MICROCOMPUTERS IN SPECIAL EDUCATION:
A STUDY OF COMPUTER APPLICATIONS AND TEACHER CONCERNS

DONALD COLLINS

Microcomputers in Special Education:
A Study of Computer Applications
and Teacher Concerns

by

Donald Collins

A thesis submitted in partial fulfillment

of the requirements for the degree of

Master of Education

(Curriculum and Instruction)

Faculty of Education

Memorial University of Newfoundland

May 1991

St. John's Newfoundland

ISBN 0-315-68248-5

MICROCOMPUTERS IN SPECIAL EDUCATION: A Study of Computer Applications and Teacher Concerns

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd.)

TABLE OF CONTENTS (Cont'd.)

LIST OF TABLES (Cont'd.)

ABSTRACT

This study was motivated by the perceived need for appropriate staff development programs for special education teachers in educational computing by one major school board which was currently implementing Computer Assisted Instruction in all of its schools. The school board administration was concerned about the use being made of the computers placed in its schools and with teachers' perceptions of need, attitudes and current concerns. During the time period from 1986 to 1990, a variety of staff development activities were ongoing.

Number of computers, location, presence of educational software, years experience of the teachers, availability of a software guide, and amount of time being spent using computers were factors investigated. The study examined the concerns of the special education teachers of one major school board and compared the High Schools, where computers have been in place for at least 5 years, to the Grade Schools (primary, elementary and junior high), where computers have been placed only over the past 3 years. The results were analyzed to determine if differences were apparent in 'level of use' and 'stages of concern' with this innovation - microcomputers.

Subjects for this study were the special education teachers of 38 schools in one major school board. Data were received from 29 schools, i.e., approximately 76% of the sample.

The data were gathered in January of 1987 and a preliminary analysis carried out over the next two months. A follow-up study was conducted in the spring

of the 1989-90 school year.

Most teachers had their highest level of concern on the area of 'staff deve'opment' with the 'availability of software' ranking second. This indicates that teachers require more information of a specific nature about the available software for Computer Assisted Instruction, what its capabilities are, and desire to know how teachers' roles will be affected by the introduction of this technology.

The concerns of teachers in schools where a computer room existed were notably different from the concerns of teachers in those schools where accessibility to only 1 computer or to a few computers existed. Especially notable was the difference in the amount of time that High School teachers, who had access to a computer room containing at least 10 computers, spent on Computer Assisted Instruction compared to the grade school group of teachers who possessed far fewer than 10 computers.

Significant differences were found at the 'awareness' and 'consequence' stages of concern between high schools, where computers have been in existence for a longer period of time, and the grade schools where only 2 to 3 years of exposure is the case. Teacher concerns in High Schools were found to be more pronounced in the 'consequence' and 'collaboration' stages of concern while teachers in grade schools rarely approached these stages of concern.

ACKNOWLEDGEMENTS

The writer wishes to thank the many people who contributed to this study. They include the Roman Catholic School Board for St. John's, school principals, special education teachers, the Diagnostic & Remedial Unit of Memorial University, cooperating members of the Special Education faculty at MUN, the Supervisory Committee members (Mrs. J. Green, Dr. R. Lehr, Dr. M. Glassman), and the cooperating members of the Department of Education for the Province of Newfoundland. Their support and willingness to share, hopefully reflect in the depth of this study of the current use of microcomputer technology.

CHAPTER I

BACKGROUND TO THE STUDY

An Overview of the Introduction of Computers in Schools

Great progress has been made over the last 5 to 10 years in the development of microcomputer technology and educationally appropriate software which can facilitate the attentiveness and learning of exceptional children. Similarly, public attitudes toward the exceptional population are changing and today it is widely recognized by society that disabled and mentally-handicapped individuals can have a productive role in society. It has taken time for the place of microcomputers and electronic technology to be established in education, and it will take time for the needs to be fully recognized and met (Cain & Taber, 1986).

The potential of this technology for innovation in special education may not be realized if the implementation effort is not based on an important component in the educational change process - the teacher. Stevens (1980) indicates that:

> Before any educational change can be implemented efficiently, the levels of expertise and attitudes of educators must be determined prior to designing preservice and inservice programs. (p. 222)

Hence, educational administrators can presume that, in order to increase the probability of the educational use of microcomputer technology, teachers' attitudes and expertise must be assessed prior to the designing of staff development programs.

The potential impact of microcomputers on education has been recognized at various levels. In the only study by the Newfoundland and Labrador Department of Education (1985) researchers identified educators' needs for

information and called for the introduction of courses about microcomputers and the use of computers as instructional tools. In 1985 and 1986, several Newfoundland school boards such as the Terra Nova Integrated School Board, the Avalon Consolidated School Board, the Roman Catholic School Board for St. John's, and the Burin Peninsula Integrated School Board recognized the importance of computer education for their students. They have budgeted expenditures for microcomputer hardware and software acquisitions, primarily at the high school level, but also including some thrust into the primary, elementary and junior high school levels. In addition, parents of many school Parent Teacher Associations (PTAs) such as the Roman Catholic School Board for St. John's have recognized the importance of computer education for their children. They have responded by raising funds to purchase computers, educational software and peripheral devices for the computers.

The 1980's were years of recognition that an adoption of change was inevitable. Fullan (1982) made this observation in respect of computers and further commented that the 1990s would be years of essential implementation. He drew the distinction between "adoption (a decision to accept change) and implementation (the process of practising based on change)." Scott (1985) indicated the pressure of PTAs on their schools and school boards to incorporate computer education in their curricula. Scott (1985) also estimated that by the end of 1985-86, approximately 1366 microcomputers would have been purchased for use in the schools of Newfoundland and Labrador.

The Organization for Educational Computing Development (OECD)

in 1988 pointed out the need for the revitalization of education in its statement, "the potential has not been realized to date in most schools in countries where microcomputers are now relatively commonplace". They state further that such revitalization should involve, for example, "the implementation of laptop computers into daily education as an essential support of curriculum and learning experiences". Nuccio (1989-90, p. 279) noted in a recent issue of the USA Today newspaper that there has been an "explosive growth of microcomputers in the nation's classrooms from slightly more than 15% at the beginning of the decade to nearly 95% today", and that "perhaps a more telling statistic is the reduction of the student-per-computer ratio from nearly 125:1 to 32:1 during the past five years". These numbers indicate the growing presence of computer technology as part of the everyday materials for teachers to deliver instruction.

In a brief statement of the current role of boards and departments of education, Downes (1990) of the University of Western Sydney, Australia gives examples of the emphasis being placed on computer education by various states through funding programs which involve hardware purchase, curriculum development, and teacher inservice. She states:

> There is currently in Australia much debate about the significant challenges facing Australian Education as it moves into the 21st Century. One thing that is generally agreed, however, by all parties concerned is that teachers and students should be using computers in schools. In fact, significant financial commitments toward putting computers in both primary and secondary schools have been made at various times in the last ten years by both national and state governments, and school communities. For example, the New South Wales government is

> currently spending over $50 million dollars on a programme of hardware and software purchase, and professional and curriculum development. (p. 430)

In an additional Australian study by Fitzgerald, Hattie, and Hughes (1986) they estimated that, "in late 1985, there were thirty-five thousand microcomputers in Australia's ten thousand schools, with 98% of secondary schools and 57% of primary schools having at least one computer". This contrasted with the total of one or two mainframe computers in the early seventies. The sharp increase in numbers has coincided with various state and national Computer Education Programs designed to deal with a number of significant issues including the place of computers in teaching and learning (CSC, 1984). This program addressed teacher inservice as a major priority.

A comment on the reactions of Westernized educational systems to the innovations in computer technology is made by Kennett (1990):

> Numerous reports and strategies for revitalizing education have been given prominence in the 1980s. Likewise, much has been written about the importance of computers in education. A new era of constructive action and revitalizing strategies to ensure quality education in schools within Westernized educational systems (e.g., Carnegie Forum, 1986; Scott Report, 1989) has coincided with new developments and educational innovations in computer technology. Computers, like numerus reports and commissions on education, have been around for the past decade or so; the difference is that as the 1990s begin, the notion of voluntary adoption has been replaced by a compulsion to change, implement, adapt and ensure improvements that demonstrate and signify higher quality education, including increased computer competence. (p. 403)

In summary, Kennett states that "the 1980s have been a decade of adoption accepting

change, with reactions often demonstrating rear-vision thinking" (p. 430). "The process to a better educational product will rest upon an examination of what is (the acceptance of a finite resource allocation), on what has to be (the implementation of quality education), and solutions that do things smarter, faster and with more fun."

These pressures for change are causing decision makers in the educational system to effect policies regarding the purchase of more computers and for their implementation in instructional activities. Government and communities expect to find computers being used in schools with the general rhetoric covering computer awareness, teaching and learning with computers, the study of computers (in separate courses in secondary schools) and the use of computers in school administration (Downes, 1990).

The question aries, therefore, "Do teachers have the attitude and skills necessary to use microcomputers effectively in education?" The results of a Canadian survey by Scott (1985) indicates that, in Canada, 37% of teachers had introductory training on computer use in education, while in the province of Newfoundland and Labrador, only 14% had such training. In a report to the Minister of Education by the Computer Advisory Committee (Newfoundland and Labrador Department of Education, 1985) the need for teacher education in microcomputer applications was addressed in recommendation 13 which stated: "An inservice training program in computer literacy be made available to all educational personnel in the school system of the province" (p. 14). The committee also recommended that "inservice programs relating to specific applications of computers

to education be developed and made available throughout the province" (p. 15).

Teacher Education in the Use of Microcomputers

As of 1986-87, there existed at Memorial University of Newfoundland one education course, L6480, for the preparation of teachers for use of the microcomputer and several courses (Ed. 3801, 3802, 4164 [H], 4168) that included components that addressed microcomputers. In addition, various instructors such as Drs. G. Fizzard, B. Spain, and M. Glassman, within the Faculty of Education, and Dr. W. Nesbit, Mrs. J. Green and Mrs. B. Hopkins, of the Special Education Faculty have provided their expertise within the University for the training of teachers in the area of educational computing. Several special education courses containing a computer education component are Ed. 3630, 3650, 4530, 4540. While instructional computer facilities at MUN for teaching Computer Assisted Instruction to full classes of teachers were limited in quantity and type of computers and in software variety at the time of conducting this survey, various resource staff were invited to guest lecture to students by many University professors. Various schools boards such as Avalon Consolidated and Roman Catholic School Boards within the St. John's area, the NTA, and the Department of Education have had some instructional facilities and programs in place as well since 1985, although these were mostly introductory workshops aimed at familiarization with the operation of microcomputer hardware and such uses as word processing and database handling. Throughout the recent years leading up to this study, the availability of courses specific to instructing teachers in computer competencies were short in supply at the undergraduate level.

It is expected that this will be a possible factor affecting teacher attitudes and knowledge about computers.

In light of the report by Collis & Muir (1986) that only 38% of educational faculties in Canada have made a computer course a requirement for graduation, it appears that the present need for such teacher education can be met only through post-graduate courses and/or inservice education.

Throughout the development of school board inservice activities related to the use of microcomputer technology, the key areas of concern for study have been: 1) increasing computer expertise, 2) determining computer applications, 3) assessing teacher attitudes and concerns, 4) monitoring the stages of computer use in education, and 5) developing models for Computer Assisted Instruction (CAI). Teachers' concerns have been studied at the level of a school system by Cicchelli & Braecher (1985) and Wedman (1986). Cicchelli and Braecher comment on the need for teacher input into the planning and preparation for the introduction of microcomputers into the classroom environment. They state:

> Unless the real concerns of teachers are seriously and systematically considered as a critical variable in the process of change, the use of computers will take on the usual "hit and miss" orientation so typical of innovations that we educators effectuate. For innovations to be successfully implemented, attention must be given to the involvement of individuals in the change process, for change will occur only when individuals change (p. 56).

The school board involved in this study had already in place policies, programs and personnel for developing the use of microcomputer technology, and

had already begun to conduct preliminary surveys of teacher attitude, availability of computers, and types of computers and software present in its schools. Inservice programs had been provided to high school Computer Studies teachers, Mathematics teachers and most Special Education teachers over a two-year period from 1983 to 1985. The board was now interested in determining its teachers' computer expertise, current attitudes and concerns, the extent of use of computers within the inserviced areas, and the effectiveness of its inservice programs.

In summary, it appears that in order to keep pace with the rest of Canada, and indeed with the educational thrusts of other countries worldwide, massive staff development activities will be required to provide the knowledge necessary for successful implementation of microcomputer technology into the schools. This will require a comprehensive strategy for such action, including such activities as continuous assessment of inservice programs, an important focus of which will have to be the concerns of teachers. Prior to addressing the future directions, it is necessary to determine the present status of microcomputer use and teacher concerns.

Purpose of the Study

Because each individual has different classroom situations, and each person has students with different needs, teachers' concerns will be different. In achieving instructional goals and objectives, each teacher will respond to the demands of his or her own way using those means and actions which are at his or her disposal to reach the prescribed ends. The purpose of this study was to attempt to determine

what factors affect a teacher's decisions to use or not use microcomputers in reaching the educational goals and objectives set out for each special education student. Its aim was also to broaden knowledge about the individual groups of teachers for whom inservice programs in the immediate future were to be designed.

The study of a target group of special educators within this school board was chosen because of a major thrust by this board into the use of Computer-Assisted Instruction for special education students. Its aim was also to broaden knowledge about the individual teachers for whom inservice programs in the immediate future were to be designed. The size of the special education teacher group and the range of their services is quite broad in itself, without attempting in this study to address the needs and concerns of all the other groups of teachers receiving inservice within this school board. The special education professionals deliver programs to such student groups as the cerebral palsied and the physically handicapped, the hearing impaired, the profoundly mentally handicapped, the multiply handicapped, students, the learning disabled, and regular remedial students receiving special education in one or more subject areas, and junior and senior work experience (i.e., cooperative education) students who can benefit from knowledge of computer applications such as word processing, data basing and inventory control, and computer assisted design (CAD-Key) to today's business world.

In the present study, an attempt was made to determine the concerns of special education teachers in one major school board of the province of Newfoundland and Labrador regarding their use of microcomputers in education.

Knowledge of such concerns was important in their planning and designing of both program development at the curriculum level and for staff development. These areas of concern were to be analyzed, along with data about current levels of use of microcomputers, to ascertain what factors appear to most profoundly influence teachers's decisions in this regard.

The specific questions this study attempted to answer are outlined in Chapter II.

Description of the Study

Through most of the seventies and early eighties the rationale for introducing computers into schools related to the need for computer literacy. More recently the emphasis has shifted towards the need to 'improve' education but the significant challenge is still perceived to be the provision of hardware and software (Downes, 1990, p. 431). In a report of the 1984-86 national Computer Education Programme, Bigum, et al., (1987) note that, while real changes have occurred in policy and in practice, most changes to date have been 'technology' driven with little attention being paid to classroom implementation. A new medium was being tried out for its own sake with the problems to be solved taking second place to the actual use of the equipment. They conclude that greater importance needs to be attached to the design of the program or accompanying materials than that which is attached to the equipment used. They contend that real improvement will not occur until we redefine the challenge in terms of the grounding of current and future classroom practise in theories of teaching and learning (Bigum, et al., 1987).

The focus of the present study is on determining the penetration and level of use of microcomputer technology and teacher concerns in the area of special education as related to their use of the technology and of inservice activities directed toward them. The factors investigated which were considered to affect teacher usage of computers included the types of students taught, types of computers available locally, accessibility of the technology, availability of educational software for various subject areas, and the need for, or availability of a guide book describing the use of software programs in the curriculum. Other factors investigated were the level of support services, the level of computer literacy, and the present stage of concern regarding the use of this new technology (based on the Concerns-Based Adoption Model). The responses of two distinct groups of teachers, high school and grade school, were analyzed to see if any differences between their levels of usage and concern were immediately evident, and to determine if a change had occurred over the two year time frame of this study.

The population for this study were all special education teachers in one major school board of the province of Newfoundland and Labrador during the school year 1986-87. Thirty-eight schools were involved giving a sample of 125 special education units and 138 special educational personnel. This study was replicated in the Fall of 1989 and the data compared with the previous study.

Data were gathered for the study by means of a questionnaire survey which used a self-administered instrument. Each school in the sample was sent a questionnaire (Appendix A) that attempted to determine the concerns, attitude, and

use regarding microcomputers in special education. The Survey instrument consisted of two sections; the first, a collection of data about the special education unit, and a second, which gathered data about the respondents and their use of and perceived need for computers in special education. The data collected were used to answer the questions posed by this study.

Limitations of the Study

The results of data gathered in this survey are limited in the following ways:

(1) The sample chosen consisted of teachers from one major school board and the results can only be generalized to that population.

(2) The completion of questionnaires by collaboration may result in some influence on the data that could have been avoided by completing them individually.

(3) The return of completed questionnaires through the school board mail, to an immediate supervisor, the principal, and then on to the board coordinator may have influenced the responses given by teachers. Despite an attempt to overcome this potential bias by providing envelopes in which to seal the completed instrument, some responses may reflect this influence.

Thesis Format

In Chapter II of this report, a review is made of the literature relating to the use of microcomputers in special education. The literature review

concentrated on those educational uses which were instructional and/or oriented towards communication. One model of use, Computer Assisted Instruction (CAI), will be described in detail since it forms the conceptual basis for the assessment by teachers for the predominant use of computer technology. Some description will be given to the use of computers for simulation, word processing, data processing, scheduling and administration, and in the area of augmentative communication for communication-impaired individuals.

The specifics of the design of the study will constitute Chapter III with a description of the sampling procedures, the instrumentation, and the questions to be answered together with a description of the analysis to be performed on the data to answer each question.

In Chapter IV, the results of this investigation are described on a question-by-question basis.

In Chapter V, a summary of the study and a discussion of the results will follow. This chapter will conclude with some recommendations based upon the results and the implications of the same.

CHAPTER II

REVIEW OF THE LITERATURE

This review of the literature will examine the research on the educational use of microcomputers and on the process of change and its implications for this study. A major portion of this chapter is a detailed description of the findings of research and of one model of computer use, Computer Assisted Instruction (CAI). The chapter will focus on research of teacher concerns about staff development and the use of microcomputers in the schools. The concluding sections will include a review of the research on Hall's "Seven Stages of Concern" as they relate to the Concerns-Based Adoption Model for the implementation of innovations and on the implications of the model for this study.

The Literal Summary

During the 1960's, computer advocates were confident the computer would become a teaching tool that would provide instruction in as efficient a manner as traditional methods. The age of this new technology was heralded in, and with the benefit of hindsight, resulted in the birth of a new era, the "Information Age" (Anderson, 1983). The technology of the 1970's and 1980's has reduced the size and expense of microcomputers relative to that of the 1960's (Pepper Wood Elementary-High School Report, 1986, pp. 5-8).

In this report it is noted that today, computers are powerful, relatively inexpensive, and readily available to schools. They have been used in classrooms for

more than ten years to provide instruction in a number of modes (e.g., simulation, drill and practice, as well as tutorials) (Blanchard, Mason, Daniel, 1987). The microcomputer of the 1980's has through software development a wide range of features (e.g., voice synthesis and recognition, music, painting and design, plus linkage with a great variety of peripheral devices such as telephones, printers and modified keyboards). These peripherals add new and exciting possibilities for the educational use of computers (Kinzer, 1986).

In order to develop an understanding of the role of computers in society, students need to be exposed to the basic uses of a computer as a data processor, word processor, simulator, and for numerical analysis. The responsibility, therefore, lies with the educational system to incorporate the wide range of uses of computers into instruction in all applicable subject areas, and to teach programming, where appropriate, so that students will be aware of all the possibilities for computer use (Graystone, 1983, in Hopkins, p. 37).

Coupled with the outside demand of the public for increased student awareness of the uses of computers, is the pressure on our schools to keep up with other systems of education elsewhere in Canada and the world. The interest of administrators and individual teachers within the schools is strong in this regard with no school wanting to be the last to acquire microcomputers (Cain & Taber, 1986).

To buy a computer system and have it introduced into the school is not enough. There is also the need for purchasing high quality educational software for the computer. Some are more expensive than others, and all require extensive field

testing in order to be selected as appropriate for individual student's needs. Over a period of time it is expected that teachers, through increased computer literacy and in-service training, will become selective and discriminating in their software purchasing (Pickerson & Pritchard, 1981). This will improve the quality of the educational experience which Computer Assisted Instruction will provide to the students whom it is intended to serve.

Just as with other educational innovations, the teacher is the key to the success or failure of computers in education. Some will not feel the need to know about computers and others will feel that such knowledge is beyond their grasp. Collis & Muir (1986) state that in the wake of the rapid developments in the field of Computer Assisted Instruction, many will feel hopelessly inadequate in their abilities to keep up. The answer to these concerns is continuous retraining. Will school boards recognize the critical needs and budget for teacher computer education as well as purchase all the necessary software and hardware? Will it be left up to the private sector, individual schools, or to individual teachers to attend university courses in order to receive upgrading? These and many more questions become the subject of study in current educational research (Anderson, 1983).

The success of the implementation of computer technology in education will require not only decisions from the "top-down", but input and decisions at the grass roots level of teaching professionals in the schools. Wallin (1983) warns that the failure to involve teachers in the planning stages could lead to inefficiency and waste of resources. There seems little doubt that computers, being versatile and

powerful tools with a broad range of applications, will impact strongly on education. Computer companies have certainly already identified the schools as a market with great potential for growth (Zigmond, Vallercosa, Silverman, 1983). Teachers must consequently become knowledgeable about computers and software programs so that they can judge their capabilities and limitations, their use, and the value of computer applications; otherwise teachers, and indeed the educational system, will have surrendered control of education to outside social and technological pressure agents (Zigmond, Vallercosa, Silverman, 1983).

Computers and Special Education

In recent years, educational computing has undergone a period of expansion. Adams and Fuchs (1986) note that in the United States the number of microcomputers in classrooms went from about 300,000 in 1983 to nearly 2,000,000 by the end of 1986; and this increase was seen at all grade and subject levels. Their research revealed that the percentage of increase in special education was even higher. Special educators, it seems, are less resistant to new technologies that help them reach children who do not learn in the usual ways. They point out that there are even a number of new Individualized Educational Plan (IEP) Microcomputer programs available, but caution that simply supplying computers to the school, software to teachers, and courseware to students should not be equated with meeting special needs or having a program (Adams & Fuchs, 1986). They also put forward two strong opinions:

1. that before yielding to the impulse to purchase equipment and programs, we must consider which special needs are best dealt with by microcomputers, and

2. that staff development is the key consideration. Teachers must be involved in determining how computers can best assist them, since they are the ones who must put any program into operation. Ideally, teachers need some training and knowledge about how things will fit into the curriculum before large numbers of computers arrive at the school.

The students for whom the computers are being provided must be considered as well. Whether gifted or handicapped, Adams & Fuchs (1986) state that children with special needs fall off the profile of how children learn; some are capable of extraordinarily high performance and are bored by the usual school curriculum, while others require special services because of medical, intellectual, physical, social and/or emotional disability and hence they will need special teaching techniques if they are to access learning.

Description of Computer Assisted Instruction

To instruct using the microcomputer implies that the content or message of what is to be learned can be delivered by the computer in such a way that it can be comprehended by the "learner-receiver". This implies that the process whereby the learning takes place involves interaction between the learner-user and the computer. The term most commonly used in describing this mode of instruction is Computer Assisted Instruction (CAI).

The following is a list of basic requirements for CAI as cited by Alper & Holmberg, 1981; and Kulm, 1984:

1. a message - some content or information that has an intended meaning.

2. a language - a symbol system that is shared by a user group; for example, English, Blissymbolics, or B.A.S.I.C.

3. a means of delivering the message - drawing, speaking, writing, pointing to symbols, or using an electronic scanning device, etc.

4. a means of receiving the message - seeing, reading, listening, etc., and comprehending.

It is important to note the varied parameters of communication, nonlinguistic and linguistic, non-written and written, and pictures and animation which are incorporated features of microcomputer software programs.

In order to be chosen for educational use, a suitable computer education system has to be extensive enough to support the CORE curriculum and the broad range of educational objectives. These objectives are outlined in the Curriculum Guidelines of the Department of Education for the Province of Newfoundland and Labrador.

An Overview of Selected CAI Applications in Education

It was not until the early 1960's that the first computer based educational programs had been developed at American colleges and universities (Blanchard, Mason, and Day, 1987). These development projects were launched by partnerships among universities, the government, and computer manufacturers (e.g.,

IBM System 1500 and Stanford University). The programs developed were mainly for elementary and secondary education. They ran on expensive mainframe, time sharing computers, and unfortunately this approach did not spark enough widespread public interest for continued support.

By the late 1960's, with the development of less expensive microcomputers (versus mainframe computers), hundreds of microcomputers began to get introduced into the schools of many developed countries. Aroused by greater public interest, the numbers of computers in the American and some European School systems began to increase by the thousands, and diverse computer applications for education continued to grow. The early programs were designed for use principally with drill and practice activities with few innovations. Over the next 10 years, into the 1970s, much progress had been made in the refinement of drill and practice programs, especially by companies such as the Computer Curriculum Corporation and the Control Data Corporation - PLATO (Blanchard, Mason and Day, 1987). These drill and practice programs provided valuable instructional support for regular as well as special education teachers.

Microcomputers and software of the 1970s were developed further to include tutorial features. These computer based instructional programs are called tutorials because their algorithms make decisions about student performance; they alter (branch) the program content, level, or rate. These computer decisions and the accompanying adjustments in the program, increase the remedial focus of the student's attention and thus increase the likelihood of student success in mastering

the program content.

Computer applications also include such areas as simulations, information retrieval, word processing, telecommunications, and record keeping. Simulation involves the generation of models of the real world to simulate reality, and allow students and teachers to role play decisions without the consequences often associated with the real world (danger, expense and time). Information can be retrieved from sources such as libraries and on-line databases, and correspondence can be carried out using electronic mail. Many word processor packages are in existence which enhance all aspects of language skills, including prewriting, composing, editing grammar, spelling and punctuation, and proofreading. Computer telecommunications can provide access to information and/or correspondence via telephone lines to anywhere in the world that an on-line service is provided. Computers can ease most educational record keeping tasks by managing data such as student files, class schedules, mark records, and can be used to record and manage changes to instructional activities (such as assignment outlines and quizzes).

Computer Technology and its Specialized Uses

The development of alternative modes of education is always a welcome breakthrough for exceptional students and educators. Until the 1970s, for example, an exceptional student with physical handicaps such as cerebral palsy was very limited in his/her methods of communication. Other children who either lacked speech or exhibited severe speech disorders were limited to the use of signing, picture-boards or word-boards for communication. The acquisition of skills for self-

expression hence became limited to the basic expression of needs and wants. Professionals and parents feared that the learning potential of such disabled children would not be maximized, and that the existing learning environments for their children were not the least restrictive settings (Green & Hopkins, 1983). However, the evidence is accumulating to indicate that the use of electronic and microcomputer technology could have positive effects on the academic and psychological development of exceptional children (Vanderheiden et al., 1982). Additional benefits are also expected in social and emotional development as a result of the students' improvements in communication abilities. Based on the results of research by Vanderheiden et al. (1982) on the impact of augmentative communication modes, including the use of microcomputer Blissymbolics, on the communication ability and speech-language pathology of the cerebral palsied population it can be concluded that teachers of C.P. and other communications disabled children must have a thorough working knowledge of and training in the area related to microcomputers and communication development (especially where speech is not the primary mode of expression).

From the use of microcomputers for Augmentative Communication with small groups of cerebral palsied children, the use has spread widely throughout Britain, the United States and parts of Canada; its use was estimated by Green & Hopkins (1983) to be in the area of 28-30,000 in North America. To date, researchers such as Enstrom (1990) at the Communication Resource Center (CRC) of the Department of Human Services in New Jersey and Duganne & Glicksman

(1990) at the Computer Access Center for People with Disabilities in Santa Monica, California are actively involved in research dealing with service delivery models and progress in assistive technology for disabled students. Berliss, Borden, & Vanderheiden (1989) point out the importance of communication between diagnostic clinicians and the families of users in the evaluation and selection process for communication aids. In an effort to make information more readily available to clinicians, parents and the users themselves, the Trace Research and Development Center was developed in Wisconsin-Madison University, WI 53705, USA and is accessible as a nationwide service delivery directory for rehabilitation technology. A database also exists which contains information on all of the communication, control, and interface aids which are currently available (Vanderheiden, 1990). This database, which will run on a standard desktop computer, provides pictures of the products and actual high-fidelity recorded samples of voice synthesizers used in the communication aids. The most recent version of the database has also been extended to access by individuals with mild, moderate, and severe physical and visual impairments, and hearing impairments. In addition, the database has been designed in such a fashion that it can be operated by individuals having a much lower cognitive level than traditional databases.

The number of uses of microcomputer technology can be expected to grow as further research studies are completed and their findings reported.

Through the late 1970s, innovative educational programs together with research in cognition, language, and communication have emerged and evolved into

new approaches for educating exceptional learners of many types and levels of disability. There is a growing acceptance by many professionals - teachers, psychologists and others - that learning is more than content, and that alternative modes and ways for learning exist which can be used as tools for the benefit and development of this group of students.

Grimes (1981) addresses the pedagogical issues of motivation, instruction, and practice in promoting the learning of academic skills by handicapped students. She states,

> "There are many advantages to using computers with handicapped students; most learn through the incidental learning process, however, handicapped students need more formal instruction to learn even the basic skills which other students take for granted: attending to and learning new information, remembering new information, learning new concepts, applying new concepts, and transfer and generalization of learning to new situations." (p. 4)

Grimes believes that the classroom use of microcomputers with carefully chosen software programs can provide the structure, motivation, and added practice that many handicapped and learning disabled students need in order to learn academic skills.

In the study by Kleiman and Humphrey (1984) the authors state several benefits of using microcomputers with mentally retarded students. Some of the individual learning needs which they meet are:

1. because of their lesser knowledge, these students can benefit from the attention given in the 1 to 1 involvement with the computer;

2. the continuous, positive, and immediate feedback and praise provided by the computer gives the mentally retarded student a higher sense of self-esteem;

3. the game-like design of the early age-group software is motivating for the mentally retarded student, and tends to keep his/her attention on the materials being presented;

4. the computer software programs can 'model characteristics of real situation' which is uniquely suited to the discovery method of learning needed by learning disabled children;

5. once the [Computer Assisted Instructional] lesson has been taught, the teacher, through the use of the software program, can represent the lesson at a later date as a review of learning, thus meeting the needs of learning disabled students for 'routine and repetitious practice'.

Further instructional advantages are cited by Alper & Holmberg (1981) for Computer Assisted Instruction in special education. They describe the advantage of the computer for 'simulating real-world activities', and they relate that such simulations are particularly well suited to teaching 'problem solving skills' since they can present the problem pictorially as well as in words. By simplifying the picture, these simulations help focus the student's thinking onto a few important variables.

Gerald Kulm (1984), regarding the use of microcomputers for teaching problem solving strategies, writes that "parent and child teams are effective in working through problem solving strategies on the computer" (p. 1). He observed in his study that several effective techniques which the parent-child teams used were:

1. thinking of a related problem.

2. explaining how a table is used to organize data;

3. breaking the problem into subproblems;

4. relating the algorithms to the drawing of a diagram or figure.

In conclusion he says, "these steps in problem solving do not develop easily, however the metacognitive level of the parent's thinking (monitoring, assessing, and evaluating the solution process) are a valuable guide that helps the child to become aware of the benefit of referring to cues as well as discussion in the thinking out of problems" (p. 3).

A variety of cautions for the use of CAI in education are cited by Hannaford, Alonso, Sloane and Eydie (1981). They address the concern for "proper programming", and they caution teachers to be conscious of what, how, and why they are using a particular software program. They make the following recommendations:

1. determine the 'behavioural objectives' or 'instructional objectives' of each computer lesson;

2. determine the 'teaching/learning mode' of the program to be used, whether it is diagnostic, tutorial, drill and practice, simulation, enquiry, game, or problem solving;

3. sequence lessons to ensure that the content of a lesson uses past learning or experiential background from a previous lesson; and

4. evaluate each lesson to ensure that it is appropriate for meeting the learning needs of the student using it. (This implies that it should fit into the exceptional student's Individualized Program Plan (IPP).

The mediational use of the microcomputer, whether wholly or partly independent of the teacher, enhances the student's awareness of his/her own role in the thinking/learning process. Use of the microcomputer for communication and education is a novel situation for many physically handicapped, mentally delayed, or

learning disabled students, and provides an alternative structured mode for the teaching/learning process to take place (Hannaford et al., 1981).

Throughout the early 1980s, schools were getting a few educational software programs that were included with their computer, borrowed from the local computer store, or ordered by direct mail from catalogues. Many were of the drill and practice variety, and instructions and product support were crude or non-existent (Adams & Fuchs, 1986). By 1984-85 there was a flood of new software programs, and many teachers were receptive to having computers in the classroom. By 1986, the teachers' concerns shifted toward the area of program selection and how to systematically integrate some of the good courseware into the classroom curriculum. Software reviews were available in every issue of dozens of journals such as the AEDS Journal, Classroom Computer Learning, Computers and Education, The Computing Teacher, Educational Computer Magazine, and the Journal of Computer-Based Instruction to cite a few.

The evaluation of courseware as motivating or easy to integrate into the instructional program is subject to individual teacher's evaluation. Familiarity with software over a period of several years tends to facilitate the process of evaluating software, modifying existing programs, and incorporating computer-based instruction into a teacher's instructional plans. Many of the evaluation techniques used with regular print materials are also applied to computer software, but with hundreds of samples to choose from, teachers couldn't possibly sample everything themselves.

As teachers and students move through various stages of educational computing, information and communication about how the new technology works become key elements (Adams & Fuchs, 1986). These stages range from decisions about how to adopt or reject the innovation - to implementation on a widespread basis - to refinement. In the final analysis, it comes down to the teacher knowing enough about learning and the characteristics of effective instruction to make instructional judgements about computer courseware.

Research on Change

A challenge for educational institutions is to keep pace with the rapid development of computer technology. While some educational institutions have managed to stay abreast of these developments, others have not.

In the field of education, curriculum development and reform occur at all levels. However, there have been few studies done to determine the impact of such innovations upon the individuals that will be required to make the innovations work successfully (Fougere & Olinsky, 1990, p. 463). Since individual teachers ultimately will be the key factor in the success or failure of curriculum innovations, it is very important that their feelings or concerns about such innovations be known. Fougere and Olinsky (1990) report on a model aimed at understanding the adopters of educational innovation; they state:

> The Concerns-Based Adoption Model (CBAM) was developed to describe the process involved when educational institutions adopt innovations. The model is a result of a three and one-half year study of innovation adoption in educational institutions. The

> three primary data sources for the development of the model have been 1) the literature on change, 2) extensive field-based experiences of the developers and school-based adoption agents, and 3) documentation of the innovation process in teacher education institutions.
>
> The CBAM views the adopting institution as a User System composed of individuals, each of whom has his own set of concerns, problems, skills, agendas, and needs. In combination, these individuals represent the institution and its functionings. In sum, CBAM views the change process within formal organizations as entailing individuals moving through seven identifiable Stages of Concern About the Innovation and eight Levels of Use of the Innovation. (p. 463)

Hall (1973) proposed labels to describe the stages of transition through which nonusers of an innovation pass on inservicing or course training converts them into users of the innovation. Hall first described seven stages using the following labels:

Stage 0 - Unaware
Stage 1 - Awareness
Stage 2 - Exploration
Stage 3 - Early Trial
Stage 4 - Limited Impact
Stage 5 - Maximum Benefit
Stage 6 - Renewal

In further describing the levels of use, Hall et al. (1975) emphasized that the levels are distinct states that represent observable distinct types of behaviour and patterns of innovation interaction as exhibited by individuals and groups. These levels, which were seen to characterize a user's development in acquiring new skills and varying use of an innovation, are described as:

0	NON-USE	The state in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.
I	ORIENTATION	The state in which the user has acquired or is acquiring information about the innovation and/or has explored its value orientation and its demands upon the user and user system.
II	PREPARATION	The state in which the user is preparing for first use of the innovation.
III	MECHANICAL USE	The state in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user need than client needs. The user is primarily engaged in a step-wise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
IVa	ROUTINE	Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.
IVb	REFINEMENT	The state in which the user varies the use of the innovation to increase the impact on clients within the immediate sphere of influence. Variations are based on knowledge of both short and long-term consequences for clients.

V	INTEGRATION	The state in which the user is combining his own efforts to use the innovation with the related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
VI	RENEWAL	The state in which the user re-evaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovations to achieve impact on clients, examines new developments in the field, and explores new goals for self and system. (Reference, p. 54)

These seven Stages of Concern were later renamed by Hall et al. in 1977 as:

Stage 0 - Awareness
Stage 1 - Informational
Stage 2 - Personal
Stage 3 - Management
Stage 4 - Consequence
Stage 5 - Collaboration
Stage 6 - Refocusing

These stages move from "early self-oriented concerns, to task-oriented concerns, to ultimately impact-oriented concerns" (Hall, 1979, p. 204). As teachers transition from being nonusers to users of an innovation, they will range from stage 0 to 6 on Hall's 'Seven Stages of Concern' model.

Individuals do not have concerns on only one stage but some stages show relatively more intensity than others. Research on this model confirmed the existence of these stages and their developmental nature (Hall & Loucks, 1978). Teachers who are nonusers of an innovation will have concerns high on stages 0, 1

and 2. They are more concerned about gaining information (Stage 1) or how using the innovation will affect them personally (Stage 2). As they begin to use the innovation, Stage 3 (Management) concerns become higher and more intense. The results of gains in experience and skills with an innovation have a definite impact on the system in which the individual works. When teachers become experienced and skilled with an innovation, the tendency is for concerns at Stages 4, 5 and 6 to become more intense with a decrease in Stages 0, 1, 2 and 3 (Hall et al., 1977). Because they are aware of the impact of the innovation on clients, they are usually anxious to work toward achieving its maximum benefits for other potential users.

Development of the Concerns-Based Adoption Model

Hall, Wallace, and Dossett (1973) propose that the perceptions, feelings and concerns of people experiencing the change process should be assessed, and that this personal dimension is critical to the adoption or rejection of an innovation.

Fougere and Olinsky (1990) concur with the need for using the CBAM model in their statement: "Since individual teachers ultimately will be the key factor in the success or failure of curriculum innovations, it is very important that their feelings or concerns about such innovations be known."

The current study will expand on those original findings by exploring additional information about the use of CBAM by institutions in order to more completely understand the adopters of this important educational innovation - microcomputers.

There are certain assumptions of the CBAM. The model as postulated

is based on certain underlying assumptions that set the perspective from which change in schools is viewed. Hall & Loucks (1978) state that:

1. In educational institutions change is a process, not an event. Too often policymakers, administrators and even teachers assume that change is the pivotal result of an administrative decision. They casually assume that a teacher will put aside an old reading text and immediately apply an individualized program with great sophistication. Somehow the conviction lingers that with the opening of school under the new program the teachers will blend their talents into effective teams. As reflected in the CBAM, the reality is that change takes time and is achieved only in stages.

2. The individual must be the primary target of interventions designed to facilitate change in the classroom. Other approaches to change (e.g., Organizational Development) view the composite institution as the primary unit of intervention and place their emphasis upon improving communication and other organizational norms and behaviours. Concerns-Based Adoption Model, however, emphasizes working with individual teachers and administrators in relation to their roles in the innovation process. CBAM rests on the conviction that institutions cannot change until the individuals within them change.

3. Change is a highly personal experience. Staff developers, administrators and other change facilitators often attend closely to the trappings and technology of the innovation and ignore the perceptions and feelings of the people experiencing the change process. In CBAM, it is assumed that the personal dimension is often of more critical importance to the success or failure of the change effort than is the technological dimension. Since change is brought about by individuals, their personal satisfactions, frustrations, concerns, motivations and perceptions generally all play a part in determining the success or failure of a change initiative.

4. Staff development can be best facilitated for the individual by use of a client-centered diagnostic/prescriptive model. Too many in-service activities address the needs of the trainers rather than those of the trainees. To deliver relevant and supportive staff development, change facilitators need to diagnose the location of their clients in the change process and to direct their interventions toward resolution of those diagnosed needs.

5. The staff developer or other change facilitators need to work in an adaptive, yet systematic way. They need to stay in constant touch with the progress of individuals within the larger context of the total organization that is supporting the change. They must constantly be able to assess and reassess the state of the change process and be able to adapt interventions to the latest diagnostic information. At the same time the facilitator must be aware of the "ripple effect" that change may have on other parts of the system.

In additional research conducted by Hall alone (1978), he comments further on the change process:

6. There are identifiable stages and levels of the change process as experienced by individuals. The change process is not an undifferentiated continuum. There are identifiable stages that individuals move through in their perceptions and feelings about the innovation, and identifiable skill levels that individuals move through as they develop sophistication in using the innovation.

7. Full description of the innovation is a key variable. All too frequently it appears that innovation developers have not clearly or fully developed operational definitions of their innovations. Change facilitators and teachers do not know what the innovation is supposed to look like when it is implemented. Thus another key assumption for concerns-based change is that there must be a full description of what the innovation entails when it is fully in use.

Through the process of organizing information about an innovation in their minds, individuals make decisions about the nature of change and take a positive or negative stand with respect to it. The perceptions which affect this process are shaped uniquely when and if the individuals to be changed are integrated into this process in a timely manner. Further, it can be argued that including staff in the changes can only enhance the management process (Khosrowpour & Calpan, 1989-90, p. 61).

Assessing the Stages of Concern

Hord and Loucks (1980) are two among the researchers who frequently use the open-ended concerns statement to determine teacher concerns about an innovation. In this technique, respondents are asked to write complete statements to answer the given question; the response is then read twice; once to get an overall feel for the individual's concerns, then, on the second reading, to provide a more substantive and detailed assessment of the concerns (Hord & Loucks, 1980).

The most formal and precise measure of the Stages of Concern is through the use of the Stages of Concern Questionnaire (SoCQ) (Hall et al., 1977). This pencil and paper instrument is a Likert-type questionnaire which allows the respondents to react to 35 statements of concern by indicating how closely each statement describes a concern they feel at that point in time. This measure provides a profile for each individual or the group showing those concerns which are most intense.

Either method can be utilized to provide the facilitator with data related to the concern level of an individual or group. The Stages of Concern concept can be used to assess teachers' concerns about an innovation in preparation for staff development (Cicchelli & Braecher, 1985). This "teacher concerns" dimension can be used to study the change in teachers' concerns before, during, and following inservice activities, and the progress through the 7 stages can be monitored over time, usually a period of one to several years.

CHAPTER III

METHODOLOGY AND RESEARCH PROCEDURES

Overview of the Methodology

The descriptive study method of research was chosen for this project because it seemed a most effective means for determining the variables that seem to bear upon teacher use of microcomputer technology in education.

Through the focus taken in this study on one school board, a more peripheral study of several school boards could be carried out by some other researcher at a later date. This process of studying one school board would establish a comparative base, and could ultimately be extended to include observations and product analysis of all the school boards within the province of Newfoundland and Labrador at such time as computer-based systems utilizing educational computer technology are determined to be in place throughout.

In this research study, of the descriptive study variety, an individual school board was studied to determine the penetration and usage of microcomputer technology, to survey the applications of computer-assisted instruction, and to address any apparent teacher concerns. The design of this research study was towards a process-, rather than product-orientation.

The focus of a similar Stages of Concern study conducted by White (1987) was on teacher attitudes towards microcomputer technology. His title was: An Investigation of the Concerns of Teachers About the Implementation of Microcomputers in the schools. In the present study, this researcher went beyond an 'attitude survey' approach, and collected demographic and numerical data about

the level of use being made of microcomputer technology, accessibility of the technology, availability of educational software, curriculum support for use of the technology, types of students being taught on microcomputers, the level of teacher computer literacy, the status of inservice activities directed towards teachers, and teachers' Stage of Concern regarding the use of this new technology. All of these factors were considered to impact on a teacher's decision to use the innovation, microcomputers, in meeting the objectives of the curriculum.

White (1987) surveyed urban and rural schools at all grade levels but did not test for significant differences between the grade levels. The present study tested for significant differences between the grade levels on a variety of survey items, specifically for high schools versus the grade schools on Stage of Concern.

Statement of the Problem

A question worthy of ongoing investigation, as cautioned by Kerr (1987, 1990), is whether schools (and teachers) which have been provided with the hardware and thus have been exposed to microcomputer technology will indeed use the capabilities of the microcomputer in their daily classroom instruction instead of ignoring it and continuing with more traditional 'paper and pencil' methods of teaching. It is this question that is primarily addressed in this study.

The implementation of microcomputer technology in the schools is more than a purchasing arrangement. In order to maximize the use of the technology, efforts toward staff development must be considered. Teachers' concerns about microcomputers need to be addressed both in the area of computer literacy

and in the knowledge and use of educational software.

The diagnostic component of the Concerns-Based Adoption Model can be applied to the introduction of microcomputers into schools to provide a means of assessing where teachers are, both individually and as a group, relative to the implementation of microcomputers. This is a first step in planning appropriate interventions and guiding the success of future inservice programming.

The concerns and level of use of an individual or group relative to an innovation, together with the adaption being attempted can be assessed using principles of this model. The data collected can tnen be used to prescribe interventions needed for an individual or group in order to improve the likelihood of change occurring.

Description of Sample

A previous study of the availability of microcomputers in schools across Canada by Scott (1985) had selected a relatively large population of schools. In his study, he determined that in Canada 37% of teachers had introductory training on computer use in education, while only 14% had such training in the province of Newfoundland and Labrador. He also projected that by the end of the 1985-86 school year there would have been purchased approximately 1366 microcomputers in the schools of Newfoundland and Labrador.

Due to the magnitude of the task of trying to verify Scott's projection, and because the collection of data from all the school boards would have been beyond the scope of this task, it was decided to choose a smaller sample of the

broader population of Newfoundland and Labrador schools by selecting one major school board. A specific subpopulation of the broader teacher population, being the special education teachers, was targeted for a study of their uses of and concerns about microcomputers in education.

The population that resulted as the subject of this study consisted of the 138 special education teachers of one major school board in the capital city of St. John's, Newfoundland during the school years of 1987/88 and 1989/90. This population consisted of those teachers who were engaged in teaching on a full-time basis. Excluded from this sample were itinerant special education personnel from the school board.

Sampling Procedure

The investigator decided to select a sample from a larger, more established urban school board that would most likely be representative of the larger population of urban school boards within the province of Newfoundland and Labrador. The sample for this study was selected by arranging a meeting with the Associate Superintendent of Curriculum for the largest school board within the St. John's region. As a result of that meeting a survey sample was made available which included all 38 schools within this school board, ten of which were high schools and the remainder being primary, elementary, and junior high schools. All special education units within these schools would be included in the survey from 'work experience' and 'regular special education' units to units for the multiply-handicapped and the profoundly mentally handicapped. All special education teachers in each

of the selected schools were the subjects for this study. The decision to sample in this manner was made based upon the belief that it would increase the response rate (in the 1987/88 survey) and make the followup survey easier when carried out two years later (in 1989/90).

Research Procedure

The school board surveyed was in the process of implementing the recommendations of the 1983 report by the Department of Education for the province of Newfoundland by placing one computer per 50 students in each school. There already existed in each of the board's high schools a computer room containing a minimum of 10 microcomputers, and the board had already purchased one computer for most of its primary and elementary grade schools.

Because the board had not designated a position for coordinator, it was agreeable to permitting an outside researcher to study various aspects of the status of microcomputer use within its schools. Through consultation with the board's associate superintendent, agreement was reached on the use of a questionnaire survey format. The researcher consulted with several education faculty members to arrive at a final draft of the questionnaire which was to be used as the survey instrument. Questions were included which would collect demographic, numerical, and objective data as well as teacher comments. It was then submitted to the school board for scrutiny and eventual distribution. A covering letter (Appendix B) was enclosed with the questionnaire which explained the purpose of the study and which requested participation from the school staff in providing information about

computer use. An additional letter supplied by the Associate Superintendent of Curriculum (Appendix B) indicated that the study had the sanction of the school board, and requested that the teachers prepare a response to the questionnaire. In order to facilitate the delivery and return of questionnaires, the internal mail service of the school board was used. All questionnaires for a given school were sent care of the principal. The special education teachers were asked to meet and to complete their questionnaire within the next two weeks. They were then to place it in the envelope provided, seal it, and return it to the principal. The principal was then to return the questionnaire to the school board office where it was to be held for collection by the researchers.

Data for this study were gathered over a three year time span beginning in February of the 1987-88 school year and culminating with a repeat questionnaire survey in February of the 1989-90 school year.

At the end of each data gathering period, the information was analyzed, the status of computer use (penetration) assessed, and teachers' computer literacy level and 'stage of concern' evaluated.

The data were then compared between the two gathering periods, and any significant changes, as determined by statistical analysis, reported. Comments were made as to any relationships that appeared to exist between various variables (or factors) and their effects on the use of CAI by the teachers involved in this study.

The discussion of the findings of this study involved a look at the relationships between information technology, instructional practices, and recent

developments in educational computing.

By the year 2000, many programs of research should have contributed to the theory of design of computer-based models of instruction (CBI), the development of computer-based courses, and a system of evaluation of instructional achievement where new information technologies are used.

For the Province of Newfoundland and Labrador, it is this researcher's intention to provide information which describes present instructional environments in which CAI (or CBI) is used, to help establish the various skill and ability levels of teachers currently being inserviced on CAI use, to present recent findings on pedagogy of microcomputer use in education, and to present recent theory on the practice of preservice and inservice preparation of teachers as they relate to computer technology.

Methodology

Research Instruments

The questionnaire instrument being used in the present study was the kind of survey instrument best suited to the collection of demographic data and descriptive data needed for answering the questions posed by this study. The first part of the instrument was designed to collect descriptive data relating to the demographic characteristics of the respondents. It gathered both numerical data regarding the respondents and their schools, and information regarding the locations and uses of computers. The questions were designed to elicit information regarding grade level taught, special education categories of students in the school, availability,

number, location and accessibility of microcomputers, experience and training with microcomputers, types of software and its availability, and the level of CAI in the school. Several questions were designed to determine the level of curriculum support through the provision of materials such as guide books and packaged programs, and to gain information about inservice activities provided to the subjects of the study. Respondents were provided the opportunity at the end of the questionnaire to write comments or to express any specific concerns relating to microcomputers.

The second part is an adaptation of the Stages of Concern Questionnaire (SoCQ) (Hall et al., 1977) which was developed at the Research and Development Center for Teacher Education at the University of Texas at Austin. The SoCQ contains items, each of which has a Likert scale, on which the respondents indicate their present level of concern regarding each statement about a particular innovation. The SoCQ questionnaire is based conceptually on the Concerns-Based Adoption Model (CBAM). The statements have been tested for their reliability and validity measure for assessing the Stages of Concern hypothesized in the Concerns-Based Adoption Model based upon a number of studies by Hall et al, (1977). This instrument provides a quick-scoring means of evaluating the adoption of an innovation.

The questionnaire items for the present study were created using a modification of the questionnaire developed by White (1987) (see Appendix G). Each statement for the present study was designed to match the appropriate Stage

of Concern statement used in the White (1987) study.

Teachers were asked to circle or tick the choice that best represented their answer, and/or fill in the blank information areas.

Section two of the survey also uses the 'Open-ended Concerns Statement' to determine teacher concerns about the innovation (see questionnaire items 10, 11 and 12). In this technique, respondents are asked to write complete statements to answer the given question; the response is then read twice - once to get an overall feel for the individual's concerns, then on the second reading to provide a more substantive and detailed assessment of the concerns (Hord & Loucks, 1980). It is expected that the teachers being surveyed in this study will take full advantage of the opportunity to write their comments and to expound on their concerns.

The existence of the Hall et al. (1977) and White (1987) instruments, with the reliability and validity confirmed, eliminated the need to design and test a format which would provide data to determine the concerns of teachers.

The White (1987) study was an attitude survey that investigated the concerns of teachers regarding microcomputer technology, while the present study investigated the results of introducing microcomputers into the schools and the use being made of this technology, with a view to assessing teachers' concerns regarding past, present, and future staff development activities. The present study attempted to expand on those original findings of Hall and Rutherford (1977, 1979), and White (1987), and by exploring additional information about institutions, specifically one

major school board in St. John's, Newfoundland, it aimed to more completely understand the adopters of this important educational innovation. The re-survey, one full year later than the date of initial survey, was considered necessary so as to adequately report on the adoption or non-adoption of this innovation and to be able to identify what may be considered critical factors affecting it.

The mail survey method was selected because it could provide data from a large dispersed population without an excessive expenditure of time or money (White, 1987), and because of freedom from interviewer bias (Kanuk & Berenson, 1978) who report that respondents are encouraged to respond truthfully and freely when they can remain anonymous. The collection by mail was selected despite the common problem of low response rates (Ibid.). In the final analysis, the questionnaire survey instrument was judged to be appropriate for supplying information to be used in answering the questions posed by this study.

Specifically the study attempted to answer the following questions:

Question 1: What categories of exceptional students predominate within this school board being studied for whom microcomputers are to be provided?

Question 2: What is the penetration of microcomputer technology into the field of Special Education, especially for this school board?

Question 3: At what stages of computer literacy are the Special Education teachers for whom inservice on this innovation is being planned?

Question 4: What is the current status of curriculum support available for Computer-Based Instruction?

Question 5: What is the level of use and planned level of use by Special Education teachers for microcomputer technology?

Question 6: What are the main factors that affect a teacher's decisions to use or not use microcomputers in reaching the educational goals and objectives set out for each special education student?

Question 7: Over the timespan of this study, was there a shift in the Stage of Concern of this group of special educators?

Treatment of the Data

As previously stated, the demographic data collected on section one of the instrument was used in its raw form to stratify the respondents into various subgroups, and to provide answers for questions 1, 2 and 3 posed by this study (see page 45-46). Percentages were calculated for each school to assess the response rate of the special education units, the predominant categories of exceptionality for which Computer Assisted Instruction is being used, and the number, types, and locations of computers and educational software.

In section two, the procedure for interpreting the descriptive data about the respondents and their use and concerns about using microcomputers in special education (see questions 4, 5 and 6 above) is as follows. Scores such as 1 or 2 on question 5, which represent teacher's experience with computers and familiarity with software, will both indicate 'low' ratings, while a score of 3 will be considered 'average', and scores of 4 or 5 will be considered 'high' ratings.

The data being gathered in the present study was used to determine the stages of concern for the Special Educator group of teachers and to uncover any relationships that might exist between the dependent variables in the study (Stages of Concern) and the independent variables studied. The category names referred to

as "Low Concern" and "High Concern" could also be considered synonymous with the terms "Low Familiarity" and "High Familiarity" (Fougere & Olinsky, 1990, p. 466). Stages 1 and 2 were also grouped together as "Low", and Stages 4 to 6 were grouped together as "High" in the Fougere and Olinsky (1990) study.

The data from questionnaire items 1 through 5 were subjected to factor analysis using appropriate statistical procedures aimed at determining relationships between the dependent variables (the Stages of Concern) and the independent variables of the study which were: 1) types of students taught, 2) types of computers available, 3) accessibility of the technology, 4) availability of educational software for various subject areas, 5) support services and materials, 6) the teachers' level of computer literacy, and 7) teachers' plans for use of this technology.

To supplement the results provided by the percentage scores from questionnaire item 6, a profile showing the group mean percentage scores on each type of software was constructed thus highlighting the data relating to educational software availability.

Scores on questionnaire items 7 through 9 will be indicative of the straight-forward frequency of use, types of use, and perspective on use of this teaching innovation.

Questionnaire items 10 through 12 were scored according to types of teacher needs and concerns (such as subject matter for the inservice, and involvement of self as a presenter). It is also recognized that the most often used method of inservice for teachers is the workshop, whereas some individuals prefer a 1 to 1

personal contact by a consultant. In this study, an effort was made to determine the level of concerns of teachers about making use of CAI workshops, and for their preferences on receiving inservice.

In order to determine the Stage of Concern for this survey sample, a raw intensity of respondents' score was computed by totalling the responses on each of the statements from the questionnaire (see Appendix E for a listing of the statements by Stage of Concern). From these individual raw scores, a group mean raw score was calculated for each of the seven Stages of Concern. The raw scores for each stage were converted to percentage scores using an adaptation of the conversion chart (see Appendix F) outlined by Hall et al. (1977) in their scoring manual.

In addition, subgroup mean raw scores were calculated for each stage. The subgroups were determined as per the stratification described on page 10-11, and 46. These subgroup mean raw scores were then converted to percentage mean raw scores to enable the investigator to compare the high school group with the special educators in Primary, Elementary and Junior High schools on each Stage of Concern.

Profiles showing the relative intensity of concerns on each stage were constructed by graphing the percentage scores on each stage. The profiles were constructed using the group percentage mean scores and for each subgroup as stratified for questions in the study.

A series of charts have been developed to display data relating to the

independent and dependent variables in the study in order to show a profile of the categories of each independent variable across the Stage of Concern. The charts present a way of looking at the information analyzed in the ANOVA and STATISTICS ALL tests. The charts depict the means of each level of the independent variables separately. Thus, the charts form a profile of teacher concerns for each level of the independent variable across the Stages of Concern.

Additionally, concerns were analyzed to determine if differences existed between the status of computer use by different subgroups of the Special Education teacher population. These subgroups were stratified based on level of school (i.e., high school versus grade schools), type of student taught, access to microcomputers, and users versus nonusers of the technology. Through this understanding, the change agents will be in a better position to manage their adoption process.

The interpreted data together with the descriptive data from section two were analyzed to provide answers to the questions posed in this study.

Summary Expectations

As teachers transition from being nonusers to users of an innovation, they will range from stage 0 to 6 on Hall's 'Seven Stages of Concern' model. If a particular group of teachers exhibits stage 0, 1, or 2 concerns on the survey, then it can be interpreted that they are either nonusers of the innovation, are concerned about gaining information, or are concerned about how using the innovation would affect them personally.

If the higher, more intense concerns of stage 3 (Management) are

exhibited, this will be indicative that the teachers are in the beginning stages of using the innovation or are starting to make some regular use of the innovation. One aim of this study is to find whether teacher inservicing has resulted in sufficient gains in experience and skills with the innovation such as to have a definite impact on the system in which the individual works. An indication of such impact would be data indicating the regular scheduling of CAI into the curriculum (see questionnaire item 8).

When teachers become experienced and skilled with an innovation, the tendency is for concerns at Stages 4, 5 and 6 to become more intense with a decrease in Stages 0, 1, 2 and 3 (Hall et al., 1977). Such a change would be apparent on comparing the graphs of Stage of Concern data from the 1987/88 to the 1989/90 survey period. This study hopes to find teachers who are aware of the impact of the innovation on their clients, and who would therefore be anxious to work toward achieving its maximum benefits for other potential users.

Hall proposes that the perceptions, feelings and concerns of people experiencing the change process should be assessed, and that this personal dimension is critical to the adoption or rejection of an innovation. It is this researcher's expectations that the analysis of the data for this study will show strong indications of either adoption or rejection of the innovation, microcomputers.

These survey methods were utilized to provide fascilitators with demographic, numerical and objective data and as well information related to the concerns of this group. The perceptions, plans and concerns of the people

experiencing the change process are gathered using the Questionnaire type of instrument, and this personal dimension combined with the demographic data should provide an assessment of the adoption or rejection of the innovation. This information is critical to decision making by facilitators at the administrative level of a school or school board.

CHAPTER IV

THE RESULTS OF THE INVESTIGATION

Overview

The study did show that the more years of experience that teachers had with the innovation resulted in their becoming significantly more familiar with its uses. The study did not show that schools which had a longer period of adoption of the innovation were significantly further along in their stage of concern development. There was a significant difference in the level of perception of microcomputer uses between those teachers who were unfamiliar with the innovation and those who were familiar with implementing Computer Assisted Instruction.

The 'grade level taught' variable and the 'presence of a computer room' were found to be significant. The 'types of students taught' and 'the types of computers available' were not found to produce significant differences in the stage of concern. An additional variable, 'availability of educational software ...', was found over the duration of the two-year study to be significant.

Lastly, it was found that self-development was a highly individual factor and teachers could be found at either the high school level or the grade school level to be in stages 5 or 6.

Analysis of the Data

As previously stated, the demographic data collected on section one of the instrument was used in its raw form to stratify the respondents into various subgroups (either high school or grade school). Percentages were calculated for each

school to assess the response rate of the special education units, the predominant categories of exceptionality for which Computer Assisted Instruction is being used, and the number, types, and locations of computers and educational settings.

In section two, the procedure for interpreting the descriptive data about the respondent's use and concerns about using microcomputers in special education is as follows. Scores of 1 or 2, which represent teacher's experience with computers and familiarity with software will both indicate 'low' ratings, while a score of 3 will be considered 'average', and scores of 4 or 5 will be considered 'high' ratings.

The factor analysis technique, applied to the data, uncovered relationships between the dependent and independent variables. In Chapter 3, it is commented that several underlying patterns of relationships result in the data being reduced or rearranged to a smaller set of factors or components that may be taken as source variables accounting for the observed interrelationships in the data. The reduction of the 7 stages of concern levels of "High Concern" and "Low Concern" resulted from the factor analysis procedure of the Stages of Concern data. These two category names were considered synonymous with the terms "High Familiarity" and "Low Familiarity" with regard to the innovation, and seemed appropriate based on the analysis of the data (Fougere & Olinsky, 1990, p. 466).

The Stages of Concern concept can be used to assess teachers' concerns about an innovation in preparation for staff development (Cicchelli & Braecher, 1985). This "teacher concerns" dimension can be used to study the change in teachers' concerns before, during, and following inservice activities, and the progress

through the 7 stages can be monitored over time (usually a period of one to several years). (The results of this study will be transmitted to the school board being surveyed for their use in monitoring their inservice activities related to this innovation).

Interpretation of the Data

The questionnaire collected data on five items related to the use of microcomputers and seven on the intensity of concerns expressed by teachers regarding microcomputers in special education. The questions which this study attempts to answer, together with the statistical analysis used to test them or to describe the data collected, are given below.

Question 1. What percentages of schools have special education units, and what categories of exceptional students predominate for whom the microcomputers have been provided?

From questionnaire item 1 it was determined whether the school had a special education program and hence had a need for inservicing from its school board regarding the use of microcomputers in special education? The question was answered by tabulating the number of teachers who responded with either a 'yes' or 'no' answer. All 28 respondents of the 38 schools surveyed in 1987-88 had special education units. 75.9% of the respondents were Primary, Elementary, or Junior High school special education teachers while 24.1% are in High Schools. With the school board's implementation of the Department of Education policy for 1 microcomputer per 50 students, this should result in a definite need for teacher inservicing.

In the 1989-90 survey, no appreciable change was indicated to the percentages of 75% and 25% respectively for the respondents. Contact with the associate superintendent of curriculum indicated that the school board was still actively implementing the Department of Education policy for 1 microcomputer per 50 students during the 1989-90 school year. It was also active in providing a variety of inservice programs and computer courses to meet the needs of its teachers.

What are the categories of exceptional students for whom the use of the microcomputers can be provided?

The question was answered using data obtained from questionnaire item 2, and by calculating the percentages of the responses regarding each level of exceptionality.

Only 4.5% of the respondents reported having Severely Mentally Handicapped students; 13.6% reported Physically Handicapped; 28.6% reported dealing with Emotionally or Behaviourally Disordered students; 9% of grade schools and 43% of high schools reported Cerebral Palsy units; 18% of grade schools and 14% of high schools reported Learning Disabled students; 27% of grade schools and 43% of high schools reported Moderately Mentally Handicapped students; 55% of grade schools and 57% of high schools report Mildly Mentally Handicapped students; 64% of grade schools and 29% of high schools report Regular Special Education students; and 57% of the high schools reported having Work Experience units.

In the 1989-90 survey, the percentage of Physically Handicapped special education students was approximately the same as for 1987-88. The students with

Table 1

Categories of Exceptionality

1987-88

	Grade School % reported	High School % reported
Work Experience	--	57%
Regular Sp.Ed.	64%	29%
Mild Mental Handicap	55%	57%
Moderate Mental Handicap	27%	43%
Cerebral Palsy	9%	43%
Emot./Behav. Disorders	--	29%
Learning Disabled	18%	14%
Physical Handicap	14%	--
Severely Mental Hand.	4.5%	--

Cerebral Palsy were reported at an increase from 9% to 14.3% for grade schools, with the statistic for high schools remaining the same at 43%. For Severely Mentally Handicapped students, a slight increase was reported between 1987-88 (4.5%) and 1989-90 (9.5%). This increase was reported only within grade schools. The population of Moderately Mentally Handicapped students remained about the same at 27% in 1987-88 and 29% in 1989-90 in the grade schools, with a slight increase being reported from 43% to 57% in high schools. The increase from 43% to 57% for high schools should be noted as it may be showing a trend toward more high school programs being provided for MMH and life-skills students. There was a

Table 2

Categories of Exceptionality

1989-90

	Grade School % reported	High School % reported
Work Experience	4.8%	29%
Regular Sp.Ed.	76%	29%
Mild Mental Handicap	67%	43%
Moderate Mental Handicap	29%	57%
Cerebral Palsy	14.3%	43%
Emot./Behav. Disorders	--	14.3%
Learning Disabled	4.8%	14.3%
Physical Handicap	14.3%	—
Severely Mental Hand.	9.5%	--

reported change in percentage for Mildly Mentally Handicapped students over the two-year period from 1987-88 to 1989-90. High schools showed a decrease from 57% to 48% while grade schools reported an increase from 55% to 67%. These changes may indicate actual differences in numbers or may reflect differences in the use of the term 'mildly mentally handicapped'. The percentage of Regular Special Education students was reported at an increase from 64% to 76% for grade schools, while it remained the same at 29% for high schools. The increase seen in grade schools may be due to more grade schools assessing and reporting special education students, to a change in the use of the term 'regular special education' student, or to

increased special education services through the use of Remedial Resource Teachers such as reading specialists whose role has received increased attention in recent years. In the area of Work Experience, one grade school reported having begun a Work Experience program. A decrease was noted from 57% to 29% in reported high school Work Experience programs. This may be due to the limited sample size, in which case, reports from 2 fewer schools out of 7 results in an apparently large percentage change of 28 percentage points (in the high school survey group). If this decrease is a valid statistic, then the trend may be indicative of movement away from Work Experience programming and toward increased alternative remedial programming in high schools. In the 1989-90 survey, a decrease from 29% to 14.3% was reported for Behaviourally and Emotionally Disordered students. This statistic may reflect the current use of alternative treatment programs or facilities for meeting the needs of this segment of the school population, or it may reflect a decrease by teachers in the use of this term. There was no reported difference in the percentage reported for Learning Disabled students in high schools, however, grade schools reported a decrease from 18.2% to 4.8%. This decrease may reflect a trend away from the use of the term 'learning disabled' and toward the diagnostic term 'regular special education'. It could however be the case that fewer students may be getting diagnosed as Learning Disabled in the grade schools.

Question 2. What is the penetration of microcomputer technology into the field of Special Education, especially for this school board, and will the number of computers in the school have any effect on the use of the

technology?

The question was answered by analyzing the data from questionnaire items 3 and 4.

Questionnaire item 3 provided data on the presence of computer technology in the schools. Respondents were asked whether they had a computer and what type of computer it was. Additionally, it was asked whether the computer was there for educational use.

The question was answered by calculating the percentages of responses to question 3 using the raw data.

Table 3

Types of Computers

1987-88

	Grade School % reported	High School % reported
Have computers	86%	100%
Have Apple Computer(s)	5%	14%
Have Commodore Computer(s)	81%	100%

In the 1987-88 survey, 86% of the grade schools and 100% of the high schools reported having computers. Apple computers were in 5% of grade schools

and 14% of high schools, while Commodore computers were in 81% and 100% respectively. The types of Apple and Commodore computers reported indicated that they were for educational use. The average number of computers per school was 2.7 for grade schools and 6.6 per school for high schools. Given the average group size for special education varies from 3 to 12 students per class, this would result in a classroom ratio of 1 computer per 2 students, and at times 1 computer per student (especially in the high schools) which have a Computer Studies Room. Only 2 grade schools and 7 high schools who responded met the Department of Education policy guidelines of 1 computer per 50 students.

Table 4

Types of Computers

1989-90

	Grade School % reported	High School % reported
Have computers	100%	100%
Have Apple Computer(s)	85.7%	85.7%
Have Commodore Computer(s)	81%	100%

The 1989-90 survey indicated that 100% of high school Special Education units have access to computers. It is important to note for grade schools

within this School Board that an increase from 86% to 100% was reported in the 1989-90 survey. This reflects the School Board's commitment to achieving the Department of Education recommendation of 1 computer per 50 students.

There was no change in 2 years by either increase or decrease in the Commodore brand of hardware in the schools of this Board, however, the change in use of Apple brand hardware should be noted. Apple computers increased from 5% to 85.7% in grade schools, and from 14% to 85.7% in high school Special Education units. Commodore computers were still in 81% of grade schools and 100% of high schools. These statistics reflect the continued high school use of Commodore 64s and 128s for the course, Computer Studies 2206, while emphasizing School Board policy that new acquisitions during the 1989-90 school years for educational computers be the Apple brand name. The increase in the number of computers in the schools should result in an increase in the use of Computer Assisted Instruction and a consequent increase in the need for teacher inservicing within this school board.

Questionnaire item 4 provided information concerning the locations of any computers in the school, is used to determine whether the location had any effect on the use of the technology?

The question was answered by calculating the percentage of responses to question 4 using the raw data. 11.8% reported computers in school offices; 6.7% are located in the Guidance Room; 23.5% of grade schools use Resource Rooms as a location; 42% of grade schools and 43% of high schools report computers located in the Special Education classroom; 12% of grade schools and 100% of high schools

use Computer Studies Rooms; 41% of grade schools and 14% of high schools have computers located in their Libraries; and only 6.7%, all grade schools, rotate the computers around to different classrooms.

Of those schools which have computers, 100% report having access to their computers for educational use in both the 1987-88 and the 1989-90 surveys.

Table 5

Locations of Computers

1987-88

	Grade School % reported	High School % reported
In Sp.Ed. Classrooms	42%	43%
In Comp. Studies Room	12%	100%
In the Library	41%	14%
In a Resource Room	24%	--
In the Guidance Room	7%	--
Rotate Location	7%	--
In School Office	--	12%

A variety of locations for computers within the schools was again studied in the 1989-90 survey. The statistics indicated that no greater than 15% of

grade school or high school offices are the locations of computers within the schools. It is, however, notable that there has been a significant increase in the number of computers situated in Special Education classrooms. The percentage increased from 42% to 91% for grade schools and from 43% to 86% for high school special education classrooms. There was a reported statistic of 42% for Resource Rooms

Table 6

Locations of Computers

1989-90

	Grade School % reported	High School % reported
In Sp.Ed. Classrooms	91%	86%
In Comp. Studies Room	4.8%	100%
In the Library	24%	--
In a Resource Room	42%	--
In the Guidance Room	4.8%	--
Rotate Location	29%	--
In School Office	14.3%	14.3%

as locations of computers within grade schools, with 0% for high schools. This information probably reflects that the term 'resource room' may be peculiar to grade

schools and may be synonymous with 'special education classroom'. The 1989-90 survey continued to show that high schools rather than grade schools use computer studies rooms as locations for their computers. Because of the course, Computer Studies 2206, a computer studies room is necessitated in the schools. The survey also showed a slight decrease in the reported use of computer studies rooms by grade schools from 12% to 4.8%. The use of Libraries as the location setting for educational computers decreased from 41% to 24% for grade schools and from 14% to 0% for high schools. No high schools and only 4.8% (one) grammar school report the Guidance Room as a computer location. In the 1989-90 survey, no high schools reported the practice of rotating their computers around the classrooms. Within the grade schools, however, an increase in the practice was noted. This increase was from 7% to 29% for rotating the computer(s) around the school from classroom to classroom. This trend most likely reflects the demand by regular teachers for use of the computers within a school. It could also reflect a possible trend toward team teaching and the tendency for the Remedial Resource teacher to bring materials (including computers) into the integrated setting rather than to remove the student to a segregated setting.

Question 3. At what stages of computer literacy are the Special Education teachers for whom inservice on this innovation is being planned?

Data from questionnaire item 5 was used to ascertain how teachers rate their 'experience with computers' and their 'familiarity with software'. The interpretation of the data deals with how this will affect their use of the technology?

The question was answered by calculating the percentage of responses to questionnaire item 5, using the recoding: 1 or 2 indicates low experience, 3 is average, and 4 or 5 indicated high experience with computers and software. In the 1987-88 survey, the mean score for 'computer experience' was 2.27 for grade schools and 2.14 for high school special education teachers. This is interpreted to mean that both groups rate themselves low in experience with microcomputers. This is cause for some concern considering the fact that computers have been in the high schools for at least 4 years, which is ample time for someone to become well experienced with its use.

In the 1989-90 survey, the mean score for 'familiarity with software' was 2.05 for grade schools and 1.86 for high school respondents. Both groups are thus seen to rate themselves low with regard to familiarity with educational software. This is rather alarming in light of the fact that good educational software has been available commercially since 1983-84.

Based on statistics gathered on the 1989-90 survey, both the grade school group and the high school group have increased their self-ratings from low to moderate in experience with microcomputer use. The grade school teacher mean increased from 2.27 to 2.71, while the high school teacher mean increased from 2.14 to 2.71. The additional 2 years since last survey has given the grade school special education teachers time to catch up to their high school counterparts on computer literacy. Since the 1987-88 survey, there has been some improvement in familiarity with software, but both groups still rate themselves as low. The mean for grade

school teachers increased from 2.05 to 2.38, while the mean for high school teachers increased from 1.86 to 2.28 on a 1 to 5 Liekert scale. These slight improvements in self-rating suggest a need for a concerted effort by the school board for reviewing available software and providing it to pilot groups of Special Education teachers at both the grade school and high school levels.

Question 4. What is the current status of curriculum support available for Computer-Based Instruction?

Questionnaire items 6 and 7 were used to provide the information needed for answering this question.

Item 6 asked the respondents about the availability and distribution of specific types of educational software in the schools. Analysis of the data should provide information regarding how this will affect the use of microcomputer technology for Computer-Based Instruction and also for CAI.

The question was answered by calculating the percentage of responses on questionnaire item 6 using the raw data.

In the areas of Reading and Language Arts, the reported use in 1987-88 of word processing software for developing the 'writing process' and of reading software for developing comprehension and reading speed was relatively low. This was especially true in the case of high school respondents. Analysis of the correlation between 'time allocated for CAI' and 'being given software' indicated that 68% of grade schools and 32% of high school special education teachers would make more use of CAI if software were made available to them.

Looking at the graph table (on p. 69) for "Distribution of Software" for 1987-88, it was clear that some schools had an abundance of software while others, even though geographically close by, had relatively little. Ten schools reported having between 5 and 8 types of software while fourteen indicated that they had from 0 to 4 types. An average-equipped classroom or computer studies room should have 6 types.

In 1987-1988, it appeared obvious that a stronger effort was needed towards dissemination of information regarding software useful for remedial education programs. In addition, 94% of grade schools and 100% of high schools reported that they felt it was the school board's responsibility to provide these curriculum materials and related inservicing.

By the 1989-90 survey, 100% of the respondents reported having Mathematics software, and Reading Comprehension software had also increased from 41% to 81% in grade schools and from 29% to 57% in high schools. There was a moderate increase in Word Processing software from 53% to 57% in grade schools and from 43% to 71% in high schools. Some increase in Language Development software was noted from 53% to 62% in grade schools and from 14% to 29% in high schools. Decreases were noted in the reported statistics for software in the Language areas of Grammar and Spelling; there was a drop from 65% to 52% in grade schools, while a slight increase from 14% to 29% was noted for high schools using grammar software. Both grade divisions reported decreases in Spelling software with grade schools dropping from 71% to 33% and high schools from 43% to 29%. These

Table 7

Types of Software

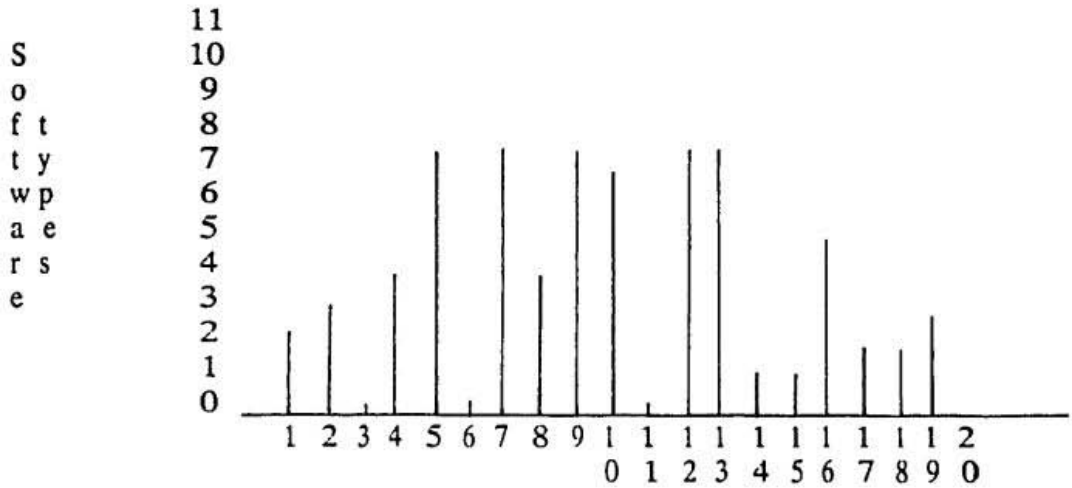
1987-88

	Grade School % reported	High School % reported
LANGUAGE ARTS		
- Spelling	71%	43%
- Lang. Development	53%	14%
- Grammar	65%	14%
- Word Processing	53%	43%
READING		
- Word Recognition	59%	14%
- Comprehension	41%	29%
- Reading Speed Devel.	29%	14%
MATHEMATICS		
- Concepts/Drill & Pract.	77%	71%
Business	6%	--
Social Studies	12%	--
Admin. & IPP Reports	6%	--

Table 8

Distribution of Software

1987-88



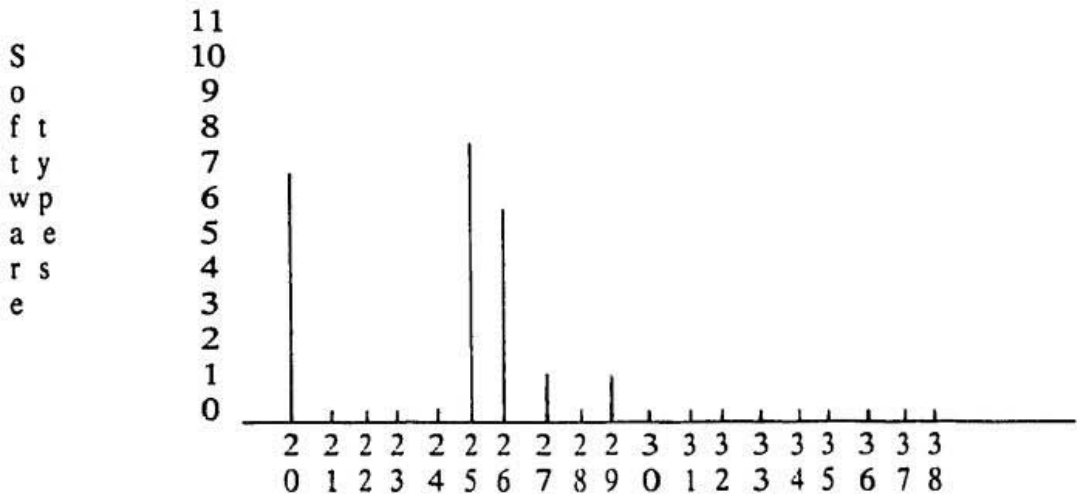


Table 9

Types of Software

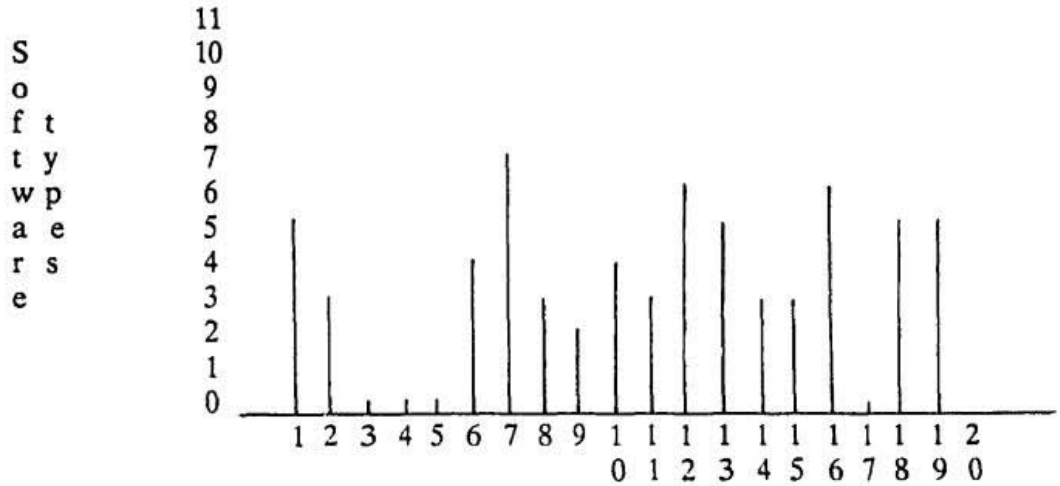
1989-90

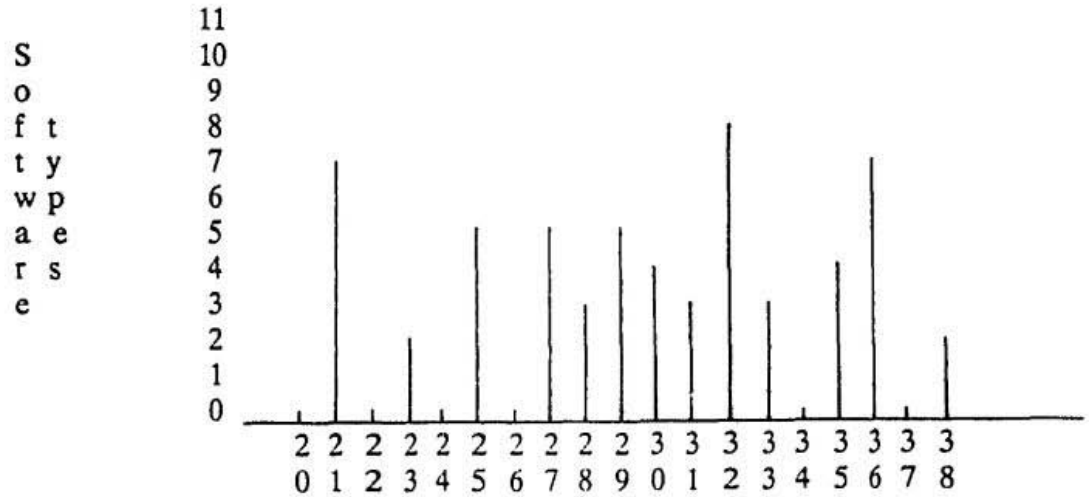
	Grade School % reported	High School % reported
LANGUAGE ARTS		
- Spelling	33%	29%
- Lang. Development	62%	29%
- Grammar	52%	29%
- Word Processing	57%	71%
READING		
- Word Recognition	67%	--
- Comprehension	81%	57%
- Reading Speed Devel.	4.8%	--
MATHEMATICS		
- Concepts/Drill & Pract.	100%	100%
Business	--	--
Social Studies	19%	--
Admin. & IPP Reports	--	--

Table 10

Distribution of Software

1989-90





decreases may likely be a reflection of the movement in Language Arts away from rote spelling instruction and rules of grammar, while increases in other Language areas are likely reflecting current trends towards the Whole Language Approach and to Literature based approaches to Reading. The strong increase in acquisition of Mathematics software likely relates to the quality of existing software for teaching Mathematics concepts and to the outstanding need of special education students for reinforcement and drill-and-practice with Mathematics skills. Credit also has to be acknowledged for the efforts of school board coordinators in researching into their particular areas of curriculum specialty as it relates to Computer Assisted Instruction, for their inservicing efforts for fellow professionals, and for their actions in piloting software programs over several recent years.

Questionnaire item 7 was used to determine whether Special Education teachers, who possess the skills for 'task analysis', determine the 'objectives' of software programs; or do they prefer to have this done for them? It also sought to find out whether they would increase their use of Computer Assisted Instruction if curriculum materials, software and lesson plans were made available to them?

This question concerning task analysis was answered by calculating the percentage of respondents replying 'yes' to question 7. Using the raw data, we see from the 1987-88 survey that 41% of grade schools and 57% of high school special education teachers had analyzed their software programs to determine the behavioural objectives prior to using the software in a student's individualized program plan. The ideal situation would be for every special education teacher to

be able to analyze software curriculum materials. A check on the correlation between 'CAI use' and 'software analysis' indicated that the 50% who are analyzing their software, use CAI up to 3 times a week, while those who do not, report their use to be 1 period a week.

In the 1989-90 survey, there was noted to be a general decrease in the activity of analyzing software for its behavioural objectives. The decrease in grade schools was from 41% to 29% and in high schools from 57% to 43%. The cause of this occurrence is not certain, however, it may be that there is simply less new software coming to these teachers to analyze, the task may be becoming too time consuming, or teachers may want this task of analyzing and evaluating software to be carried out at the school board level.

Question 5. What is level of use and planned level of use by Special Education teachers for microcomputer technology?

The data from questionnaire item 8 was analyzed to determine how much weekly instructional time was being spent using computers in the high schools versus the grade schools, and how much teachers would increase their use of Computer Assisted Instruction if either software or 'pre-packaged' instructional programs were made available.

The question was answered by using raw data responses from questionnaire item 8. Grade school special education teachers reported in 1987-88 to be using CAI between 1 and 2 periods a week, while high schools reported spending from 2 to 3 periods a week. Considering the responses in questions 4 and

6, it appears that the availability of a Computer Studies Room such as in high schools, or at least having more computers available, does result in increased use of CAI.

The indication given by the teachers in 1987-88 for increasing the amount of time they would use CAI, if software and individualized lessons were developed for them, was that grade school teachers would increase from 1 to more than 2 sessions a week, and high school teachers would increase from 2 to more than 2. This would seem to indicate a need for the school board, through its coordinators, to develop pre-packaged instructional programs for educational software.

Table 11

Time Spent Weekly on C.A.I.

	1987-88	1989-90
grade schools	(group mean = 2.59) 1-2 periods/wk	(group mean = 2.76) 1-2 periods/wk
high schools	(group mean = 3.57) 2-3 periods/wk	(group mean = 3.00) 2-3 periods/wk

A check on the correlation between 'intended increase of CAI use' and 'packaged programs' indicated that both grade school and high school special education teachers' intentions to allocate more than 2 periods per week of CAI are

strongly influenced by 'pre-packaged programs being developed for them'.

Statistics gained from the 1989-90 survey indicate that there has been no appreciable change in the amount of time reported for special education students using educational software programs. In spite of teachers' increased familiarity with computers over the additional two years of inservicing, the teachers of special education students have only slightly increased their use of Computer-Assisted Instruction. The reason for this increase only being slight could be that there is a lack of software being made available to the teachers, or there may be a need for increased inservice with the software for individual subject areas being focused on.

In the 1989-90 survey, 100% of the respondents reported that they would make more use of C.A.I. if software were made available to them and if a curriculum guide were provided. The percentage of the "rarely to not at all" category of users of C.A.I. decreased from 29% to 14%. The group "using CAI from 1 to 3 periods per week" increased from 50% to 82%, while those "using CAI more than 3 periods per week" decreased from 21% to 3%. On the whole, this survey showed that 82% of teachers reported that they were using CAI in the range of 1 to 3 periods a week. 100% of the respondents reported that they "want a curriculum guide plus software made available to them".

Question 6. What are the main factors that affect a teacher's decision to use or not use microcomputers in reaching the educational goals and objectives set out for each special education student?

Questionnaire item 9 was used to determine teachers' perspectives on

the use of computer technology. Information supplied on this item was used as an indicator of which perspective predominated - its use as a diagnostic tool, remedial teaching tool, or student progress monitoring tool.

The question was answered by calculating the percentage of responses to question 9 using the raw data. In the 1987-88 survey, from 94% to 100% of all respondents perceive computers to be a useful diagnostic tool; 100% saw its usefulness as a remedial-teaching tool; and 83% to 93% perceived it to be useful as a progress monitoring tool for development IPPs.

In the 1989-90 survey, these respondents maintained their previous perspectives on the use of computers as a diagnostic tool, a remedial teaching tool, and as a student progress monitoring tool. The perspective which individuals have on any new technological innovation is often critical in determining the use which they will make of that technology. This perspective is readily shaped through preservice and inservice activities or the lack of them.

The responses to questionnaire item 2 indicated that the teachers replying to that survey work with a wide range of student disabilities. The school board requires all of its special education teachers who work with exceptional groups to prepare Individualized Program Plans and to monitor progress on a frequent basis. The task of preparing IPP's can be facilitated by the use of IPP software such as PENN STAR which is currently available and is in use in several of this board's schools (6% as reported in question 6). The PENN STAR program runs only on APPLE and IBM computers however, and, since in 1987-88, question 3 indicated only

5% of grade schools and 14% of high schools had Apple computers the use of PENN STAR would have required the purchase of the computer itself.

The 1989-90 survey indicated that 86% of the schools now have 1 or more Apple Computers. Special Education teachers should, consequently, be able to broaden their uses for computers to include student program monitoring.

An additional factor considered to affect strongly a teacher's decision to use microcomputers was the availability of in-service training. Questionnaire item 10 provided information regarding whether these teachers had attended an inservice session over the past year or two years. Analysis of the data on this item was used to determine whether inservice attendance is affected by the level of use of the technology. What amount of in-service time teachers recommend be allocated to this technology, and what the predominant subject areas of interest are to these teachers all are factors expected to affect use of the innovation. The question was answered by calculating the percentage of responses to questionnaire item 10 using the raw data. Based on the 1987-88 survey, only 19% of teachers reported 'attending a workshop 2 years ago'; 26% of grade schools and 17% of high school special education teachers reported 'attending a workshop within the past year'. This would appear to account for the lack of 'computer experience' and 'familiarity with software' as indicated on questionnaire item 5.

In the 1989-90 survey, 83% of grade school respondents and 57% of high school respondents reported "attending a workshop on computers within the past

2 years"; 52% and 86% respectively "attended a workshop on computers within the past year". This data appears to indicate that inservicing related to computers has been on-going within this school board for the past 3 to 4 school years.

Analysis of teacher-reported needs in 1987-88 indicated 75% of grade schools and 86% of high schools would be most interested in receiving a workshop on the availability and use of Mathematics software, 65% and 71% on Reading software, 70% and 57% on Language Arts software, and 25% and 29% respectively on software useful in other subject areas. It would appear that the predominant concern in 1987-88 was with the core-curriculum subjects - Reading, Language Arts and Mathematics.

In the 1989-90 survey, teacher-reported interest in workshops for Mathematics was slightly decreased from 75% to 67% for grade schools and from 86% to 71% for high schools; The request for workshops in computer use for Reading was slightly decreased from 65% to 57% for grade schools and from 71% to 43% for high schools. Interest in Language Arts workshops on computer use decreased slightly for grade schools from 70% to 67%, but increased greatly from 57% to 86% for high schools.

The 1989-90 survey showed a general decrease in "workshop interest for other uses of software" than the CORE curriculum subjects. Grade school statistics indicated a drop from 25% to 5% while high school interest in other uses remained about the same (at 29%).

Considering the information supplied by question 6, Mathematics

software is fairly well distributed, and the Reading and Language Arts areas (especially writing) should be the focus of immediate inservicing efforts to meet the expressed needs of these teachers.

Question 7. Over the timespan of this study, was there a shift in the Stage of concern in this group of Special Educators?

Questionnaire items 11 and 12 were used to provide answers to this question. These items sought to provide information regarding what past experience any of these specialists have had in giving presentations on computer use, and what individuals are currently capable and interested in staff development efforts regarding this technology. An additional consideration in answering question 7 concerned how the option of 'having regular visits' from a school board consultant might compare with the choice of 'attending workshops' (as indicated in Question 10a).

The question was answered by calculating percentages of 'yes' responses on questionnaire item 11 using the raw data. In the 1987-88 survey, only 15% of grade schools and no high school special education teachers reported having ever given a presentation on CAI use. Only 11% of the respondents reported being capable, at present, of giving a workshop presentation on CAI to their peers.

By the 1989-90 survey date, there were still no more than 11% of the respondents who reported being capable of giving a workshop or presentation on Computer Assisted Instruction to their peers.

The concern for receiving inservice on CAI was reflected in the response of 82% of grade schools and 100% of high school special education teachers

preferring to have 'regular visits from a school board computer education consultant'. The mode indicated for receiving inservice on CAI through workshops was 2.5 and 2.6 workshop days a year for grade school and high school teachers respectively.

In 1987-88, the high school group indicated 43% - 1 day and 57% - 2 days maximum of workshop time, and grade schools indicated 39% - 1 day, 22% - 2 days, and 22% - more than 2 days as being needed. The concern by grade school

Table 12

Workshop Inservice Days

	Grade School % reported	High School % reported
1 day	39%	43%
2 days	22%	57%
>2 days	22%	--

special education teachers is most likely related to their 'low amount of inservicing' over the past 2 years (questionnaire item 10), the predominant categories of exceptional students which they teach (questionnaire item 2), and somewhat to their 'perception for use' (in questionnaire item 9).

In the 1989-90 survey, 95% of grade schools and 86% of high schools reported preferring "regular visits from a school board computer education

consultant". The number of days indicated for receiving inservice on CAI through workshops was increased generally from 72% previously wanting from 1 to 2 days, to 82% now wanting from 2 to more than 2 days a year. It would appear that the large increase in numbers of computers provided to the schools has created a renewed demand for inservicing. Teachers who have already had their computers for several years and who have had several workshops also are seeing a greater need for new information.

The 1989-90 survey showed a general increase from 45% to 54% of respondents have between 1 and 4 computers per school, an increase from 34% to 46% who have from 5 to 10 computers per school. No one is without at least one computer (the increase having been from 83% in the 1987-88 survey to 100% in the 1989-90 survey). It should be reiterated here that only 14% report themselves to be "rarely or not-at-all" users of CAI, 82% report using CAI from 1 to 3 periods per week, and that 4% report using CAI more than 3 periods per week. The figure of 82% renders the microcomputer a significant educational tool in Special Education classrooms.

By the 1989-90 survey, 100% of the respondents reported that they intend to use CAI for 2 to more than 2 periods per week "if software plus a set of CAI programs were developed for them". This is in keeping with the previously stated statistic that 100% of special education teachers' perspective is that computers are a valuable remedial teaching tool. It will be a challenge for the school board to respond to the increase from 88% to 93% of special educators who now respond that

there is a need to "have a computer consultant" and for "that person to provide regular visits". This survey sample, 75% of grade schools and 70% of high schools, provided a good cross section of the teaching population of this school board. It is hoped that the high response rate for both the 1987-88 and 1989-90 surveys will enhance the reliability of the statistics obtained from the analysis of these data.

In order to ascertain whether there had been a shift in the Stage of Concern for this group, it was necessary to analyze the data supplied in this survey so as to get an indication of the 'Stage of Concern' of those teachers with this innovation. It was also decided to factor analyze the data to determine if there was any significant difference between high school versus grade school special education teachers in their Stage of Concern.

The question was answered by conducting a Hall's Seven Stages of Concern analysis on each of the statements from the questionnaire. A listing of these statements is found in Appendix E.

As described previously, for each of the Stages of Concern a raw intensity score (percentage of respondents) was computed by totalling the responses on each of the statements from the questionnaire (see Appendix E). From these individual percentage scores a group mean score was calculated with each Stage of Concern.

In addition, subgroup mean raw scores were calculated for each stage. These subgroup mean raw scores were then converted to percentage mean raw scores to enable the investigator to compare the high school group with the special

educators in the grade schools on each stage of concern.

Profiles showing the relative intensity of concerns on each stage were constructed by graphing the percentage scores on each stage. The profiles were constructed using the group percentage mean scores and for each subgroup as stratified to facilitate interpretation of the information

The interpreted data together with the descriptive data from section two was analyzed to provide answers to the questions posed in this study relating to each survey year 1987-88 and 1989-90, and to compare the two survey years for similarities and differences.

The graph of the stages of concern data from the 1987-88 survey produced a bimodal distribution with the respondents equally distributed between the two lobes. The lower lobe of the graph contained 34.8% of high school and 32.6% of grade school respondents, while the upper lobe contained 36.8% of high school and 32.1% of grade school respondents. This homogeneity indicated that the percentages of grade school and high school special education teachers were equal for their levels of concern. The lower lobe consisted mostly of those between stage 0 and 2, and the upper lobe contained essentially those between stages 4 and 5.

These lower stage teachers were in transition from being nonusers to users of the innovation, microcomputers. The nonusers have concerns high on stages 0, 1 and 2. They are more concerned about gaining information (Stage 1) or how using the innovation will affect them personally (Stage 2). As they begin to use the innovation, Stage 3 (Management) concerns become higher and more intense. The results of gains in experience and skills with an innovation have a definite impact on the system in which the individual works. As noted previously, when teachers

Table 13

Stages of Concern

1987-88

Stage 0

Item Number	Statement	Grade School %	High School %	Combined %
26.	I rate my experience with computers 1.	27%	43%	31%
27.	I rate my familiarity with software 1.	41%	43%	41%
47.	I have not attended a computer workshop within the past 2 years.	77%	100%	83%
		48%	62%	52%
	Stage 1			
26.	I rate my experience with computers 2.	41%	29%	38%
27.	I rate my familiarity with software 2.	32%	29%	31%
48.	I have not attended a computer workshop within the past year.	64%	71%	66%
42.	I spend less than 1 period per week on CAI programs.	27%	14%	24%

Item Number	Statement	Grade School %	High School %	Combined %
		Stage 2		
26.	I rate my experience with computers 3.	14%	14%	14%
27.	I rate my familiarity with software 3.	14%	21%	17%
48.	Yes, I have attended a computer workshop within the past 2 years.	18%	0%	14%
42.	I spend 1 to 2 periods per week on CAI programs.	32%	29%	31%
		20%	18%	19%
		Stage 3		
26.	I rate my experience with computers 4.	14%	0%	10%
27.	I rate my familiarity with software 4.	9%	0%	7%
39.	No, I have not determined the behavioural objectives of my software programs.	46%	43%	45%
48.	Yes, I have attended a computer workshop within the past year.	23%	14%	21%
42.	I spend more than 2 periods / week on CAI programs.	18%	57%	28%
		22%	23%	22%

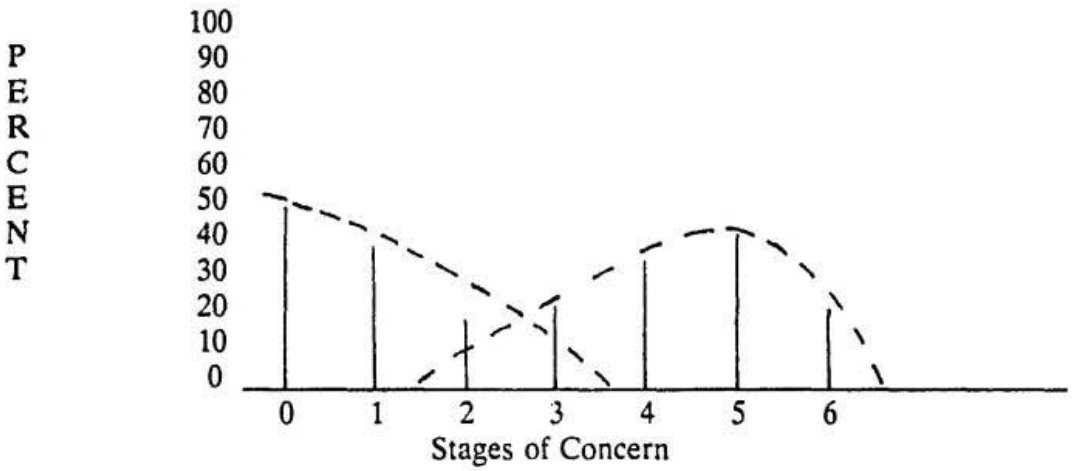
Item Number	Statement	Grade School %	High School %	Combined %
		Stage 4		
26.	I rate my experience with computers 5.	4.5%	14%	7%
27.	I rate my familiarity with software 5.	4.5%	0%	3.5%
39.	Yes, I have determined the behavioural objectives of my software programs.	32%	57%	38%
40.	Yes, I would make more use of my computer if more software programs were available to me.	32%	100%	48%
56.	Yes, I would like to have regular visits from a computer-education consultant to my unit throughout the school year.	68%	100%	76%
		28%	54%	35%
		Stage 5		
49.	I would recommend 1/2 to 1 day of workshop time / year.	46%	43%	45%
50-53.	I would be interested in the subject areas Mathematics. Language Arts, Reading, or other.	77%	100%	83%

Item Number	Statement	Grade School %	High School %	Combined %
54.	Yes, I have given a presentation on the use of software programs.	14%	0%	10%
		46%	48%	47%
		Stage 6		
49.	I would recommend 2 to >2 days of workshop time per year.	36%	57%	41%
55.	Yes, I am interested in providing a presentation at a future workshop.	9%	0%	7%
		23%	29%	24%

Table 14

Stages of Concern

1987-88



became more experienced and skilled with the innovation, the tendency was for concerns at Stages 4, 5 and 6 to become more intense with a decrease in Stages 0, 1, 2 and 3. Because the higher stage individuals are aware of the impact of the innovation on clients, they are usually anxious to work toward achieving its maximum benefits for other potential users.

Hall proposed that the perceptions, feelings and concerns of people experiencing the change process should be assessed since this personal dimension is critical to the adoption or rejection of an innovation (Hall et al., 1977).

Analysis of the between groups variance for the two subgroups, in the 1987-88 survey compared to the 1989-90 survey, indicated that there were only two areas of significant difference, those being Stage 0 and Stage 4.

Stage 0 is indicative of non-users of the technology, while at the other end of the scale Stage 4 indicates individuals who are anxious to maximize the benefits of the innovation to their clients, and who are concerned about meeting the needs of other potential users. The non-user and users who are in a stage of awareness or orientation to using microcomputers will need information specifically about its value and the demands it places on the user and user system. These issues are essential to make the transition into a stage of personal use on a day-to-day basis. The user will need assistance with mastering the tasks required for using the innovation so as to progress in focus from self to the client and his/her use.

The user at the Stage 4 level of concern knows how to make routine use of the innovation, and is making refinements to increase the impact on his/her

Table 15

Stages of Concern

1989-90

Stage 0

Item Number	Statement	Grade School %	High School %	Combined %
26.	I rate my experience with computers 1.	0%	0%	0%
27.	I rate my familiarity with software 1.	24%	29%	25%
47.	I have not attended a computer workshop within the past 2 years.	14%	43%	21%
		13%	24%	15%

Stage 1

26.	I rate my experience with computers 2.	52%	57%	54%
27.	I rate my familiarity with software 2.	33%	14%	29%
48.	I have not attended a computer workshop within the past year.	48%	14%	39%

Item Number	Statement	Grade School %	High School %	Combined %
42.	I spend less than 1 period per week on CAI programs.	20%	0%	14%
		38%	21%	34%
		Stage 2		
26.	I rate my experience with computers 3.	29%	29%	29%
27.	I rate my familiarity with software 3.	29%	57%	36%
48.	Yes, I have attended a computer workshop within the past 2 years.	71%	57%	68%
42.	I spend 1 to 2 periods per week on CAI programs.	48%	71%	54%
		44%	54%	46%
		Stage 3		
26.	I rate my experience with computers 4.	14%	0%	11%
27.	I rate my familiarity with software 4.	10%	0%	7%
39.	No, I have not determined the behavioural objectives of my software programs.	71%	57%	68%
48.	Yes, I have attended a computer workshop within the past year.	52%	86%	61%

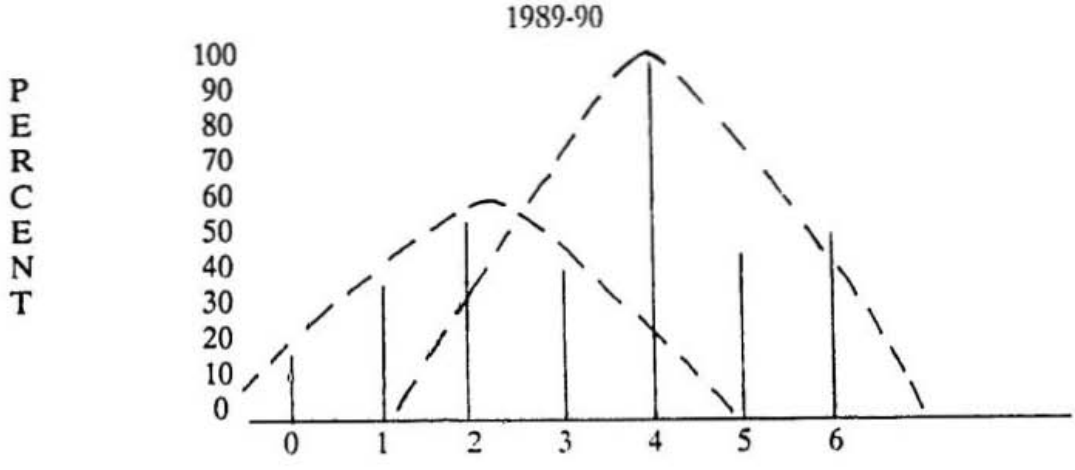
Item Number	Statement	Grade School %	High School %	Combined %
42.	I spend more than 2 periods / week on CAI programs.	29%	29%	29%
		35%	34%	35%
		Stage 4		
26.	I rate my experience with computers 5.	5%	14%	7%
27.	I rate my familiarity with software 5.	5%	0%	4%
39.	Yes, I have determined the behavioural objectives of my software programs.	29%	43%	32%
40.	Yes, I would make more use of my computer if more software programs were available to me.	100%	100%	100%
56.	Yes, I would like to have regular visits from a computer-education consultant to my unit throughout the school year.	95%	86%	93%
		95%	86%	93%
		Stage 5		
49.	I would recommend 1/2 to 1 day of workshop time / year.	10%	43%	18%
50-53.	I would be interested in the subject areas Mathematics, Language Arts, Reading, or other.	91%	100%	93%

Item Number	Statement	Grade School %	High School %	Combined %
54.	Yes, I have given a presentation on the use of software programs.	10%	14%	11%
		37%	52%	41%
		Stage 6		
49.	I would recommend 2 to >2 days of workshop time per year.	91%	57%	82%
55.	Yes, I am interested in providing a presentation at a future workshop.	10%	0%	7%
		50%	29%	45%

Table 16

Stages of Concern

1989-90



clients. Through interaction with colleagues, knowledge is gained concerning both the short-term and long-term consequences for clients. This knowledge is acted upon over time so as to reevaluate the quality of use of the innovation. The Stage 5 and 6 user seeks major modifications of or alternatives to present innovations to achieve impact on clients. This leads to an examination of new developments in the field and an exploration of new goals for self and for the user system.

Summary

The diagnostic component of the Concerns-Based Adoption Model was applied to the introduction of microcomputers into schools, to provide a means of assessing where teachers are, both individually and as a group, relative to the implementation of microcomputers. This is a first step in planning appropriate interventions and guiding the success of future inservice programming.

The concerns and level of use of an individual or group relative to an innovation, together with the adaption being attempted was assessed using principles of this model.

The data collected from this assessment will be used in Chapter 5 to prescribe interventions needed for an individual or group in order to improve the likelihood of change occurring.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Since the introduction of educational computers in 1975, microcomputer technology has been the subject of considerable discussion in educational circles regarding its place and possible uses. Because of the versatility and power of this technology and the potential for use in education, educators have given much thought to it as a technological innovation. The impact of this technology on our daily lives as seen in recent years implies that it is more than a passing fad.

A large portion of the initial discussion about the technology centered on what students should be taught in order to be able to function in a society in which computers are prevalent and at what grade level "computer literacy" should be introduced. Currently, it appears that more interest and research is focusing on using the microcomputer for communication by the disabled, as a mode and manager of instruction, and on the merits of using microcomputers for instruction in contrast to other teaching strategies. However, insufficient consideration appears to have been given to the issue of the role and preparation of teachers to use this new technology.

Comments made by White (1988) appear to be still valid today:

> Initial work in the area of teacher education for this technology focused on the competencies or knowledge needed to control this technology. There appears to be no consensus, however, of the skill and knowledge required to use the microcomputer for instructional purposes. The debate has followed a somewhat parallel path to that evolving in the discussion of student computer literacy.

> Most controversy surrounds the issue of the need for and level of programming competence. Recent advances in the "user friendliness" of software has resulted in more support for the view that proficiency in programming is unnecessary and emphasis on it probably results in increased computerphobia.
>
> In spite of the debate over the skills needed, there appears to be little disagreement about the need for preparation of teachers to use this technology. Due to stable teaching staffs and lack of undergraduate preparation both in the past and presently, it appears that staff development is required to ensure a teaching population competent in the use of the technology. (p. 87)

White (1988) notes that the majority of initial attempts at providing such staff development has followed the pattern prevalent in education - the "oneshot, one day workshop, with little or no follow up to ensure continued use, predominates."

Evaluation of this type of staff development has indicated that the results are less than satisfactory for implementation of innovations (Pepper/Wood EL-Hi Report, 1986). Successful implementation requires more than a single day one-shot workshop to introduce teachers to a change and then expect them to feel prepared to use the innovation proficiently. Research has shown that for change to be successful, teachers must exhibit the change on a long-term basis and this requires a well-planned, comprehensive, and ongoing staff development program.

Hall (1978, p. 4) points out that the full description of the innovation is a key variable, and that all too frequently it appears that innovation developers have not clearly or fully developed operational definitions of their innovations. It is

important that change facilitators and teachers alike know what the innovation is supposed to look like when it is implemented and when it is fully in use.

In planning for staff development, it is important to determine teachers' attitudes towards, reactions to, and uses of the proposed innovation. This study attempted to determine the uses, reactions, and plans of teachers to use this innovation by assessing their concerns, in particular the concerns of special education teachers of one major school board within the province of Newfoundland and Labrador. The assessment of the intensity of their concerns plus a follow-up study was considered to be needed as an evaluation of the implementation effort at the school district level. To determine if differential plans were necessary for various groups, the study also sought to find factors that may have influenced these concerns for the high school group of teachers versus the grade school level of teachers in special education.

The analysis of the findings of this study should shed some light on a proposed definition of the innovation, better known as Computer Assisted Instruction, and provide change facilitators with some direction in hypothesizing what its full implementation with teaching will be like through the use of the Concerns-Based Adoption Model.

This study attempted to determine if differences existed between various groups, grade school versus high school, and the intensity of concerns were compared for the two groups with such factors as availability of microcomputers, the type of computers used, the number of computers, and the location of the computers

which were all considered to be potential factors influencing teachers concerns. Finally, the choice between workshop inservicing versus visits to the school by a computer specialist were considered as a variable which could have a profound impact on teacher concerns about this innovation, the microcomputer.

The Study

By the end of 1986, the Adams and Fuch's research in the United States had revealed that the percentage increase in the number of microcomputers in special education was even higher than the regular grade levels. They cautioned educators to be mindful of the various stages through which they will pass in implementing this new computer technology on a widespread basis. Beyond the stages of gaining information and learning how the technology works, they noted that, in the final analysis, the full adoption of the innovation comes down to the classroom teacher knowing enough about learning and the characteristics of effective instruction to make instructional judgements about computer courseware.

The population studied for the present investigation was those special education teachers in one major school board of the province of Newfoundland and Labrador for the school year 1987/88 and compared to data analyzed for a follow-up survey in 1989/90. A sample consisting of 138 special education teachers within 38 schools was chosen, and data collected regarding the availability of microcomputers, teachers' knowledge, and their concerns about microcomputers and inservice on computer use were assessed. The sample was stratified into two different subgroups for the purpose of data analysis.

The study was conducted using a survey questionnaire (Appendix A). The questionnaire used was a modified version of the Stages of Concern which had been postulated by Hall and Loucks (1978).

During the spring of the 1987/88 school year, the questionnaires were distributed to the principal of each of the 38 schools selected. Each special education unit received a questionnaire to complete and return to the principal within a two-week period. Upon receipt of the completed questionnaires the principals were to return them to the investigator.

In addition to collecting data related to the concerns of teachers, certain other data were collected. Information was obtained relating to the teachers' familiarity and background with inservice training in general and specifically with reference to the microcomputer. Data were obtained about the composition of teacher's instructional groups as well as the grade level taught. The number and location(s) of microcomputers present in each school and information relating to software programs were also determined together with teachers' experience with microcomputers.

The information collected on teacher concerns, together with the information collected on the other questions, provided the data for analysis. A discussion of the results of this study follows in the next section.

Discussion of the Results

The results of this study were presented on a question-by-question basis in Chapter IV. This section will provide a discussion of these results. Prior to that,

the impact of the response rate and scope of the study will be discussed together with possible explanations for the response received.

Response Rate

Of the total of 38 schools sampled, only 28 responded, resulting in a response rate of approximately 75%. This response rate was better than expected but less than the ideal 100%. Any discussions of the results of this study must be done being fully cognizant of this response rate and of the limitation of this study to only one school board. Several probable reasons can be surmised to try to explain the missing 25% of respondents. The research method employed, being the mailed survey questionnaire, has a history of low response rates (Dillman, 1978; Kanuk and Berenson, 1978) but was used despite this inherent problem because of the advantages discussed in Chapter III. In addition, in the 1987/88 survey, it may be that both teachers and principals questioned the applicability of the study to them since either they had no experience with microcomputers or their schools had no machines in use. Respondents sharing this view probably did not respond, thus affecting the response rate. In the 1989/90 survey, it is apparent that the similar response rate bears out Dillman's (1978) and the Kanuk and Berenson (1978) findings once again. In general, however, there were fewer incomplete responses to questions, and fewer blank sections noted on the questionnaires which means that the teachers to whom the principals distributed the questionnaires have had more contact with computers or at least have been exposed to computers in their schools. The repeated low response rate on the 1989/90 survey may also be explained in that

those individuals who failed to respond on the 1987/88 survey perhaps have a history of refusing to complete questionnaire surveys and simply followed the same pattern two years later.

Due to the low response rate and limitations of the sample for this study, inferences will be valid only for those who responded. Projections of these results to the teaching population of Newfoundland and Labrador must take into account the low response rate and the limited scope of this st. dy and hence their implications for generalizability. In spite of these limitations, certain new hypotheses can be generated that could be resolved in future work.

Discussion

This study found that the majority of the teachers responding had the highest intensity of concerns on one of the middle three stages or levels (see graph - Table 16). These three - Informational, Personal, and Management - are associated with concerns about the use and impact in relation to the innovation. Persons having these concerns as most intense are typical of beginning users of the innovation (Hall et al., 1977; Adams and Fuchs, 1986). This was borne out in the fact that by 1989/90, approximately 80% of the respondents had used the microcomputer for instructional purposes.

The study also attempted to determine how extensively each user used the microcomputer, and by 1989/90, 90% of the respondents indicated that they would classify themselves as either novice users or moderate users. A further breakdown revealed that 46% of the respondents had most intense concerns on

either the Personal and Management levels or to some extent were entering into the Consequence level.

The profile of this group of special education teachers showed that the mean percentile scores for this group are highest on the middle three stages, while the upper two levels - Collaboration and Refocusing - showed lower intensity of concern especially for the grade school group. These results are similar to those found by others (Cicchelli and Braecher, 1985; Wedman and Heller, 1984; Wedman et al., 1986; Whiteside and James, 1986) about the concerns of teachers in the early stages of receiving inservice on a technological innovation.

The initial low intensity on task and impact concerns, seen in the 1987/88 survey, was most likely due to the limited use or nonuse of this technology by the majority of teachers. Hall et al. (1977) indicated that with increased use of the new technology, these concerns become aroused and more intense. The existence of a one-to-one relationship between level of use and the level of concern has been postulated (Loucks and Hall, 1977) and appears to be reflected in these results.

These results have implications for the design of staff development activities for those who responded and as well for all teachers of the province where an implementation effort in microcomputer teacher education is to be undertaken. If one could assume that the majority of the respondents in the 1989/90 survey had experienced very little or no change with their use of microcomputers since 1987/88, they would most likely continue to have their most intense concerns on the Awareness and Informational stages. It was decided in the design of this study, that

this hypothesis could be tested by administering a Stages of Concern Questionnaire to the 1987/88 group and readministering it at a later date, 1989/90 to the same group. Since they had been slated for inservice activity during the years following the initial delivery of the ¡uestionnaire, a restudy in 1989/90 would confirm whether higher level concerns existed at the later date.

The high intensity of arousal of concerns at one level requires resolution prior to any increase in the intensity of concerns at the higher levels. This resolution can be accomplished through provision of staff development targeted at the resolving of issues related to these concerns, such as exist with regard to the use of microcomputers in the field of education.

At the Awareness stage, teachers are not likely to be excessively concerned about the microcomputer or involved with it. Staff development to such a group should include information that will make the teachers more aware of the microcomputer and its potential for education.

Groups of teachers who are found to be on the Informational level have only a general awareness of the microcomputer but are seeking more information about it. To resolve these concerns, teachers should be provided with general information about the technology, what it is, how it works, what its capabilities are, what will be required in order to use it, and what are its effects. Some information about software available for computers and some experience with the operation of that software on the microcomputer should be provided. It is most important that continued contact be carried out following any inservice encounter on

unfamiliar technological innovations such as the microcomputer. No concentration should be given to programming with teachers at this level, and those who have an interest in programming could pursue it on their own or at a later date when inservice provides it. Teachers should be made aware that to successfully use computer technology does not require knowledge or extensive background in BASIC or any other programming language.

At the Personal level of Hall's Stages of Concern, teachers are concerned about the demands that the new technology will place on them and how well they can cope with these new demands. Teachers should be reassured that keeping up with this technology will not become a burden for them but that aid will be frequently provided to them and that cost will not be a prohibitive factor. Various utility software such as the PENN STAR individualized program planner, and word processing software should be illustrated at this level to show teachers how it can aid them in their every day work.

Management use of the computer such as to calculate marks or to produce schedules, and instructional uses such as to print out posters or to save worksheets are uses that all teachers could benefit from. Staff development for this group could concentrate on specific information about computer technology and about the types of software available for various subject areas, especially the core curriculum subjects. It is important that no attempt be made to present impact level concerns at this time since they are not most intense (Anderson, 1983). Attempts to do so may arouse these levels of concerns prior to the resolution of personal and

task-oriented concerns.

Teachers must feel comfortable with the use of the technology in their instruction before concerns of the higher levels are broached. No emphasis should be placed on the impact of the technology on students at the early stages of implementation, nor should excessive time be spent on dealing with the charting of use of the microcomputer in the classroom setting. As the self-oriented and task-oriented concerns, such as daily scheduling for use and the acquisition of suitable software are resolved, then the concerns related to impact on the student and on the system in which the teacher works will, naturally, become more intense. These should be resolved on an individual basis through staff development targeting those specific concerns.

Teachers whose concerns are beyond Management and Consequence stages and more at the Collaboration and Refocusing levels, could be identified in each school district. They could be approached for their service as instructors for staff development for their colleagues. At some point when investigation reveals enough teachers at the Collaboration and Refocusing concern levels, then staff development activities by the school board should be provided in order for the issues and concerns to be resolved.

This study has shown that microcomputers are present in 100% of the schools responding, and that by 1989/90 approximately 80% of the teachers were using them for instructional purposes. This level of use of microcomputers is due in large measure to the availability of the machines, however, the lack of teacher

education regarding software programs available for computers (noted in the 1989/90 survey) is another important factor limiting their potential use. This could be corrected in part by beginning a staff development program based on the levels of concern assessed in this study.

This study also attempted to determine if different groups of teachers had different concerns. The results of analyzing the concerns of teachers at the grade school level and at the senior high level were somewhat unexpected. It was assumed that the stage of concerns of grade school teachers would be more different from that of the high school teachers by the 1989/90 survey date. It appears, however, that the concerns of grade school and high school teacher groups are more closely related and that the initial gap seen in 1987/88 has closed. While the most intense concerns are at the task and personal levels, the concerns vary quite a bit and both grade school and high school special education teachers have Consequence concerns in common. The lower self-oriented concerns of the grade school teachers and the slightly higher Consequences and Collaboration concerns of high school teachers could be the result of many factors. For high school teachers, the differences may result from microcomputers already being present in these schools for several years. It is likely that their awareness of computers in the school and discussion with colleagues who teach the Computer Studies 2206 course may have resolved their lower order concerns to some extent. The closing of the gap between the grade levels by the time of the second survey may reflect the rapid development of a strongly positive attitude toward the microcomputer in that some of these

teachers feel that the teaching strategies they presently use are adequate but could accommodate intervention by the new technological approach.

The presence of microcomputers in the grade schools over the past two years may likely explain the more intense task-oriented concerns and decreased awareness and informational concerns. This does not explain, however, the generally higher level of concern for grade school teachers on almost all stages. An additional explanation for the high school teacher group being slightly higher on the Collaboration stage is likely the fact that they have had more opportunity for evaluation of the technology and consequently are anxious to work toward achieving maximum benefits of the innovation for other potential users.

The similar high intensity on task-oriented concerns for all groups has some implications for staff development. It appears that it may not be necessary to have different programs for teachers in these different settings since their initial concerns on Stages 0, 1, and 2 based on the 1987/88 survey are now shifted upward, in 1989/90, predominantly to Stages 2, 3, and 4. Information from questions 9, 10, and 11 of the questionnaire indicate that different activities need to be developed for some teacher groups beyond the resolution of task and impact-oriented concerns. These could include such topics as the availability of software specific to the subjects which they teach, information regarding the evaluation of software, and the identification of coaches among their colleagues who could model the best uses of software for instruction. Due to the rapid increase in movement along the continuum of concerns, the intensity of concerns should again be assessed following

the next year of staff development activities. The coming year's inservice may greatly influence the arousal of these higher order concerns. Later assessment may show greater differences between the grade school and high school groups due to the likelihood of the more experienced teachers engaging in the process of Refocusing as they evaluate how the system has progressed in its use of computer technology in education.

This study has shown a fairly rapid movement along the continuum of the Hall's Stages of Concern. This confirms the hypothesis of. The CBAM (Concerns-Based Adoption Model) that as use increases, higher level concerns become more intense and lower level ones become less intense. Tables 14 and 16 confirm this difference in levels of concerns from the 1987/88 to the 1989/90 survey.

As an outcome of finding that there are several individuals who are at the highest levels of Collaboration and Refocusing concerns, this could have an impact on the provision of inservicing within this school board. Those teachers who are already experienced in using the microcomputer for Computer Assisted Instruction could assist with the staff development program and thus alleviate the load that usually becomes placed on the shoulders of one coordinator. For these individuals, separate inservice could be set up and a variety of course levels could be devised to accommodate the variety of levels of concerns presented by teachers along the Stages of Concern continuum. These teacher coaches could alternatively be divided into regional resource persons whose role could be to approach any teachers who have computers but who are experiencing frustration with first use and trial with

the innovation.

The implications of this study for the staff developer or other change facilitators is that they need to work in an adaptive yet systematic way while staying in constant touch with the progress of individuals within the larger context of the total organization that is supporting the change. This requires the constant assessment and reassessment of the change process.

Hall and Loucks (1978, p. 38) note that the facilitator must remain aware at all times of the "ripple effect" that change may have on other parts of the system.

The lack of a 100% response rate will without a doubt be a factor which influences the intensity of concerns levels evidenced in this analysis. The author surmises that the lack of responses was from individuals with either a lack of interest or a lack of knowledge and information, and that the lack of response probably deflated the magnitude of intensity that would have been expressed on the Stage 0, 1, and 2 oriented concerns. This could only be confirmed by an indepth followup to this survey by administering the Stages of Concern Questionnaire personally to each school. The questionnaire could be administered more broadly to the entire province by the Department of Education to ensure greater potential response and generalizability of the results, or could be administered by another researcher engaged in thesis study.

The results of this study, though affected by the limited sample size, have implications for the implementation of microcomputers in any school or school

board.

Implications

The discussion of the literature from the previous section of this paper, noted that computers can act as a stimulus in many special learning situations across the spectrum of mental and physical handicaps. It can be used as a communications vehicle between the individual and others in his or her environment, and it can be a concrete part of a disabled person's real life environment at home or in the work place. For slow learners and those with specific learning disabilities, microcomputers can provide the right level of drill and practice, repetition for mastery, and success with learning, thus enabling them to approach subjects they were previously either failing or unable to keep up with.

It is the job of the teacher to decide the relationship of the technology to the instructional goals (Adams & Fuchs, 1986, pp. 164-165). Computer controlled instructional technology is beginning to play a large role in providing valuable and professionally required life-long learning experiences. It affects the knowledge base of instruction and how we access knowledge. Computers are used in many electronic appliances and machines, and in the various areas of industry such as banking, vehicle electronic analysis, and in libraries. Hence, computer information has applications to all levels of special education from TMH classes and regular special education remediation to work experience and vocational training courses. But it is the professional attitude toward innovation on the part of the teacher that is a key factor for permanent change in the nature of how knowledge is accessed. Guidelines

for computer applications are just starting to be developed into conceptualized frameworks, and teachers are the ones who must assume responsible leadership positions in shaping the educational use of computer technology.

Educational computing has evolved from 1980. To make the most effective use of human-electronic tool partnerships educators must learn to sift the good software programs from the mediocre (Adams & Fuchs, 1986, p. 119). With hundreds of samples of software to choose from, teachers couldn't possibly sample everything themselves. Like books, software programs are viewed as good, bad, and indifferent. In fact, many of the evaluation techniques used with print materials can also be successfully applied to computer software. Some practical specific questions that curriculum coordinators and teachers alike can build into the evaluation process are:

1. Does the software meet the memory and attention span demands of your students?
2. Can the courseware be modified to meet individual requirements?
3. Can it be adjusted to the learning style of the user?
4. Education is an increasingly visual process. Are the aesthetics and graphics (visual processing) dynamic and appropriate?
5. Does the software make use of the unique qualities of the computer?
6. Does it meet instructional objectives - and is it educationally sound?
7. Are higher order thinking skills involved in the computer lesson?
8. Can the children understand the language level?

9. Does the courseware give appropriate feedback?

10. Does the software free the teacher for more rewarding and challenging teaching?

Evaluating software does not have to be a long tedious task.

(Adams & Fuchs, 1986, p. 117)

Goldman et al. (1987) caution against reacting idiosyncratically to microcomputer technology. Their research showed that many school districts were reacting by rapidly acquiring microcomputers while failing to have in place definite policies and practices on microcomputer acquisition, allocation, access, or use. How microcomputers are to be used, teacher preparation for instructional uses of microcomputers, which students get to use them and for how long, appear to be related to complex variables including the student's educational program and age. They recommend close interaction between regular and special education personnel with the administration regarding decisions relative to number of computers to be acquired by a school, policies on software acquisition, allocation and access, and the formation of organizational structures such as microcomputer committees and staff development programs. Their research data indicated a movement away from having a designated staff position exclusively associated with the microcomputer educational program, to providing training and skill development opportunities to all the existing staff of a school. Where districts are large, they recommend employing a specific microcomputer specialist responsible for coordinating and implementing staff microcomputer instruction.

Goldman et al. (1987, p. 338) comment that it is likely that greater differentiation of the microcomputer training of special compared to regular education teachers will occur as each group gets beyond basic and introductory levels of microcomputer adoption. In particular, they would expect differential software needs to emerge as teachers identify ways to optimize microcomputer effects for different types of students. Potentially, these different needs may mandate different types of training activities.

One such area is the requirement in Special Education for writing Individualized Education Plans (IEPs). Adams and Fuchs (1986, p. 99) comment that IEPs are an essential part of education for children with special needs, and advise strongly the use of new IEP microcomputer programs. They place the responsibility upon the special education teacher and the regular classroom teacher for providing adaptations of the regular curriculum to meet the needs of special students. They caution that there is more to meeting special needs than simply supplying computers to schools and software to teachers, and that staff development is the key consideration in conjunction with cost. Teachers must be involved in determining how computers can best assist them, for they are the ones who must put any program into operation.

Adams and Fuchs (1986, p. 166), in noting that teachers were among the first to accept the new technology, comment that computer use in the classroom may be the first major change to move from the bottom of the educational hierarchy up, rather than from the top down. They can be quoted as saying, "When teachers

have a hand in making decisions and suggesting what changes are desirable and necessary, changes will take on greater credibility than if the 'experts' or authority figures initiate the type and direction of change (p. 166)." Their recommendation is that teachers and administrators from the same school or school district enrol in any workshop together so as to enhance the communicative environment and create a support group of colleagues and administrators that will carry over to later communication on a day to day basis. They also point out that taking on the feeling of ownership of this technology will increase both the likelihood, intensity, and legitimacy of change.

The current research data on the movement in education towards microcomputer use, seen in this study, reflects a mixture of centralized and decentralized activity. It can be predicted that special education programs involved in CAI will move toward more formal communicative structures that involve personnel at all levels in the system (e.g., microcomputer committees, university education programs, and task forces) as programs in the schools develop. This trend will likely be seen in the development of both informal and formal communication networks around microcomputer hardware, software, and the training aspects of CAI. Goldman et al. (1987, p.339) anticipated that, within special education programs, as knowledge about microcomputers, particularly effective software, increases in terms of amount (depth) and dissemination (breadth), microcomputer usage with handicapped students will be increasingly optimized for effectiveness. Such effective use of technology will depend on the availability of knowledgeable personnel and on

software that is flexible and that can be readily adapted to individual needs.

In this study, by 1989/90, 60% of the respondents rated their experience with computers as 'low', indicating that their training to use computers in the classroom was inadequate. The level of expertise can only be raised if the issues in using CAI are addressed. Stevens (1980, pp. 228-229) notes the three major obstacles to the implementation of computers to be specifically (a) the lack of hardware, (b) the lack of quality software, and (c) the lack of knowledgeable teachers and support staff. She recommends that teachers be provided reasonable access to adequate computer facilities and to courses aimed at acquiring computer literacy. She points out that teacher educators need to have acquired the skills and competencies related to instructional applications of computers before they can be expected to effectively implement preservice or inservice programs. How educators perceive the role of computers in the classroom is profoundly affected by their preservice and inservice training. If teacher-educators are knowledgeable about instructional computing and can impart their skill and knowledge to those teachers who learn from them, it is a likely outcome that this will maximize the success of computers in education at all levels of the educational spectrum.

Much of the current focus of research into Teacher Training for computer use is on the provision of courses. In the mid-1980's general courses were prepared by TV Ontario and ACCESS in Alberta which were instrumental in demystifying the technology and demonstrating the uses of the new technology for education (Pepper Wood El-hi Report, 1986, p. 65).

Most school boards are now at a stage of providing an introductory course for their teachers, with some going beyond an introductory component. Teachers with proximity to universities can enrol in both credit and non-credit courses.

But what of the composition of introductory courses? What are the components of such courses, and is there a sequence to their content beyond the introductory level course? In a 1986 survey of computer education courses in Canadian Faculties of Education by Collis & Muir (1986, pp. 64-65) the following list of categories of undergraduate credit courses was compiled:

Categories of Undergraduate Credit Courses

	Category	Number of Courses
A.	General, Introductory	45
B.	Second-level, General Course	29
C.	Curriculum Applications:	
	General	13
	Specific Subject	38
D.	Curriculum and Instruction for Computer Science Teachers	16
E.	Programming	31
F.	Software Evaluation, Design, and Authoring	21
G.	Computers and Specific Groups of Users	17
H.	Specific Types of Uses of Computers	30
I.	Other 45	20
	Total	260

Each of the courses was categorized as best matching one of nine descriptions.

> Group A, general introductory courses, vary in their content but typically include a survey of practical applications of computers in education, including administrative uses; some introduction to applications software, such as word processing; some instruction about the computer itself; and experiences in the evaluation of educational software.
>
> Group B, second-level general courses, typically include a more intensive look at the same categories of topics covered in introductory courses. Programming of a simple instructional program is often a component of group B courses.
>
> Group C consists of courses that focus on the use of the computer for instruction in specific curriculum areas. 13 out of 260 courses studied by Collis & Muir, addressed curriculum in general and the rest relate to specific areas, including Mathematics, Language Arts, French language instruction, and Business education.
>
> Group D includes courses aimed specifically at content and methodology appropriate for secondary level computer science instruction.
>
> Group E consists of courses focusing on programming; 11 of the 31 courses in this group were based on LOGO, 3 specifically involved BASIC programming, and 1 focused on PASCAL.
>
> Group F, which includes courses involving design and construction of educational software, presumably involves some programming instruction as well.
>
> Group G includes courses focused on the use of computers by specific groups of users including

> administrators, special education students, and primary and pre-school students. Also in this group are courses that prepare teachers to be computer-resource persons in their own educational communities, and to be a Computers in the Classroom Specialist.
>
> Group H courses focus on specific uses of computers in educational settings, such as word processing, simulations, student management, use of databases, and telecommunications.
>
> The last category, Group I includes a variety of courses which offer such topics as Computers and Society, Computers at School and Home, and the Use of Computers for Testing and Diagnosis. (p. 65)

The considerable variety of undergraduate courses, taken together, provides a thorough representation of this new area of study, Computers in Education. While a consensus about the scope of the area is emerging, there is still a need for a clear pattern or sequence of courses. Where introductory undergraduate courses stem from Group A, perhaps the second level topics could be drawn from courses in Groups B and G.

The Collis & Muir study (p. 69) reported that the use of computers in education has been accepted by virtually every faculty of education in Canadian Universities as appropriate for formal course instruction. They also show that the growth in the number of courses has not yet been matched by a cohesiveness of opinion with regard to the nature of computer education. This reflects the lack of consensus in the education profession, generally, with regard to questions such as the following:

1. Is computer education a new discipline or a methodological adjunct to existing areas of study?

2. Given the newness of the area, and the lack of consensus regarding it, what background experiences and qualifications do the instructors of the 345 credit courses share?

3. For which teachers are computer education courses appropriate or even necessary?

4. Should teachers receive some of their basic computer-related coursework in computer science departments rather than in faculties of education?

5. To what extent does the content of general introductory courses duplicate that of non-credit inservice experiences already available to teachers through school district or professional association activity? (Collis & Muir, 1986)

Since the purpose of the Collis & Muir study was to describe the current stage of computer education in Canadian universities, questions such as these remain to be answered. However, the diversity of current course offerings indicates a need for greater communication among those involved, so that a consensus regarding the range of concepts and skills appropriate to computer education can emerge (p. 69).

Recommendations

The discussions of the results of recent research, in the previous section, outlined potential approaches to providing staff development for teachers about microcomputers in the classroom. These suggestions were based on the concerns levels expressed by teachers in studies carried out by a variety of researchers and by this author in 1987/88 and a replication in 1989/90.

The review of the literature indicates that a need exists to provide staff development for teachers in the area of microcomputer education.

This study has assessed the concerns of a small group of teachers about this technology - being Special Education teachers in one school board of the province of Newfoundland and Labrador. As staff development in this area is becoming a growing concern, the necessity is also arising for completing more indepth and more frequent surveys of the implementation efforts and their outcomes.

The development of a comprehensive staff development plan to deal with computer use must be a part of any well-planned education policy. Financing is a serious consideration, and unless guided by informed policy, schools could expend exorbitant amounts of money up front only to realize later that the hardware or software are not the brands or types endorsed for development by either their school board or their provincial department of education. A developmental plan based on a long-term gradual effort would facilitate the implementation without the strain of an immediate and exorbitant budgetary expenditure.

Any plan should not consist only of budgetary provisions for the purchase of a specified number of computers. As research in this paper has shown, implementation does not result only from the decision to adopt this technology. Implementation and further development come about when planning, action, and teacher input form the important components of the long-term educational plan. The purchase of microcomputers for schools does not ensure use. This point is bourne out in the case of the province of Alberta which, by 1985, had approximately

one computer for every 19 students as the result of an extensive government purchasing agreement. In spite of the large amount of hardware, it was shown by Petruk (1985) that only 26.6% of the teachers were using the microcomputers. This lead to the acknowledgement of the need for action in developing a teacher education program aimed at realizing the benefits of the investment already made.

Inservice training needs to be more than someone with a computer background being designated to help teachers. Some general guidelines for staff development are to involve a whole range of people and skills and to train some local "expert" within each school for on-site long-term teaching (Adams & Fuchs, 1986, p. 168). Alas, programs in teacher training with the innovation must be based on research, learning theory, and sound educational practice.

A number of pilot projects could be recommended for use in this regard to explore new ways of implementing courseware and computers into the classroom. The instructor's job will be to assess the needs and responses of the students during daily lessons. This information can then be fed back into the evaluation process for making decisions about software and its uses in the educative process.

It would appear that the first step in any action plan to involve computers in education must be to work on the development of a comprehensive computer education policy. This policy, as a result of input from many sources - teachers, teacher educators, students, parents, and society at large, would create an atmosphere of collegiality and draw from the knowledge and experience of all

concerned. This policy should include more significant issues than the decision about the type or brand of hardware to be used.

Vitally important is the determination of those groups to whom Computer Assisted Instruction (CAI) is being provided and for whom it is best intended. This study focused on the area of Special Education where a major thrust into the use of CAI is being undertaken. Beyond the findings of this study that large percentages of cerebral palsied, physically handicapped, moderately and mildly mentally handicapped, learning disabled, and regular special education students are receiving CAI, the extent of CAI use in regular education classrooms should receive attention. The purpose of such a study would be to broaden knowledge about the group of regular classroom teachers (i.e., the non-special education teachers) for whom inservice programs in the immediate future could be designed.

As previously noted by Graystone (1983 in Hopkins, p. 37), the responsibility lies within the educational system to incorporate uses of microcomputers into instruction in all subject areas. There is a wide variety of uses and "modes for use" of microcomputers in Computer Assisted Instruction. Beyond their use for tutorials and for drill and practice, Blanchard, Mason, and Daniel (1987) list such uses as word processing, numerical analysis, simulation of science and geological processes, and design. The possibilities for educational use of computers, according to Kinser (1986) are new and exciting. Students and teachers alike should be made aware of all the possibilities for computer use in education and in society, for example: voice synthesis, voice recognition, design in engineering, painting and

music, plus linkage to a great variety of peripheral devices such as telephones, printers, and modified keyboards.

In addition to an educational policy which reflects a thorough knowledge of the computer field, the focus of current efforts should be on developing "computer literate" teachers who have as a result of preservice and inservice activities, the ability to use this technology and a knowledge of a variety of available educational software for supplementing instruction in a variety of subjects. Simply being vaguely aware of computers will not be enough to use computers successfully in the classroom or to prepare students for the future.

The term "computer literacy" has been greatly overused in the past to the point of ambiguity; it means different things to different people. Adams & Fuchs (1986, p. 167) define it as "the ability to cope comfortably and effectively with computer-related technology". Their 'application level' in educational computing implies "demonstrated skill in selecting and evaluating software, implementing computer-based instruction, and adapting activities and courseware to meet instructional needs." This is the level that most teachers are striving for today. This would necessitate the preparation of teachers already in the field to use this technology, as well as improving upon existing preservice courses available at the University level. A variety of pilot projects would be strongly recommended for trial and evaluation throughout the school board district.

One of the concerns for the "Proper programming" of Computer Assisted Instruction in education provided by Hannaford, Alonso, and Eydie (1981),

well worth reiterating here, is for teachers to be conscious of what, how, and why they are using particular software programs. As this study pointed out, 100% of the respondents believed it to be necessary that some person or persons carry out the analysis and evaluation of software to be used in education. According to Hannaford et al. (1981), it should be determined, in a specific way rather than a general way the "teaching/learning mode" of the software to be used, and the "behavioural objectives" or "instructional objectives" of each computer lesson. This author strongly recommends the creation of a coordinator position(s) at each level within the educational system from the school, school board, district, and provincial department level of education for carrying out an ongoing study of Computer Assisted Instruction, especially as it relates to analyzing and evaluating education software.

Harper & Koh (1988) in their research, studied the factors affecting secondary preservice teachers' computer knowledge. Their conclusions listed some of the key objectives and content of the preservice course for teachers. By the end of the course the diploma in education student should be:

(1) Familiar with computerized teaching and learning materials - including some experience using educational application software (e.g., drill and practice, tutorial, simulations, educational games, microworlds, etc.) and documentation.

(2) Able to use the computer as a tool for teaching and learning (using applications such as word processing, spreadsheet analysis, and data base management).

(3) Able to evaluate the appropriateness and effectiveness of educational software in specific teaching/learning situations.

(4) Able to discuss moral, psychological, sociological issues of computing in society (in general and in education).

(5) Able to programme using the LOGO language and be aware of its potentials in the classroom.

(Harper & Koh, 1988, p. 501)

The results of their study seem to imply that a reasonable level of computer education literacy can be obtained in a 30 hour course encompassing the above components.

Based on the conclusions drawn from the results of their study, Harper & Koh recommend that in this fast growing information technology age, schools should be equipped with as much computer hardware and software as possible to ensure that all our teachers and students become not only computer literate but also to be able to utilize computers in their daily work. Of course, the availability of hardware and software do not guarantee that they will be used successfully. Quality teacher training is imperative.

If an attempt at implementation of any computer education policy is to be successful, staff development must be started with all teachers and continued throughout the implementation effort until regular evaluations reveal that the goal of computer literacy has been satisfactorily defined, developed, and achieved. Otherwise, the expenditure on hardware could have been better utilized elsewhere since only a small percentage of the intended users will continue to make use of it after the initial efforts have ceased.

Teacher concerns about microcomputers were examined in this study and the results have raised several questions that could be dealt with in future research. These questions are:

1. Are there significant differences between the concerns of grade school teachers and high school teachers, and if so what are the probable causes for these differences? What is to be the response to these differences?
2. Are there significant differences between the concerns of regular and special education teachers, and if so what are the probable causes of these differences?
3. How extensive is the use of microcomputers for Computer Assisted Instruction in the schools, and is there a relationship between this use and the use of other instructional pedagogy?
4. How do the concerns of teachers and their uses of computers in other school districts compare with those found in this study?
5. Will teacher concerns about microcomputers in this school board change much more in the near future, and if so what factors influence the resolution of old concerns and the arousal of the new concerns?

There are two central issues surrounding the use of computers in education: the formulation of a comprehensive computer education policy, and the formulation of a well-planned staff development program. These are a necessity for the successful implementation of Computer Assisted Instruction in the schools.

The final question that guides this review of current recommendations from the literature asks: What is the most appropriate approach or mode for the presentation of the content which constitutes the inservice session?

The inservice educator is an intervenor who enters into an ongoing system of relationships, coming between or among persons or groups, for the purpose of helping them. In order to be helpful, the inservice educator must attempt to eliminate any discrepancies which may exist between himself, the content, and his clients and their system. It seems that many discrepancies are created by the mode in which inservice content is presented. Malcolm Knowles (1981, in Grandy, pp. 15-16) reminds us that the mode of presentation must be founded on the grounds that inservice sessions are for adult learners. Knowles suggests a number of steps to guide the development, organization, and administration of inservice programs. These are as follows:

1. Climate. Malcolm Knowles referred to climate as those environmental factors which either facilitate or disrupt adult learning. All kinds of messages are constantly being communicated from the physical, human, and organizational environments in which we live and work. Inservice climates can vary considerably from being warm, informal, and stimulating to being stuffy, formal, and dull. The key issue for climate setting lies in recognizing the value of persons involved in the learning process. If adults are not recognized as self-directing and autonomous persons and if they are not allowed to function as adults, the resulting frustration will most likely have a negative effect on learning.

   Climate setting consists of the integration of three perspectives of the learning environment: the physical, the human, and the organizational. The physical surroundings include lighting, ventilation, seating, and other factors which contribute to the comfort of participants. An important concern related to the human perspective is to create as comfortable a psychological environment as possible. Factors related to the organizational climate might be organizational structure, policy, budgets, etc.

2. Adults learn better if the content is made relevant to their past experiences. Knowles suggested that the important implication for adult education practice of the fact that learning is an internal process is that those methods and techniques which involve the individual most

> deeply in self-directed inquiry will produce the greatest learning. Wright (1980) makes a similar claim. He stated that teachers may learn by doing. The implicit message appears to be that if teachers have experienced a certain strategy or activity, then they will better comprehend that strategy and, in turn understand the problems a child faces when involved in a similar task. (Grandy, 1981, pp.15-16)

These are but several of the steps outlined by Knowles. Additional steps include assessing interests and needs, mutual planning, formulating objectives, designing and implementing learning activities. Each of these has a contribution for planning and presenting inservice content.

In summary, it appears that content for inservice sessions must be related to teacher concerns. These concerns have to be considered in light of the idea or curriculum to be inserviced, the organizational setting, and any other factors which make up the teacher's reality. If teacher concerns are to constitute the content for inservice education, then there is a need for a systematic method of selection. Such a method is suggested by the Concerns-Based Adoption Model (C.B.A.M.). Finally, the principles of adult education must become the guiding lights for charting the presentation of inservice content.

Additional research is needed in order to provide planners with information to aid in the development of a comprehensive policy governing computers in education. The investigation carried out in this study, and answers to the questions posed in this section will hopefully provide some of this needed information.

BIBLIOGRAPHY

Adams, D.M., & Fuchs, M. (1986). Educational Computing: Issues, Trends and a Practical Guide, Charles C. Thomas Publishers, 2600 South First St., Springfield, Illinois 62717.

Adams, D.M., & Fuchs, M. Educational Computing Issues, Trends and a Practical Guide, Ch. 5, Ch. 6, Charles C. Thomas Publisher, Springfield, Illinois 62717.

Alper, J., Lynne, P., and Holmberg, G. (November, 1981) Software to Challenge Your Children. Family Computing, 60.

American Speech and Hearing Association. Position Statement on Nonspeech Communication. Journal of American Speech and Hearing Association, 1981, 23, 577-581.

Anderson, R.E., Hansen, T., Johnson, D.C. and Klassen, D.L. (1979). Instructional computing: acceptance and rejection by secondary school teachers. Sociological Work Occupations 6 (2), 227-250.

Anderson, C.A. (1983, June). The implementation of technology and the Concerns-Based Adoption Model. Paper presented at the NECC/5 National Educational Computing Conference 1983, Baltimore, MD. (ERIC Document Reproduction Service No. ED 235 779)

Anderson-Inman, L. (1986). The Reading-Writing Connection: Classroom Applications for the Computer, Part I, Computers and the Language Arts, November, 23-27.

Armstrong, B.L. (1990). Integrating Environmental Control, Computer Access, Communication with Developmentally Disabled Persons. A paper presented to the World ACCESS Conference, Stockholm, Sweden, August. W-ms-91, p. 138.

Bigum, C., Bonser, S., Evans, P., Groundwater-Smith, S., Grundy, S., Kemmis, S., McKenzie, D., McKinnon, D., O'Connor, M., Stratton, R., and Willis, S. (1987). Coming to terms with computers in schools. Report to the schools studies of the national evaluation study of the Commonwealth Schools Commission's National Computer Education Program. Deakin Institute for Studies in Education, Deakin University, Australia.

Blanchard, J.S., Mason, G.E. & Daniel, D. (1987). Computer applications in education, Computer Applications in Reading (3rd ed.), Newark, Delaware 19714, 1-7.

Blank, S.S. & White, R.B. (1984). Teachers and Technological Innovation. B.C. Journal of Special Education, 8 (1), 71-80.

Bolam, R. (1981) Innovations in Inservice Education and Training of Teachers. Practice and Theory. O.E.C.D., Paris.

Burin Peninsula Integrated School Board, (1986). Recommended district computer education policy for the Burin Peninsula Integrated School. Marystown, Newfoundland: Author.

Cain, E. Jr., & Taber, F.M. (October, 1986). The 21st Century: Preparing for Tomorrow's World. The Exceptional Parent, 61-65.

Caissy, G.A. (September, 1986). Using Computers in the Classroom. A Quick Overview for those new to the field. Computers in Education, 10-12.

Chan, C. (1987). Computer Use in the Elementary Classroom: A survey of computer contact persons in our school districts in Vancouver and Toronto. Computers Education, 11, 233-240.

Chan, C. (1989). Computer Use in the Elementary Classroom - 1. An assessment of CAI software. Computers Education, 13 (2), 109-115.

Chandra, P., Bliss, J. and Cox, M. (1988). Introducing Computers into a School - management issues. Computer Education, 12 (1), 57-61.

Cicchelli, T. & Braecher, R. (1985). Introducing microcomputers into the classroom: A study of teachers' concerns. Journal of Educational Computing Research, 1 (1), 55-65.

Cicchelli, T. & Braecher, R. (1985). Teacher concerns (need for teacher input into inservice planning re. introduction of computers into the classroom environment, Journal of Educational Computing Research, 2 (1), 56-62.

Collis, P., & Muir, W. (1986). A Survey of Computer Education Courses in Canadian faculties of education. The Canadian Journal of Higher Education, 16(1), 61-71.

Commonwealth Schools Commission (1983). Teaching Learning and Computers. A Report of the National Advisory Committee on Computers in Schools. Commonwealth Schools Commission, Woden, ACT, Australia.

Cote-Baldwin, C. (1982). Use of the Apple II Plus with physically handicapped children. In P.J. Nelson (Ed.), Computers and the handicapped (Tutorial). Ottawa: National Research Council of Canada.

Crabtree, D., Korba, L., P.J., & Park, G. (1982). Providing universal access to, computers - the "mod" keyboard-replacement system. In P.J. Nelson (Ed.), Computers and the handicapped (Workshop). Ottawa: National Research Council of Canada.

Darch, C. and Carnine, D. (1986). Teaching Content Area Material to Learning Disabled Students. Exceptional Children, 53 (3). 240-246.

Dickerson, L., & Pritchard, W.H., Jr. (1981). Microcomputers and Education: Planning for the coming revolution in the classroom. Educational Technology, 21 (1), 7-12.

Dillman, D.A. (1978). Mail and Telephone Surveys. New York: John Wiley & Sons.

Downes, T. (1990). Tomorrow's Challenge for Computers in Education: Putting Practice into Theory. Education, 110(4), Summer, 430-435.

Eller, B.F. & Reitzammer, A. (1990). Social Implications for Future Software. Journal of Educational Technology Systems, 18(4), 273-278.

Enstrom, D.H. (1990). The Communication Resource Centre: A Service Delivery Model. Paper presented to the World ACCESS Conference, Stockholm, Sweden, August, W-po-105, p. 142.

Fitzgerald, D., Hattie, J., and Hughes, P. (1986). Computers applications in Australian classrooms. Australian Government Publishing Service, Canberra, Australia.

Fizzard, G. (1984). From Slate to Chip: the instructional use of computers. Newfoundland: Memorial University of Newfoundland, Faculty of Education.

Fougere, K.T. & Olinsky, A. (1990). Educational Institutions Must Keep Pace with Changing Computer Technology. Education, 110(4), Summer, 463-469.

Fullan, M. (1982). The Meaning of Educational Change. Teachers College Press: New York.

Geoffrion, L.D., & Geoffrion, O.P. (1983). Computers and Reading Instruction. Addison-Wesley Pub. Co., 5-12, 144-151.

Goldman, S.R., Semmel, D.S., Cosden, M.A., Gerder, M.M. and Semmel, M.I. (1987). Special Education Administrators' Policies and Practices on Microcomputer Acquisition, Allocation, and Access for Mildly Handicapped Children: Interfaces with Regular Education. Exceptional Children, 53 (4), 330-339.

Grandy, M.H. (Feb., 1981). Inservice Education in Newfoundland: Content and Mode - Some Thoughts From the Literature. A Presentation to the Joint Liaison Committee's Institutional Symposium on Inservice Education. St. Bride's College, Littledale, St. John's, Newfoundland (Appendix H) p.p. 10-16.

Green, J., & Hopkins, B. (1984). The Communications and Telecommunications Needs of the Cerebral Palsied Population in Canada.

Grimes, L. (November, 1981). Computers Are for Kids: Designing Software Programs to Avoid Problems of Learning. Teaching Exceptional Children. 49-53.

Hall, G.E., Zigarmi, P.K., & Hord, S.M. (1979, April). A taxonomy of interventions: The prototype and initial testing. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco.

Hall, G.E. Loucks, S.F., Rutherford, W.L. & Newlove, B.W. (1975). Level of Use of the innovation: A framework, for analyzing innovation adoption. The Journal of Teacher Education, 26 (1), 52-56.

Hall, G., & Loucks, S.F. (1977). A developmental model for determining whether the treatment is actually implemented. American Educational Research Journal, 14 (3), 263-276.

Hall, G.E. (1985). A Stages of Concern approach to teacher preparation (R & D report no. 3213). Austin: University of Texas at Austin, Research and Development Center for Teacher Education. (ERIC Document Reproduction Service No. Ed. 265126).

Hall, G.E., Wallace, R.C., Jr., & Dossett, W.A. (1973). A developmental conceptualization of the adoption process within educational institutions. Austin: University of Texas at Austin, Research and Development Cener for Teacher Education.

Hall, G. E., & Loucks, S. (1978). Teacher concerns as a basis for facilitating and personalizing staff development. Teacher College Record, 80 (1), 36-53.

Hall, G.E. (1978). Concerns-Based inservice teacher training: An overview of concepts, research and practice. Austin: University of Texas at Austin, Research and Development Center for Teacher Education.

Hall, G.E., George, A.A. & Rutherford, W.L. (1977). Measuring Stages of Concern about the innovation: A manual for use of the SOC questionnaire. Austin, Tx: University of Texas at Austin, Research and Development Center for Teacher Education.

Hannaford, A., Alonzo, P., Sloane, M., and Eydie, F. (November, 1981). Microcomputers: Powerful Learning Tools with Proper Programming. Teaching Exceptional Children.

Harper, D.O. and Koh, P.Y. (1988). Factors affecting secondary preservice teachers' computer knowledge. Computer Education, 12 (4), 501-505.

Hord, S.M., and Loucks, S.F. (1980). A Concerns-Based model for the delivery of inservice. Austin: University of Texas at Austin, Research and Development Center for Teacher Education.

Ibid., 144-151.

Kanuk, L, & Berenson, C. (1978). Mail surveys and response rates: A Literature review. In R. Ferber (Ed.), Readings in survey research (pp. 299-320). Chicago, IL: American Marketing Association.

Kennett, K.F. (1990). Computers in Education: Rear-Vision Thinking or Golden Opportunities for the Future. Education, 110(4), Summer, 403-409.

Kerr, S.T. (1990). Educational Technology in the Soviet Union. Educational Technology Research and Development, 38(2), 98-99.

Kerr, S.T. (1990). The Soviet conception of the informatization of education. Journal of Computer-Based Instruction, 17(1), 1-7.

Kerr, S.T. (1987). Soviet applications of microcomputers in education: Developments in research and practice during the Gorbachev era. Journal of Educational Computing Research, 3(1), 1-17.

Kinzer, C. (1986). A 5-Part categorization for use of microcomputers in reading classrooms, Journal of Reading, 30(3).

Kleiman, G. and Humphrey, M. (October, 1984). Computers Make Special Education More Effective and Fun. Creative Computing.

Klieman, G. and Humphrey, M. (March, 1982). Word Processing in the Classroom. Compute, 22, (March), 96-99.

Knowles, M. (1970). The modern practice of adult education: Andragogy versus pedagogy. New York: Associated Press.

Kulm, G. (Spring, 1984). Team Spirit: A Computer Math Course for Parents and Gifted Children. Teaching Exceptional Children.

Loucks, S.F. & Hall, G.E. (1977). Assessing and facilitating the implementations of innovations: A new approach. Educational Technology, 17 (2), 18-21.

Mason, Margie. (1984). Using Microcomputers with LD and EMR Students. Micro-Ideas, 1335 Waukegan Road, Glanview, IL 60025.

McNaughton, S & Seybold, K. (1990). Blissymbolics and Technology. A paper presented to the World ACCESS Conference, Stockholm, Sweden, August, T-po-64, p. 117.

McNaughton, S., Staub, J., Byce, G., Seybold, K., Hasley, D., & Odell, S. (1982). Microprocessors in the work setting: An opportunity for the disabled. In P.J. Nelson (Ed.), Computers and the Handicapped (Tutorial). Ottawa: National Research Council of Canada.

Newfoundland and Labrador Department of Education. (1985). Computer Advisory Committee Report. St. John's, Newfoundland: Author.

Nuccio, E.J. (1990). The Next Generation of Teachers: Past Skills, Future Models. Journal of Educational Technology Systems, 18(4), 279-294.

OECD (1985). (Organization for Educational Computing Development). Education in Modern Society, Paris.

OECD (1988). The Search for Quality in Educational Software, Paris.

Pearson, H. & Wilkinson, A. (1986). The Use of the Word Processor in Assisting Children's Writing Development. Educational Review, 38(2), 169-189.

Petruck, M.W. (1985). Microcomputers in Alberta Schools - 1985. A final report on the results of a resource survey of Alberta schools. Edmonton: University of Alberta, Faculty of Education.

Pressman, H. (October, 1986). Computers Can Make A Difference. The Exceptional Parent, pp. 14-22.

Pugach, M. (1987). The National Education Reports and Special Education: Implications for Teacher Preparation. Exceptional Children, 53 (4). 308-314.

Rushakoff, G., & Lombardino, L.J. (Fall 1983). Comprehension microcomputer applications for severely handicapped children. Teaching Exceptional Children, 18-22.

Sapon-Shevin, M. (1987). The National Education Reports and Special Education: Implications for Students. Exceptional Children, 53 (4). 300-306.

Scott, G. (1985). The Pepper Wood el-hi report on computers in Canadian Education 1980-1986. West Hill, Ontario: Pepper Wood Inc.

Shapleigh, F. (1984). Using Computers for classroom administration and word processing. Memorial University of Newfoundland, Faculty of Education.

Stevens, D.J. (1980). How educators perceive computers in the classroom. AEDS Journal, 13(3), 221-232.

Stewart, R.G. (1987). An investigation into the use of computerized word processing procedures in a process-conference approach to writing by grade five students. MUN Thesis.

Swenson, T.L. (1981). The state of the art in inservice education and staff development in K-12 schools. Journal of Research and Development in Education, 15 (1), 2-7.

Taber, F.M. (October, 1986). Adaptive Devices and the Computer. The Exceptional Parent, pp. 29-30.

Teschner, W.P., Harbo, T, Gran, B. and Haft, H. (Editors), (1983). Inservice Teacher Training Models, Methods and Criteria of its Evaluation 1983) p. 99-113, p. 116-117, p. 119-120, p. 164-169, p. 178-179.

Torgesen, J.K. (1986). Computers and Cognition in Reading: A Focus on Decoding Fluency. Exceptional Children, October, 157-162.

Toronto ACLD Newsletter (1984). Microcomputer Benefits with Mentally Retarded Students.

Vanderheiden, G.C. (1990). Use of Hyper-Text to Create User-Accessible Databases. A paper presented to the World ACCESS Conference, Stockholm, Sweden, August, p. 116

Vanderheiden, G.C. (Summer 1983). Non-conversational communication technology needs of individuals with handicaps. Rehabilitation World, 8-11.

Vanderheiden, G.C., & Kelso, D. (1982). The talking Blissapple - a multifunctional program for displaying/printing/speaking Blissymbols. In P.J. Nelson (Ed.), Computers and the handicapped (Workshop). Ottawa: National Research Council of Canada.

Wedman, J. F., Heller, M.O., & Strathe, M.I. (1986). Changes in teachers' concerns about educational computing. Computers in the Schools, 3(7), 63-70.

Wedman, J.F. & Heller, G.E. (1984). Concerns of teachers about educational computing. AEDS Journal, 18 (1), 31-40.

Wedman, J.F. (January, 1986). Educational computing inservice design: Implications from teachers' concerns research. Paper presented at the Annual Convention of the Association for Educational Communications and Technology, Las Vegas. (Eric Document Reproduction Service No. ED. 267 797).

Wedman, J. and Heller, M. (1984). Concerns of teachers about educational computing. AEOS Journal, 18 (1), 31-34.

White, G.E. (1988). Microcomputers: An Investigation of the Concerns of Teachers about the Implementation of Microcomputers in the Schools. Thesis. Memorial University of Newfoundland. 2125 MUNFA 0018. ISBN 0-315-39492-7.

Whiteside, C., & James, R.K. (1986). Utilizing teachers' concerns to improve microcomputer implementation. Computers in the Schools, 2 (4), 29-41.

Wulf, K.W. (Ed.). (1985). Computers in the Classroom [Special Issue]. Educational Research Quarterly, 10(1).

Zigmond, N., Vellecorsa, A., & Silverman, R. (1983). Assessment for Instructional Planning in Special Education, 7, 269-272, Prentice Hall Inc., N.J.

APPENDIX A

THE QUESTIONNAIRE

SURVEY INSTRUMENT

INSERVICE AND COMPUTER USE QUESTIONNAIRE

TO TEACHERS

Directions

1. Please confer with all other special education teachers within your school in completing this questionnaire.
2. In this questionnaire, inservice is intended to mean the programs organized for teachers during the five 'professional days' allocated to each teacher. However, some wuestions will refer to other types of inservice education.
3. Please return this questionnaire by return mail in the envelope provided by February 10, since results need to be analyzed during the Spring semester for writing over the Summer months.
4. All responses to this questionnaire will remain confidential; no peson or school will be identified in any report of the results of this survey. If you wish to tear off the code number on the questionnaire, you may do so before returning it. In any case, the code number will only be used to check if a response has been received. You may wish your response to be strictly anonymous.

   You will note that the return envelope is addressed to the school board which has agreed to assit with the colleciton of these questionnaires.

   Thank you for your cooperation.

QUESTIONNAIRE

PLEASE ANSWER THE FOLLOWING QUESTIONS WITH REGARD TO THE TYPE(S) OF EXCEPTIONAL CHILDREN THAT YOU TEACH.

PLACE A CHECK MARK IN THE APPROPRIATE BOX ☑

1. Do you have a special education program in your school? ☐ yes ☐ no

2. Please indicate the categories of exceptional children that you teach:

   a) Physically handicapped ☐

   b) Cerebral Palsy ☐

   c) Severely Mentally Handicapped ☐

   d) Moderately Mentally Handicapped ☐

   e) Mildly Mentally Handicapped ☐

   f) Regular Special Education, General Special Education, Remedial, Slow Learner ☐

   g) Work Experience ☐

   h) Behavioural/Emotional Disorders ☐

   i) Learning Disabled ☐

   If OTHER, please specify _____

   _____

3. Do you have computers in your school? ☐

   If YES, are they APPLE ☐

   COMMODORE ☐

   Other (please specify) _____

   _____

4. Do you have access to the computer(s) in your school? ☐ yes ☐ no

The location of the computer(s) is:

GENERAL OFFICE ☐

YOUR CLASSROOM ☐

RESOURCE ROOM ☐

COMPUTER STUDIES ROOM ☐

LIBRARY ☐

GUIDANCE ROOM ☐

ROTATING AROUND ☐

If OTHER, please specify _____

_____

The number of computer(s) is:

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5-7 ☐ 8-10 ☐ more

5. Please rate your experience with computers:

☐ ☐ ☐ ☐ ☐

(low) 1 2 3 4 5 (high)

Please rate your familiarity with software for the computer:

☐ ☐ ☐ ☐ ☐

(low) 1 2 3 4 5 (high)

6. Do you have any of the following software programs for your computer?

	If YES
SPELLING	☐
LANGUAGE DEVELOPMENT	☐
GRAMMAR	☐
WORD RECOGNITION	☐
READING COMPREHENSION	☐
READING SPEED DEVELOPMENT	☐
WORD PROCESSING	☐
MATHEMATICS	☐
GEOGRAPHY	☐
ADMINISTRATION	☐
BUSINESS	☐

If OTHER, please specify _____

_____

7. Have you determined the 'behavioural objectives' of your software programs? ☐ yes ☐ no

Would you make more use of your computer if more software programs were made available to you? ☐ yes ☐ no

Would you prefer to have made available to you a developed curriculum and instructional program including disks, lesson plans, and objectives? ☐ yes ☐ no

8. How much time do your students spend at present on Computer Assisted Learning programs?

☐ less than 1 period per week ☐ 1 period per week ☐ 2 periods per week ☐ 3 periods per week ☐ more than 3 periods

How much time could you allot to Computer Assisted Learning if the objectives, disks, and lessons were developed and sequenced for you?

☐ none ☐ 1 period per week ☐ 2 periods per week ☐ more than 2 periods / wk.

9. Do you see the Computer as:

	YES	NO
a) a future diagnostic tool?	☐	☐
b) a useful remedial-teaching tool?	☐	☐
c) a student progress monitoring tool?	☐	☐

10. Have you attended a computer workshop within

a) the past TWO years?	☐	☐
b) the past YEAR?	☐	☐

How much workshop time would you recommend be set aside each year to share ideas and experience in using software programs for teaching exceptional children?

a) half a day ☐

b) one day ☐

c) two days ☐

d) more than two days (Please specify) _____

10 (cont'd)

In what subject areas would you be most interested?

If YES

a) Math ☐

b) Reading ☐

c) Language ☐

d) Other (Please specify) _____

11. Have you ever given a presentation on the use of software programs for any particular subject area? YES ☐ NO ☐

If YES, please specify _____

If NO, are you at present capable and interested in providing a presentation at a future computer workshop? ☐ ☐

(Specify subject area:) _____

12. Would you like to have regular visits from a computer-education consultant to your unit throughout the school year? ☐ ☐

PLEASE USE THIS AREA FOR ANY GENERAL COMMENTS THAT YOU MIGHT LIKE TO MAKE:

_____

_____

_____

_____

Thank you for taking the time to complete this questionnaire survey. Your input is extremely valuable in providing the information necessary for shaping the field of staff development.

APPENDIX B

INTRODUCTORY LETTER

&

LETTER TO PRINCIPALS

TELEPHONE 753 8530

Roman Catholic School Board for St. John's

BELVEDERE
BONAVENTURE AVENUE
ST. JOHN'S, NEWFOUNDLAND
A1C 3Z4

MEMO TO: Principals/Special Education Teachers

SUBJECT: Research on Microcomputers

DATE: 1987 01 13

Permission has been granted for Mr. Donald Collins to conduct a study on availability and use of microcomputer materials in Special Education.

I am requesting that the Special Education teachers prepare a response to this questionnaire and return it (one completed questionnaire from each school), to this office, by February 19. Send completed questionnaire to:

Ms. Diana McKinnon
R. C. School Board for St. John's
Belvedere
Bonaventure Ave., St. John's, A1C 3Z4

Geraldine Roe
Associate Superintendent
Curriculum/Instruction

GR/gfp

Graduate Studies Division
Department of Curriculum & Instruction
Memorial University of Newfoundland
January 10, 1987

Special Education Teachers
R.C. School Board for St. John's
St. John's, Newfoundland

Dear Colleague:

Please find enclosed a 'needs-assessment questionnaire' dealing with the role and use of microcomputers in Special Education.
Your response to this questionnaire would be of great assistance to me in my thesis research.

The subject of my research will deal with the availability and use of microcomputers and microcomputer materials in Special Education, and look at teachers' concerns with regard to inservice education on the use of this technological innovation - microcomputers - as it relates to Computer Assisted Instruction.

I have enclosed for your perusal a copy of the NTA POLICY ON EDUCATION AND MICRO-technology (Appendix D) 1983.

Thanking you in advance for your cooperation in this study, I remain:

Sincerely yours,

Donald C. Collins

Graduate Studies Division
Dept. of Curriculum & Instruction
Memorial University of Newfoundland
November 9, 1989

Mrs. G. Roe
Associate Superintendent of Curriculum
R.C. School Board for St. John's

Dear Mrs. Roe:

By way of this letter, I am requesting your permission to readminister my questionnaire which studies the role and use of microcomputers in special education.

In order to complete the requirements for my thesis, my supervisory committee has requested that I carry out a comparative study on the data which I initially collected in 1987. Please find enclosed a copy of the Questionnaire.

As previously directed, would you instruct the Special Education Teachers to complete one questionnaire per school, and to send the completed questionnaire to the school board office?

I appreciate greatly your kind attention in this regard.

Thanking you in advance for your cooperation in this study, I remain . . .

Sincerely yours,

Donald C. Collins

APPENDIX C

ASSUMPTIONS OF THE CONCERNS-BASED ADOPTION MODEL

Assumptions of the Concerns-Based Adoption Model

The model as postulated is based on certain underlying assumptions that set the perspective from which change in schools and colleges is viewed.

1. In educational institutions change is a process, not an event. Too often policymakers, administrators, and even teachers assume that change is the pivotal result of an administrative decision, legislative requirement, a new curricular acquisition, or procedural revision. They casually assume that a teacher will put aside an old reading text and immediately apply an individualized program with great sophistication. Somehow the conviction lingers that with the opening of school under the new program the teachers will blend their talents into effective teams. As reflected in the CBAM the reality is that change takes time and is achieved only in stages. (Hall & Loucks, 19789, p 37-38)

2. The individual must be the primary target of interventions designed to facilitate change in the classroom. Other approaches to change (e.g., Organizational Development) view the composite institution as the primary unit of intervention and place their emphasis upon improving communication and other organizational norms and behaviors. CBAM, however, emphasizes working with individual teachers and administrators in relation to their roles in the innovation process. CBAM rests on the conviction that institutions cannot change until the individuals within them change. (Hall & Loucks, 11978, p. 38)

3. Change is a highly personal experience. Staff developers, administrators, and other change facilitators often attend closely to the trappings and technology of the innovation and ignore the perceptions and feelings of the people experiencing the change process. In CBAM, it is assumed not only that the change process has a personal dimension to it, but that the personal dimension is often of more critical importance to the success or failure of the change effort than is the technological dimension. Since change is brought about by individuals, their personal satisfactions, frustrations, concerns, motivation and perceptions generally all play a part in determining the success or failure of a change initiative. (Hall & Loucks, 1978, p. 38)

4. There are identifiable stages and levels of the change process as experienced by individuals. The change process in not an undifferentiated continuum. There are identifiable stages that individuals move through in their perceptions and feelings about the innovation, and identifiable skill levels that individuals move through as they develop sophistication in using the innovation. (Hall, 1978, p. 4)

5. Staff development can be best facilitated for the individual by use of a client-centered diagnostic/prescriptive model. Too many in-service activities address the needs of the trainers rather than those of the trainees. To deliver relevant and supportive staff development, change facilitators need to diagnose the location of their clients in the change process and to direct their interventions toward resolution of those diagnosed needs. (Hall & Loucks, 1978, p. 38)

6. The staff developer or other change facilitators need to work in an adaptive, yet systemic way. They need to stay in constant touch with the progress of individual within the large context of the total organization that is supporting the change. They must constantly be able to assess and reassess the state of the change process and be able to adapt interventions to the latest diagnostic information. At the same time the facilitator must be aware of the "ripple effect" that change may have on other parts of the system. (Hall & Loucks, 1978, p. 38)

7. Full description of the innovation in operation is a key variable. All too frequently it appears that innovation developers have not clearly or fully developed operational definitions of their innovations. Change facilitators and teachers do not know what the innovation is supposed to look like when it is implemented. Thus another key assumption for concerns-based change is that there must be a full description of what the innovation entails when it is fully in use. (Hall, 1978, p. 4

(White, 1988, pp. 138-139)

APPENDIX D

CHARACTERISTICS OF THE

LEVELS OF USE OF THE INNOVATION

Characteristics of the

Levels of Use of the Innovation

Levels of Use are distinct states that represent observably distinct types of behaviour and patterns of innovation use as exhibited by individuals and groups. These levels characterize a user's development in acquiring new skills and varying use of the innovation.

0	AWARENESS	State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.
I	INFORMATIONAL	State in which the user has acquired or is acquiring information about the innovation and/or has explored or is exploring its value orientation and its demands upon the user and user system.
II	PERSONAL	State in which the user is preparing for first use of the innovation.
III	MANAGEMENT	State in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
		Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.

APPENDIX E

CONCERNS STATEMENTS BY STAGE OF CONCERN

IV	CONSEQUENCES	State in which the user varies the use of the innovation to increase the impact on clients within the immediate sphere of influence. Variations are based on knowledge of both short and long-term consequences for clients.
V	COLLABORATION	State in which user is combining own effort to use the innovation with the related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
VI	REFOCUSING	State in which the user reevaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovations to achieve impact on clients, examines new developments in the field, and explores new goals for self and system.

(Hall et al., 1977)

CONCERNS STATEMENT

FOR A STAGES OF CONCERNS QUESTIONNAIRE (SoCQ)

SURVEY

Item Number	Statement	Question
	Stage 0	
26	I rate my experience with computers 1.	3
27	I rate my familiarity with software 1.	3
47	I have not attended a computer workshop within the past 2 years.	6
	Stage 1	
26	I rate my experience with computers 2.	3
27	I rate my familiarity with software 2.	3
48	I have not attended a computer workshop within the past year.	6
42	I spend less than 1 period per week on C.A.I. programs.	5
	Stage 2	
26	I rate my experience with computers 3.	3
27	I rate my familiarity with software 3.	3
47	Yes, I have attended a computer workshop within the past 2 years.	6
42	I spend 1 to 2 periods/week on C.A.I. programs.	5

Stage 3

26	I rate my experience with computers 4.	3
27	I rate my familiarity with software 4.	3
39	No, I have not determined the behavioral objectives of my software programs.	4
48	Yes, I have attended a computer workshop within the past year.	6
42	I spend more than 2 periods/week on C.A.I. programs.	5

Stage 4

26	I rate my experience with computers 5.	3
27	I rate my familiarity with software 5.	3
39	Yes, I have determined the 'behavioral objectives' of my software programs.	4
40	Yes, I would make more use of my computer if more software programs were available to me.	4
56	Yes, I would like to have regular visits from a computer-education consultant to my unit throughout the school year.	7

Stage 5

49	I would recommend 1/2 to 1 day of workshop time per year on computers in education.	6
50-53	I would be interested in a workshop on computer use in the subject _____.	6
54	Yes, I have given a presentation on the use of software programs.	7

Stage 6

49	I would recommend 2 or more days of workshop time on computers in education.	6
55	Yes, I am interested in providing a presentation at a future workshop.	7

APPENDIX F

CONVERSION CHART FOR CONVERTING

RAW SCORES TO PERCENTAGE SCORES

(From Hall et al. scoring manual)

Raw Score to Percentile Conversion Chart

Five Item Raw Scale Score Total	Percentiles for Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
0	10	5	5	2	1	1	1
1	23	12	12	5	1	2	2
2	29	16	14	7	1	3	3
3	37	19	17	9	2	3	5
4	46	23	21	11	2	4	6
5	53	27	25	15	3	5	9
6	60	30	28	18	3	7	11
7	66	34	31	23	4	9	14
8	72	37	35	27	5	10	17
9	77	40	39	30	5	12	20
10	81	43	41	34	7	14	22
11	84	45	45	39	8	16	26
12	86	48	48	43	9	19	30
13	89	51	52	47	11	22	34
14	91	[illegible]	55	52	13	25	38
15	93	57	57	56	16	28	42
16	94	60	59	60	19	31	47
17	95	63	63	65	21	36	52
18	96	66	67	69	24	40	57
19	97	69	70	73	27	44	60
20	98	72	72	77	30	48	65
21	99	75	76	80	33	52	69
22	99	80	78	83	38	55	73
23	99	84	80	85	43	59	77
24	99	88	83	88	48	64	81
25	99	90	85	90	54	68	84
26	99	91	87	92	59	72	87
27	99	93	89	94	63	76	90
28	99	95	91	95	66	80	92
29	99	96	92	97	71	84	94
30	99	97	94	97	76	88	96
31	99	98	95	98	82	91	97
32	99	99	96	98	86	93	98
33	99	99	96	99	90	95	99
34	99	99	97	99	92	97	99
35	99	99	99	99	96	99	99

APPENDIX G

CONCERNS STATEMENTS BY STAGE OF CONCERN

For An Attitude Survey - G. White 1985-86

CONCERNS STATEMENTS

FOR A SoCQ (STAGES OF CONCERNS QUESTIONNAIRE)

ATTITUDE SURVEY

Item Number	Statement
	Stage 0
3	I don't even know what microcomputers are.
12	I am not concerned about microcomputers.
21	I am completely occupied with other things.
23	Although I don't know about microcomputers, I am concerned about things in the area.
30	At this time, I am not interested in learning about microcomputers.
	Stage 1
6	I have a very limited knowledge about microcomputers.
14	I would like to discuss the possibility of using microcomputers.
15	I would like to know what resources are available if we decide to adopt microcomputers.
26	I would like to know what the use of microcomputers will require in the immediate future.
35	I would like to know how microcomputers are better than what we have now.

	Stage 2
7	I would like to know about the effects of reorganization on my professional status.
13	I would like to know who will make the decisions in the new system.
17	I would like to know how my teaching or administration is supposed to change.
28	I would like to have more information on time and energy commitments required by microcomputers.
33	I would like to know how my role will change when I am using microcomputers.
	Stage 3
4	I am concerned about not having enough time to organize myself each day.
8	I am concerned about conflict between my interests and my responsibilities.
16	I am concerned about my inability to manage all microcomputers require.
25	I am concerned about the time spent working with nonacademic problems related to microcomputers.
34	Coordination of tasks and people is taking too much of my time.
	Stage 4
1	I am concerned about students' attitudes toward microcomputers.
11	I am concerned about how microcomputers affect students.

19	I am concerned about evaluating my impact on students.
24	I would like to excite my students about their part in this approach.
32	I would like to use feedback from student to change the program.

Stage 5

5	I would like to help other faculty in their use of microcomputers.
10	I would like to develop working relationships with both our faculty and outside faculty using microcomputers.
18	I would like to familiarize other departments or person with the progress of this new approach.
27	I would like to coordinate my effort with others to maximize microcomputers' effect.
29	I would like to know what other faculty are doing in this area.

Stage 6

2	I now know of some other approaches that might work better.
9	I am concerned about revising my use of microcomputers.
20	I would like to revise microcomputers' instructional approach.
22	I would like to modify our use of microcomputers based on the experiences of our students.
31	I would like to determine how to supplement, enhance, or replace microcomputers.