
statistical correlation between software experience and the variables of curriculum, career awareness, self, and society on the Vosburg (1993) survey; anxiety, confidence, liking and usefulness on the Gressard and Loyd (1986) survey; and the cognitive domain on the Bannon et al. (1984) survey. Due to the wording of the questions on the Vosburg scales, all correlations indicated that greater software experience was related to a more positive attitude. On the Gressard and Loyd (1986) scales for confidence, liking and usefulness, the positive correlations indicated that greater software experience was related to more positive perceptions. Moreover, the negative correlation for anxiety suggested that students with greater software experience had less anxiety. Greater software experience was also associated with a higher perception that the computer as a tool would dominate many facets of students' future. (i.e., in education, medicine, business, etc.)

To examine the relationship between Software Experience and Gender two-way analyses of variance (ANOVA) were computed for each dependent variable. Software Experience scores were recoded such that subjects below the mean were defined as low in experience (LO) while those above the mean were considered to be high in experience (HI). This allowed for two-way ANOVA's with Software Experience (HI, LO) and Gender (male, female) as the independent variables. (See Table 4 for
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**NOTE:** N = number of cases.
means and standard deviations.

There were main effects for software experience for curriculum, career awareness, self, society, anxiety, usefulness and the cognitive domain. (See Table 5). Students with greater software experience reported that they should have this training for their future employment. They also reported lower anxiety. For confidence and liking, main effects for software experience and gender were qualified by interaction effects. For confidence the high experience group showed more confidence but more so for males. There was a significant difference between males and females in the high experience group $t(74) = 3.03, p < .01$, but not in the low experience group, $p > .05$. For liking, the high experience group showed higher liking ratings but it was more so for males. There was a significant difference between males and females in the high experience group, $t(74) = 3.58, p > .05$, but not in the low experience group $p > .05$.

**Technological Experience**

To examine further the experience variable, students were grouped according to their elementary school history of technological experience. One group of students had high technological exposure (e.g., technological design, robotics, and animation) in elementary school years (N = 80) while the control group did not (N = 78).
### TABLE 5
TWO-WAY ANOVA RESULTS FOR GENDER AND SOFTWARE EXPERIENCE FOR ALL ATTITUDE VARIABLES

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**NOTE.**    
**p < .01, *p < .05**
Two-way ANOVA's were computed using elementary Technological Experience (HI, LO) and Gender (male, female) as the independent variables for all dependent variables. (See Table 6 for means and standard deviations and Table 7 for a summary of ANOVA results). The higher experience group showed significantly higher ratings for curriculum, society and liking. Also when the subjects were configured this way the males showed higher ratings for confidence and liking. (See Tables 6 and 7). As expected from previous ANOVA results, significant differences were found for confidence and liking with male students significantly higher than female students.

Table 8 shows the reliability coefficients (Alpha) for each of the attitude scales. The relatively high alpha coefficients (.65 to .88) suggests that all subscales are fairly reliable.
### TABLE 6
MEAN SCORES AND STANDARD DEVIATIONS
FOR GENDER AND TECHNOLOGICAL EXPERIENCE

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<td>12.57</td>
<td>13.17</td>
</tr>
<tr>
<td>SD</td>
<td>5.31</td>
<td>3.47</td>
<td>3.72</td>
</tr>
<tr>
<td>N</td>
<td>32</td>
<td>47</td>
<td>30</td>
</tr>
</tbody>
</table>

### AFFECTIVE

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Mean</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>19.29</td>
<td>18.70</td>
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<tr>
<td>SD</td>
<td>4.33</td>
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</tr>
<tr>
<td>N</td>
<td>31</td>
<td>47</td>
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</tr>
</tbody>
</table>

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**NOTE:** N = number of cases.
# TABLE 7
TWO-WAY ANOVA RESULTS FOR GENDER AND TECHNOLOGICAL EXPERIENCE FOR ALL ATTITUDE VARIABLES

<table>
<thead>
<tr>
<th>ATTITUDE</th>
<th>GENDER</th>
<th>TECHNOLOGICAL EXPERIENCE</th>
<th>GENDER X TECHNOLOGICAL EXPERIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Curriculum</td>
<td>.09</td>
<td>6.13*</td>
<td>.43</td>
</tr>
<tr>
<td>Career Awareness</td>
<td>1.99</td>
<td>1.08</td>
<td>.333</td>
</tr>
<tr>
<td>Self</td>
<td>.01</td>
<td>2.2</td>
<td>.25</td>
</tr>
<tr>
<td>Society</td>
<td>2.05</td>
<td>3.85*</td>
<td>.09</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.14</td>
<td>2.2</td>
<td>.04</td>
</tr>
<tr>
<td>Confidence</td>
<td>5.62*</td>
<td>2.3</td>
<td>1.73</td>
</tr>
<tr>
<td>Liking</td>
<td>6.24*</td>
<td>5.34*</td>
<td>1.58</td>
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<tr>
<td>Usefulness</td>
<td>2.77</td>
<td>.59</td>
<td>.04</td>
</tr>
<tr>
<td>Cognitive</td>
<td>2.25</td>
<td>3.27</td>
<td>.22</td>
</tr>
<tr>
<td>Affective</td>
<td>.43</td>
<td>2.25</td>
<td>.53</td>
</tr>
</tbody>
</table>

**NOTE.** *p < .05*
TABLE 8
RELIABILITY COEFFICIENTS (ALPHA) FOR EACH OF THE ATTITUDE SCALES

<table>
<thead>
<tr>
<th>Attitudes</th>
<th>Alpha</th>
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<tr>
<td>Experience (software)</td>
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<tr>
<td>Curriculum</td>
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<tr>
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<td>Self</td>
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<td>Anxiety</td>
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<td>Confidence</td>
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<tr>
<td>Liking</td>
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<td>Usefulness</td>
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<tr>
<td>Cognitive Domain</td>
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<tr>
<td>Affective Domain</td>
<td>.65</td>
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CHAPTER V
DISCUSSION

This study evaluated the attitudes of students toward the use of technology. Students were grouped on two dimensions of experience (Software Experience and Technological Experience) along with gender to examine the relationship between experience and attitude. Since subjects reported anonymously in the first study (Vosburg, 1993), this precluded a Time 1 Time 2 comparison of technological experience. Since there would not be a subject to subject comparison of the experimental group to the first study, software experience was added to this study to allow for a comparison between the students with greater software experience and those students with less software experience.

The first prediction was that adolescent students' positive attitudes about the usefulness of technology would decrease with more technological experience. Previous studies (Chen, 1986; Koohang, 1989) had found such a trend. In addition, it was expected that females students' positive attitudes would decline more than male students. Again, previous studies (Bannon et al., 1986; Reece, 1986) indicated that female responses differed from male responses. The results of the study did not support this hypothesis that student attitudes declined with
technological experience. Also, the results did not support the claim that there would be a gender difference with regard to the perceived usefulness of technology.

The correlation coefficients indicated a positive relationship between increased software experience and the variables curriculum, career awareness, self, society (Vosburg, 1993) and usefulness (Gressard & Loyd, 1986) and the cognitive domain (Bannon et al. 1985). This showed that, contrary to the prediction, students' attitudes regarding usefulness actually improved with software experience.

The two-way ANOVA computations for software experience and gender showed that the High Experience group had better attitudes for all measures except the affective domain. In addition, male students in the high software experience group showed more positive attitudes than female students in the same group with respect to confidence and liking.

The literature on the attitudes of adolescent students (Chen, 1986; Krendl & Brothier, 1991; Reece, 1986) indicated that the older the student the less they perceived technology as being useful to them in their school work or in their careers and that older female students reported less positive attitudes than male students. But grade was not significant in the present study. Since the grade comparison between grade 10 and 11 was small, there may not have been a great enough separation between the
levels to measure a change in attitudes. Students, in the Vosburg (1993) study, were very positive about the usefulness of the technology when they were in grades 7 and 8. However, the results of the responses of students in this study could not be matched one to one with the results of the Vosburg (1993) study making a Time 1, Time 2 comparison of results impossible. Direct comparisons were precluded, given the restructuring of the questionnaire.

Computers and their applications have been a part of the classroom now for over fifteen years. We may have overcome the barriers that females have experienced toward the usefulness of and anxiety over the technology. Since students are exposed to technology at an earlier age and females are expected to accomplish the same tasks as males, the barriers to females regarding technological aptitude may have almost been hurdled.

Female scores, although in the top range on the scores, were less positive than males, in the high experience group, for confidence and liking but more positive than the responses of the low experience group. Female students may be more pragmatic in their approach to technology. Realistically, they understand that technology is a practical and functional tool that must be used to their advantage in the attainment of their goals in school and eventually in the workplace. Both males and
females in the high experience group (technological and software) have indicated that this technology is essential to their future prospects.

Another major element in the positive responses could be that these students started using computers at the beginning of their elementary career and their program was intensified in the final years of their elementary education. Access to the technology at an early age may have eliminated “Technophobia”.

The second hypothesis predicted a negative correlation between experience and anxiety. Indeed, students showed a negative correlation between software experience and anxiety. As experience increased anxiety decreased. Subsequent ANOVA results indicated that there was a main effect for software experience for anxiety. Experience with the software, apparently decreases anxiety. For the negative comments (e.g., Computers make me feel uncomfortable), 74.6% of the students “disagreed” or “strongly disagreed”. For the positive comments (e.g., I would feel at ease in a computer class.), 71.5% of the students “agreed” or “strongly agreed”. The majority of the students showed no anxiety about the use of the computers.

The third hypothesis predicted a positive relationship between experience and confidence indicated by a positive correlation coefficient. The findings showed a correlation between the two variables. Thus, as
the software experience increased the confidence increased. The students responded positively to either the positively phrased questions (e.g., I could get good grades in computer courses) or negatively phrased questions (e.g., I don't think I would do advanced computer work.) in this section of the survey. The amount of experience impacted positively on the students' confidence; the more experience the more confidence. Other researchers have predicted that the level of confidence of the students decreases with age. This did not seem to be the case in this study. Some of these students have been exposed to the use of the computer and its applications for many years, where others have not, without a negative effect on confidence. Thus, various degrees of experience in the current educational setting appear not to have differentially influenced confidence. It appears that a minimal amount of experience is sufficient to boost confidence. It must be noted again the interaction effect on confidence for software experience and gender indicated that males still show higher confidence levels than females in the higher experience group. Females understood the usefulness of the technology to their careers yet, results indicated that female students may not have increased their confidence in the use of the technology to the same extent as male students, particularly for those with high software experience.

The fourth prediction was there would be a positive relationship
between experience and liking the technology. There was a significant correlation between the variables indicating that as experience increased liking increased. On questions that were positively phrased (i.e., I would like working with computers), 31% agreed "strongly" and 40.5% "agreed". Students responded to negatively phrased statements (i.e., I will do as little work with computers as possible) with 22.8% "strongly disagreeing" and 50.6% "disagreeing". The positive responses to the subscale liking showed that the greater the amount of technological experience, the greater the impact on the students liking of the technology. Both levels of experience appear to "like" using the technology and its applications. Since female students in the high experience group scored slightly lower on the liking scale than male students their liking of the computer did not increase as significantly with more experience as did the male students.

The fifth hypothesis predicted a positive relationship between the variable experience and the cognitive domain. The negative correlation coefficient between software experience and the cognitive domain indicated a positive relationship. An increase in software experience resulted in a more positive cognitive attitude. On the ANOVA for the cognitive variable, there was a main effect for software experience. The students who had more software experience were
cognizant of the application value of the technology that they employed and how pertinent this technology would be to their future. On the ANOVA results for the cognitive variable there were no main effects or interaction effects for gender and technological experience. Thus, it was software experience that seemed to influence the cognitive attitude.

In the response to the statement (i.e., Computers can create jobs needing specialized training.) on the cognitive subscale, students responded with “strongly agree” 46.8% and with “agree” 43.7%. Thus, nearly all students positively regard the technology as a tool which will further enhance their quality of life.

The sixth hypothesis predicted a positive relationship between software and the affective domain. There was no correlation between these variables. In the ANOVA, there were no main effects or interaction effects for experience or gender with respect to affective attitudes. All statements, (Computers will dehumanize society.), were negatively phrased in the subscale affective attitudes. Over 60% of the students responded “disagree” or “disagree strongly” to the statements. Again, the amount of experience (HI or LO) did not have an effect on the affective attitude.

Possibly there were not enough students in the sample to be able to measure small differences. Only 80 students of the initial 106 students of
the experimental group completed the survey. Since the element of anonymity was introduced in the first study (Vosburg, 1993), it was not possible to link the experimental group subject to subject with the first study. This made it impossible to discuss a change in attitude with regard to age and grade.

One reason for reassessing the students was to see if the “novelty” of working with the new technological applications for the computer was a factor in the positive results of the Vosburg (1993) study. The Vosburg (1993) study dealt solely with the students’ perception of the usefulness of the technology to their careers, to their curriculum and to themselves. The mean for the results of the attitudes about the technology section of the Vosburg (1993) scale was 1.70 and was 1.74 for the attitudes about learning section. Vosburg’s means were overall scores. The mean scores for software experience for curriculum, career awareness, self, and society for this study were 2.02, 1.94, 1.75, 1.82, respectively. In all areas, (curriculum, career awareness, self and society) the overall mean scores were higher for this study. This study reaffirmed the students’ positive attitudes towards the usefulness of the technology to themselves and their future.
Implications

The results of this study indicated that adolescents who have continual and varied applications with software and computer technology continue to have positive attitudes about technology. Students in high school have developed high competency levels in the use of technology. They have sustained an intense interest in the use of this technology to further the presentation of their own work. The students have expressed the belief that the use of technology has advanced them in their studies. These students continue to show an enthusiasm for the use of technology in their studies, independent of grade or gender.

Even though the two groups had varying degrees of experience (High, Low) in the use of the software, it seemed that a low amount of consistent experience was enough to allay the negative attitudes that had been reported in previous studies. Both groups have had technological experience beginning in kindergarten. The experimental group had high technological experience in grades seven and eight. The exposure to the technology was sufficient for all students to remain confident and report less anxiety. It would seem that consistent experience beginning at an early age and continuing on a regular basis permitted students, once in high school, the opportunity to dispel their fears of the technology.

In the early to late 1980s technological applications changed much
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In the early to late 1980s technological applications changed much
less compared to the last five years. In the infancy of school computer use, students usually learned how to “boot-up” the computer and use a software application that assisted them in spelling, reading, or math. Perhaps, since technological changes and applications can be applied to more aspects of learning, students are kept more “interested”.

A further result of the study showed that adolescent female students also maintain positive attitudes about technology. They do, however, need more encouragement to discover that the varied technological applications can prove to be enjoyable. It would seem that female students benefited from the consistent exposure, from an early age to adolescence, but, still reported less confidence and liking in the high-tech experience group than male students. Female students have come to understand the importance of technology to their future, but, they still may not like it or feel as confident as the male students in the use of technology.

**Recommendations for Further Research**

The specific findings of this study suggest the following recommendations for further study:

1. That a third evaluation of the pilot group be made when these same students are in grades 12 and their final year (Ontario
Academic Credit year - OAC). To date, grade level has not been a factor in the assessment of the students' attitudes. Possibly two more years may produce different results.

2. Reassess the students who were in grade five and six when the experimental group for this study were in grades 7 and 8. These students will already have had two more years than the experimental group. They are now in grades nine and ten. Perhaps they may have changed their attitudes about the technology with more experience since they were introduced to the technology at a younger age.

3. This study was limited to one elementary school in a county system. The study could be repeated with the other elementary schools with new technological centres. This would increase the population and perhaps give a more accurate response to the study. The students could be coded in some way so that a follow-up study could be completed when the students are in the senior grades in high school.

4. A study comparing the responses to a survey on students' attitudes could be completed with one group of subjects from the coterminis board and the experimental group's board. The students in the system of this study have had more technological
experience than their counterparts at the other county board.

5. The attitudes of the high school teachers could be assessed.
   Often teachers' attitudes, whether positive or negative, can
   reflect on the students' acceptance or rejection of an innovative
   idea.
REFERENCES


APPENDIX A
SET-UP OF THE ELEMENTARY SCHOOL LABS

The project at the elementary school consisted of three labs:

1. a primary lab for junior kindergarten to grade three which included 30 Macintosh Classic computers, a file server, laser printer, fridge, stove, work station, table, lego kits and primary work tables;

2. a communication lab for grades four to eight which included: 31 Macintosh Classic computers, file server, laser printer and Apple scanner;

3. a video room which included: 4 Sony Laser Disk machines, 4 Sony televisions monitors, Windows on Science Laser Discs, 2 8mm record/playback machines, 2 VHS machines, 2 televisions, 2 editing boards, 4 8mm Camcorders and 2 tripods;

4. a science lab which was equipped with: 2 Macintosh Classic Computers, 1 Macintosh LC colour computer, access to a file server, 1 plotter, 2 interfaces for Robotics, 10 Lego 1031 kits, 10 Lego 1032 kits, 2 Lego 9700 kits, 2 Lego replacement kits, 6 Teko construction kits, 7 Temsi construction kits and various standard science equipment.
APPENDIX B
PLEASE CIRCLE THE CORRECT RESPONSE TO EACH QUESTION

Personal Information

1. Please indicate who will fill out this questionnaire, (Male, Female) M F

2. What is the date of your birth? Day Month Year

3. What grade are you in? 10 11

4. How much experience do you have in years in:
   a) Word Processing 0 0.5 1 2 3 4 5
   b) Data Base 0 0.5 1 2 3 4 5
   c) Spreadsheet 0 0.5 1 2 3 4 5
   d) Graphics 0 0.5 1 2 3 4 5
   e) Telecommunications 0 0.5 1 2 3 4 5
   f) Educational Software 0 0.5 1 2 3 4 5
   g) Computer Programming 0 0.5 1 2 3 4 5
Please circle the response that best demonstrates how you feel about each statement below.

<table>
<thead>
<tr>
<th>CODE:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**Curriculum**

5. I would rather do my assignments on a computer than pencil and paper. 1 2 3 4

6. The computer helps me integrate (use different programs together) for classroom homework and projects. 1 2 3 4

7. The subjects are more interesting when the new technologies (laser disks, computers, video etc.) are involved. 1 2 3 4

8. I can complete my assignments more quickly using a computer. 1 2 3 4

9. My finished assignments are of better quality when I use a computer. 1 2 3 4

10. I can make more efficient use of my classroom time using a computer. 1 2 3 4

11. Classroom studies seem more relevant (up to date) when I use the new technologies. 1 2 3 4

12. "Hands-on materials" help me understand the topics. 1 2 3 4

13. Students are allowed to investigate beyond the outline of the lessons. 1 2 3 4

14. Our teacher(s) allows me to use the computer as much as possible. 1 2 3 4

15. I use computer technology in most subject areas. 1 2 3 4
Please circle the response that best demonstrates how you feel about each statement below.

<table>
<thead>
<tr>
<th>CODE:</th>
<th>1</th>
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<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**Career Awareness**

16. The use of computers and other new technologies (laser disks, computers, video etc.) are helpful to me in secondary school.  

17. The use of the new technologies will introduce me to new career opportunities.

18. I am aware of other career opportunities in the field of computer technology.

19. I am aware that many technological careers are available to both male and females.

20. I am seriously considering a career in a technological field.
Please circle the response that best demonstrates how you feel about each statement below.

**CODE:**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**Self**

21. I feel better about the appearance of my work (finished product) when I use a computer or the other new technologies (e.g. laser disks, audio-video editing).  

22. I think I complete more work when I use a computer or the other new technologies.  

23. I think the overall quality (appearance and presentation, ) of my work is better when I use a computer or the other new technologies.  

24. I think the overall quality (content and accuracy ) of my work is better when I use a computer or the other new technologies.  

25. I would like to have more scheduled time using the computers and the other new technologies than I am allotted.  

26. I am satisfied with my own progress using the new technologies in the school.  

27. I feel I have an advantage over other students who have not had the same exposure to the computers and the other new technologies.
Please circle the response that best demonstrates how you feel about each statement below.

<table>
<thead>
<tr>
<th>CODE</th>
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<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**SOCIETY**

28. My parents think that the introduction of computers and the other new technologies into the school was good for me.  
   1  2  3  4

29. My parents think the idea of having an educational partner is helpful to me.  
   1  2  3  4
Please circle the response that best demonstrates how you feel about each statement below.

<table>
<thead>
<tr>
<th>CODE</th>
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<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**COMPUTER ANXIETY**

30. Computers do not scare me at all. 1 2 3 4
31. Working with a computer would make me very nervous. 1 2 3 4
32. I do not feel threatened when others talk about computers. 1 2 3 4
33. I feel aggressive and hostile toward computers. 1 2 3 4
34. It wouldn't bother me at all to take computer courses. 1 2 3 4
35. Computers make me feel uncomfortable. 1 2 3 4
36. I would feel at ease in a computer class. 1 2 3 4
37. I get a sinking feeling when I think of trying to use a computer. 1 2 3 4
38. I would feel comfortable working with a computer. 1 2 3 4
39. Computers make me feel uneasy and confused. 1 2 3 4
Please circle the response that best demonstrates how you feel about each statement below.

<table>
<thead>
<tr>
<th>CODE:</th>
<th>1</th>
<th>2</th>
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<tr>
<td></td>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**COMPUTER CONFIDENCE**

40. I’m no good with computers. 1 2 3 4

41. Generally, I feel OK about trying a new problem on the computer. 1 2 3 4

42. I don’t think I would do advanced computer work. 1 2 3 4

43. I am sure I can do work with computers. 1 2 3 4

44. I ‘m not the type to do well with computers. 1 2 3 4

45. I am sure I could learn a computer language. 1 2 3 4

46. I think using a computer would be very hard for me. 1 2 3 4

47. I could get good grades in computer courses. 1 2 3 4

48. I do not think I could handle a computer course. 1 2 3 4

49. I have a lot of self-confidence when it comes to working with computers. 1 2 3 4
Please circle the response that best demonstrates how you feel about each statement below.

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<tbody>
<tr>
<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
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</table>

**COMPUTER LIKING**

50. I would like working with computers. 

51. The challenge of solving problems with computers does not appeal to me.

52. I think working with computers would be enjoyable and stimulating.

53. Figuring out computer problems does not appeal to me.

54. When there is a problem with a computer run that I can’t immediately solve, I would stick with it until I have the answer.

55. I don’t understand how some people can spend so much time working with computers and seem to enjoy it.

56. Once I start to work with the computer, I find it hard to stop.

57. I will do as little work with computers as possible.

58. If a problem is left unsolved in a computer case, I would continue to think of it afterward.

59. I do not enjoy talking with others about computers.
Please circle the response that best demonstrates how you feel about each statement below.

**CODE:**

<table>
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<tr>
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<td>Strongly Agree</td>
<td>Agree</td>
<td>Disagree</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

**COMPUTER USEFULNESS**

60. I will use computers many ways in my life.  
   1 2 3 4

61. Learning about computers is a waste of time.  
   1 2 3 4

62. Learning about computers is worthwhile.  
   1 2 3 4

63. I’ll need a fine mastery of computers for my future work.  
   1 2 3 4

64. I expect to have little use for computers in my daily life.  
   1 2 3 4

65. I can’t think of any way I will use computers in my career.  
   1 2 3 4

66. Knowing how to work with computers will increase my job possibilities.  
   1 2 3 4

67. Anything a computer can be used for, I can do just as well some other way.  
   1 2 3 4

68. It is important to me to do well in computer class.  
   1 2 3 4

69. Working with computers will not be important to me in my life’s work.  
   1 2 3 4
Please circle the response that best demonstrates how you feel about each statement below.

<table>
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</tr>
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</table>

**COGNITIVE ATTITUDES**

70. Computers can improve learning of higher order skills (e.g. analyzing, evaluating, drawing conclusions).  

71. Computers will improve education.  

72. Computers can improve drill and practice.  

73. Computers can create jobs needing specialized training.  

74. Computers will improve health care.  

75. A person today cannot escape the influence of computers.  

76. Computers are a tool just like a hammer or lathe.
Please circle the response that best demonstrates how you feel about each statement below.

CODE: 1 2 3 4
      Strongly Agree  Agree  Disagree  Strongly Disagree

AFFECTIVE ATTITUDES

77. Computers will displace teachers.  

78. Computers will dehumanize teaching.  

79. Computers dehumanize society.  

80. Computers can teach better than teachers.  

81. Computers are beyond the understanding of the typical person.  

82. Computers will replace low-skill jobs.  

83. Computers make mistakes at least 10% of the time.  

APPENDIX C
November 30, 1994

Ethics Committee
University of Windsor
Windsor, Ontario

To Whom It May Concern:

This letter is to inform you that I have granted Karen Pluard, Teacher at St. Patrick’s High School, to conduct a study at St. Patrick’s High School. The study is a follow-up to the study Doug Vosburg completed with the children at St. Helen’s School and Ms. Pluard will be reassessing these same students with regard to their attitudes about the use of the technology that has been made available at St. Patrick’s High School.

If you have any questions/concerns, please feel free to contact me.

Yours truly,

John Ross
Director of Education
and Secretary

JFR/dg

cc: Karen Pluard
APPENDIX D
Karen Pluard

Dear Karen:

Permission is, hereby, granted to you to conduct a study with the students with regard to their attitudes about the use of the technology that has been made available to them at St. Patrick's High School.

R. Griffiths
Principal
Dear Parents:

Three years ago students, in grade 7 and 8, participated in a pilot project at St. Helen’s School. The students were surveyed about their attitudes regarding the use of the new technology in the school. They were also asked if they thought the new technology enhanced their work and their ability to learn. A written report was made available to the parents explaining the results of the survey.

The children expressed a keenness for the technology and the idea that their grades and calibre of work had improved with the use of the technology. The original researcher expressed a concern that the results were so positive because of the “novelty” of using the new equipment.

I am currently in the Master’s programme, in the Faculty of Education, of the University of Windsor. I wish to reassess the responses of the students to ascertain if their attitudes towards the use of the technology have changed since they have entered high school. I will also be assessing the responses of a control group of students who were not participants of the St. Helen’s project. Your child is a member of either the original group or will be a participant in the control group.

The students will be answering questions similar, if not identical, to the first survey and questions from two professional instruments (the Computer Attitude Scale and the Cognitive and Affective Computer Attitude Scales). The surveys will be administered at the school. The results of my research will be made available to you upon request. Your child’s responses will be confidential, anonymous and participation is on a voluntary basis.
I am, therefore, requesting your permission to administer a questionnaire to your child with the purpose of evaluating the responses. Since the responses to the questionnaires are anonymous, returning the questionnaire will be taken as an indication of consent. If you wish to provide written permission please complete the following form and return it to the school by _______________.

If you have any complaints about the process please contact:

Dr. Larry Morton
Chairperson
Faculty of Education: Research Ethics Committee
University of Windsor
1-519- 253-4232 Ext.3800

If you have further questions contact me at:
332-2011 - home
332-3976 - St. Patrick’s High School

Sincerely,

Karen Pluard
Researcher

PARENT CONSENT FORM

I _______________ give my permission for my son/daughter _______________ to volunteer to participate in this research project and complete the questionnaire. I fully understand the information that has been provided.

_________________________
Parent’s/Guardian’s Signature
APPENDIX F
PERCENT FREQUENCIES FOR EACH QUESTION

Please circle the response that best demonstrates how you feel about each statement below.

CODE: 1  2  3  4

Strongly Agree  Agree  Disagree  Strongly Disagree

Curriculum

5. I would rather do my assignments on a computer than pencil and paper.
   1)40.5  2)34.2  3)15.8  4)9.5

6. The computer helps me integrate (use different programs together) for classroom homework and projects.
   1)27.2  2)55.7  3)12.0  4)5.1

7. The subjects are more interesting when the new technologies (laser disks, computers, video etc.) are involved.
   1)41.8  2)42.4  3)12.0  4)3.8

8. I can complete my assignments more quickly using a computer.
   1)39.2  2)32.9  3)17.1  4)10.8

9. My finished assignments are of better quality when I use a computer.
   1)70.9  2)23.4  3)2.5  4)3.2

10. I can make more efficient use of my classroom time using a computer.
    1)23.4  2)38.6  3)29.1  4)8.2

11. Classroom studies seem more relevant (up to date) when I use the new technologies.
    1)17.7  2)55.7  3)20.3  4)6.3

12. "Hands-on materials" help me understand the topics.
    1)34.8  2)52.5  3)9.5  4)3.2

13. Students are allowed to investigate beyond the outline of the lessons.
    1)13.9  2)54.4  3)23.4  4)7.6

14. Our teacher(s) allows me to use the computer as much as possible.
    1)15.8  2)30.4  3)37.3  4)16.5

15. I use computer technology in most subject areas.
    1)17.1  2)44.3  3)30.4  4)8.2
Please circle the response that best demonstrates how you feel about each statement below.

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**Career Awareness**

16. The use of computers and other new technologies (laser disks, computers, video etc.) are helpful to me in secondary school.  
1) 50.6  2) 39.9  3) 5.1  4) 4.4

17. The use of the new technologies will introduce me to new career opportunities.  
1) 46.2  2) 40.5  3) 10.1  4) 53.2

18. I am aware of other career opportunities in the field of computer technology.  
1) 31.0  2) 48.1  3) 15.2  4) 5.7

19. I am aware that many technological careers are available to both male and females.  
1) 49.4  2) 41.8  3) 3.8  4) 5.1

20. I am seriously considering a career in a technological field.  
1) 10.8  2) 26.6  3) 38.6  4) 23.4  
M) 0.6
Please circle the response that best demonstrates how you feel about each statement below.

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**Self**

21. I feel better about the appearance of my work (finished product) when I use a computer or the other new technologies (e.g. laser disks, audio-video editing). 1)74.1 2)22.2 3)1.3 4)2.5

22. I think I complete more work when I use a computer or the other new technologies. 1)31.6 2)37.3 3)22.8 4)7.6 M)0.6

23. I think the overall quality (appearance and presentation, ) of my work is better when I use a computer or the other new technologies. 1)66.5 2)27.2 3)3.2 4)2.5 M)0.6

24. I think the overall quality (content and accuracy ) of my work is better when I use a computer or the other new technologies. 1)46.8 2)37.3 3)12.0 4)2.5 M)1.3

25. I would like to have more scheduled time using the computers and the other new technologies than I am allotted. 1)49.4 2)34.2 3)13.3 4)2.5 M)0.6

26. I am satisfied with my own progress using the new technologies in the school. 1)20.9 2)52.5 3)16.5 4)8.9 M)1.3

27. I feel I have an advantage over other students who have not had the same exposure to the computers and the other new technologies. 1)42.4 2)30.4 3)19.0 4)7.0 M)1.3
Please circle the response that best demonstrates how you feel about each statement below.

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**SOCIETY**

28. My parents think that the introduction of computers and the other new technologies into the school was good for me.

   1) 44.9  2) 48.1  3) 4.4  4) 1.9  M) 0.6

29. My parents think the idea of having an educational partner is helpful to me.

   1) 24.7  2) 56.3  3) 12.7  4) 5.1  M) 1.3
Please circle the response that best demonstrates how you feel about each statement below.

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**COMPUTER ANXIETY**

30. Computers do not scare me at all
   1) 45.6  2) 31.0  3) 4.6  4) 8.9

31. Working with a computer would make me very nervous.
   1) 10.1  2) 14.6  3) 32.9  4) 41.8
   M) 0.6

32. I do not feel threatened when others talk about computers.
   1) 28.5  2) 36.7  3) 23.4  4) 10.8
   M) 0.6

33. I feel aggressive and hostile toward computers.
   1) 11.4  2) 15.2  3) 32.9  4) 39.9
   M) 0.6

34. It wouldn't bother me at all to take computer courses.
   1) 34.2  2) 36.1  3) 20.9  4) 8.9

35. Computers make me feel uncomfortable.
   1) 11.4  2) 13.3  3) 37.3  4) 37.3
   M) 0.6

36. I would feel at ease in a computer class.
   1) 26.6  2) 44.9  3) 16.5  4) 11.4
   M) 0.6

37. I get a sinking feeling when I think of trying to use a computer.
   1) 7.0  2) 8.9  3) 45.6  4) 30.0
   M) 0.6

38. I would feel comfortable working with a computer.
   1) 35.4  2) 40.5  3) 16.5  4) 7.0
   M) 0.6

39. Computers make me feel uneasy and confused.
   1) 10.1  2) 12.7  3) 35.4  4) 40.5
   M) 1.3
Please circle the response that best demonstrates how you feel about each statement below.

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**COMPUTER CONFIDENCE**

40. I'm no good with computers.  
   1) 13.3   2) 14.6   3) 41.1   4) 31.0

41. Generally, I feel OK about trying a new problem on the computer.  
   1) 17.1   2) 49.4   3) 20.3   4) 12.7
   M(0.6)

42. I don't think I would do advanced computer work.  
   1) 17.1   2) 27.8   3) 36.1   4) 19.0

43. I am sure I can do work with computers.  
   1) 29.1   2) 56.3   3) 8.2   4) 6.3

44. I'm not the type to do well with computers.  
   1) 10.1   2) 18.4   3) 48.1   4) 22.8
   M(0.6)

45. I am sure I could learn a computer language.  
   1) 18.4   2) 43.0   3) 25.9   4) 12.0
   M(0.6)

46. I think using a computer would be very hard for me.  
   1) 7.6   2) 14.6   3) 44.9   4) 32.9

47. I could get good grades in computer courses.  
   1) 19.0   2) 51.3   3) 17.7   4) 11.4
   M(0.6)

48. I do not think I could handle a computer course.  
   1) 7.0   2) 27.2   3) 36.7   4) 27.8
   M(1.3)

49. I have a lot of self-confidence when it comes to working with computers.  
   1) 21.5   2) 48.1   3) 19.6   4) 10.8
Please circle the response that best demonstrates how you feel about each statement below.

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**COMPUTER LIKING**

50. I would like working with computers.  
   1)31.0  2)40.5  3)19.6  4)8.2  
   M)0.6

51. The challenge of solving problems with computers does not appeal to me.  
   1)19.0  2)29.1  3)37.3  4)12.7  
   M)1.9

52. I think working with computers would be enjoyable and stimulating.  
   1)13.3  2)49.4  3)20.9  4)15.8  
   M)0.6

53. Figuring out computer problems does not appeal to me.  
   1)20.3  2)34.8  3)36.1  4)8.2  
   M)0.6

54. When there is a problem with a computer run that I can't immediately solve, I would stick with it until I have the answer.  
   1)11.4  2)38.0  3)32.3  4)17.1  
   M)1.3

55. I don't understand how some people can spend so much time working with computers and seem to enjoy it.  
   1)20.3  2)27.6  3)39.1  4)12.7  
   M)1.3

56. Once I start to work with the computer, I find it hard to stop.  
   1)12.0  2)23.4  3)43.0  4)20.9  
   M)0.6

57. I will do as little work with computers as possible.  
   1)10.1  2)15.8  3)50.6  4)22.8  
   M)0.6

58. If a problem is left unsolved in a computer case, I would continue to think of it afterward.  
   1)6.3  2)32.3  3)39.1  4)21.5  
   M)1.3

59. I do not enjoy talking with others about computers.  
   1)21.5  2)38.0  3)26.6  4)13.3  
   M)0.6
Please circle the response that best demonstrates how you feel about each statement below.

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**COMPUTER USEFULNESS**

60. I will use computers many ways in my life.  
   1) 38.0  2) 52.5  3) 4.4  4) 4.4
   M) 0.6

61. Learning about computers is a waste of time.  
   1) 6.3  2) 51.1  3) 51.9  4) 36.7

62. Learning about computers is worthwhile.  
   1) 32.9  2) 55.1  3) 7.0  4) 5.1

63. I’ll need a fine mastery of computers for my future work.  
   1) 12.7  2) 52.5  3) 29.1  4) 5.7

64. I expect to have little use for computers in my daily life.  
   1) 5.1  2) 41.1  3) 47.5  4) 23.4

65. I can’t think of any way I will use computers in my career.  
   1) 3.8  2) 8.9  3) 47.5  4) 39.9

66. Knowing how to work with computers will increase my job possibilities.  
   1) 56.3  2) 34.8  3) 6.3  4) 2.5

67. Anything a computer can be used for, I can do just as well some other way.  
   1) 8.2  2) 16.5  3) 51.2  4) 16.5
   M) 0.6

68. It is important to me to do well in computer class.  
   1) 12.0  2) 63.3  3) 19.0  4) 5.1
   M) 0.6

69. Working with computers will not be important to me in my life’s work.  
   1) 5.7  2) 17.1  3) 51.3  4) 25.9
Please circle the response that best demonstrates how you feel about each statement below.

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**COGNITIVE ATTITUDES**

70. Computers can improve learning of higher order skills (e.g. analyzing, evaluating, drawing conclusions).
    1) 36.7  2) 44.9  3) 11.4  4) 5.7
    M 1.3

71. Computers will improve education.
    1) 47.5  2) 37.3  3) 8.2  4) 6.3
    M 0.6

72. Computers can improve drill and practice.
    1) 35.4  2) 50.6  3) 8.9  4) 3.8
    M 1.3

73. Computers can create jobs needing specialized training.
    1) 46.8  2) 43.7  3) 5.1  4) 3.2
    M 1.3

74. Computers will improve health care.
    1) 32.3  2) 35.4  3) 22.2  4) 8.9
    M 1.3

75. A person today cannot escape the influence of computers.
    1) 38.6  2) 39.9  13.3  4) 7.0
    M 1.3

76. Computers are a tool just like a hammer or lathe.
    1) 31.6  2) 40.5  3) 20.3  4) 6.3
    M 1.3
Please circle the response that best demonstrates how you feel about each statement below.

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**AFFECTIVE ATTITUDES**

77. Computers will displace teachers.

1) 12.7 2) 24.7 3) 40.5 4) 20.3
M: 1.9

78. Computers will dehumanize teaching.

1) 18.4 2) 25.9 3) 39.9 4) 14.6
M: 1.3

79. Computers dehumanize society.

1) 14.6 2) 22.8 3) 43.7 4) 16.5
M: 2.5

80. Computers can teach better than teachers.

1) 7.0 2) 13.3 3) 38.6 4) 39.2
M: 1.9

81. Computers are beyond the understanding of the typical person.

1) 8.9 2) 30.4 3) 44.9 4) 14.6
M: 1.3

82. Computers will replace low-skill jobs.

1) 21.5 2) 45.6 3) 25.9 4) 5.1
M: 1.9

83. Computers make mistakes at least 10% of the time.

1) 13.9 2) 29.1 3) 38.0 4) 1.9
M: 1.9

---

**NOTE.** M = Missing Answer.
VITA AUCTORIS

The following is the history of my educational experiences:

1963 - Grade 12 - Ursuline College - Chatham, Ontario
1966 - College - Windsor, Ontario
1971 - University, B.A. - Windsor, Ontario
1996 - University, MEd - Windsor, Ontario