TEACHERS' ATTITUDES TOWARD COMPUTERS

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by

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ABSTRACT

Research studies suggest that computers are not being introduced into public schools and incorporated into classroom instruction at a fast enough pace. The major reason cited for such a slow introduction was the negative attitudes teachers had toward computers. Furthermore, it was suggested that certain groups of teachers had more negative attitudes toward computers than others.

The purpose of this present study was to examine the relationship between four teacher characteristics - computer literacy level, teaching area, teacher gender, grade level taught - and teachers' attitudes toward computers. In order to discover the nature of the relationship between teachers and attitudes toward computers a Likert - type scale was constructed and administered to 487 teachers. The results showed that computer literate teachers demonstrate more positive attitudes toward computers than non - computer literate teachers; science and language arts teachers show more positive attitudes toward computers than social studies teachers; male teachers have more positive attitudes toward computers than female teachers; and intermediate - high school teachers (grades 7 to 12) have more positive attitudes toward computers than primary - elementary school teachers (grades K to 6).

These results have important implications for an education system in the process of incorporating computers into its program.

If it is true that certain groups of teachers hold less positive attitudes toward computers, then teachers with these less positive attitudes might be more resistent to the introduction of computers into the educational system.

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To my wife, Beverley, I say that she loves me very much. Beverley sacrificed her job, moved to a new community, accepted a lower standard of living and a reduction in the time that we spent together and still found time to help with this thesis. I can never repay all the hours that she spent on the computer, typing and retyping my work. I can only say thank you, and I love you very much.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

Western society is currently experiencing a transition from a labour - intensive economy to an information - intensive economy (Naisbitt, 1982). This transition has been accelerated by innovations in microcircuitry that have prompted the expansion of the use of computers to nearly all aspects of society. It is not surprising, therefore, that high technology should eventually have a strong impact on education. But, while microcomputer technology is now available in most schools (Ingersoll, Smith, and Elliott, 1984) it has still not achieved universal acceptance among teachers (Grossnickle, Laird, Cutter, and Tefft, 1982). Researchers suggest several reasons for this resistance including "technostress" and "computerphobia" (Blank and White, 1984; Jay, 1981); perceived effectiveness of computer assisted instruction (Atkinson, 1984; Halworth and Brebner, 1980); and teachers' low level of computer literacy (Madsen and Sebastiani, 1987).

Traditionally, education has always been associated with literacy and "being schooled" and "being literate" were considered synonymous (Ringle, 1981). According to Ringle (1981):

> to be literate means to be educated in the fundamental ideas and modes of communication of one's society. Applying the term "literacy" to knowledge of computers is a way of signifying that this knowledge is as important to one's educatidn in contemporary society as knowledge of reading and writing has been in the past. (p. 12)

Lawton and Gerschner (1982) suggest that in order to raise the level of computer literacy, the most important consideration is the people who are affected by computers. These authors believe that staff development, more planning, and more awareness of the computer's impact on people would make teachers more receptive to computers and would encourage the growth of computer literacy within that group. Several studies (e.g., Madsen and Sebastiani, 1987; Harmon, 1986) suggest that a knowledge of, and positive attitudes toward computers by teachers, will subsequently lead toward acceptance of computers in the classroom.

In reviewing the literature on the implementation of computers in the classroom, Lawton and Gerschner (1982) suggest that there has been too much emphasis placed on studying instructional gains resulting from computer instruction. However, there appears to be few studies that research attitudes toward computers and how they may affect successful implementation of computer assisted instruction. For example, the Dallas Independent School District has over 1000 microcomputers, and there has never been any empirical research conducted regarding the attitudes of the teachers or the students (Lawton & Gerschner, 1982).

With the increasing availability of computer technology for education it is important to learn about the many ways in which the technology might affect the life of the classroom and the lives of the students and teachers contained therein. Simmons (1975) concluded that teachers are the key to any effective implementation of technological media such as television, audio and video tapes

or computers. Their opposition guarantees failure of even the best systems. This has strong implications for educational administrators who might be considering introducing computers into the schools of their district. Simmons (1975) suggests that no proposed project should be adopted and moved into the stages of implementation until the teachers whom it will affect have been educated to the point where they can contribute to the planning and implementation of the project.

According to the literature (e.g., Harmon, 1986; Wagschal, 1986) attitudes are an important factor in determining whether or not computers are successfully accepted into the classroom. Yet, a literature search covering the period from 1962 to 1987 reveals that virtually no empirical research has been conducted to study these attitudes. The present study proposes to examine the relationships that exist between teachers' attitudes toward computers and four teacher characteristics - teaching area, teacher gender, grade level taught, and computer literacy level. The practical consequence of this study is that the results would reveal new information that might better facilitate the introduction of computers into the schools. The economic consequence of this study is that results might indicate that negative attitudes toward the computer are restricted to a particular segment of the teacher population. Such information would allow school districts to perhaps reduce the cost of training the total teacher population in computer literacy. Also, these findings might provide post - secondary institutions with data that

could be of benefit in the pre- training of teachers in the use of computers. The scientific consequence of this study is that the results would significantly add to both the quantity and quality of the current literature on this subject.

CHAPTER 2: ATTITUDES, TEACHERS, AND TECHNOLOGY

Attitudes

In conducting research in the field of social psychology many people have attempted to define the construct "attitude". As early as 1935, Gordon Allport defined an attitude as "A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related". (p.810). In examining Allport's definition Halloran (1967) wrote the following commentary.

> First, an attitude is a state of readiness leading the individual to perceive things and people around him in certain ways...Secondly, attitudes are not innate - they are learned they develop and they are organized through experience. These states of readiness are relatively enduring but they are modifiable and subject to change...Attitudes are not merely latent states of preparedness awaiting the presentation of an appropriate object for their activation. They have motivational qualities and can lead a person to seek (or avoid) the objects about which they are organized. (p.14)

Fundamental to the study of attitudes is the assumption that the construct of attitude is defineable; that it is measureable, and that it predisposes a certain type of behavior toward the attitude object. After reviewing the literature, Osgood, Suci, and Tannenbaum (1967) report that an attitude is usually thought of as having three components: an affective component which consists of the individual's feelings about the attitude object; a cognitive component, which is the individual's beliefs or knowledge about the attitude object; and a behavioral component, which is the

individual's predisposition to act toward the attitude object.

An essential underlying assumption of most research involving attitudes is that attitudes do influence behaviors. The basic rationale for understanding attitudes hinges on the notion that attitudes will reveal something about probable behavior; and since behaviors are difficult to predict and to measure, the assumption has been that attitudes would provide a shortcut to understanding behaviors (Kahle, 1984). While the debate continues among social psychologists regarding the nature of the attitude -behavior relationship there exist a number of empirical studies that strongly suggest that the relationship is positive (Fazio, 1978; Schuman, 1976; Schwartz, 1973; & Taylor, 1975).

Teachers and Technological Innovation

Having thus accepted that attitudes are organized through experience, and further, that they are learned, it was necessary to explore research findings regarding the relationship between the knowledge of and experience with technology as it may affect attitudes toward technological innovations.

As early as 1962 researchers were studying the relationship between knowledge of new technology and its acceptance and use among teachers. Knowlton and Hawes (1962) conducted a study on the use of audio - visuals in instruction; something which, for that time was considered as technologically advanced as computers would be today. They found that the more knowledge a teacher had

regarding audio - visual equipment and materials, the more positive was the attitude of that teacher toward audio - visuals. Leader and Null (1974) studied types of teachers who use instructional films in relation to those situations that are most conducive to encouraging maximum use of instructional films. The results showed that there was a significant positive relationship between such factors as familiarity with equipment, appropriateness of films, value of films for instruction, training of teachers, and increased film usage.

With the suggestion that knowledge of technology influenced attitude toward and use of this same technology, Tobias (1968) set out to research what teachers' attitudes were. He found that teachers had generally unfavorable attitudes toward programmed materials described in technological terms. They were less favorable toward the terms "automated instruction", "teaching machine", and "mechanical tutor", than they were toward the terms, "flash card", "exercise book", or "workbook". It might therefore be concluded that teachers would be less predisposed to using this technology. Twenty years later this was confirmed by Blank and White (1984) in a review of the technological and psychological literature. These authors presented a number of arguments for the existence of two psychological constructs that had a severe impact on teachers' use of new technology, especially computers: Technophobia and Computerphobia. The review cited evidence for the misuse, non - use and distorted use of computers due to these constructs. The authors summarized their findings by stating that

"if those who are going to be given the responsibility for determining the place of new technology in education are not helped to overcome this anxiety, the computer and other high technology tools will continue to gather dust in backroom closets". (p. 77)

While our education system is generally thought to be the route through which new ideas and innovations would logically pass to the society at large, Lichtman (1979) conducted a survey in which he found that educators seemed less enthusiastic about the computer's role in society than did the general public. Teachers were found to feel that computers dehumanize society and prevent normal social interaction. Also, he found that most teachers regarded computers as a mathematical tool rather than a universal symbol manipulator.

Martellaro (1980) proposes that computers in education have a long, uphill struggle before they become well established in the classroom. She suggests that in order for computers to be accepted by teachers it must have a perceived advantage over older, more established teaching methods. Moreover, the values, experiences, and needs of the teachers and students will have to alter so that computers are an integral part of their learning and life.

While this would seem to suggest that teachers are categorically against the introduction of computers, this may not be the case. Grossnickle, Laird, Cutter and Tefft (1982) studied the introduction of microcomputers into a local high school. They found that the majority of faculty sampled did not use the available microcomputers. The reasons given by the faculty for

not using the microcomputers included such things as lack of training, time, and available software. The authors disagreed with the faculty, however, and concluded that these were "excuses" made in an attempt to rationalize an overriding resistance to change their established teaching routines.

In fact, what may be perceived as denial of this new technology may simply be cautious reluctance as these later studies propose. Stevens (1980) conducted a survey and found that educators strongly favored instruction to foster computer literacy in secondary schools; however, the respondents did not feel qualified to teach computer literacy. Stevens also found many participants who expressed a desire to learn the computer skills necessary to respond to the technological needs of students. There were more participants receptive to the potential of using computers as instructional tools in classrooms than there were those who disagreed with the concept. However, the number of educators responding as undecided provided evidence that many educators were cautious and hesitant in making judgments perhaps until more success was experienced in instructional uses of computers.

Stevens' study is supported by Reed (1986) who also found that teachers believed that computers should be an integral part of the instruction. He also suggested that the degree of effectiveness and efficiency of computer related instruction would determine whether school administrators and teachers would further commit themselves to meeting needs for improvements in computer based instruction.

However when researchers look at the attitude - acceptance relationship that exists when introducing new technology, they all agree that educators and their attitudes play a major role. Wagschal (1986) states that the starting place for successfully introducing computers into the instructional process is not as an educational tool for children but as an administrative aid for teachers. Once teachers have discovered the power of the computer as a tool for their own professional purposes, this will allow them to see the advantages of using such a tool as a part of their instruction.

One must also consider the view that teachers find computers difficult to use. The computer operating system is not as easy to learn as the manufacturers claim. Further, no sooner has the user learned one system than another comes on the horizon. DOS, for example, will be superceded by UNIX as school systems recognize the advantages of LAN systems; and UNIX is notoriously user unfriendly. Thus, by encouraging teachers to discover the power of the computer, inadvertently one might be helping them discover how difficult they are to use -- at least, at present.

Teachers and Computer Literacy

Since teachers, like many, perceive computers to be mathematical tools rather than universal symbol manipulators it is not surprising that unless they are mathematics or science teachers who require such a tool, they do not see the need for their involvement with computer technolgy. Kelman (1984) argues that as

with language literacy, all teachers - not just teachers of mathematics or computer science - should be computer literate and should infuse computer literacy into all teacher - student interactions. In addition, Kelman states that from the earliest years of schooling, students should both use computer literacy skills in a wide variety of everyday tasks of importance to them, and build new skills through teacher - directed activity.

Madsen and Sebastiani (1987) found significant improvement in both the attitude and in the level of computer literacy of high school teachers who participated in a district - mandated computer literacy inservice program even though they were not all mathematics or science teachers. While the results of this study are as expected, it should be noted that they are open to contamination in two respects. First, the teachers were taken from a waiting list of people who had signed up for inservice; and second, it was a district mandated program. Teachers might have espoused a positive attitude toward computers for ulterior reasons.

While these previously mentioned studies support the fact that a higher degree of computer literacy leads to a more positive teacher attitude, Forcheri and Malfino (1986) suggested that teacher computer literacy training and computer assisted instruction should concentrate on a few selected areas rather than try to cover a broad range of material.

Computers and Sex Differences

Gender is another of the potential influences on attitudes toward computers. Hawkins (1985) examined the findings of several research projects and concluded that the extensive work on the emergence of sex differences in relation to learning and achievement appears to be connected to many factors: the impact of societal images on girls, the expectation of different life goals for boys and girls, the structure of learning tasks, the nature of feedback in performance situations, and the organization of the classroom setting. It is interesting to note that in their study Collis and Ollila (1986) researched the use of writing as a focus of computer literacy experiences for secondary school females. They found that this experience helped transfer the positive feelings that females had about themselves and writing to the attitudes they developed about themselves and computers. They do not, however, give comparative results for males in the same computer assisted activity.

In a more recent study Durndell, Macleod and Siann (1987) in their survey of college students' attitudes, knowledge and experience regarding computers, concluded that male students' knowledge and experience regarding computers were markedly greater than female students' knowledge and experience regarding computers, even for students specializing in computer/electronic studies. The authors suggest that in view of their answers to questions concerning the use of computers outside the college setting, girls enrolled in computer courses may be less interested in computers

per se than their male counterparts.

This lack of interest in computers may be due to some degree to the fact that girls perceive computer studies as having a masculine image both in its use and presentation. Gardner, McEwen & Curry (1986) in a report of their findings state that on the one hand females look upon computer technology as socially beneficial and the acquisition of computer skills as being important for career projects, yet on the other hand they do not appear to be taking advantage of opportunities to study computer science to the same extent as males. To conclude, they say that if this picture is an accurate reflection of male and female differences in perception of computers, it is evident that girls are in danger of not taking their full share of computer based opportunities in school and subsequently, when choosing careers, may not fully explore the career opportunities which may exist in the area of computer technology.

In a Dutch research study that examined the performance and engagement of computer literacy of boys and girls, Voogt (1987) showed that boys perform better in computer literacy, enjoy computers more and feel more confident about their ability to deal with computers than do girls. Voogt also measures performance as a function of attitude and the results of the study showed that there are no differences in performance in computer literacy between girls and boys with a negative attitude toward mathematics and physics. However, when the attitude toward mathematics and physics is positive, a difference between boys and girls has been

found in favour of boys.

Computer Assisted Instruction

In assessing the effectiveness of computer assisted instruction, Thomas (1979) found that computer assisted instruction seemed to lead to achievement levels equal to or higher than traditional instruction. However, in their review of the literature Lawton and Gerschner (1982) found that there was very little agreement on attitudes toward computerized instruction. Few researchers are willing to guarantee that students could learn or would like to learn on computers. The authors suggest that this is a factor that contributes to the low level of computer literacy. They offer several suggestions to raise the level of computer literacy; for instances, to train people affected by computers; to include more planning and staff development; and to be aware of the computer's impact on people.

A more recent study by Atkinson (1984) examines various research that have assessed the advantages of using computer assisted instruction. She concludes that overall, computer assisted instruction has had a small positive effect on student achievement. The biggest and most significant finding on the effectiveness of computer assisted instruction is in its ability to shorten instruction time. However, Atkinson writes that "although much has been learned about computer assisted instruction research is still needed on several variables -- how to utilize the unique characteristics of the computers themselves -- how to

actually integrate computers into the schools and classrooms" (p.98).

Recently, one particular study has looked at the use of computer assisted instruction to improve the achievement of a special group of students. Goldman and Pellegrino (1987) report that the use of microcomputer technology by learning disabled students does have a positive impact on the achievement abilities of these students.

CHAPTER 3: RATIONALE

The literature reveals that teachers' attitudes toward computers have not yet been studied very thoroughly or systematically. Consequently, much of the rationale for this study is based on research that investigated teachers' attitudes toward previous instructional innovations in the classroom. There is evidence to suggest that regardless of the specific medium involved, for instances educational radio, instructional film, programmed instruction, and computer - assisted instruction, teacher attitudes tend to cluster into four general areas of concern: professional threat, overall effectiveness, changes to teaching modes, and technical/logistical problems (Sandeen, 1984).

A number of studies have suggested "perceived effectiveness" as a factor that influences teachers' attitudes toward the use of instructional media in the classroom. Broussard (1978) found that positive teacher ratings of statements which indicated that teachers believed in the effectiveness of instructional television were positively correlated with the frequency of television use in the classroom. Leader and Null (1974), in studying teachers' attitudes toward instructional film, reported that the availability of instructional films made possible through massive funding of media distribution centers in the 1950's and 1960's did not result in instructional films being as thoroughly incorporated into classrooms as was initially expected. Teacher perceptions of and attitudes toward instructional films seemed to be one

possible explanation for the general resistance. The authors reported that teachers of certain subject areas, particularly social studies, language arts, and science, tended to use film more often than teachers of other subject areas. Also, teachers generally perceived films as more appropriate for some grade levels than for others. Specifically, teachers of elementary level students perceived instructional film as being a "valuable instructional aid", more so than did teachers of junior and senior high level students. Research conducted to examine perceptions of programmed instruction has yielded similar results. O'Toole (1964) uncovered teacher perceptions which could influence teachers' use of programmed materials. Perceived effectiveness emerged again as an important factor in determining teacher attitudes. One can infer from these findings that perception is an important factor in attitude formation. The way one perceives an object or event influences one's attitude toward that happening or phenomenon.

These findings propose that "perceived effectiveness" of the computer might be an important factor in determining teachers' attitudes toward the use of computers in the classroom. In addition, these findings might suggest that there are specific groups of teachers, possibly mathematics and science secondary teachers, who might perceive computers as being more effective tools of instruction than would other groups of teachers, possibly social studies teachers. Hence, these groups of teachers who perceive computers as being more effective tools of instruction would hold more positive attitudes toward computers than would

teachers who perceive computers as being less effective tools of instruction.

Coupled with "perceived effectiveness" is the notion of "perceived threat". Research conducted thus far tends to suggest that the degree of teacher knowledge about computers is positively correlated with teachers' attitudes toward computers. Knowledge and experience are the basis for attitude formation and are affected by variables such as subject taught, grade level taught, level of computer literacy and teacher gender. Madsen and Sebastiani (1987) studied the effect of computer literacy instruction on teachers' attitudes toward microcomputers. They surmised that the greater the level of computer literacy, the more positive attitudes teachers would have toward computers. On the basis of these findings, therefore, one might hypothesize that regardless of other factors such as teacher gender, grade level taught, or subject taught, teachers with high levels of computer literacy would hold more positive attitudes toward computers than teachers with low levels of computer literacy.

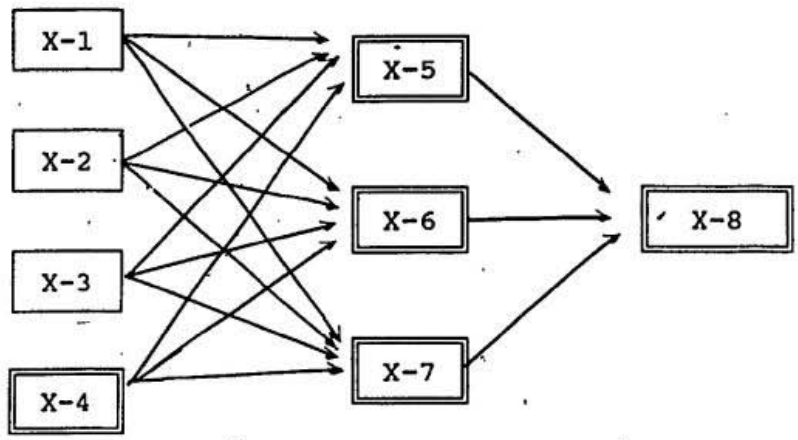
Another factor that might influence teachers' attitudes toward the use of computers in the classroom is teacher gender. Although no research has been conducted that specifically examines teacher gender and its relationship with teacher attitudes toward computers, there is evidence available that would tend to suggest that a significant relationship does exist (e.g. Sheingold, Kane and Endreurieit, 1983; Saunders, 1979). Hess and Muira (1985) documented sex differences in the use of computers and found that

boys tended to be more interested in, and used computers more, than girls. Hawkins (1985) reported that computers are linked to an area - mathematics and science - that has long been dominated by males. Consequently, computers typically enter the classroom with an aura of sex related inequality that has an impact on both learners and teachers.

On the basis of these studies one might presume that there exists a similar link between teachers' attitudes toward computers and teacher gender. It would be hypothesized, therefore, that male teachers would have more positive attitudes toward computers than female teachers.

From the literature it is apparent that evidence exists that would substantiate the formulation of hypotheses concerning the relationships that purportedly exist between teachers' attitudes and such teacher characteristics as subject taught, grade level taught, teacher gender, and computer literacy level.

Figure 1 is a schematic diagram showing the interaction of factors which may influence teacher attitudes toward computers.



Where X-1 = subject, X-2 = gender, X-3 = grade, X-4 = computer literacy, X-5 = threat, X-6 = knowledge, X-7 = effectiveness, X-8 = attitude toward computers; and where variables in single - lined boxes are observed variables and variables in double-lined boxes are latent or composite variables.

FIGURE 1. A schematic diagram showing the interaction of factors which affect attitudes.

CHAPTER 4: METHODOLOGY

Procedures

The present study involved the construction and administration of a Likert - type attitude scale questionnaire to 487 teachers who were located on the Avalon Peninsula, Newfoundland, Canada. Following the collection and entry of data the attitude scale was analysed to determine its reliability. A factor analysis was then performed to determine what and how many factors the scale was measuring. Finally, multivariate and univariate analyses of variance were completed using factor scores as dependent variables and teachers' characteristics as independent variables.

The Instrument

The development of the instrument (Appendix A) for this study proceeded in the following way. First, a literature review pertaining to teachers' attitudes toward computers revealed that the construct **attitude toward computers** was composed of the following six factors: perceived threat to job; attitude towards computers in school; anxiety towards computers; perception of computers as male versus female machines; perceptions of who should be responsible for teaching computer literacy in school; and

attitude towards computers in society. Second, from the same literature review a list of ninety statements were compiled and selected as being representative of the 6 factors. The list of questions and the factors they were deemed to represent were then carefully studied. Redundant and seemingly inappropriate items were discarded. The questionnaire was made up of three parts.

Part A: This was a Likert - type attitudinal scale comprised of 54 statements. Subjects responded to each statement by checking one of the possible answers (1) Strongly Agree, (2) Agree, (3) No Opinion, (4) Disagree, (5) Strongly Disagree. Some of the statements were positively worded so that a low score value indicated a positive attitude towards computers while some of the statements were negatively worded so that a high score value indicated a positive attitude towards computers. Prior to analysing the data, the values of the negatively worded statements were reversed so that they agreed in meaning with the positively worded statements. The statements were arranged so that every seventh statement pertained to the same factor. Each of the 6 factors was represented by 9 statements.

Part B: Each of the 12 statements contained in this section of the questionnaire referred to a subject's range of experience with computers. Each subject was asked to check all statements that accurately described his or her knowledge of and experience with computers. Subjects were defined as being computer literate

if they checked any or all of the following statements:

- I have access to and use a personal computer.
- I can instruct others in the social role and impact of computers in society.
- I am knowledgeable regarding the processes of involving students in computer assisted instruction.
- I can integrate computerized teaching materials into my courses.
- I am familiar with computer equipment, for example, everyday operation and use of a range of different machines.
- I have the ability to evaluate the effectiveness of a course that uses computerized teaching materials.
- I can write computer programs.

Subjects who did not check any of these statements were defined as non - computer literate.

Part C: This section of the questionnaire identified teacher characteristics: subject taught, grade level taught, and teacher gender.

The Sample

The sampling of teachers who participated in this study was selected from the following seven school board districts that are located on the Avalon Peninsula of Newfoundland: Avalon North Integrated, Avalon Consolidated Integrated, Conception Bay South Integrated, Ferryland Roman Catholic, Conception Bay North Roman

Catholic, Placentia - Saint Mary's Roman Catholic, and St. John's Roman Catholic. The sampling procedure was accomplished by dividing the total teaching population into two groups: intermediate - high school teachers (grades 7 to 12), and primary - elementary school teachers (grades kindergarten to 6). 500 teachers were randomly selected from intermediate - high, and 500 teachers were randomly selected from primary - elementary. It was necessary to sample this number of teachers in order to obtain an acceptable number of subjects in each cell. Specifically, because of the lower percentage of female teachers at the intermediate - high level, it was felt that in order to obtain at least 20 female respondents in the science area, it would therefore be necessary to sample 500 teachers.

The random selection of subjects was accomplished after stratified sampling on the basis of grade levels taught. Individual information cards regarding all intermediate - high schools in seven school districts were prepared and placed in a box. The information recorded on each card included: (a) the name and address of the school and (b) the number of teachers employed in that school. The individual cards were then drawn in sequence from the box. Following each draw the name of the school and the number of teachers employed in that school was recorded. When the number of teachers drawn from the box reached 500 the drawing stopped. The same procedure was repeated for teachers in the primary - elementary division.

Method of Data Collection

The appropriate number of questionnaires was mailed to each selected school together with a letter of explanation to the principal (Appendix B); a letter of consent from the superintendent of the school's district (Appendix C); and a large self adressed postage paid envelope. The principal was asked to distribute the questionnaires to all teachers in his/her school, and after the questionnaires had been completed by the teachers to return them to the researcher in the enclosed envelope. If the questionnaires were not returned to the researcher within 3 weeks of mailing, a follow - up telephone call was made to the school principal inquiring as to their status.

If the questionnaires were not returned after a further 3 weeks they were not included in the sample. A total of 1000 questionnaires were mailed out and 487 or 48.7 percent were returned. In general, a return rate of 50% for mailed questionnaires is considered average for graduate student surveys (Jackson, 1988).

Statistical Analysis

Item analysis using Cronbach's alpha was used to determine the reliability of the attitude questionnaires. The initial 54 -

item scale was pared to a 29 - item scale by eliminating those items that were either redundant or inconsistent with the other items and total score. Initially this procedure involved examining all 54 questionnaire items noting the statements that appeared to be measuring the same thing. For example, item 1 reads "I would feel comfortable working with a computer", while item 19 reads "I will never feel comfortable if I ever have to use a computer in my work or career". After noting these items as being redundant the researcher examined the correlation matrix to confirm or refute his selection. If the interitem correlation coefficient was above .7 then the second item was considered to be redundant and was therefore discarded from the final scale. Also, items having negative correlation with the total score were discarded. The final 29 items were subjected to a factor analysis using maximum likelihood and oblique rotation which revealed 4 factors that accounted for 37 percent of the variance. The factor scores for these 4 factors were then used as the dependent variables in both multivariate, and univariate analysis of variance to test research hypotheses. Each univariate analysis of variance was performed only if the multivariate analysis of variance was significant.

Ethical Considerations

In complying with the requirements of the Ethics Review Committee the researcher provided to the participants an attached letter of introduction to the study. This letter provided the following information.

1. It identified the researcher by name, and title.
2. It provided a brief and adequate description of the purpose of the study and all the procedures to be carried out.
3. It provided an estimate of the amount of time that was required to complete the questionnaire.
4. A statement to the effect that the return of the completed questionnaires would constitute their consent to the researcher using the data.
5. The subject was promised that the data would be used with complete anonymity. (See Appendix D for copy of letter of introduction.)

CHAPTER 5: RESULTS AND DISCUSSION

The results of the present study concerning the relationship between teachers' attitudes toward computers and four teacher characteristics - computer literacy level, subject taught, grade level taught, and teacher gender, are presented in this chapter. The results from reliability analysis, factor analysis, mulivariate analysis of variance (MANOVA), and univariate analysis of variance (ANOVA) are reported. Descriptive statistics regarding Mean and Standard Deviation are presented in Appendix H.

Data Analysis

The reliability analysis using the Cronbach alpha revealed that the internal consistency of the original 54 - item Likert - type scale was .92. Following the culling of redundant items the new Cronbach alpha revealed that the internal consistency of the final 29 - item Likert - type scale was .89, which indicated a high degree of reliability. An intercorrelation of a batch of attitude statements can reveal general relationships among statements. However, factor analysis can cluster data generated by many statements into four or five groups, a format that helps to separate major from peripheral statements on an attitude scale. Using oblique rotation, (appendix F), the maximum likelihood solution in the factor analysis revealed 4 factors that accounted for 37 percent of the variance. , The individual statements (Appendix G) comprising each of these 4 factors were then examined to determine what common dimension each factor was representing.

Each factor was named according to its respective dimension: factor 1 - Acceptance/Rejection of Computers; factor 2 - Attitude Towards Computers in Education/Work; factor 3 - Attitude Towards Computers in Society; factor 4 - Computers as Villains.

For each factor, a factor score was obtained for each respondent by calculating the composite score of the product of standardized value of each variable (with factor loading exceeding .3) by its factor score coefficient. Since these 4 factors were correlated (see Table 1) each univariate analysis of variance using factor score as the dependent variable was preceded by a multivariate analysis of variance to determine if the overall multivariate F was significant. If the overall multivariate F was not significant at the .05 level, no further univariate analysis of variance was performed.

Table 1

Factor Correlation Matrix as Produced by Factor Analysis

	Factors			
Factors	1	2	3	4
1	1.00000			
2	.32087	1.00000		
3	.27677	.35065	1.00000	
4	-.39107	-.22441	-.19857	1.00000

Given that certain attitude continuums had been identified in previous research regarding teachers' attitudes toward computers and that many of the statements contained in the present scale were constructed based on this knowledge, it seemed inevitable, therefore, that some of the factors identified in this study would be similar to factors identified previously. Two factors that were identified both previously and in the present study are - Attitudes Toward Computers in Education/Work, and Attitudes Toward Computers in Society. In addition to these, the remaining two factors of the present study - Acceptance/Rejection of Computers, and Computers as Villains, both contain aspects of factors cited previously. These aspects include job threat and anxiety towards computers.

The frequency with which each of these 4 factors tested significant ($P<.05$) following a significant multivariate F is listed as follows:

Factor 1 - Acceptance/Rejection of Computers was significant with 3 variables: computer literacy, teacher gender and grade level taught.

Factor 2 - Attitude Towards Computers in Education/Work was significant with one variable: computer literacy.

Factor 3 - Attitude Towards Computers in Society was significant with three variables: computer literacy, major teaching area, and teacher gender.

Factor 4 - Computers as Villains was significant with one variable: computer literacy.

Computer Literacy

The multivariate F test for Computer literacy was significant; $F(4, 408) = 28.62$, $P<.002$. Four univariate analysis of variance procedures using individual factor scores as the independent variable were conducted, and they were significant: factor 1 (acceptance/rejection of computers) $F(1, 408) = 99.13$, $P<.001$; factor 2 (attitudes towards computers in education and work) $F(1, 408) = 29.01$, $P<.001$; factor 3 (attitudes towards computers in society) $F(1, 408) = 13.50$, $P<.001$; and factor 4 (computers as villains) $F(1, 408) = 10.36$, $P<.001$.

The mean factor scores indicated that computer literate teachers have more positive attitudes toward computers regardless of the other variables - teaching area, grade level taught, and teacher gender. This particular result was not unexpected given the fact that computer literate teachers are those teachers who have "access to and use a computer", while non - computer literate teachers are those teachers who are "unfamiliar with and do not use a computer".

Major Teaching Area

The multivariate analysis of variance indicated that major teaching area was significant, $F(3, 248) = 1.93$, $P<.05$. The univariate analysis of variance indicated that only factor 3 (attitudes toward computers in society) was significant, $F(3, 255) = 3.90$, $P<.009$. The mean factor scores indicated that both science and arts teachers were more positive toward computers than social studies teachers. The analysis of variance conducted on major teaching area did not include teachers from the primary -elementary level because teachers at this level teach all subjects and cannot be distinguished by area. Therefore, the number of subjects included in this particular analysis is approximately half of the total respondents included in the study.

The results produced by the present analysis showed two unanticipated findings. Firstly, science teachers did not show more positive attitudes toward computers than arts teachers. Secondly, arts teachers did show more positive attitudes toward computers than did social studies teachers.

Science teachers were expected to have more positive attitudes toward computers than arts teachers for several reasons - one being the predominance of male teachers in the area of science. Table 2 shows that the highest percentage of male teachers is in science while the lowest percentage of male teachers is in arts.

Table 2

Numbers and Percentages of Male and Female Teachers for 3 Areas of Teaching

	Number of Teachers in Each Teaching Area		
Gender	Science	Social St.	Arts
Male	60	21	44
Col. %	74.1	61.8	53.7
Female	21	13	38
Col. %	25.9	38.2	46.3

Since male teachers are presumed to have more positive attitudes toward computers than female teachers, it was therefore expected that science teachers would have more positive attitudes toward computers than arts teachers.

A second reason is the predominance of computer literate teachers in science. Table 3 shows that the science area contains the highest percentage of computer literate teachers while the arts area contains the lowest percentage of computer literate teachers.

Table 3

Numbers and Percentages of Computer Literate and Non-Computer Literate Teachers for 3 Areas of Teaching

	Number of Teachers in each Teaching Area		
Literacy	Science	Social St.	Arts
Non-Computer Literate	20	15	38
Col. %	23.5	41.7	44.2
Computer Literate	65.	21	48
Col %	76.5	58.3	55.8

Since computer literate teachers have more positive attitudes toward computers than non - computer literate teachers, it was expected that this would result in science teachers having more positive attitudes toward computers than arts teachers.

A third reason is that science teachers are presumed to "perceive" computers as being a more "valuable instructional aid" than the social studies or arts teachers. Accepting this premise as correct could possibly suggest that the significant F ratio should have occurred using Factor 2 (attitude toward computers in education and work) as the dependent variable, rather than using Factor 3 (attitude toward computers in society), as the dependent variable.

Despite the reasons why arts teachers were expected to have significantly less positive attitudes toward computers than science teachers, the analysis showed they did not. This tells us that both arts and science teachers view computers in a more positive light than social studies teachers; it does not explain why this is so.

Teacher Gender

The multivariate analysis of variance indicated that teacher gender was significant, $F (1, 408) = 4.01$, $P<.003$. The univariate analysis of variance indicated that factor 1 (acceptance/rejection of computers), $F (1, 408) = 6.38$, $P<.012$; and factor 3 (attitudes toward computers in society), $F(1, 408) = 3.87$, $P<.050$ were significant. The mean factor scores showed that male teachers have more positive attitudes toward computers than female teachers regardless of other variables: computer literacy, teaching area, grade level taught.

It is worth noting that there was no significant interaction between teaching area and teacher gender. Male teachers in all 3 teaching areas seemed to have more positive attitudes toward computers than female teachers.

Grade Level

The multivariate analysis of variance indicated that grade level taught was significant, $F (1, 425) = 2.46$, $P <.044$. The univariate analysis of variance indicated that only factor 1

(acceptance/rejection of computers) was significant, $F(1, 425) = 6.74$, $P < .010$. The mean factor scores indicated that intermediate - high school teachers showed more positive attitudes toward computers than primary - elementary school teachers.

These results were expected for several reasons: first, Table 4 shows that male teachers comprised 61.4 percent of the intermediate - high school level teaching population whereas male teachers comprised just 21.3 percent of the primary - elementary school level teaching population. Given the fact that male teachers hold more positive attitudes toward computers than female teachers, one would therefore expect intermediate - high school teachers to hold more positive attitudes toward computers than primary - elementary school teachers.

Table 4

Numbers and Percentages of Male and Female Teachers for 2 Levels of Teaching

	Number of Teachers in Each Teaching Area	
Gender	Primary-Elementary	Intermediate-High
Male	39	159
Col.%	21.3	61.4
Female	144	100
Col.%	78.7	38.6

A second reason was that of the predominant number of computer

literate teachers in the intermediate - high school level. Table 5 shows that the intermediate - high school level is comprised of 63.9 percent computer literate teachers while the primary - elementary school level is comprised of 50.2 percent computer literate teachers.

Given the fact that computer literate teachers hold more positive attitudes toward computers than non - computer literate teachers one would therefore expect the intermediate - high school level teachers to have the more positive attitudes.

Table 5

Numbers and Percentages of Computer Literate and Non-Computer Literate Teachers for 2 Levels of Teaching

Literacy	Number of Primary-Elementary Teachers	Number of Intermediate High School Teachers
Non-Computer Literate	100	99
Col.%	49.8	36.1
Computer Literate	101	175
Col.%	50.2	63.9

Summary of Results

The results of this study can be summarized as follows:

1. Computer literate teachers hold more positive attitudes toward computers across all levels of other variables: teaching area, teacher gender, and grade level taught. However, there was no significant interaction effect between literacy and any other variable.

2. As expected, science teachers hold more positive attitudes toward computers than social studies teachers. However, it was not expected that arts teachers would hold significantly more positive attitudes toward computers than social studies teachers. Also, it was not expected that there would be no significant difference between science teachers' attitudes toward computers and arts teachers' attitudes toward computers.

3. Male teachers hold more positive attitudes toward computers than female teachers across all levels of all variables except grade level taught.

4. Teachers in the intermediate - high school level hold more positive attitudes toward computers than teachers in the primary - elementary school level within both levels of gender and literacy.

CHAPTER 6: CONCLUSIONS

Computer Literacy

The results of the present study are in keeping with those of other researchers (Madsen and Sebastiani, 1987) who found that teachers who received inservice training in computer literacy held more positive attitudes toward computers following inservicing than prior to inservicing. The present findings clearly show that regardless of teaching area, gender, or grade level taught, teachers who have access to and use computers have more positive attitudes toward computers than those who do not.

There are important implications, especially for an education system in the process of incorporating computers into its program. Simmons (1975) states that attempts to introduce computers without the support of teachers is guaranteeing failure. Given the fact that researchers (Fazio, 1978; Schuman, 1976; Schwartz, 1973; and Taylor, 1975) have shown a direct attitude behavior relationship, one might argue that because non - computer literate teachers have less positive attitudes toward computers, then non - computer literate teachers might not support the introduction of computers into the system. An option available to a decision - maker, given the results of the study, might be to increase the number of computer literate teachers by training non - computer literate

teachers - thereby improving these teachers' attitudes toward computers (Lawton and Gerschner, 1982). Improving the attitudes toward computers of a particular group of teachers might therefore improve the chances of computers being accepted into the system.

Major Teaching Area

The results regarding teaching area are somewhat surprising because while it is confirmed, as expected, that science teachers have more positive attitudes toward computers than social studies teachers; it did not confirm as expected that science teachers have more positive attitudes toward computers than arts teachers. In addition, the results showed that arts teachers have more positive attitudes toward computers than social studies teachers. The implications of these findings are important to educational decision - makers for two reasons: One, they question the traditional idea that science teachers are perhaps the most appropriate people to teach computer related material; two, they identify social studies teachers as having less positive attitudes toward computers than teachers in arts and science. Again, it might be argued that this group of teachers are less likely to support the introduction of computers into the system. Therefore, a decision - maker might wish to take steps toward staff development in order to improve the attitude towards computers for this group of teachers (Lawton and Gerschner, 1982).

In addition to the implications for educational decision - makers these results have implications for further research.

Lichtman (1979) found that most teachers regarded computers as a mathematical tool rather than a universal symbol manipulator. Given the finding that arts teachers are just as positive in their attitude towards computers as are science teachers, it would appear that, to a certain extent, teachers' perceptions of computers have changed. However, given that social studies teachers have a less positive attitude towards computers, it might be that these teachers continue to view computers as mathematical tools rather than as universal symbol manipulators.

Teacher Gender

The results showed that male teachers hold more positive attitudes toward computers than female teachers. These results are in keeping with the findings of Hess and Muira (1985) who documented sex differences in the use of computers between male and female students. Hawkins (1985) states that sex differences are related to many factors: the impact of societal images on girls, the expectation of different life goals for boys and girls, the structure of learning tasks, the nature of feedback in performance situations, and the organization of the classroom setting.

The implications of these results are again important to educational decision - makers given that female teachers are in a majority in every area of teaching except science. For a decision - maker it is important to know how female teachers are going to react to the introduction of computers into the school system

because it might affect the success of such a move. It is also important for a decision - maker to know how the female teachers' attitudes toward computers may have an impact on the female students' attitudes toward computers. Given that female teachers have less positive attitudes toward computers it might mean that female students would have less positive attitudes toward computers. A decision - maker can therefore take steps in staff development to improve the attitudes toward computers of female teachers (Lawton and Gerschner, 1982).

Grade Level Taught

The results showed that teachers in the intermediate - high school level have more positive attitudes toward computers than teachers in the primary - elementary school level. The implication of this finding is once again important to educational policy decision - makers. Students will have their first formal educational introduction to computers between Kindergarten and Grade six, yet teachers who teach Kindergarten to Grade six have the lesser positive attitudes toward computers. Future studies in this area should investigate the possible repercussions that this degree of teachers' attitude toward computers has for students attitudes toward computers.

Future Research

The following is a list of suggestions for further research in the area of teachers' attitudes toward computers.

1. The influence of the non - computer literate teachers' attitudes toward computers upon their students' attitudes toward computers.

2. The relationship between male and female students' attitudes toward computers and male and female teachers' attitudes toward computers.

3. The difference in attitudes between social studies teachers and arts teachers.

4. The relationship between teachers' attitudes toward computers and teachers' interaction with school computers.

Limitations of the Study

1. The generalizations of the present study are restricted to the population of teachers from which the sample was collected, and only to those who were willing to fill out the questionnaire.

2. Since a stratified sampling technique was used, larger population tends to be underrepresented while smaller population tends to be overrepresented.

3. The measurement of teachers' attitudes toward computers was not in the absolute sense - positive versus negative. Rather, groups of teachers' attitudes were measured relative to each other: Certain groups of teachers held more positive attitudes toward computers than others.

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APPENDIX A: THE INSTRUMENT

PART A

The following statements give opinions that some people have about computers. Please indicate your opinion about these statements by checking the appropriate blank which corresponds with the following headings:

SA - Strongly Agree
A - Agree
NO - No Opinion
D - Disagree
SD - Strongly Disagree

	SA	A	NO	D	SD
1. I would feel comfortable working with a computer.					
2. Computers will improve our society.					
3. Computers are not very important to me in my work.					
4. Computers will eventually replace people in many areas of teaching.					
5. Teaching computer literacy should be the responsibility of all teachers at all levels.					
6. Boys have more talent for working with computers than girls.					
7. The idea of using a computer makes me shudder.					
8. As jobs become increasingly oriented toward the use of information, society demands and rewards individuals who know how to use computers.					
9. It is up to educators to see that the next generation become adept in the use of modern technology.					
10. Computers in the classroom are a threat to teacher job security.					

A-2

	SA	A	NO	D	S
11. Computer literacy is important if an individual is to succeed in today's world.					
12. Boys have more talent for computer programming than girls.					
13. I get nervous whenever I have to operate new technology.					
14. Personal choice and freedom in some areas of life are restricted by computers.					
15. If there was a computer terminal in my classroom it would help me to be a better teacher.					
16. Computers are going to replace teachers in the classroom.					
17. Students should be educated in the use of computers only at the primary school level.					
18. Computers users have an unemotional view of life.					
19. I will never feel comfortable if ever I have to use a computer in my work or career.					
20. Computers have raised the quality of life in my province.					
21. Extensive use of computers imposes too much of a workload on teachers.					
22. The introduction of computers will mean fewer chances for promotion in my job.					
23. The school has no responsibility to educate students in the use of computers.					
24. It is more appropriate for boys to use computers than it is for girls.					

A-3

	SA	A	N	D	S
25. Computers are extremely frustrating machines.					
26. Computers concentrate too much power in the hands of experts.					
27. Computer assisted instruction would relieve teachers of routine duties and help to make fuller use of their capabilities.					
28. Computers will make it harder for teachers to find jobs.					
29. The ability to use computers is as basic and necessary to a person's formal education as reading, writing and arithmetic.					
30. Women have just as much ability as men to become computer experts.					
31. I am very contented when I am working on a computer.					
32. Computers are not very important to most people.					
33. Material which is otherwise boring would be interesting when presented using a microcomputer.					
34. Computers are eliminating teaching jobs.					
35. All teachers should be computer literate, i.e. aware of the basic operation of a computer.					
36. Computer users are insensitive people.					
37. Computers are beyond the understanding of the average person.					
38. In general, if computers and computer output are used to help make decisions human judgement will be improved.					

A-4

	SA	A	NO	D	SD
39. I should learn more about microcomputer instruction in education.					
40. Over the next decade, sweeping economic and technological transformations will alter the jobs people do and the ways in which they do them.					
41. Teaching computer literacy should be the responsibility of teachers at the intermediate level only.					
42. Computer use can bring out human creativity and self-expression.					
43. I am apprehensive about using computers in my classroom.					
44. Computers will be important for Canadians in their future work and jobs.					
45. In my school, computer assisted instructio should be used by all teachers.					
46. It's only a matter of time before computers put teachers out of work.					
47. Teaching computer literacy should be the responsibility of high school teachers only.					
48. Computers make the overall economic situation worse for women.					
49. Computers are a tool, just like a hammer or a saw.					
50. Computers dehumanize society by treating everyone like a number.					
51. Computer assisted instruction will help students become more responsible people.					
52. If technology continues to develop at its present pace, soon we will be out of work and computers will have taken our place.					

A-5

	SA	A	NO	D	SD
53. High school mathematics teachers should have sole responsibility for teaching computer literacy.					
54. Computers are mainly for people who are good at Math and Science.					

PART B

Check all statements that accurately describe your computer qualifications:

1. I have access to and use a computer. _____
2. I use the automatic teller at a bank. _____
3. I can instruct others in the social role and impact of computers in society. _____
4. I wouldn't know a computer if I bumped into one. _____
5. I'm aware of the value of involving students in the development of computerized instructional materials. _____
6. I can recognize a computer but I would not be able to turn it on. _____
7. I'm knowledgeable regarding the processes of involving students in computer assisted instruction. _____
8. I can turn on a computer but I wouldn't know how to operate one. _____
9. I can integrate computerized teaching materials into my courses. _____
10. I am familiar with computer equipment, i.e. everyday operation and use of a range of different machines. _____
11. I have the ability to evaluate the effectiveness of a course that uses computerized teaching materials. _____
12. I can write computer programs. _____

PART C

Although you are not asked to identify yourself, your cooperation in providing the following information would be much appreciated. It is essential to the study being carried out. Thank you.

SEX: Male___/Female___

AGE: Check appropriate group: ___< 25

___25 - 30

___31 - 35

___36 - 40

___41 - 45

___46 - 50

___51 - 55

___>55

Indicate which best describes your present role:

___ Administrator (full-time)
___ Administrator/Teacher
___ Classroom Teacher
___ Counsellor or Therapist
___ Special Education or Remedial Teacher
___ Substitute Teacher

Indicate the grade level(s) with which you are currently involved:

___ Primary (K - 3)
___ Elementary (4 - 6)
___ Intermediate (7 - 9)
___ High (10 - 12)

Teaching experience: No. of years: _____ (up to and including 1987-88).

Major area of teaching responsibility (subject taught):

_____

Secondary area of teaching responsibility (subject taught):

_____

My school is located in a community where the population is:

_____ between 0 and 5,000.

_____ between 5,000 and 10,000.

_____ between 10,000 and 20,000.

_____ greater than 20,000.

APPENDIX B: LETTER OF EXPLANATION TO PRINCIPALS

General Delivery
Paradise, NF
A1L . 1C3
March 29,1988

Dear Sir/Madam:

I am a Graduate student in the Educational Psychology Masters Program at Memorial University. As a part of my thesis requirements I am studying the factors that influence teachers' attitudes toward computers and computer-assisted instruction.

Your superintendent has granted permission for me to survey a selected number of teachers from your Board (See attached copy of signed Permission Form). I am hereby requesting your cooperation and assistance in including the teachers in your school in this survey.

Please be assured that I recognize that even a small amount of your time is significant when you have so many important duties in your daily schedule. I do think, however, that this research is important - not only to me but to others who now, or who may in the future, work with computers in an educational setting. I am hoping that you will foresee some potential future benefit and support me in this by lending your assistance.

I am asking you 1) to distribute the enclosed questionnaires to __ teachers in your school and 2) to collect the completed questionnaires and return them to me in the pre-addressed stamped envelope provided.

While I realize that this represents an imposition, I am respectfully asking that you give this request your serious consideration.

Thank you for your time and attention. I hope that I may look forward to your cooperation and support.

Sincerely yours,
David Touchings

APPENDIX C: LETTER OF EXPLANATION TO SUPERINTENDENT C-1

General Delivery
Paradise, NF
A1L 1C3
March 29,1988

Dear Sir/Madam:

I am a Graduate student in the Educational Psychology Masters Program at Memorial University. As a part of my thesis requirements I am studying the factors that influence teachers' attitudes toward computers. The purpose of this letter is to request your permission to sample the attitudes of approximately 140 teachers from your district.

My sampling procedure would require that I survey 35 teachers in each of four levels of school: Primary, Elementary, Intermediate, and High School. I propose to mail the questionnaires directly to the principal of the randomly selected schools, asking the principal to distribute them to the appropriate teachers and to return them to me upon completion. I would assume the responsibility of mailing costs by including self-addressed stamped envelopes. The amount of time required by the principal would be that spent on distribution and collection; the amount of time required by each teacher would be approximately fifteen minutes to complete the questionnaire.

I have enclosed a copy of the proposed questionnaire. The option of completing it or not is purely voluntary. Please be assured that I am fully aware that even a small amount of time is significant when teachers and administrators have so many important duties in their daily schedules. I do think, however, that this particular research is important, not only to myself, but to others who now, or who may in the future, work with computers in an educational setting. The findings of this study may, in the long term, contribute to an improvement in the way computers assist with instruction.

While I realize that this represents an imposition, I am respectfully asking that you give this request your serious consideration. I appreciate your attention to this letter and I look forward to hearing from you at your earliest convenience. Please reply by returning the attached form to me. Thank you.

Sincerely yours,

David Touchings

C-2

Date:

To the attention of David Touchings:

Yes, I approve of your proposed research procedures and you have my permission to survey approximately 140 teachers from my School Board District. I understand that immediately following the random selection of the various schools I will be notified as to which schools are selected. Also, a copy of this notice (researcher will copy and enclose with questionnaires) will notify the respective principals that permission to survey in their schools has been granted.

_____

Superintendent's Signature

Date:

To the attention of David Touchings:

No, you do not have my approval to conduct research in my School Board District.

_____

Superintendent's Signature

APPENDIX D: LETTER TO RESPONDENTS

March 29,1988

Dear Sir/Madam:

On the back of this questionnaire you will find a tea bag. When you have a few minutes, go to the staff room, plug in the kettle, and make yourself a cup of tea.

My name is David Touchings. I am a Graduate student in the Educational Psychology Masters Program at Memorial University. Presently I am in the process of writing a thesis regarding teacher attitudes toward computers. It would be much appreciated if you would take fifteen minutes from your busy schedule and complete the attached questionnaire.

The return of your questionnaire will indicate your consent to my using the data for my research. At no point are you required to give your name or any other information that might identify you. I assure you that the derived information will be used with complete anonymity.

Sincerely yours,

David Touchings

APPENDIX E: FACTOR SCORE COEFFICIENT MATRIX FOR THE 29 VARIABLES

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
Q1	.95445	-.26436	.2196	.33981
Q2	-.00065	-.15577	.32041	.06732
Q6	.01644	.08533	-.05739	.01833
Q8	.01813	.05523	.06337	.10604
Q9	.02062	-.00391	.03463	.09704
Q10	.01104	-.06079	-.03830	.00035
Q11	.01835	.09473	.05577	.03260
Q14	-.01755	-.05748	-.02305	-.21066
Q15	-.00247	-.00157	.13688	-.05857
Q18	-.00411	-.06634	.07441	-.08526
Q20	-.01074	-.15754	.35009	-.00802
Q21	-.00800	-.00868	-.08732	-.21710
Q22	-.00053	-.18960	-.14941	-.09560
Q23	.03420	.19040	-.15000	.06007
Q25	-.00395	.07697	.00217	-.15975
Q26	-.03444	.06453	-.04869	-.57257
Q29	.00352	.04307	.02269	-.07460
Q35	.02034	.15582	-.08107	-.00498
Q37	.02127	.15649	-.07888	-.00892
Q39	.01928	.26179	-.05876	-.12272
Q40	.02499	.20724	.01093	.04608
Q42	.01509	.11856	.14721	.03119
Q44	.03963	.29066	.00789	.04930
Q48	.01268	-.13112	.12189	.11498
Q49	.01791	.09617	-.07347	.04748
Q50	-.02764	-.17046	.11943	-.25806
Q51	.00188	-.01013	.36525	.02275
Q52	.01425	-.11032	.08065	.07886
Q54	.03828	.26339	.01123	.05514

APPENDIX F: Table of Oblique Factor Loadings

Factor	EIGENVALUE
1	2.38829
2	5.14372
3	2.25975
4	.95147

FACTOR CORRELATION MATRIX

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.00000			
Factor 2	.32087	1.00000		
Factor 3	.27677	.35065	1.00000	
Factor 4	-.39107	-.22441	-.19857	1.00000

APPENDIX G: STATEMENTS RELATED TO EACH FACTOR STUDIED G-1

FACTOR 1 - ACCEPTANCE/REJECTION OF COMPUTERS

1. I would feel comfortable working with a computer.
2. Computers will improve our society.
10. Computers in the classroom are a threat to teacher job security.
15. If there was a computer terminal in my classroom it would help me to be a better teacher.
18. Computers have an unemotional view of life.
21. Extensive use of computers imposes too much of a workload on teachers.
22. The introduction of computers will mean fewer chances for promotion in my job.
23. The school has no responsibility to educate students in the use of computers.
25. Computers are extremely frustrating machines.
26. Computers concentrate too much power in the hands of experts.
50. Computers dehumanize society by treating everyone like a number.
54. Computers are mainly for people who are good at math and science.

FACTOR 2 - ATTITUDES TOWARD COMPUTERS IN EDUCATION/WORK

9. It is up to educators to see that the next generation become adept in the use of modern technology.
11. Computer literacy is important if an individual is to succeed in today's world.
23. The school has no responsibility to educate students in the use of computers.

29. The ability to use computers is as basic and necessary to a person's formal education as reading, writing, and arithmetic.

35. All teachers should be computer literate, i.e. aware of the basic operation of a computer.

37. Computers are beyond the understanding of the average person.

39. I should learn more about microcomputer instruction in education.

40. Over the next decade, sweeping economic and technological transformations will alter the jobs people do and the ways in which they do them.

42. Computer use can bring out human creativity and self-expression.

44. Computers will be important for Canadians in their future work and jobs.

49. Computers are a tool, just like a hammer or a saw.

51. Computer assisted instruction will help students become more responsible people.

54. Computers are mainly for people who are good at math and science.

FACTOR 3 - ATTITUDES TOWARD COMPUTERS IN SOCIETY

2. Computers will improve our society.

8. As jobs become increasingly oriented toward the use of information, society demands and rewards individuals who know how to use computers.

9. It is up to educators to see that the next generation become adept in the use of modern technology.

11. Computer literacy is important if an individual is to succeed in ~~today's~~ world.

15. If there was a computer terminal in my classroom it would help me to be a better teacher.

20. Computers have raised the quality of life in my province.

29. The ability to use computers is as basic and necessary to a person's formal education as reading, writing, and arithmetic.

39. I should learn more about microcomputer instruction in education.

42. Computer use can bring out human creativity and self-expression.

44. Computers will be important for Canadians in their future work and jobs.

50. Computers dehumanize society by treating everyone like a number.

51. Computer assisted instruction will help students become more responsible people.

FACTOR 4 - COMPUTERS AS VILLAINS

1. I would feel comfortable working with a computer.

10. Computers in the classroom are a threat to teacher job security.

14. Personal choice and freedom in some areas of life are restricted by computers.

18. Computer users have an unemotional view of life.

21. Extensive use of computers imposes too much of a workload on teachers.

22. The introduction of computers willmean fewer chances for promotion in my job.

25. Computers are extremely frustrating machines.

26. Computers concentrate too much power in the hands of experts.

37. Computers are beyond the understanding of the average person.

39. I should learn more about microcomputer instruction in education.

48. Computers make the overall economic situation worse for women.

50. Computers dehumanize society by treating everyone like a number.

52. If technology continues to develop at its present pace, soon we will be out of work, and computers will have taken our place.

54. Computers are mainly for people who are good at math and science.

APPENDIX H: MEANS AND STANDARD DEVIATIONS

		Computer Literacy	Non-Computer Literacy	Total
Teacher Gender	Male	$\bar{X}$=-.4149 SD=.74	$\bar{X}$=.3755 SD=.88	$\bar{X}$=-.2181 SD=.87
	Female	$\bar{X}$=-.2811 SD=.86	$\bar{X}$=.6509 SD=1.03	$\bar{X}$=.0503 SD=1.03
Major Teaching Area	Science	$\bar{X}$=-.4542 SD=1.51	$\bar{X}$=.3997 SD=.95	$\bar{X}$=-.2597 SD=1.43
	Social Studies	$\bar{X}$=.0426 SD=1.00	$\bar{X}$=.5870 SD=1.19	$\bar{X}$=.2166 SD=1.09
	Arts	$\bar{X}$=-.5062 SD=.98	$\bar{X}$=.3089 SD=.90	$\bar{X}$=-.1460 SD=1.00
Grade Level	Primary-Elementary	$\bar{X}$=-.2280 SD=.80	$\bar{X}$=.6154 SD=.89	$\bar{X}$=.1869 SD=.95
	Intermed. High	$\bar{X}$=-.4040 SD=.7996	$\bar{X}$=.4050 SD=.9461	$\bar{X}$=-.1087 SD=.9391

NOTE: Negative numbers indicate more positive attitudes.
Positive numbers indicate less positive attitudes.