THE UNIVERSITY OF MANITOBA

A SURVEY OF PERCEPTIONS OF COMPUTER ASSISTED INSTRUCTION BY EDUCATION LEADERS IN MANITOBA

A Thesis

Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of Master of Education

Department of Curriculum:
Mathematics and Natural Sciences
Faculty of Education

by

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PREFACE

Educators are not afraid of truths. In fact the role of the educators is to train the young to keep an open mind. The task, unfortunately is not always successful. This little gem of thought is combed from the book of Tao, one of those ancient Chinese philosophers.

Truthful words are not beautiful,
Beautiful words are not truthful;
Good men do not argue,
Those who argue are not good;
Those who know are not learned,
The learned do not know;
The sage do not hoard --
The more he does for others, the more he has;
The more he gives to others, the greater his abundance;
The Tao of heaven is pointed but does not harm,
The Tao of the sage is work without effort.

- TAO 81 -

The contemporary philosophers offered other gems of thought.

> "... It isn't a matter of mental capacity or even of temperament. The trouble is that the average individual leaves most of his tasks unfinished, his mental tasks in particular. The world is fairly crowded with truncated minds belonging to people who learned the scales up to three flats and two sharps. If the tune they are interested in happens to be written in any higher signature, they have either to get it transposed into one of the keys they have learned or give it up. Most people try to get along with a vocabulary of about six hundred words. This enables them to understand what is going on in the kitchen, the shop, and on the street. Any idea that can't be translated into kitchen-lore or shop-lore or street-lore is dismissed..." (Source forgotten).

Thus although the goals of education are change-oriented, human nature dictates the reluctance to accept CHANGE. Let us take heart in this prayer which was attributed to one of the Saints:

God, grant me --
the Serenity to accept the things I cannot change,
the Courage to change the things I can,
and the Wisdom to know the difference.

ABSTRACT

PREMISE FOR THE STUDY

This study is based on the premise that achievement of change-oriented goals in education will be facilitated if an orderly plan of development is employed. With this premise in mind the writer notes the following objectives for the study.

OBJECTIVE 1

The first objective relates to a need to know the level of acceptance of microcomputers as valuable medium in the process of education. Such information will enable planners to gauge more adequately the direction and rate of curricular changes which may be required if Computer Assisted Instruction (CAI) is to play a large role. The ultimate acceptance or rejection of CAI will be determined by present and future educational leaders. Their present perceptions of this mode of instruction will be most important in both immediate and long range planning.

OBJECTIVE 2

The second objective is to determine the motivation or dedication of educational leaders to the task of planning for the implementation of programs which employ microcomputers in schools. The study will provide a bird's-eye view of where we are now in the Province of Manitoba in our goal-setting and immediate curriculum planning made necessary by the advent of these "practical-priced" microcomputers.

OBJECTIVE 3

A third but important by-product of the assessment proposed in this study may be the increase in awareness of educational change which will be generated amongst the respondents. While the intended group of participants is made up of knowledgeable persons, the very act of spending half an hour in answering direct questions plus the discussions which will follow will, in all likelihood, raise the level of awareness of microcomputers in education within the group.

The issue raised by the study is current and vital to the schools of Manitoba. The writer believes that by conducting this research at this point in time, the orderly development of programs for the schools may be enhanced. Never before has any development of instructional medium been as rapid as that of the "practical - priced" microcomputer.

THE PROBLEM

The problem of this study is two-fold:

1) To determine the perceptions of educational leaders of the Province of Manitoba regarding the impact and importance of Computer Assisted Instruction in our schools over the following 12 - 24 months.

2) To assess the priority assigned by educational leaders to planning and implementation of Computer Assisted Instruction in the future.

The general question areas considered were:

1) Knowledge by education leaders of microcomputers in education.

2) Plans for future development and application of CAI by education leaders .

3) How education leaders define CAI.

4) Educational changes which may result from CAI.

5) Range of subjects which can be taught by CAI.

6) Rate of installation of CAI.

7) Staff training needs.

Because even the experts have divided opinions about the definition of CAI and because consensus on the definition of CAI is what the writer intends to discover, the term has been left undefined.

MAJOR OBSERVATIONS

As of 1981, leading educators in Manitoba appeared to be rather confused as to what CAI is or what CAI should be and there emerged no consensus of direction regarding the use of microcomputers as teaching tools.

CONCLUSION

The writer has concluded that in both immediate and long term planning of CAI as a mode of instruction, the Department of Education has to get involved to a greater degree even to the extent of establishing a new branch to shape, to assist and to

administer the works of CAI. Getting CAI back to the hands of the professionals has been advocated time and again by educators throughout North America; nevertheless, the cries in the wilderness fell into deaf ears. The writer trusts that CAI correspondence courses can be offered by the Correspondence Branch of the Department of Education in the near future. The spiralling increase in postal costs plus the rapid changes in curricula render this idea feasible and may even be acceptable.

CONTENTS

I. COMPUTER ASSISTED INSTRUCTION IN MANITOBA

Educators in Manitoba are faced with an important and perplexing issue. They have to decide what to do about Computers in Education. They know that in the future, which may be less than ten years from now, computers will become household utilities. The issue facing them is what should be done NOW.

COMPUTERS IN EDUCATION

Computers can be grouped into three classes. In terms of size, huge computers are classified as mainframes and compact desktop computers are called microcomputers. The medium sized computers are called minicomputers. In terms of capability, mainframe computers are the most powerful. They can usually function as multiprocessing machines. They can process gigantic volumes of data and control many peripheral devices. The microcomputers can usually perform one "job" at a time and the amount of data that they can handle is often limited. The minicomputers are somewhere in between the mainframes and the micros. However, given all the generations of computers, these classifications based on size and power are often blurred.

> "And what happens as the distinction between mainframes, minis and micros disappears? Already it seems the chief distinction between mainframes, minis, and micros is their methods of distribution, and those methods are changing rapidly. Soon, the distinction between minis and micros may be almost meaningless, although the term mainframe will remain for those shrinelike machines that can be tended only by experts." (1)

Users of computers in business are fully aware that the microcomputers of today can have capabilities similar to that of the large mainframe computers of the early 1970's. As a matter of fact, sales reports of computer manufacturers show that mainframe users have been converting to minicomputers or even microcomputers. With few exceptions, the mainframe users of today are government and international agencies such as -- the census bureau, health science centers, travel and banking industries, and companies involved in large scale production. Most small and medium sized commercial users find that microcomputers are adequate for their needs. Even mainframe users are obtaining microcomputers for departmental use. With the software capability to access large mainframes and serve as a complete stand-alone system within a department, that is not only practical, it is extremely cost-effective.

Computer manufacturers and their articulate salesmen are besieging educational leaders with information and displays of machinery. Claims William Ridley, Control Data's vice president for education strategy: "If you want to improve youngsters one grade level in reading, our PLATO program with teacher supervision can do it up to four times faster and for 40% less expense than teachers alone." ("The Computer Moves In", TIME, January 3, 1983. Pp.15) Others claim that if microcomputers were to be used only for Computer Science classes and for Data Processing classes, only the few students having those particular talents would benefit. However, in the future society a degree of computer literacy will be required for all.

Literacy, in the traditional sense, means the ability to express oneself and to exchange communications with others by means of written words. Computer literacy would then imply the ability to express oneself by means of computers. People must be familiar with computer utilities ranging from Word Processing to more complicated simulators. The computer manufacturers claim that microcomputers can be used as a medium of instruction. On one hand, Robert S. McLean of The Ontario Institute for Studies in Education argued eloquently for computer literacy and listed the types of applications that would give students an appreciation of the power and versatility available to them now and in the future. "However, CAI and CMI were more suitably implemented on larger machines as argued elsewhere." (2) But this argument was valid prior to 1978. The writer suggests that CAI and CMI are the best means to raise the level of computer literacy for students who are not inclined to pursue a career directly relating to computer.

> "If the function of schools is to prepare students for the world in which they will live most of their lives, it would seem that schools are faced with a difficult challenge. We can see that machines which process information will increasingly affect our lives, but in ways that we cannot predict. We have information processing devices available now. Unfortunately, they come from a short history that has been linked to rather mundane first applications in the economic concerns of society such as payroll and management of insurance plans. It is clear that some form of computer literacy instruction is needed, but the current computer course in secondary instruction often reflect models of information processing that were current in industry a decade ago; the equipment, if available, often reflects that era as well. These courses attract only a few students, often ones who are interested in the field for career possibilities." (3)

Computer Assisted Instruction (CAI), as defined by the manufacturers, is a form of instruction based on the use of the computer as a medium of instruction -- as a means of assisting the teacher in teaching subjects such as reading, mathematics, language arts, physics and chemistry. The TRS-80 brochure states: "The CAI techniques that have proven effective for supplementing regular classroom instruction have centered on individualized learning sessions where the computer generates and presents exercises for a student to solve in an appropriate subject area." Indeed the prices of microcomputers are rapidly coming within the range of the budgets of local school authorities. Timex Corp. announced in late April 1982 that it will begin marketing a new compact, lightweight model -- the Timex Sinclair 1000 -- for just $99.95 as of July 1982. This Timex computer is aimed at first-time users and the educational market. (NEWSWEEK, May 3, 1982, pp. 63) Few administrators can resist the temptation to offer assistance to their students through the medium of CAI using such "practical-priced" microcomputers.

In the world of business, more and more small companies who have not heretofore used computer services are now contemplating converting their manual accounting procedures to computer systems to keep up with the competition. Businesmen know the extent to which computers have been in service for generations (i.e. computer generations) and business applications have been well documented. To simplify matters, the first-time users can now purchase software packages such as Invoicing, Billings,

Accounts Receivable/Payable, Payroll, Inventory Control, General Ledger, etc. Their concern is that they will need skilled personnel and that such personnel may not be readily available. Business leaders now turn to the educational leaders and inquire, "Do we have sufficient numbers of trained persons to operate our computers? Are you going to train greater numbers in the very near future?" The answers received will, in all probability, affect the decisions regarding the purchase of hardware.

Even if schools have their own computers they may not utilize the machines or the personnel effectively. A survey of large American school systems has shown that school districts with their own computers tend to use their own staff to develop administrative computer programs. (4) Administrators may use the teachers or machines to cut costs or red tape instead of letting the students practice. Although most of our Manitoba schools have obtained administrative computer services in one way or another, school administrators may even be tempted to develop their own administrative computer programs if they can break the contracts of the service bureaus. One incentive is the reduction in cost if the present administrative computer services were done by service bureaus. If the service is purchased by the regional consortium the incentive would be that the school administrators may have special programs tailored to their unique needs without having to obtain the approval of the majority. Even if the service is provided at cost by the government agency, not having to ask, "Mother, may I?" Every

time is incentive enough. This temptation is greatest in small schools which have not yet been using administrative computer service. Whether it is simply diverting staff time or machine time, the students suffer from insufficient supervision or "hands on" practice.

Many educational administrators have become aware of the potential of the microcomputer but there is an element of confusion in their decision-making process. Through sales promotion, they have become convinced that the new hardware may be within the range of their budgets. The administrators know the potential of the teachers in their employ and can assess whether or not these teachers can carry the computer "load". Administrators are learning that microcomputers can be useful in science and mathematics classes and that limited developmental work has been done in other disciplines. Their vision of the applications of the so-called Computer Assisted Instruction (CAI) is not clear. Therefore, it is essential that education develop a well articulated consensus in the applications of CAI.

COURSEWARE

The administrators know that any computer or microcomputer is useless without software. Courseware is a special kind of software designed to teach. Courseware is expensive and difficult to develop, and has had a limiting effect on the applications of microcomputers in schools. Several companies are addressing the problem of courseware. "We have involved the experts -- the teachers and curriculum developers and the schools -- in designing and field testing our new courseware

products. The new educational programs listed in this section represent a growing commitment to the development of courseware...", claims a TRS-80 advertisment. Few administrators have faith in the advertising but fewer administrators know where to obtain good CAI courseware.

To further complicate matters, there seems to be a "babel" of computer languages in CAI. The system being used in Alberta does not seem to be compatible with that of Ontario or with the various systems being used in the United States. Administrators are turning to the specialists for guidance. Should there be standardization in computer languages? Should the equipment be standardized? Unfortunately, educational leaders and specialists do not have a precise answer to offer. Ludwig Braun described their predicaments vividly:

> Faced with pressures of staff, students, parents, and school boards to get their schools into computing, educators seek advice from any quarter about which machines to buy. Salespeople usually are more interested in making a sale than they are in meeting the needs of their customers. Because many educators have no competent, objective person to give them the help they need, they turn to the salespeople for advice and sometimes buy computers that do not meet their needs... (5).

RESEARCH

The National Research Council of the United States provided a grant to the Honeywell Corporation to develop CAI courseware using NATAL (National Authoring Language) but this language has not been supported nor accepted by other computer manufacturers. (6), (7), (8) Since courseware is machine dependent, the research does not seem to cater to the immediate needs of our

educators. To date, most CAI software is directed toward "drill and practice" with no emphasis on "tutorial" or original teaching. Limited research has been conducted to evaluate the effectiveness of this more extensive application of CAI. If schools are advised to spend money on microcomputers, with the present courseware the slow learners may be the only students who will benefit from this mode of education.

The software "video games" are impressive. In fact, some of these are "arcade" quality. However, can justification be made for large investments for such "recreation"? In short, the documentation of applications of computers in education is not as extensive as it is for business applications.

Due to the multitude of opinions expressed by manufacturers and users, teachers are confused, and in some cases skeptical of the ultimate impact of microcomputers in the classroom. After outlining the nature of recent technological "firsts" in the field of computers, for example, silicon chips, communication satelites, and fibre optics, Dr. Harvey Williams of the University of Manitoba noted:

> What has all this to do with education? Education has done a pretty good job of insulating itself from the real world out there so far. Films came and are still around but little used. It's too much trouble to order them, preview them, and learn to thread a projector. Besides, projectors and films cost money so at budget time, we can cut such frills out of the budget. Television came and went for the same reason. The major benefit of all the TV sets the schools bought was to provide lunch break TV programs for the custodial staff. Then B.F. Skinner came on the scene with teaching machines and the fast buck entrepreneurs got into the act, selling machines with promises of courseware support and then fading back into the woodwork.

> Who can blame teachers for being skeptical about new technological innovations in education? Everyone knows that schools are shoestring operations run at the lowest possible cost. Putting a teacher in front of Johnny or Susie and giving them books and paper is the least expensive kind of education, and that is what schools will always do.
>
> But it is because schools tend to operate at the least possible cost that they will, ultimately, implement the new technology. As soon as an appropriate system is presented (and it will be) which can be implemented at a cost less than the teaching staff it replaces, computers will become significant factors in education. (9)

The computer in education has the potential to become an important means of providing effective and economical education, but if the development is not logical and acceptable it may become another ineffective tool of instruction. At this point in time education leaders are being bombarded with questions, some of which are not being answered. To complicate matters, the few specialists in computers in education do not speak with one voice. They are debating amongst themselves the precise definition of CAI. With the passage of time and the advances in computer technologies, CAI means many things to many people. It is getting to the point where CAI defies precise definition and categorization. It is no wonder that education leaders have doubts about computers in education in general, and CAI in particular. However, "doubts are the stuff of great decisions", but so are dreams.

COMPUTER MANAGED INSTRUCTION (CMI)

Some of the education leaders insist that CAI must be more than interaction with computer programs designed to teach. These educators have been concerned that our school system is increasingly impersonal. A school should not be run as if it is a knowledge factory. Even if there is quality control at the end of the assembly line, students are not products and defective parts will be very difficult to replace or repair, if at all. Teachers would like to use the computer to monitor the student's individual progress and to apply the monitored information to plan the student's individualized program. The teacher must have access to the blow by blow performances of the students to diagnose their weaknesses and make recommendations as to remedial instructions before it is too late. This definition of CAI, in fact, the proper term should be CAI with CMI features (10), (11), (12), requires teacher stations, "host" computers to upload and download programs, and a network of student stations.

It is thus feasible to dream of things that never were because of the technological advances. Perhaps businessmen see things and plan ahead but the education system does not seem to care. Perhaps government grants were spent on research independent of the needs and requirements of the education system or the business world. Perhaps teachers are skeptical of another technological innovation in education. Concerned educators are aware of the potentials of CAI and CMI but they are reluctant to be pressured into making hasty decisions on matters which they feel that they are not well prepared to handle. For these reasons the writer believes that there is urgency in the quest for answers to these very important

questions.

PREMISE FOR THE STUDY

This study is based on the premise that achievement of change-oriented goals in education will be facilitated if an orderly plan of development is employed. John Goodlad, writing in the Saturday Review several years ago, noted the lack of continuity in educational change of the past and suggested a need for research at every stage of the developmental process.

> The most significant question for the future is whether the current curriculum reform movement, long overdue, has built-in mechanisms to guarantee continuing self-renewal... If the current effort is to continue with vigor, it must either become established within the research and development of the universities or be taken over by new institutions capable of reaching both the needed and the schools. (13)

With this premise in mind the writer notes the following reasons for the study.

The first reason relates to a need to know the level of acceptance of microcomputers as valuable media in the process of education by education leaders. Such information will enable planners to gauge more adequately the direction and rate of curricula changes which may be required if Computer Assisted Instruction (CAI) is to play a large role. The ultimate acceptance or rejection of CAI will be determined by present and future educational leaders. Their present perceptions of this mode of instruction will be most important in both immediate and long range planning.

The second reason to assess perceptions of educational

leaders on matters relating to CAI arises from the need to determine the motivation or dedication of educational leaders to the task of planning for the implementation of programs which employ microcomputers in a multitude of ways in the school systems. The study will provide a bird's-eye view of where we are now in the Province of Manitoba in our goal-setting and immediate curriculum planning made necessary by the advent of these "practical-priced" microcomputers.

A third but important by-product of the assessment proposed in this study may be the increase in awareness of educational change which will be generated amongst the respondents. While the intended group of participants is made up of knowledgeable persons, the very act of spending half an hour answering direct questions plus the discussions which will follow will, in all likelihood, raise the level of awareness of microcomputers in education within the group.

The issues raised by the study are current and vital to the schools of Manitoba. The writer believes that by conducting this research at this point in time, the orderly development of programs for the schools may be enhanced.

II. CAI's PROGRESS

ADVANCES IN COMPUTER TECHNOLOGY

Before we discuss Computer Assisted Instruction, we should talk about computers. Looking back, four generations of computers can be loosely delineated in terms of technological advances. The first generation of computers can be characterized by the vacuum tube, the second generation by the transistor and the third generation by the integrated circuit. The microprocessor is the outstanding feature of the present or the fourth generation of computers. Looking to the 90's, the Japanese have begun a ten-year Research and Development effort intended to yield a fifth generation system. The Japanese government invited scholars and researchers from around the world to an international conference in Tokyo in October 1981. There were delegations from the United Kingdom, France, West Germany, Belgium, Bulgaria, Canada, India, Italy, Mexico, the Netherlands, the Phillipines, the Republic of China, and Sweden. The U.S. delegation included people from Cray Research, Digital Equipment Corp., Honeywell, IBM, NCR, Sperry Univac, Texas Instruments, Cii-Honeywell Bull, Nixdorf and Olivetti. For lack of a better name, this fifth generation is called the "Artificial Intelligence", which is more of a conceptual advance than a technological breakthrough.

When foreign participants were asked to comment on the project, a number of them avoided the technical aspects and thoughtfully questioned whether the Japanese really understood the society they were trying to influence. John Riganati of the

U.S. National Bureau of Standards (NBS) referred to Studs Terkel's book, WORKING, an eye-opening look at the attitudes of people, in all walks of life, towards their jobs. C. Read of the U.K. Interbank Research Organization lamented the world's reliance on statistical data to justify so many things. "Least cost solutions or maximum productivity are not desirable in themselves. Indeed, they are often very harmful." So he warned against automation, in support of efficiency and productivity, when it leads to a growing sense of isolation on the part of the consumer.

> "If the fifth generation (system) does all that is hoped for, it will make it possible for us to make proper use of nonnumeric information," he added. "...If we can do that, then we can use qualitative value judgments in our decision-making." He continued, "If that can be done, that alone would justify the fifth generation computer. I believe it is perhaps the one intellectual development that could have the greatest benefit to society by improving the quality of decision-making... particularly by our governments." (14)

THE COMPUTERIZED SOCIETY: IMPLICATIONS FOR CANADA

In his perspective essay on Canada in the Age of Microelectronics, T. Ran Ide (President of Information and Communications Technologies, Scarborough, Ontario) questions if the long term benefits of the revolution in communications and information processing will automatically outweigh the penalties... (The writer wonders whether the conservative stance brought on by concern for social reaction causes our education leaders to perceive a need for slower acceptance.)

Ran Ide points to the critical differences between computers and steam powered engines that led to the 18th century

industrial revolution. Steam power extended man's physical capabilities. Computers are an extension of the human brain... He sees computer technologies impacting on our economy in three main ways.

1) Microelectronics will replace mechanical elements in product design,

2) Create new products, and

3) Make others obsolete.

Ide sees unusual opportunities for nations that are bold and innovative in exploiting the new technologies. But where other countries have been quick to recognize the strategic value of electronic communications to their economic future, we seem reluctant to do so. As a result, Canada is "particularly vulnerable to the less desirable aspects of the computerized society."

Ide noted that education is a provincial responsibility and, while there is no suggestion here that it should not be, it is an almost impossible task to persuade eleven different jurisdictions to modify their curricula in time to meet the changing demands of what is, in effect, a totally new type of industrial system...

> "The major hurdle we have to overcome, if we are to share in the benefits of the new information society, is lack of awareness of the nature of the changes taking place and the absence of the necessary policies to make the maximum advantages of them. If we are not informed, it is not because the voices have not been there... At the present time we face a lack of skilled people, a shortage of high risk capital and the opposition of the labour unions who quite naturally unwilling to be the sacrificial lambs on the altar of technological efficiency..." (15)

COMPUTERS, TELECOMUNICATIONS & CANADA: OPTIONS FOR OUR FUTURE

Eric G. Manning (Director of Computer Comunications Networks Group, University of Waterloo) is equally concerned with our response to the challenge of microelectronics. In his essay, "Computers, Telecommunications and Canada: Options for our Future", he points to what countries like Japan, Britain and France are doing to preserve their "livelihoods and wealth" and finds Canadian government support for research and development "so glaringly inadequate in comparison to the money which the competition is spending as to merit only derisive laughter, or, perhaps, tears..."

We must conclude that information technology will dominate our economic and cultural future, and that microelectronics are the raw materials of the new information technology. Thus the role of microelectronics in the late 20th century will be rather like the role of the steam power in the early 19th century, and national failure to master the one will have the same disagreeable consequences as failure to master the other... (16)

COMPUTERS IN EDUCATION

Carole Greenes, an editorial panel member of The Mathematics Teachers, emphatically states that computers in education is not a transient fad. Films, TV sets, teaching machines, etc. may be frills for education, but computers in education is nothing less than a necessity.

It is no longer a question of whether educators

> should be involved with computers. With the pervasiveness of computers, it is essential that students should be involved with computers. For some individuals, this may simply be a matter of computer literacy, that is, familiarity with their capabilities and the kinds of functions they can perform. For others, the computer provides a vocational opportunity, and more detailed knowledge is required.
>
> In addition, in the educational process in general, the computer has untapped potential as a medium of instruction. Its value stems from its ability to individualize instruction and provide interactive communication. One of the major current educational uses is for drill and practice. This requires little computer know-how on the part of the teacher and can be readily "plugged in" to the curriculum. The computer may even generate tests and work-sheets. The computer can also provide self-paced instruction with elaborate record keeping. (17)

As if to underscore the role of computers in everyday life in the near future, Pittsburgh's Carnegie-Mellon University signed a deal with IBM to develop what will be the largest computer network in the world. Each of CMU's 5,500 students will probably be required to buy their own microcomputer at a cost of up to $3,000 over four years, but they will be able to take them when they graduate and maintain access to the network as alumni. ("The Computerization of CMU", NEWSWEEK, November 1, 1982, pp. 91)

THE HISTORY OF CAI

In "A Report Presented to Alberta Education" by H.J. Hallworth and Ann Brebner in June 1980, the history of CAI is well documented.

> Computer Assisted Instruction has been used in several large scale projects, some of which began in the early 1960's. A detailed review was made of the large and more important CAI projects in the United States, Europe and Canada. An account is given of the

> Stanford University project and its drill and practice programs. These are now distributed commercially and are used more extensively than any other form of CAI at school level, principally for mathematics, readings, and language. They provide the courseware for large-scale use of CAI in the schools of Chicago. The PLATO project at the University of Illinois is characterized by the size of the computer used and the large number of terminals supported, also by the technical ingenuity of its plasma screen terminals with high resolution graphics. It is now supplied as a turnkey CAI system by Control Data Corporation, with a large amount of quality courseware. In the TICCIT project, the most notable feature is the use of colour monitors at the terminals, and the development of college level courseware by authoring teams. (18)

The CAI courseware in the PLATO system (Programmed Logic for Automated Teaching Operations) is written in TUTOR, a powerful authoring language which can be used by teachers with little knowledge of computers. It was the individual classroom teachers who developed much CAI courseware. The computer which supports some 250 terminals in the Chicago area is a powerful mainframe computer. (19) The TICCIT (Time-shared Interactive Computer Controlled Information Television) system was developed by the Mitre Corporation. Courseware was developed by teams of technical and educational specialists using two minicomputers. (20) The cost of the TICCIT system is considerably less than that of the PLATO system in terms of per student per hour per terminal.

DIRECTIONS IN EDUCATION

If the computer industry is gearing up for a conceptual breakthrough, can our education leaders ignore the trend of the future? Can educational leaders keep on re-inventing or trying to make better page-turners whereas electronic mails, satellite

transmitions may render papers of today obsolete and there may not be paper pages to turn in the 21st century? The definition of CAI and Computers in Education must be clarified. If the consensus leans towards CAI incorporated with CMI features, instead of the loosely termed CAI, the role of the classroom teacher of today may have to be redefined.

It is great to be told that microcomputers have uptapped potentials as a medium of instruction. But what exactly is Computers in Education? What is meant by CAI? Or CAL? Or CBI? Or CMI? There apears to be a proliferation of three-lettered "acronyms" but no coherent policy on this issue. The definition of (CAI) Computer Assisted Instruction is still a subject of intense academic debate. To most educators, CAI is associated with the concept of computers being used as a medium of instruction as long as the subject matter being taught is not directly related to Computer Science or Data Processing. To others, this conceptual view of CAI is akin to using the computer as an expensive version of a page-turner. Some CAI experts consider that unless the computer is used to keep records of student performances and let teachers evaluate them for subsequent guidance, then the computer is not being used for CAI.

Thus, although most educators do not dispute that Computer Assisted Instruction (CAI) and Computer Assisted Learning (CAL) or even Computer Based Instruction (CBI) are somewhat synonymous, purists insist on using the term Computer Managed Instruction (CMI) to distinguish it from the generalists points of view of CAI, CAL or CBI. In pure CMI, the teacher uses the

computer only for test scoring, diagnosing, prescribing, and reporting. (21) There are pre-tests and post-tests to see if the students have mastered a unit of the subject matter. Diagnosing is used to describe the process of assessing the progress reports to see if the student is progressing satisfactorily. Reporting may cover several reports. One might list the names of the students, the units of instruction, the objectives, and the scores for each objective in the unit. Based on these reports, the teacher could study the pattern of accomplishment of each of his/her students and determine which of them required additional help. The teacher could use this information to detect common strengths and weaknesses in his/her class and adjust the instruction accordingly. Note that pure CMI has left out instructions by computers. Cooley and Glaser described the goal of a CMI system as:

> "The primary function of the computer in a CMI system is to make possible more complicated decision process than would be possible without the computer and to do this on a continuous basis. Automation cannot be justified if the computer is used simply to keep records. Clerks tend to be cheaper record keepers than computers. In an individualized system, the teachers continuously need information and assistance in making instructional decisions ..." (22)

With the breakthough of computer capability, some educators felt that CAI can be used to complement CMI as a method of instruction. The University of Pittsburgh has the IPI/MIS (Individually Prescribed Instruction/Management Information System). The New York Institute of Technology has the AIMS (Automated Instructional Management System). The University of Alberta (Edmonton) has the TAIM (Teacher-Authored-Instruction

Manager) system. (23) CAI, using mainframe computers, has demonstrated its capabilities of storage and retrieval of student information. Technologically, microcomputers have the same capability if a number of them are hardwired together in a network, having one of them serve as host computer for record keeping and the others as data terminals.

CAI IN CANADA

Simon Fraser University has been experimenting with CAI since 1969. Courseware was created by teaming a lecturer with an experienced CAI programmer.

The Ontario Institute for Studies in Education (OISE) has been working for many years on a CAI remedial mathematics program.

The University of Alberta (Edmonton) has been carrying out research in CAI for many years.

The Quebec Department of Education has also been experimenting with CAI. (24)

In Manitoba, the academic year of 1974-1975 was year one of our debut in CAI. Because of shoestring budgeting and expensive hardware costs, only 3 schools were involved. By 1980, there were 12 schools participating. Basically, it was a time-sharing service, a telephone dial-up to a mainframe computer service bureau, and the terminals at the schools ranging from phased-out obsolete teletypes to new cathode ray tubes (CRTs). (25) The academic year of 1980-1981 was year one of downloading mainframe CAI courseware to fill the immediate needs of the sudden influx of schools having microcomputers. (26)

TOO MANY MODELS

Unfortunately, courseware is machine-dependent. That is, a program which can be used on one model of computer will not run on another model even if the programming language is the same. Thus, downloading involves modification and that requires knowledge and time. If a school has multiple models of computers, the courseware has to be modified for each model. A conservative estimation of the number of microcomputer models potentially available is in excess of two thousand.

COMPUTER LANGUAGES FOR CAI

The NREPP report (May 1980) on Microcomputers in Education focused on three models of hardware. The PET, the APPLE and the TRS-80 because of the predominant position of these models. The programming languages used also varied. This NREPP report again focused on only three CAI programming languages. BASIC is the primary language for CAI programming and, in some cases, the only available language for most microcomputers. PASCAL is another language for CAI programming. It is available for the APPLE, the PET and the TRS-80 and others because it has received strong support from the computer science community. However, PASCAL is more difficult than BASIC for novice programmers although it can execute faster. Moreover, PASCAL places greater demand on hardware. Therefore, the NREPP report concluded that PASCAL will not be important at the precollege level for a few more years. The PILOT language is designed to be used by educators who are not interested in learning the details of

programming. It is available only for the APPLE at present.

Recent announcements in most trade journals all touted the CP/M BASIC. CP/M (Control Program Monitor) is available for most computers using the 8080 or the Z-80 chip. Programs written under CP/M BASIC are portable to all computers on which CP/M has been implemented. At this time, the writer has no first-hand experience with CP/M BASIC.

There are other alternatives for teachers to develop courseware without learning any programming languages. Some such programs use the course-writer programs to develop courseware. Generally speaking, the teacher is "prompted" by the program at logical junctions and reacts by keying in the few options available. The major drawback of these course-writer programs is that of rigidity. The many subjects, disciplines, pedagogical methods and theories all require different approaches, and for every educational topic there are probably a dozen pedagogical theories and alternative emphases that can be placed upon it.

CAI has come a long way from its inception to its reluctant acceptance by some educators. The technological advances in hardware and software have even made educators define and redefine what CAI is or should be. Some educators, who are aware of the need for computers for the future, sense that CAI can be the means to satisfy that need, and they are looking forward to answering the question, "Where do we go from here?"

III. SEARCHING FOR A DIRECTION

In order to achieve the objectives of the thesis, it is necessary to assess the perception of the educational leaders in Manitoba regarding the applications of microcomputers as teaching tools in general, and CAI in particular. There is a need to determine the degree to which leaders agree on the direction which should be taken.

THE PROBLEM

The problem of this study is two-fold:

1) To assess the perceptions of educational leaders of the Province of Manitoba regarding the impact and importance of Computer Assisted Instruction (CAI) in our schools over the next 12 - 24 months.

2) To evaluate the priority assigned by educational leaders to planning and implementation of Computer Assisted Instruction (CAI) in the near future.

GENERAL QUESTION AREAS

To secure data on the perceptions of selected educational leaders of Computer Assisted Instruction (CAI), the general question areas to be considered were:

1) Knowledge by education leaders of microcomputers in education.

2) Plans for CAI by education leaders or the general question areas dealt with educations.

3) How education leaders define CAI.

4) Changes which may result from CAI.

5) Range of subjects which can be taught by CAI.

6) How soon CAI will be implemented.

7) Availability of trained staff.

Data was gathered by means of a questionnaire. In the questionnaire, the term CAI was left undefined because the writer intends to discover how education leaders define CAI.

To the writer's chagrin, many respondents homed in on this fact. "This survey has one serious oversight, namely that 'CAI' is never defined and you assume all persons surveyed will have an intimate knowledge of 'CAI'", one respondent commented. Other comments were: "I have a lot of trouble with the design of this questionnaire: poor or no guidelines; ambiguity; no demographic profile"; "I have very little practical knowledge on this topic"; "Your survey does not allow for much information from those schools using 'CAI' at present" and "You do not define 'CAI' but refer to its symptoms instead".

A physician who refers a patient to his colleague for second opinion would not state "Will you check out this case of 'whatyoumightcallit' disease?" Most likely he will simply describe certain symptoms relating to the disease, plus other unrelated symptoms as well. The idea is that the physician prefers to let his colleague arrive at the same conclusion independently, without prejudicing the fact finding process.

All the doubts concerning Computer Assisted Instruction require clarifications. First-hand experience may not be objective. Moreover, a personal opinion may not reflect the

consensus of the majority. In order to gather information, personal interview would be the best. Direct interactive exchange provides greater flexibility. The interviewer can gauge the respondent's reliability, misunderstanding, ignorance, reticence, or bias. Depending on the respondent's reactions, the interviewer can reiterate, rephrase, branch back or bypass prepared questions. Unfortunately, in all real-life situations, one has to make compromises and settle for second bests or something further down the line. Personal interviews are too time-consuming and Gallup-style professional polling is beyond the budget of most educators, leading or otherwise. The writer finally settled for the old fashioned pencil-and-paper survey by mail.

There is no shortage of precedents in gathering information by mail. The major concern at this moment of time was to focus on the issues without revealing and expressing the writer's point of view.

The study after this point in time became literally a text book aproach. After consultation with the writer's thesis advisor, the survey was set up in the form of straight forward questions.

In order to detect inconsistency in responses, the questions were arranged in random order. Ideally, rephrasing the same idea in various perspectives would enable the interviewer to detect inconsistency in the responses of the respondents. However, this would entail repetition. This study tries to cover a large area and further lengthening of the questionnaire invites alienating the respondents. Our intended respondents are

educational leaders and if the questionning does not follow a clear logical path, he or she may feel that his or her valuable time is being ungainfully exploited. They are doing a stranger a great favour by spending some half an hour to fill out this survey form. How can a person show his appreciation by questionning the sincerity of those who are willing to help? Furthermore, these intended respondents are knowledgeable persons and any attempt to disguise the main issues can be easily unearthed. Since there is nothing to gain by asking more questions than necessary, the questionnaire was presented in a straight forward manner.

RESEARCH DESIGN

Arriving at this logical conclusion, the next step was to design the questions. The questionnaire, in this kind of survey, is usually designed in the form of either multiple choice replies, true and false reponses, or fill in the blank answers. Most of the commercial statistics packages available place strict restrictions on heterogeneous-type questions. Usually a user of these statistics packages will not deviate from having homogeneous-type questions for the entire survey. Since there is no existing statistics package which could provide opportunities for a heterogeneous-type questionnaire, the writer chose to free himself from the shackles of the commercial packages and custom design a statistics package to suit the needs of this survey.

One draft after another of the survey form was prepared and revised. The semi-final version was field tested on students in the Faculty of Education, University of Manitoba.

From the results of the field test a pattern distinguishing the Language/Arts respondents from the Mathematics/Science respondents was detected. However, this distinction is beyond the scope of this study and the writer made no further attempt to pursue this matter. The writer has his integrity at stake and honours his pledge of confidentiality and did not attempt to bury hidden codes on the questionnaire, as one respondent feared. There is simply no advantage in knowing "Who" is answering "What". There were built-in spelling and grammatical errors in order to provoke respondents to make comments so that the writer might have more feed-back from the respondents. Inadvertently there were several genuine mistakes as well. All comments were carefully scrutinized and gratefully welcomed, even the nasty ones. In analysing the data, the writer referred to these comments, either agreeing with them or rebutting them, in order to build up the argument for the logical conclusion.

Further modifications were made and the first batch of this final version was mailed before the Christmas rush. Subsequent batches were mailed in January and February of 1982.

The survey forms were mailed out in separate batches to give the writer a chance to further modify the questionnaire, if need be. Since completed questionnaire returns from the first batch indicated that no further modification was necessary, the second and third batch were mailed on schedule. Another reason for mailing the survey forms in batches was that the writer hoped to save money on postage. Professional pollsters note that in surveys by mail, a 30% return is an acceptable rate of return. In a survey by David Whieldon, a 12% return is termed

"healthy". (27) If there were enough data collected from the returns of the first two batches, then the third batch would be withheld. Since the professional pollsters proved that they know what they say, the writer had no choice but to release the third and last batch. These professionals also concluded that postage paid return envelopes bear little significance on the rate of return. The writer did not enclose postage paid return envelopes. This ploy succeeded in drawing one teasing comment ("Why not pay postage?") and one rebuke ("Send stamped envelope next time!").

RANDOM SELECTION

The respondents were randomly selected. The master list was borrowed from the Department of Mathematics and Natural Sciences. This list was compiled from all inquiries and correspondences to the Department from those who were interested in knowing something about Computers in Education since 1980. The names of superintendents and administrators were added to this list because their names were published and could be easily obtained. The master list was printed on "three-up" address labels, that is, the address labels were in sheets of three labels across. The sheets of labels were then in the hands of the secretary. The secretary peeled the labels at random and pasted them on the prepared survey envelopes.

The writer believes that the sample was truly random because there were two blank returns from the first batch. One of those had a note enclosed stating that the respondent was sorry that he could not complete the survey for he was not in a

school or with the school system and thus could not do anything with CAI.

Subsequent returns had more notes and more apologies to Dr. A.M. McPherson. Some respondents claimed that since the stated purpose of the study was "to assess the perceptions of persons who are aware of microcomputers", they strongly felt that they did not qualify for the description. Some apologized for being tardy in completing the questionnaire. Moreover, there were 5 survey forms that the post office was unable to deliver. It takes no genius to conclude that the writer did not intend to send the questionnaire to disappearing respondents.

FOUR PARTS

In the mean time, the writer was busy developing the system of statistics programs which was to be used to analyse the returning data. The system consists of four programs due to the limitations of memory size of this particular model of microcomputer. Sections 1 and 2 are analysed by Program A. Sections 3 and 4 are analysed by Program B. Sections 5 and 6 are analysed by Program C. Section 7 has its own Program D. Each program has the capability of verifying the responses of any particular respondent to ensure that there is no error in data entry, and of computing the overall responses of all the respondents. Cross-references of responses are conducted by activating segments of subroutines and substituting variables which are to be cross-referenced.

The final batch was mailed out on February 18, 1982 and by the third week of March, the returned data were entered and the

results were analysed question by question. By the end of the fourth week, the preliminary draft of the report was 80% done, except for the conclusions. The writer decided that the findings of each of the seven general question areas would have a section conclusion and a final conclusion as a result of the overall findings of the entire questionnaire. Moreover, the findings would not be presented in the traditional manner of a research paper. Academic works do not have to be associated with the adjectives "dry" or "boring". Discussions would be interspersed with statistical findings. Then more straggling returns showed up and the entire report had to be updated and revised. The writer does not wish to be disrespectful, but there ought to be a deadline on this report, and since most of the readers must have faced similar deadlines, the writer trusts that the respondents will understand.

If the writer wishes to stretch the fact a little, the rate of return can exceed 50% without fibbing. Since the writer does not know how professional pollsters treat blank returns or incomplete returns or returns direct from the post office, the writer decided to tell it like it is.

The final conclusion turned out as a surprise to the writer and undoubtedly to many readers as well. Let the writer simply put it this way; the maxims "Be true to oneself" and "expect the unexpected" are quite true. However, another maxim may be truer, "The truth always hurts".

IV. FINDINGS I

KNOWLEDGE OF MICROCOMPUTERS

The writer attempted to see how knowledgeable the respondents were regarding microcomputers or the use of microcomputers as teaching tools. The results were tabulated on the original questionnaire on the following page.

186 survey forms were mailed out and 112 returns were received, but only 93 questionnaires returned were usable. Usable returns, by the writer's definition, were those returns where over 90% of the questions were answered. This makes a usable return rate of 50%. An impressive but not ideal figure.

ATTENDANCE AT SHOW-AND-TELL SESSION

Of the 93 completed returns, 84.95% of the respondents had attended conferences regarding "Computers in Education". Only 15.05% had never done so. 88.17% had attended demonstrations showing the applicability of computers in education. Only 11.83% had never done so. 81.72% of them indicated that they were willing to attend a conference within the next 6 months (if there is one). 13.98% had no desire to do so. 4.30% had not decided whether to attend or not. 58.07% indicated that there was no need to ask a computer vendor for demonstrations in the next 6 months. 40.86% still wanted to see demonstrations from vendors, while 1.08% could not make up their minds. Most of these respondents remarked that they had seen the demonstrations already and there was no need to see them again so soon. Sample comments: "No, I know what the vendors have and have close relations with them"; "Done already"; "I know what they can do";

and "We are currently using a TRS-80 Model II".

When drafting the questionnaire, the writer intended to see if the distinctions of a "conference" and a "demonstration" were observed by the respondents. Generally speaking, in a "demonstration", the audience attended a show-and-tell session. Follow-up questions were seldom answered due to the lack of time or the lack of knowledge on the part of the demonstrator. In a "conference", participation from the attendants was expected. Views and opinions were usually exchanged freely. A selectively chosen point of view would be challenged without mercy. One can demonstrate only the advantages of Computers in Education or the highlights of a CAI program, but at a conference, both sides of the issue could be evaluated. Thus, the respondents proved that they knew what they were being asked regarding "conference" and "demonstration" by indicating that they were willing to attend future "conferences" but not "demonstrations".

Most of the respondents had knowledge of what microcomputers could do in the area of education at this point in time. They had attended conferences regarding "Ccmputers in Education" at an average of only 3.47 months before the survey, and had seen a demonstration at an average of only 3.13 months before. Only 12.90% of the respondents had never attended any conferences regarding "Computers in Education", and only 13.98% of the respondents had never attended any demonstrations concerning what microcomputers can do in the area of education.

52.69% of the respondents never had CAI (at this point in time, we were not sure how the respondents would define CAI) placed on the agenda at staff meetings. 6.45% either said that

CAI was discussed during meetings other than staff meetings. For the other 40.86%, they had CAI placed on the agenda at staff meetings rather recently, at an average of 2.96 months ago. 61.29% would not put CAI on the agenda for discussion at the next staff meeting even if they had the authority to do so. Such a high percentage was due to the fact that some of them had discussed the issue already ("No, because it's already been discussed"; "No. There are separate 'after school' meetings for those interested"; "Committee is set up and working"; "We have an on going Computer Implementation Committee"; "But I was transferred"; "We have a Computer Committee" or "Unrelated questions -- we are into a deep computer commitment at our school"), some of them placed the emphasis on the term "next", and others made a distinction between "school" and "school division". Those who were willing to discuss CAI at the next staff meeting were doing it soon; at an average of 1.58 months after they had answered the survey. However, 63.44% of them would invest money in a microcomputer for CAI in the next term as opposed to 21.51% against. Sample comments were: "I would - principal won't - still trying"; "Yes. I would as principal but our superintendent refuses to authorize such expenditures at this time"; "Yes, we have 18 micros in our division"; "No, because they are already in the schools where I teach"; "We already have"; "Yes, some monies have already been allocated"; and "No authority. Will try to influence the decision". 15.05% did not answer.

When the writer drafted the questions, the "When did you do it or when will you do so?" questions were designed for the

respondents to fill in the number of MONTHS. It was quite unexpected when the respondents crossed out the word "months" and filled in "years", or "weeks" or "today". It was not impossible to fine tune the program but when the writer first encountered such replies, more than half of the returned data were entered. Fine tuning the program and re-entering the data would involve too much work. Even if the writer decided to reprogram the responses in terms of DAYS, then the task would be to try to determine which day the respondent filled in the questionnaire. A simple 30-day month or even 61-day every two months would not be exact. Thus the writer bent the responses a little. It did not take much work to decide that there are 12 months in one year but any period between one day and one month was entered as one month.

What are the implications of these numbers? It would be safe to say that all respondents knew something about microcomputers in education. However 53.57% of those who had attended conferences regarding "Computers in Education" or who had seen demonstrations as to what computers could do in the area of education had done so within the past month, (some of them became aware of CAI within the past few weeks only, one of the respondents attended a demonstration on the very day that he/she completed the questionnaire), quite a way below the average of months of awareness. Nevertheless, most of them were impressed by what they saw about CAI. Only 21.62% of those who had seen what computers could do in education would not invest money in a microcomputer for CAI in the next term. (The writer searched for the data that the respondent had attended a

conference or a demonstration but would not spend money on CAI.) The writer discovered later that most of these money spenders had no authority to do so. However, since the question was prefaced with the wording "If you have the authority, ...", these respondents were merely following the instruction to the letter.

This average months of awareness of Computers in Education was not a valid indicator considering that some respondents had several years of CAI experience with mainframe computers and some had several years of microcomputers in their school system. In short the "mode" had a much lower value than the "mean". Since the heading of this section of questions was "Knowledge of Microcomputers in Education", what could the writer say to those respondents who asked, "Why didn't you ask about mainframe CAI?" Another respondent wrote, "Many of the questions do not relate to our situation. We have a 3-year 'jump' on most schools in this area".

It is prudent to assume that the level of awareness of microcomputers in education is high. Conferences regarding "Computers in Education" would be more effective in enhancing the level of awareness than mere demonstrations showing what computers can do in the area of education. We can say that no matter by what means, if the respondents came, they saw and they were impressed by computers in education.

V. FINDINGS II

RESPONDENTS' PLANS FOR COMPUTER ASSISTED INSTRUCTION

Is there a plan to implement CAI in the near future? If there is a plan, then what about available personnel? How do schools plan to obtain necessary courseware? Is there a consensus as to the construction of courseware? These and many other questions are crucial in the decision-making process.

CAI PLANS

58.07% of the respondents had a plan to implement CAI in the next 12-24 months but 36.56% did not have a plan to do so. 5.08% didn't answer. A sample of the comments were: "Hopefully!"; "Depends on your definition of CAI. What is it?"; "No. We do have a long-range plan"; "Division has a task force re implementation"; "Done already"; "Have taught Computer Science and Data Processing for the past 6 years. Therefore some degree of 'CAI' involved"; "We now have 'CAI'"; and "Yes. Only in our learning assistance centre".

Even if they had plans to implement CAI, 52.69% of the respondents did not have available personnel resources to program the necessary courseware. Only 32.26% have available personnel to do the programming. 15.05% didn't know. Some of the remarks were: "Not really!"; "Uncertain of what courseware is"; or "Don't know".

COURSEWARE

59.14% of the respondents were going to purchase commercial

courseware. Sample comments were: "Such as it is"; "Eventualy"; and "When funds are available". 6.45% were not going to purchase commercial courseware. "Not in my understanding of CAI -- it is my opinion that there is little good CAI courseware available". 34.41% regarded this question as not applicable to them since they had no plans.

43.01% were not going to have the necessary courseware custom designed. Sample comments are: "No, we do most ourselves" and "We will play around with it." 22.58% wanted to have the necessary courseware custom designed. Sample comments were: "I will make my own or use those developed by other teachers"; "If not commercially available"; "When funds are available" and "Yes, in some instances where they canot be purchased". Again 34.41% considered this question as not applicable to them since they had no plans.

34.41% of the respondents could construct their own courseware but 63.44% of them could not do so. "Me? No! Others in the division, yes! But primitive." (2.15% were not even sure what construction of courseware means). 45.16% could modify existing courseware to suit their particular needs versus 51.61% of the respondents who could not.

LANGUAGES

50.54% had no programming languages at all. 36.56% had the BASIC language. 3.23% had the BASIC language plus one other language (mostly FORTRAN). 4.30% knew BASIC plus two other languages (again FORTRAN plus APL). 3.23% knew BASIC plus three other languages (usually FORTRAN, ASSEMBLER, APL, COBOL, PL/I,

PASCAL or PILOT). 1.08% had other computer languages but not the interactive language generally used to develop CAI courseware. Another 1.08% did not have any ordinary programming languages but could use course-writer programs to develop courseware. Two of the course-writer programs cited were PASS and TELIDON. (One respondent supplied this information on March 11, 1982).

THE TELIDON SYSTEM

The word Telidon is derived from two Greek words: tele (distant) and idon (I see). Telidon was developed by H. Bown and his group at the Federal Department of Communications' (DOC) Research Centre. (28) Telidon is regarded as the second generation of videotex technology. It connects modified TV sets and a keyboard through special electronics hardware to a communications link and then to a central computer which has information retrieval capabilities. A subscriber terminal including TV is presently available for about $1,000. The communications link may be telephone, two-way cable TV system, or for limited information retrieval, broadcast TV. According to the Toronto GLOBE AND MAIL, the Ottawa firm of Roger Hough and Associates was commissioned by the federal Department of Communications to prepare a three-year study which was handed in late 1980. Among the findings were the forecast that Telidon service may cost just $25 a month in 1985. (29) Telidon has the highest resolution colour graphics of any such available system today. The system was developed to serve public information retrieval needs. Homecom Learning Systems, Limited (Thornhill, Ontario) has applied for a grant from the DOC to interconnect the CAN-8 system with Telidon to provide complete CAL services.

EDUCATOR'S AUTOMATED AUTHORING SYSTEM (EAASy)

EAASy is a new approach in authoring courseware which will capture the instructional design in terms of: branching, media presentation and judging of student responses. The system interacts with the educator in a natural language and does not require use of a programming language. The educator completes forms interactively using a computer display with the stored program. EAASy, to monitor all aspects of course development, even the video and audio action sequence production for the videodisc. By using EAASy, course production which is now one of the most expensive components of CAL, time may cut by 50% -

75%. It is anticipated that course developers will not be able to afford to code in any authoring language in a few year's time. (30) The writer is ignorant of the PASS program. However, most microcomputers canot support this authoring program.

COURSE-WRITER PROGRAMS

The writer considered that course-writer programs lack flexibility. The logic sequencing is rigid although the teacher has the option to branch out at any logical junction. As a stop-gap measure, it is an alternate solution. However, can the courseware generated by these course-writers "run" on other machines? Can course-writer generated courseware be modified to "run" on other machines? Most of these course-writer programs require extra hardware adaptations to the brand name microcomputer models, driving up the costs. The writer feels strongly that reliance on bare empiricism or bare intuition in education practice is a mental form of streaking, and nudity of mind is not as appealing as nudity of body.

39.79% of the respondents did not have a microcomputer yet ("Haven't bought one yet. If I do the answer would be 'after objective comparison of various models'...") but the other 43.01% of the respondents bought their particular model of microcomputer after objective comparison of various models and arrived at their conclusions knowingly. The influence of friends in the choice of a particular model of microcomputer was minimal (only 2.15%). Blaming the salesperson or the devil rated only 1.08%. 8.60% bought their microcomputer because the money/the price was right, suggesting that they would get a different model if they were not inhibited by budgetary restraints. There were respondents who stated: "Divisional (central office) decision"; "the school bought it"; "they made the decision"; "Similar model already in use in division" or "Decision of the school division committee".

These figures were deceptive. 32.50% of those who bought a

particular model of microcomputer because they were knowledgeable in computers did not have any programming languages at all. If the respondent bought a particular model of microcomputer and did not list competency on any programming languages, it can be inferred that he/she did not have first hand experience of any particular model. On the other hand, few chairmen of the boards of airlines fly their planes and fewer hospital administrators know how to handle bedpans properly. Therefore, these respondents' knowledge in computers must be in other aspects. As long as the administrators know exactly what is required and as long as their microcomputers can perform what is required, one can hardly argue that first hand experience is a prerequisite.

A few respondents did not know what "courseware" means. The fact that more respondents claim that they can modify existing courseware than those who claim that they can construct their own is again subject to interpretation. Red River Community College is using courseware for remedial mathematics leased from Ontario Institute for Studies in Education (OISE). This courseware was written in CAN-8 (another interactive programming language -- Completely Arbitrary Name). OISE at first provided the courseware in "source form". But modifications by the early users lead to malfunctions and then to requests for help from OISE. OISE had too much trouble trying to "debug" these malfunctions, resulting in users losing direct text control. OISE agreed to lease the courseware in "object code form" only, making direct modification next to impossible. Modifications are done by OISE when they have received requests from the users and

their modification specifications. (31)

Thus, for those who have first hand experience in programming, most of them would prefer to construct their programs from scratch rather than to modify someone else's program.

CONCLUSION

From this section, the writer can only say that there were not sufficient available personnel resources to program the courseware required. Even if there were sufficient available personnel resourses to program or modify or simply course writing, this was not the way to do it. As one respondent wrote, "Some personnel can modify or construct courseware but don't have the time." Commercial courseware restricted direct text control by the users. Moreover, the quality of commercial courseware varied greatly, ranging from superb to poor to just plain awful. Consumers were really purchasing an unknown item at their own risk. Unless school administrators agree to some drastic conceptual measures as to what is expected of CAI, and plans are carefully plotted, the writer shudders at the thought of full CAI implementation.

VI. FINDINGS III

WHAT IS CAI (COMPUTER ASSISTED INSTRUCTION)

Is CAI really in the eyes of the beholder? This section of the questionnaire tries to find out what the respondents' view of CAI is. Is it a help or a threat? The findings are tabulated on the questionnaire on the following page.

A clear majority of the respondents agreed that CAI will free the teaching staff from mundane chores, giving teachers more time for individualized teaching, guidance and counselling. 11.83% strongly agreed versus 5.38% strongly disagreed. 41.94% mildly agreed versus 22.58% mildly disagreed. 18.28% expressed no opinion. The consensus was that this conception of CAI is correct theoretically but whether this can be done in practice is another matter. "Has the potential to do so" was the common comment.

A landsliding consensus of the respondents disagreed that with the implementation of CAI, machines will take over the work of teachers. The percentages were: 75.27% strongly disagreed; 17.20 mildly disagreed; 4.30% expressed no opinion; 2.15% mildly agreed and 1.08% strongly disagreed. The fact that some respondents feared for job security was disturbing. This may hinder the full implementation of CAI. However, one extremely knowledgeable respondent conceded that machines may eventually take over some of the present "workload" of the teachers, but by then the "workload" of the teachers would have been altered.

In the early days of business applications of computers, people feared for job security also. With the assistance of

computers, work flow increased and more people were required to handle the extra workload. At the introduction of specialized teaching, one-room school teachers feared for job security. It turned out that the concept of one-room schools was obsolete and the teachers of those schools managed to cope with the changes.

A workshop on "Policy issues in Computer-Aided Learning (CAL)", conducted by the Science Council of Canada in the spring of 1982, noted that computers will radically change the role of the teacher, but exactly what form this change will take is not clear. The workshop participants came to the conclusion that teachers need not be displaced by the new technology but will be able to act as resource persons. Students can work at their own pace on their own terminals, and the computer will prepare, administer and record tests. The teacher will be there to complement the program by spending time with individual students. (32)

When the writer talks about CAI in this manner, the writer is referring to CAI in conjunction with CMI features. The microcomputers, or mainframe computers, should be able to interact with the students. They should be able to diagnose whether the student has mastered a subject matter or a concept. They should be able to store the student information so that the teacher could review it when time permits and make the final decision as to what the student should be doing next. CAI in this sense includes classroom management, from machine time scheduling to diagnostic records to future projections.

Another clear majority of respondents objected to the statement that CAI was an attempt to reduce the cost of

education through efficient use of a new technology. 44.09% strongly disagreed versus 5.38% strongly agreed. 20.43% mildly disagreed versus 16.13% mildly agreed. 11.98% expressed no opinion. Comments ranged from "I don't believe CAI reduces costs. Do you have any examples?" to "WILL reduce the cost of education".

Examples:

1) For students who are handicapped, either physically or mentally;

2) For students who are in institutions;

3) For students who are in remote rural areas with rapid teacher turnover;

4) For students who are in classes where students range from slow learners to accelerators.

All such students require a high teacher-pupil ratio because of the variety of student problems and needs. In these cases, a high cost per student hour of instruction results. Yet the amount of individual attention and continuity provided for each student is still inadequate. In such situations, CAI is both comparatively inexpensive and likely to effect the greatest change in the least time. (33)

Educators in the past few decades have convinced parents that their children require more individual attention. Teachers are fully aware of the fact that one can lead a horse to water but one cannot make him drink. In the group situation of classrooms, teachers have to cater to the needs of the majority of the students. They have to proceed at the optimum speed of the lowest common denominator, ranging from slow to dead stop;

at the cost of rendering the few elite students to boredom.

CAI offers the teachers more time for individualized teaching. CAI gives the students a chance to learn at the time of their choice. Moreover, CAI lets the students proceed at their own speed without bothering their fellow students. This new technology is necessary to keep up with the changes of time. The need for youngsters to have literacy in computer should be the underlying concern of any hands which happen to control the purse strings. In the long run, CAI may indeed be able to reduce the cost of education in conjunction with the changing role of teachers, but in the short term, along with the capital outlays and start up costs, the cost of education will spiral upwards.

The following statement was poorly phrased. A number of respondents commented on it, some kindly but others were not so kind. What the writer had in mind was to assert that the forte of CAI is in drill and practice. When the writer drafted the statement, the writer had inserted the unnecessary preface. The end result was: "In a traditional classroom, the teacher spends more than 60% of his or her time in drill and practice (which is the forte of CAI)." Some respondents objected to the percentages. ("I agree if your percentage is right"). The writer would assume that his percentage holds in the subject of mathematics but it may not be accurate in the case of Language/Arts subjects. Other respondents wondered about the forte of CAI and commented "Really!" or "Depends on the level".

CONCLUSION

All squabbles aside, the writer feels that most respondents

knew what the writer wanted to state. The responses almost ended in a draw with the favourables having a slight edge. 10.75% strongly agreed versus 8.60% strongly disagreed. 37.63% mildly agreed versus 34.41% mildly disagreed. 7.53% expressed no opinion and 1.08% didn't answer. For those who had experience in CAI, their general comments were that the present CAI courseware placed too much emphasis on drill and practice and too little on tutorial.

USES OF CAL

A clear cut majority of the respondents disagreed with the statement: "CAI cannot be used to teach new concepts". 33.33% strongly disagreed versus 3.23% strongly agreed. 43.03% mildly disagreed versus 17.53% mildly agreed. 11.83% expressed no opinion and 1.16% didn't answer. "Not using the courseware I have seen" and "I doubt this statement" were the usual comments.

The statement: "Having a microcomputer in a classroom can keep the students occupied in computer games, thus lightening discipline problems." drew comments ranging from "A dubious role for microcomputers" to "We keep all our computers in a 'computer center' under a high security system. Students come to our center and do not play games. They learn what a computer can do, programming and become 'computer aware', plus electronics (the guts of the machines!). Only our slow to below average students work on prepared tapes and discs often made by our bright students" to "I wouldn't touch this question with an eleven foot pole" to "Technically correct but a better way to deal with discipline problems is to provide sound learning experiences and

not games of entertainment". Another clear cut majority disagreed. 39.79% highly disagreed versus 2.15% highly agreed. 23.66% mildly disagreed versus 24.73% mildly agreed. 8.60% expressed no opinion and 1.08% abstained. Certainly computer games can keep students occupied, even many adults. Some of these games are "arcade" quality. However, would it be justified for schools to invest huge funds for disciplinary measures?

There was nothing dubious as to the consensus of this statement: "Microcomputers can be used for classroom managements as well as CAI, benefiting both students and teachers." 24.73% strongly agreed versus 6.45% strongly disagreed. 44.09% mildly agreed versus 9.68% mildly disagreed. 12.90% expressed no opinion and 2.15% didn't reply. One respondent wrote, "I suppose". Another respondent demanded to know what is meant by "classroom managements".

In the jargon of Computers in Education, classroom management can mean anything from generating report cards to keeping track of the whereabouts of students at any given moment in time to Computer Managed Instruction (CMI). A student in a sizeable high school may skip several classes or even an entire semester without being noticed. One teacher may simply assume that the student has enrolled in another course. Horror stories? Indeed, it is being circulated. There is one commercial package on classroom management where student's personal information can be entered. General information as to address and phone number, names of parents or guardian, teacher's comments etc. Its application is rather dubious but it is "classroom management" nevertheless.

The final statement in this section drew one or two comments. "Through CAI, students can learn the subject matter at their own speed without the fear of peer group pressure." The critics feels that "learning at their own speed" is one issue whereas "the fear of peer group pressure" is another issue. When drafting the statement, the writer's emphasis was on "learning at their own speed" and the writer feels that most of the respondents shared the same emphasis.

All bantering aside, 33.33% strongly agreed with "speed" and "fear" whereas 1.08% strongly disagreed. 46.24% mildly agreed versus 7.53% mildly disagreed. 9.68% expressed no opinion and 2.15% didn't answer.

Another persistent critic claimed that according to the courseware that he or she had seen, CAI could not be used to teach anything, let alone concepts. Moreover, students could not learn any subject matter from CAI, let alone at any "speed" or "fear".

CONCLUSION

From this section, the writer feels that the majority of the respondents know about CAI in its very general point of view. Only in a few cases, where the respondents' schools offer subjects such as Computer Science or Data Processing, did the respondents remark that they have microcomputers for CAI already. The majority seemed to know that when the computers are used to teach subject matters directly relating to computer technology or data processing, the teaching process is not considered as CAI. They know that on paper microcomputers have

great potential in education, but the process of implementing the theory into practice is not an easy task. If a teacher thinks that CAI is just a simple "turn-key" system -- that is, all one has to do is to turn the key and the machine will take over automatically -- then the writer disagrees categorically. The backup system is not being developed yet. Unless Manitoba intends to have a system similar to the OISE system, those teachers in schools which have bought microcomputers for CAI already will face a long period of frustration and agony.

Another respondent wrote, "CAI is a tool that will be as successful as the creativity of the people using it. But it will not replace teachers and may not even be as successful as its proponents' imagine if the use of TV in the classroom is any guide... Many of my responses are based on a personal interpretation of CAI. Might have been helpful to state your definition or understanding of this concept in a preamble."

There was no consensus among the respondents as to what CAI is or what CAI should be. Perhaps it is in the eyes of the beholder. Experts could not agree on its definition. The responses reflected the personal interpretations of CAI by the respondents. Such diversity of opinions defied any attempt to clarify the concept of CAI, and the writer failed to detect what the educators surveyed believe CAI is?

VII. FINDINGS IV

CHANGES WHICH MAY RESULT FROM CAI

It is just prudent to discover the consequences if CAI is to be implemented in the near future. How will this medium of instruction affect the teachers and their students? Looking into the unpredictable future there are too many uncontrolled and uncontrollable variables. Even if the writer knows that forecasting is an inexact science, an honest attempt must be made.

IMPACT OF CAI

This is a "future shock" section. The writer trusts that psychiatrists would have a field day either with the writer or with the respondents. Perhaps there are respondents who share similar sentiment with the writer trying to discern something about "things that one always wanted to know but is afraid to ask". Isaac Asimov's "I, ROBOT" is a science fiction novel set in a society so throughly computer-dominated that the people cannot do arithmetic. Would this be our future society? Humanist Critic George Steiner acerbically calls the computer generation the advance guard of a breed of "computer-mutants". "They will be out of touch with certain springs of human identity and creativity, which belong to the full use of language rather than mathematical and symbolic codes." Others are more sanguine. University of Chicago Philosopher of Science Stephen Toulmin predicts that computers will "re-intellectualize" the television generation. (34)

This section is an attempt to discover what may happen if full CAI implementation has been completed after a decade or two. The writer is unable to locate articles written on this kind of "environmental" impact. The reason may be due to the fact that knowledgeable people involved in computers do not want to write about this topic and people who do not know much about computers have very little to say.

However, computer fraud has been making front-page news more and more often. This, by itself, is not too alarming because crimes are committed by people in many areas. What is hair-raising is the attitude of law abiding citizens towards people who are caught commiting computer fraud. If a person admits that he or she has been making illegal long-distance telephone calls, most law abiding citizens will frown on him or her -- to say the least. However, when the founders of a successful microcomputer company admitted that they made illegal electronic attachments that allowed users to make long-distance calls for free, they were written up by TIME magazine as heroes. (TIME, February 15, 1982).

In 1980, four New York junior high students (Dalton -- a private school) used school computer terminals and managed to eavesdrop on private data banks, juggle accounts and erase 10 million bits of data from a Canadian cement company's computer in the east over a period of six months. (35) They were traced and caught but the charges were dismissed as the judge considered it a lark. When newsmagazines commented on the casual treatment of computer criminals by society, a prisoner wrote to a newsmagazine testifying that computer crimes pay. Although

this prisoner was still serving time behind bars because of computer fraud, he was besieged with job offers from reputable computer companies to work on their computer systems. In fact, it has been documented by Donn B. Parker that it is one easy step to move from computer crimal to computer security consultant. (36)

Administrators probably would like to take note that computer vandalism occurred also. In 1968 the SAN FRANCISCO CHRONICLE reported a case where an unknown perpetrator, probably a person out of a job, fired two shots from a pistol at an IBM 1401 computer at the State Unemployment Office in Olympia, Washington. No significant damage was done. The bullets merely dented the metal cabinet of the central processor. It went right on functioning.

In 1972 a case was reported by Reuters News Agency. A tax-processing computer for the city of Johannesburg, South Africa, was shot four times by a person firing at the computer through a window from the public sidewalk. The computer was also dented but continued to function. It was believed that the person may have received an exorbitant tax bill and was just venting his frustration.

A verified case was reported in 1973 in Melbourne, Australia, where antiwar demonstrators attacked a United States computer manufacturer and shot a computer with a shotgun. It was a total loss.

In 1974 a verified case was reported at a life insurance company in an eastern state. A computer operator ran the computer all by himself during the night shift. He had to obtain

paper and supplies to run the computer by crossing a dark alley in a high crime area of the city. It was his practice to carry a pistol in a holster for protection. One night he got so frustrated with the computer that he performed a fast draw and shot the computer right between the bits! The computer was seriously damaged and was returned to the manufacturer... (37)

In November 1981, COMPUTER DECISIONS reported that a computer installation in Houston, Texas, was shot in the back late one night by an unknown assailant using a .22-caliber pistol. The bullet entered a Nixdorf 280 data-entry terminal, penetrated the main circuit board, hit one integrated circuit dead center, and deflected off the frame of the monitor onto the fiberglass base of the terminal. Fortunately, the terminal only needed a new circuit board -- a minor operation.

According to Mickey Manter, field technical specialist at Nixdorf's Houston office, "The customer was as baffled as we were as to the apparent motive for the shooting." (38)

Recent advertisements in computer magazines have begun to emphasize computer security. A recent IBM advertisement depicts a computer terminal in a police station lineup of suspects with the caption: COMPUTERS DO NOT COMMIT CRIMES, PEOPLE DO. In smaller print, the advertisement highlights the security system the company has to offer. (39)

In Manitoba, we do not have any memorable reports of computer fraud yet. Perhaps Manitoba residents are more honest than residents of other places, or perhaps our technological advances have not been keeping up to those of other places. Nevertheless, prevention is better than cure. That is why the

writer would like to see what kinds of insight our leading educators have regarding this kind of environmental impact.

RESULTS

"A student educated with the assistance of CAI may not be able to cope with life in the real world. He/She may be conditioned to the computer world of black and white, losing touch of different shades of gray in human interaction." 30.11% of the respondents strongly disagreed versus 2.15% strongly agreed. 32.26% mildly disagreed versus 15.05% mildly agreed. 20.43% expressed no opinion ("Wow! You don't say!"). Our respondents were optimistic. A few respondents noted that the wording "with the assistance of CAI" was a dead giveaway implying that there was still human interaction. One respondent underlined "not able to cope with life in the real world" and wrote, "This is true of much of what happens in schools". Others wrote, "It depends on the degree of use of computer at school and at home", or "Dependent on the degree of implementation".

"An adolescent educated with the assistance of CAI may have trouble with the social structure of his/her world." 27.96% of the respondents strongly disagreed versus 2.15% strongly agreed. 35.48% mildly disagreed versus 10.75% mildly agreed. 22.58% expressed no opinion and 1.16% didn't answer. The optimists won again. Again, "social structure of his world" was underlined. One respondent wrote, "Depends on what else happens in school". Another wrote, "An adolescent who is too involved in computers can lose touch with some of the 'social' environment around him, but it would have to be someone who works at computers at home

as a hobby as well as at school".

"Computers cannot be programmed to react with the emotional growth of the students." 9.68% strongly agreed versus 4.30% strongly disagreed. 24.73% mildly agreed versus 25.81% mildly disagreed. 33.33% expressed no opinion and 2.15% did not answer. Neither group could muster 50%. One respondent remarked, "I don't know this but I strongly sense/feel so."

"Computers may inadvertently serve as a greenhouse for adolescents, shielding them from problems which may arise from human interactions." 21.51% of the respondents strongly disagreed versus 4.30% strongly agreed. 26.88% mildly disagreed versus 27.96% mildly agreed. 18.28% expressed no opinion. The group which disagreed won, albeit at a slight margin. One of the responses was: "Not unless they live in 'isolation'."

"Ideals, morals, and religion cannot be learned from CAI." 9.68% of the respondents strongly agreed versus 7.53% strongly disagreed. 20.43% mildly agreed versus 33.33% mildly disagreed. 27.96% expressed no opinion. If the "strongly" opinionated respondents carry more weight than the "mildly" opinionated ones, then the group which agreed with the statement barely edged out a victory if the weight differential was high enough. If it is based on the system of "one man - one vote", then the group which disagreed won. Still, neither group could muster 50%. One respondent remarked, "Try a porno game on the micro!" Another respondent remarked, "Not in the way I envision learning in these areas." The writer notes that learning can be envisioned in many areas. In a case argued in the U.S. Supreme Court regarding whether or not schools can ban books, the Island

Trees (New York) school district's attorney George Lipp Jr. argued, "The transmission of moral values is a primary function of the school board." (NEWSWEEK, March 15, 1982, pp. 82.)

"Heterosexual interests and activities are some of the things that CAI is lacking." 4.30% of the respondents strongly agreed versus 2.15% strongly disagreed. 21.51% mildly agreed versus 21.51% mildly disagreed. 47.31% expressed no opinion and 3.23% didn't answer. Too close a contest. The no opinion and didn't answer group got more than 50%. A curious respondent teased, "Teaching or an affair ?" Another respondent rebuked, "To us 'CAI' means areas of learning in relationship to computers. I hope you are using 'CAI' to mean the same thing ???"

"Intergroup relations and attitudes may be enhanced when students are educated with the assistance of CAI." 6.45% of the respondents strongly agreed versus 2.15% strongly disagreed. 25.81% mildly agreed versus 22.58% mildly disagreed. 41.94% expressed no opinion and 1.08% didn't answer. The optimists edged out the pessimists, but the "non-commmitted" group has more adherents. "Not in my opinion, but I don't rule out creative developments in this area", commented one respondent.

"Among teaching staffs, intergroup relations and attitudes may be enhanced by CAI due to minimizing areas of conflict". 4.30% strongly agreed versus 2.15% strongly disagreed. 25.81% mildly agreed versus 21.51% mildly disagreed. 44.09% expressed no opinion and 1.08% didn't answer. Again, the optimists beat the pessimists, but again the "fence sitting" group gathered a larger crowd. "Areas of conflict" was underlined and one

respondent wrote, "I don't know what this means."

"When CAI is fully implemented, teacher-pupil relations will be improved." 8.60% of the respondents strongly agreed versus 5.38% strongly disagreed. 37.63% mildly agreed versus 11.83% mildly disagreed. 35.48% expressed no opinion and 1.08% didn't answer. Once more the optimists beat the pessimists but they managed to surpass the "expressionless" respondents as well. One respondent demanded, "For instance?" Another asked, "How can you possibly answer this question?"

CONCLUSION

The statements about human interactions should be a matter of degree. How extensively involved are the students with the computers? Do the students have other aspects to their social lives besides dealing with computers? Can a person look upon machines (for example, computers) as sex objects? What is really surprising is that there is a plurality of educators who are inclined to think that machines may affect human relations. The writer challenges all readers to find a person who has never kicked or punched a coin operated machine -- be it soft-drink or food dispensers or pay phones?

VIII. FINDINGS V

RANGE OF SUBJECTS WHICH CAN BE TAUGHT BY CAI

How much help can CAI provide to teachers as well as students, if it is indeed a help at all? What can CAI do? And what can't CAI do?

LIMITATIONS OF CAI

What are the limitations of CAI? The most imaginative educator knowledgeable in computers will find that it is impossible to write courseware to teach unquantifiable subjects. The most advanced computers of today cannot make use of qualitative information. All qualitative information must be quantified before the computers can process the information. Even then, the results generated may be completely meaningless.

For traffic violations, drivers get demerit points. However, can one really equate demerit points accumulated from "speeding" to demerit points acquired because of "drunken driving"? Can music be appreciated quantitatively? Can artistic qualities be measured by numbers? Can "Man and his Values" be enumerated?

RESULTS

24.73% of the respondents strongly agreed that "CAI can be used to teach any subject matter" versus 10.75% strongly disagreed. 34.41% mildly agreed versus 15.05% mildly disagreed. 15.05% didn't make any comment. Thus, there is no subject matter that cannot be taught by CAI. If one looked upon "subject

matter" as simply the quantitative aspects of the issue involved, then CAI can be used to teach everything. The limitation is on the imagination of the teacher/programmer.

23.66% of the respondents strongly agreed that "CAI can minimize hazards and dangers by 'simulating' real life situations" versus 2.15% strongly disagreed. 38.71% mildly agreed versus 10.75% mildly disagreed. 22.58% didn't comment and 2.15% didn't reply. The spelling of "hazards" was a "planted" error. Only 2 respondents made comments on this error. One respondent remarked: Is hazardous synonymous to dangerous?" Good question but its aim was slightly off target. The emphasis of this statement is on "simulation". "One respondent demanded, "Give me one significant illustration."

SIMULATORS

There are flight simulators for pilot training, from single engine aircrafts to space shuttles. In simulation, the real purpose is to go through the real actions without using the real things. At times, simulation is used to minimize costs. At times, simulation is used to minimize hazards or dangers. At times, simulation is used to save time. (40)

CARTOONS

It takes an entire season for most flowers to blossom. Photographers have simulated the blossoming of flowers by taking pictures of the same flower once every 24 hours or even once a week. When shown in a continuous series, the flower seems to have bloomed in a matter of minutes. What a person sees from these movies is actually a continuous motion of a set of "contiguous" but "discrete" frames of the projections of the film. Ask the kids if they have seen any "simulated animation" displays the answer would probably be 'no'. But if the question is rephrased in technical jargons, most of them must have watched "cartoons" by the hours. What is so mysterious that computers can process data to achieve "simulation"?

SIMULATIONS EMPLOYED

Professor Ludwig Braun of the Huntington Computer Project has suggested several criteria when computer simulations should be employed... (41)

1) When facilities or equipment needed to conduct an actual experiment are costly or complex and, as a consequence, where the experiment would not otherwise be performed (e.g. complex chemistry experiments).

2) When the actual experiment is hazardous and might endanger the experimenter (e.g. science experiments which involve radiation, high temperatures, explosive gases).

3) When time scales involved are either too short to allow easy measurement or too long to fit into the school year (e.g. biological studies in genetics -- observing successive generations of a particular species).

4) When the sample size available in the real world is too small to permit generalizations (e.g. the study of rare diseases by medical students).

5) When the experimental technique is complex and must be developed over an extended period of time.

6) When it is impossible to experiment directly (e.g. studies of politics, economic, and social systems, human genetics).

"A computer cannot set a moral, ethical or social model for students." 13.98% of the respondents strongly agreed versus 4.30% strongly disagreed. 25.81% mildly agreed versus 33.33% mildly disagreed. 22.58% expressed no opinion. This statement is "loaded". Since the "value system" is one of "quality" rather than of "quantity" and computers cannot process nonnumeric data, never mind what is expected of the school system by the tax-paying parents (many parents expect the teacher to teach everything but others feel strongly that the "value system" should be taught at home).

"Given factors affecting ecology, a teacher can simulate our environment in one teaching period which may not be evolved until the next century." 24.75% of the respondents strongly agreed versus 3.23% strongly disagreed. 38.71% mildly agreed

versus 5.38% mildly disagreed. 23.66% expressed no opinion and 4.30% didn't answer. One of the comments was "Wow". What is so amazing about this? The entire world contour can be reduced to a wall map and the wall map can be reduced to the size of a postage stamp, the matter is one of scale. Any Mathematics/Science major should have no trouble picking out the appropriate response.

"A basketball coach can use a computer to plot strategy but he still has to give personal demonstration to teach basic skills." 45.16% of the respondents strongly agreed versus 2.15% strongly disagreed. 32.26% mildly agreed versus 9.68% mildly disagreed. 10.75% expressed no opinion. The concept of individualized teaching is based on the uniqueness of each individual student. Each individual student has his/her own potential. The writer was disappointed that no comment was made about this aspect.

"For students who want to master a subject matter, CAI can be a bonus. They can practice to their heart's content without getting their classmates and teachers frustrated. At the same time, the teacher can monitor their progress at his/her leisure. This is an example of what CAI can do." One respondent wanted to know "what leisure?". 61.29% of the respondents strongly agreed versus 1.08% strongly disagreed. 32.26% mildly agreed versus 2.15% mildly disagreed. 3.23% expressed no opinion. Indeed drill and practice is the forte of CAI and the common complaint of existing courseware is that this emphasis of CAI leaves not much else worthy to mention. "Referring to subject matter, do you mean a complete program? That is, Science or Mathematics or one

or two or more concepts in these areas. I don't believe you could learn a whole program on your own", commented one respondent.

"Any teacher can use CAI to complement the classroom teaching." 39.79% of the respondents strongly agreed versus 8.60% strongly disagreed. 33.33% mildly agreed versus 10.75% mildly disagreed. 7.53% expressed no opinion. Some respondents remarked, "Definitely!" Others were more reserved, "It depends on whether he/she has any knowledge of the equipment and how it could be used" to "No, No, No !!!" to changing 'any teacher' to 'most teachers'.

"In order to take full advantage of CAI, a teacher has to learn something about computers and the programming techniques. After all, a computer can perform only as instructed. The quality of a CAI courseware directly reflects the capability of the teacher/programmer." 50.54% of the respondents highly agreed versus 4.30% highly disagreed. 35.48% mildly agreed versus 6.45% mildly disagreed. 2.15% expressed no opinion and 1.08% didn't answer.

CONCLUSION

Some respondents considered that there were three to four issues involved here which may have been overlooked by the researcher.

(1) Whether the teaching using CAI should know something about computers.

(2) Whether the teacher using CAI should know something about programming techniques.

(3) Whether a computer can perform only as instructed.

(4) Whether the quality of CAI courseware reflects the capability of the teacher/programmer.

The teacher/programmer who writes the courseware does not have to be the same person who is in the classroom. The only requirement of a non-programming teacher is that he/she does not ask for something the machines are incapable of performing. One respondent remarked, "Teachers do not need programming skills but do need courseware skills." Many respondents spotted the multiple issues involved. The writer bent the responses again and the percentages reflect only one issue -- the teacher using CAI should know something about computers.

"Without the guidance and counselling of teachers, students may not benefit from CAI." 36.56% of the respondents highly agreed versus 1.08% highly disagreed. 39.79% mildly agreed versus 15.05% mildly disagreed ("Many have their own programs"). 7.53% expressed no opinion. Generally speaking, CAI courseware is designed in discrete units. A student may master several modules of subject matter without ever relating these modules to each other.

From this section, the findings indicate that the knowledge of the respondents concerning computers and the concept of CAI is rather weak. There are times when the respondents do not seem to be able to relate computers to CAI.

IX. FINDINGS VI

HOW SOON WILL CAI BE FULLY IMPLEMENTED ?

If CAI is to be implemented, how soon can it be done? If it has to be done, to what extent will CAI be implemented?

"Although CAI has been in existence for over two decades, complete implementation in Manitoba schools is still a dream." "Complete implementation" was underlined and remarks such as "and perhaps undesirable" were penned in. Another wondered, "Is 'complete implementation' in existence anywhere?" The writer defined "complete implementation" as a simple "general acceptance". It is a generally accepted fact of life that "complete implementation" in its exact diction is only an ideal in particular school activities. For example, the French Language, sports such as football, basketball, etc. or music and the arts have been considered fully implemented in Manitoba schools. However one can always find isolated cases where certain schools lack certain activities. 27.96% of the respondents strongly agreed versus 4.30% strongly disagreed. 36.56% mildly agreed versus 26.88% mildly disagreed. 4.30% expresed no opinion. Several respondents asserted that "general implementation underway ..." One respondent wrote, "I'm taking a course at Red River Community College. The teaching level is low and the momentum of the course is slow. Even from the courses taken at RRCC I get the impression that the general attitude is very much that microcomputers are nice but the old way was easier and more desirable." The writer assumes that the "old way" means the "non-CAI" way. Another wrote, "Reluctance of

acceptance by teachers".

"Although the rate of progress of Manitoba schools participating in the CAI project has been slow full implementation is expected in most schools within the next 24 months." 3.23% of the respondents strongly agreed versus 39.79% strongly disagreed. 10.75% mildly agreed versus 18.28% mildly disagreed. 27.96% expressed no opinion. The writer is perplexed by the responses. In Chapter IV, 65.12% of the respondents will invest money in a microcomputer for CAI in the next term if they have the authority to do so. Even discounting variances, the figures simply cannot jibe. Why would educators invest money in microcomputers for CAI in the next term if they do not expect full implementation by then, if not earlier? Wouldn't it be more prudent to wait and see which way the wind blows?

"According to the sales figures of microcomputers, it seems that most schools will have microcomputers by the fall of 1982." 4.30% of the respondents strongly agreed versus 20.43% strongly disagreed. 25.81% mildly agreed versus 17.20% strongly disagreed. 32.26% expressed no opinion. Again the responses do not fit in the pattern. "Sales figures" was underlined and one respondent wrote, "Who has these?" Others have reservations, "will have microcomputers" was modified to "will have access to microcomputers".

> Microcomputer industry is a multibillion dollar industry. Would these companies churn out fictitious sales figure to the public and give fictituous dividends to share holders? If there are real buyers of microcomputers, who are these buyers? From the business sector? Private individuals? What would these buyers want to do with their microcomputers? Already, the computer trade magazines sound the alarm to warn

> the manufacturers that if they are not providing more software support, the boom will turn to bust. How long can the microcomputer industry sustain on video games, hobbies, or amateur enthusiasts? Accounting packages are aplenty already. New markets must be developed in the softwares to sustain the growth of the hardwares. In the meantime, would the owners of microcomputers sit idle and wait for new softwares. If the industry does not produce softwares for their needs, they want to learn something about computers to develop their own programs. Even if parents know that not every school children has the knack to develop the programming techniques, they still want their children to have something to do about computers. Thus, schools will buy microcomputers, if not for Data Processing, if not for Computer Science, if not for CAI, then use them for Word Processing. Just as if schools were getting typewriters a generation ago.
>
> TIME magazine has decided that the most significant force in 1982's news was not a single individual but a process, and a widespread recognition by a whole society that this process was changing the course of all other processes. TIME's Man of the Year for 1982, the greatest influence for good or evil, was not a man at all. It was a machine: the computer. "The sales figure are awesome and will become more so. In 1980 some two dozen firms sold 724,000 personal computers for $1.8 billion. The following year 20 more companies join the stampede... and sales doubled to 1.4 million units at just under $3 billion. When the final figures are in for 1982, according to Dataquest, a California research firm, more than 100 companies will probably have sold 2.8 million units for $4.9 billion." ("The Computer Moves In", TIME, January 3, 1982, pp.8)

"CAI can never be fully implemented because industries lure away trained computer personnel and our Manitoba education system cannot compete with industries for fringe benefits and working conditions." 5.38% of the respondents strongly agreed versus 17.20% strongly disagreed. 15.05% mildly agreed versus 39.79% mildly disagreed. 21.51% expressed no opinion and 1.08% didn't answer. One of the comments received was that the issue involved is not simply a case of industry versus education. Many issues are indeed involved. For unwary bystanders, nevertheless, all they can see is that industry seems to have the upper hand.

Moreover, a career in computer seems to garner a certain glamour whereas a career in teaching appears to be less than glamorous.

"CAI can never get beyond the experimental stage because there are not enough proficient teachers who can program courseware and there are not enough proficient computer programmers who can teach." Many respondents glanced at the statement and were offended by the term "proficient teachers". There was absolutely no intention by the writer to offend anyone. But, have the readers taken note that some of the great computer experts cannot teach? Or, have the readers noticed courseware written by great teachers? Other respondents emphatically substituted "not enough" by "too few". The "planted" grammatical error here provoked several rebukes.

3.23% of the respondents strongly agreed versus 22.58% stronly disagreed that CAI could never get beyond the experimental stage. 16.13% mildly agreed versus 41.94% mildly disagreed. 13.98% expressed no opinion and 2.15% didn't answer. One respondent remarked, "Teachers are adaptable -- easily debatable!" Another respondent wrote, "Educators must deal with this problem and must free teachers to program, otherwise business program without knowledge of learning theories may produce undesirable courseware." There were some optimistic responses, "At the present time."

"CAI can achieve full implementation in Manitoba schools within three years because we are training more and more people in Computer Education." 1.08% of the respondents strongly agreed versus 17.20% strongly disagreed. 29.03% mildly agreed versus 23.66% mildly disagreed. 29.03% expresed no opinion. The

respondents do not seem to be very optimistic. One optimistic respondent wrote, "More professional software is being produced both within and outside Manitoba." Another respondent wrote, "Industry is but educators are not." Another commented, "I feel that personnel are being trained, but software (and cost!) will be a problem." It takes time for a teacher/programmer to become proficient. In the business world, statistics show that a proficient computer programmer requires a relatively lengthy period to develop programs. On the average, in order to get slightly more than a dozen lines of coding operational requires one hour. Of course, the work involved is from the initial conception, through flow-charting, coding, debugging, testing and parallel runs or full scale production tests. It is estimated that between 20 to 100 man-hours are required to produce one hour of tutorial CAI. (42)

"Schools which have microcomputers will be in for a great disappointment if they are faced with insufficient software and/or few trained personnel to develop it." 29.03% of the respondents strongly agreed versus 1.08% strongly disagreed. 49.46% mildly agreed versus 16.13% mildly disagreed. 3.23% expressed no opinion and 1.08% didn't answer. One respondent who strongly agreed wrote, "The real problem as I see it". It has already been established that there are not enough teacher/programmers to develop the necessary courseware (50.54% of the respondents do not know any programming languages). It has also been established that commercial courseware is lacking not only in quantity but in quality as well ("Such as it is" or "If they are available"). Of course the degree of disappointment

depends on one's aspirations or expectations of microcomputers.

CONCLUSION

By now, the respondents appeared to have became disillusioned with CAI. Full implementation of CAI will await for the day when teachers are ready to learn to use it. "Let's not develop a bandwagon effect," admonished one respondent. Most of the respondents were beginning to become aware of how much extra work CAI will involve.

The PLATO project got the backing of the University of Illinois. The TICCIT project got authoring teams to do the work. Simon Fraser University's CAI is the team work of the instructor and the experienced CAI programer. The Ontario's OISE project, the University of Alberta's CAI, and the Quebec Department of Education's CAI all institued the "turn-key system". All these projects pointed to the fact that extensive support is required. Teachers tend to resist CAI if they see it as a threat to their jobs or to traditional teaching methods, or if it requires considerable re-training. In order for CAI to be widely accepted, teachers must find their new role attractive. Moreover, the relationship between student and computer lacks personal, human qualities such as the ability to listen to a student's voice, to observe his bewilderment, or to sympathize with his problem. That is what CMI's advocators are pushing for. Unless Manitoba can come to grips with Computer Assisted Instruction, and provide extensive support to educators, we have a problem with no solution. This may be the turning point and at this point in time the writer is unable to foresee whether it is

the end of the beginning or if it is another beginning of the end of Manitoba's CAI.

The Minneapolis school district closed nearly one-third of its high schools due to the lack of money and students in 1982 -- but it is continuing to spend hundreds of thousands of dollars to train teachers in the use of microcomputers. Virtually every student from preschool to college has access to computer-based education. The state is plugging into the electronic era through a unique agency called the Minnesota Educational Computing Consortium. The University of Minnesota, the state-university and community-college systems and the state department of education formed MECC in 1973 as schools around the state were clamouring to follow Minneapolis's lead in computer learning. MECC's major asset is its stash of 700 computer programs. Ideas for the programs originate with teachers and take shape in MECC's modest headquarters in St. Paul. There a staff of 25 curriculum-development experts and programmers concoct programs which range from the rules of volleyball to marketing techniques in simulated hypothetical life environments. For a one-year fee of about $3,000 for single school districts and up to $25,000 for a statewide membership, MECC clients receive programs for scores of courses, training in how to use them, and a discount on hardware. The mainframe time-sharing systems in Minnesota have been losing ground to microcomputers. In November 1982, Control Data began offering its PLATO courseware -- 8,000 hours worth, developed over the past 20 years -- in a converted form for use on microcomputers. This Minnesota venture proved that even in hard economic times,

which have forced retrenchment at every level of education, there has been surprisingly little opposition to the computer fever. (43)

X. FINDINGS VII

AVAILABILITY OF TRAINED STAFF

Educators in Manitoba are faced with an urgent and worthy problem. Preliminary studies tend to indicate that CAI is a medium of instruction in which money and manpower may be worth while to spend.

25.87% of the respondents felt that in conjunction with the basic core-teaching, it was feasible to implement CAI in 12 months. This optimistic group usually had reservations. "If implementation means 'starting a solid program'" or "Depends on which subject". 10.75% thought that it would take at least 18 months. One respondent in this group wanted to know if the implementation was for just one school division or for the entire province. 17.20% considered 24 months. 21.51% deemed 36 months. 9.68% regarded that even with the basic core-teaching CAI could never be implemented. (A "core teacher" is a coordinator. He/she has a solid background/ability in the given subject matter under discussion. He/she is a resource person who can direct interested persons to the further development and understanding of the given subject matter.) Another 15.05% didn't answer. One respondent remarked: "The facilities are with us now. It is not a matter of when it can be done but how soon can the program be accepted." Another respondent circled "basic core-teaching" and demanded: "What does this mean?" and another wrote, "I bet 36 months and never".

12.90% of the respondents stated that they had sufficient trained staff to implement CAI now. 19.36% felt that they could

do so in 12 months. Another 19.36% thought that it would be in 24 months. 16.13% considered 36 months. 12.90% regarded that they would never have sufficient trained staff to implement CAI and 19.36% didn't answer. It appeared that those respondents who replied 'never' have low esteem of themselves and their colleagues. One stated, "In this school? Never." For those who did not answer, they knew that they could not do it and they did not know about others.

21.51% of the respondents first learned about the concept of CAI from the news media (i.e. newspapers, journals, etc.). 24.73% learned from informal discussion with fellow colleagues. 9.68% learned from formal discussion with fellow colleagues. 37.63% learned about CAI from conferences relating to education. 1.08% admitted that they had never heard of CAI until they received this questionnaire. How their names got entered onto our master list is a mystery. 5.38% did not answer. (Sample remarks were: "I don't even remember" or "By whom?"). No one learned about CAI from salespersons from computer manufacturers. It looks as if the salespersons did not perform their jobs aggressively enough. Or perhaps their sales pitches were so subtle that people did not recognize their silent persuasions.

24.73% of the respondents had their interest in CAI aroused by the news media. 29.63% by informal discussions with fellow colleagues. 10.95% by formal discussions with fellow colleagues. 27.96% by conferences relating to Education. 3.23% admitted that they were never aroused. 4.30% didn't answer. No one was aroused by the sales pitches of the computer salesmen. One respondent stated that his/her interest in CAI was aroused by science

fiction stories. (Some science fiction writers are great conceptual thinkers. They've been to the other planets long before astronauts set foot on the moon. Dick Tracy's fancy communication gadgets and the short stories of H.G. Wells can be really thought provoking.) In this case, the writer simply considered science fiction as another form of news media.

95.70% of the respondents took the initiation and had discussed the CAI concept with fellow colleagues. A mere 4.30% had never done so. This implies that the majority of the respondents were quite impressed with the CAI concept in one way or another. They wanted to share with others this 'good' or 'bad' news. At least they considered that it was newsworthy enough to mention to their fellow colleagues.

83.87% of the respondents were approached by other staff/colleagues about CAI. 16.13% were not approached by colleagues. The implication of this statement is that the respondents took a passive role. Their colleagues took an active role. Their colleagues considered the CAI concept newsworthy enough to mention to the respondents.

Only 5.38% of the respondents never approached colleagues nor were approached by colleagues to discuss the concept of CAI. (This figure was arrived at by checking the questionnaires when the respondents reply 'No' in both questions). This unresponsive group may exist due to the fact that the respondents were too busy and their colleagues simply did not have the chance to broach the subject.

93.55% of the respondents were willing to give CAI a try if it was available then. 5.38% were not willing to try. 1.08%

didn't answer. Most of those who were willing to give CAI a try were speaking for themselves only. They could not vouch for the teachers with whom they worked. Some respondents were so enthusiastic that they urged: "Yes. Definitely, and the sooner the better" but some remarked, "I am willing but the teachers I work with are not"; or "We are discussing the topic"; or "Will you buy the computer?"; or "Some of us are giving it a try".

69.89% of the respondents had teaching staff in their school or school division to serve as core teachers in CAI then. One respondent remarked that they had core teachers in a few schools then but not yet in most schools. 26.89% did not have or did not know of anyone amongst themselves who could serve as core teacher in CAI now. 3.23% did not answer simply because they did not even know what a core teacher is.

CONCLUSION

From this section, it was safe to conclude that implementation of CAI was feasible and the process would be speeded up if CAI is implemented in conjunction with the basic core-teaching. On a divisional level, some knowledgeable teachers may have to be transferred to different schools to serve as CAI core teachers. On the provincial level, some teachers may even have to be transferred out of the division.

Conferences relating to Education were still the best way to keep the teachers informed as to new educational concepts. In-service conferences indeed have their merits. The CAI concept certainly had become a hot topic, a conversational piece among educators. Since most respondents were willing to give it a try,

it appears as if the CAI concept cannot be too bad an idea.

Before we push on, let us pause for a moment of reflection. Did the respondents mean what they say? The figures do not seem to correlate. Why is it that 69.89% claimed that they had teaching staff to serve as a core teacher in CAI then but only 25.89% of them considered that it was feasible to implement CAI in conjunction with the basic core-teaching in 12 months time? The discrepancy is simply too high to ignore. Would it be that they didn't know what they said? The writer would defer judgment and say, "Don't jump to any conclusions. We have to do more analysing".

XI. THE DIRECTION

Now that the survey is completed and the data has been analysed by the computer and the writer and his advisors, let us pause for a moment of reflection. Have the objectives of the study been fulfilled?

The first objective of the study was to know the level of acceptance of microcomputers as valuable tools in the process of education. We discovered that an overwhelming majority of the respondents had either attended conferences regarding "Computers in Education" (84.95%) or had seen demonstrations as to what microcomputers can do in the area of education (88.17%). A great majority of these respondents (78.38%) would invest money in a microcomputer for Computer Assisted Instruction (CAI) in the next term if they had the authority.

There was the fine art of buck passing involved here. "I would as a teacher -- but the principal won't". "I would as principal -- but the supervisor won't". Although the writer has been unable to quote the supervisors, it can be stated that at the grass roots level, the microcomputer as a medium for education is generally accepted. On the supervisory level, the writer has glimpses at the level of acceptance. "We have over 50 micros curently and there are being utilized for CAI, Programming Instruction, etc."; "Funds has already been allocated"; "We are using a TRS-80 Model II at present"; "We have a 3-year 'jump' on most schools in this area"; or "The division has similar models".

IMPLEMENTATION OF CAI

A simple majority (58.07%) of the respondents have plans to implement CAI in the next 12 - 24 months. "We have an on-going Computer implementation committee"; or "We already have CAI". 60.21% of the respondents have bought their microcomputers already. They also have a healthy respect for the use of microcomputers in education. Time and again, the writer was rebuked for making such outrageous suggestions as playing "video games" on the micros. "A dubious use for micros"; "I won't touch this question with an eleven foot pole"; "We keep our microcomputers in the 'computer center' with high security". Most teachers", if not "any teacher", (73.12%) could use CAI to complement the classroom teaching. Full implementation of CAI in Manitoba schools could be achieved (57.05%).

The last but not the least significant clue was that fully 93.55% of the respondents were willing to give CAI a try if it were available now. A solid vote of support indeed. However, the sample included only those who had already expressed a desire to know more about computers in education. It would be rather dubious to draw any conclusions based on this finding.

95.70% of the respondents had taken the initiation to discuss the concept of CAI with their colleagues. 83.87% of the respondents had initiative colleagues who had discussed the concept of CAI with them. Only 5.38% of the respondents had never discussed the concept of CAI with their colleagues.

The plans for implementation of programs which employ microcomputers in a multitude of ways in the school system nonetheless seemed to concentrate on the purchase of

microcomputers for Computer Science and Data Processing. "I am not sure what courseware means"; "What is meant by classroom management ?" or "What is the concept of core-teaching?" An average of 11.45% of the respondents expressed no opinion in the section of "What is CAI (Computer Assisted Instruction)?" An average of 33.46% of the respondents expressed no opinion in the section of "Changes which may result from CAI". An average of 13.62% of the respondents expressed no opinion in the section of "Range of subjects which can be taught by CAI". And an average of 19.51% expressed no opinion in the section of "How soon will CAI be fully implemented?"

Some of the questions raised might not have answers but others have obvious solutions. The fact that there was such a high percentage of 'no opinions' showed that the respondents were very cautious or had never given it a thought yet. The fact that their average months of awareness were only a shade over 3 months before they had received the questionnaire might explain why they had not given "Computers in Education" much thought yet.

Although the consensus pointed to the fact that there were too few coursewares available for CAI and/or too few trained personnel to develop them (only 32.26% have available personnel to implement CAI as planned), only one respondent advocated, "Education administrators must free teachers to develop coursewares". Others seemed to be content with purchasing commercial coursewares "if they are available", or "such as it is". Several would use their own courseware and those developed by other teachers. Other alternatives included the use of

course-writing programs for teachers who do not have programming skills. Only one respondent nailed the real issue on the head, "Some teachers can modify existing programs or develop their own but they have no time". Even sales brochures of computer manufacturers noted that the lack of coursewares has been the limiting factor in applications of microcomputers in CAI in schools. Somehow administrators still expect their teachers to develop coursewares during evenings or weekends. In short, it was apparent that plans for CAI were nonexistent or misguided.

Oscar Wilde has said that "A cynic is one who knows the price of everything but the value of nothing". People involved in computers tend to be problem solvers. Were those "computer frauds" committed motivated not by profit making but by ego satisfying? "You really think that a few levels of security codes can stop me?" If the education system got involved heavily with computers only in the capacity of problem solving, would our future graduates all be "cynics" having little respect for the value system? At times even the writer has a similar "syndrome". The issue then becomes whether or not we should have computer involvement without developing a system of computer ethics first.

The third objective of this study was to raise the level of awareness of microcomputers in education of the group of respondents. This objective was achieved beyond doubt. This study had raised not only the level of awareness of microcomputers in education, but eye-brows and even some blood pressures as well -- judging from the comments and remarks of the respondents. Many of the respondents spent far in excess of

the half an hour which the writer hoped that each respondent would take to complete the questionnaire.

It must have became apparent that educational leaders considered microcomputers as educational tools for students in Computer Science or in Data Processing. Computer Assisted Instruction (CAI) was relegated to the slow learners. "Students come to our 'computer center' and do not play games. They learn what a computer can do, programming and become 'computer aware' plus electronics (the guts of the machines!). Only our slow to below average students work on prepared tapes and discs often made by our bright students"; "We have CAI only in our learning assistance centre". No wonder there were general complaints of the poor quality of CAI coursewares. Students are still students, no matter how bright they are -- and even that would not matter if we could keep in mind that teachers should be teachers. The students still do not have the learning theory as to why certain subjects must be approached in such a manner. As long as educational leaders perceive that CAI is good for slow learners only, a full-fledged program of CAI for all students can never get beyond the experimental stage.

Serious discussions must be made to explore all the possible directions which Manitoba schools can go with CAI. Until then, we cannot even claim that we have any plans for CAI implementation, let alone the assignment of priorities.

The writer had obtained a draft of "Educational Applications for Microcomputers in Division X" dated June, 1981. It was admittedly the first draft, and for discussion purposes only. Thus, the draft was a feasibility study of implementation

of CAI rather than a plan to implement CAI. The project team included the principals, project coordinators, the librarians, the resource teachers, and those teachers and other personnel who were involved in either computer literacy activities, computer assisted instruction, or computer managed activities. No where in this draft paper was there an acknowledgement of the need of a full-time teacher/programmer. The project coordinator had the role of the core teacher. Everyone involved in this project team had other full-time duties. There was one consolation in this Division X draft; nothing was said about slow learners. However the goals of applications of microcomputers in Division X were so wide ranged, from computer literacy to administrative applications, to CAI and so on, that one could hardly argue that Division X assigned a top priority to the implementation of CAI. One could only say that Division X planned to introduce microcomputers into the curriculum and into the schools. To put it mildly, Division X did not have a framework, or a bare outline of ideas, let alone a policy on CAI. Even the priorities of applications of microcomputers were set by default.

XII. THE FUTURE OF CAI

In order to assess the future of CAI realistically, the writer shall look into two aspects of CAI to date. (A) Trends in Industry, and (B) Some obstacles to implementation of CAI in Education. Based on these historical facts, the writer shall try to see what can be done about CAI in education.

TRENDS IN INDUSTRY

In the computer industry, technology is constantly advancing and new products are being placed on the market almost daily. Many manufacturers have adopted CAI as a means of keeping their staff abreast current developments. Industry is making use of this individualized learning mode for in-service education.

The British Columbia Telephone Company Limited (B.C. Tel) is an example of an organization which is providing leadership in this endeavour. Preliminary results of an experiment began by B.C. Tel in 1979 indicated that the objective can be achieved. (44)

SOME OBSTACLES TO IMPLEMENTATION OF CAI IN EDUCATION

Why is it then that CAI in the school systems failed to gain general acceptance? Plausible explanations are:

1) Cost of courseware development.
2) Ineffectiveness of effort,
3) Simplistic approach relying too heavily on drill and

practice,

4) Obstacles to improvement of quality,

5) Non-compatability of courseware, and

6) Confusion of administrators over objectives.

COST OF COURSEWARE DEVELOPMENT

The B.C. Tel experiment proved that courseware development may be too expensive for individual schools. Although CAI will enable a reduction of 20-40% in training time required per individual, an increase in long-term retention of 10-30%, and a reduction in overall training costs by 20-40% (amortized over 5 years). Industry experience suggests that it takes from 75 to 200 man-hours of development time for each hour of instruction. Differences in subject matter and instructional techniques account for the wide range of time required. B.C. Tel courses tend to be technical in nature. Their estimate was that 100 to 125 hours would be required to develop each hour of course material for B.C. Tel.

With few exceptions, CAI has always been treated as a form of hobby club similar to chess clubs or stamp collectors. It is virtually unheard of for teachers in Manitoba, or anywhere, to be spending full time on developing courseware. There are few enthusiastic teachers who spend their after school hours helping out the interested students. Unfortunately, courseware development is time-consuming and few teachers have the inclination and time to do it. The few Computer Science teachers often delegate their bright students to do the job. This courseware often lacks lesson objectives and insights. Very

little courseware was developed by full-time professionals. The PLATO project is indeed exceptional but we do not know how much help the individual teachers get from the university.

Most of the CAI courseware was developed by employees of the computer manufacturers. The emphasis of these CAI courseware has been on drill and practice and not on tutorial. In the business of softwares, the megabuck is in the development of video games. Thus, although computer companies always make grand proclamations that they are making great efforts to develop courseware for CAI, their grand designs are only window dressings in order to boost the sales of their models. The limited courseware listed on their brochures has to satisfy a wide range of customers. So, they play it safe by touching all bases. The CAI courseware listed covers all subjects and all grades. Since these are low budget productions, their quality tend to suffer. The programmers in their employ seldom are teachers. They just follow a set format in their program development. To make matters worse, this courseware does not come in sets. The computer manufacturers try to appeal to too wide a market by using the fragmented approach. For example, if you have purchased a program in mathematics on addition of integers, you cannot get another on addition of decimals or on addition of fractions, let alone on other aspects of the same subject. If you are lucky enough to have several courseware on the same subject, chances are that they are not for the same grade.

OBSTACLES TO IMPROVEMENT OF QUALITY

Courseware is difficult to protect and copyright. An executive of a software company admitted that software protections are not for professionals. Says Steven P. Jobs, 26, chairman of Apple Computer: "I've never seen a software protection scheme that someone around here couldn't break in 24 hours". (45) As far as the computer companies are concerned, the incentive to produce more high quality courseware is simply not there. Teachers may develop high quality courseware during summer vacations but again the incentive cannot compensate for the labour.

Few administrators would expect their teachers to develop textbooks for their students in their spare time. Why would they expect their teachers to develop their own courseware? The cry to free the teachers to work on the courseware can be heard more and more often. Moreover the question of copywriting the courseware has been raised by CAI users everywhere. The schools or even the divisions do not have the funds and means to solve these issues. Professor John Palmer, director of the Centre of Economic Analysis of Intellectual Property Rights at the University of Western Ontario believes that existing copyright laws may leave computer software virtually unprotected. (46)

The problem of software was discussed by the Science Council of Canada, including the issue of copyright. Authors must be protected, according to the workshop's proceedings, without limiting the possibilities offered by the new technologies for altering materials to suit the needs of various

clients or users. According to the workshop, the involvement of both public and private sectors (a hybrid common in Canada) in the creation of software could lead to a solution, and put Canada in the forefront of the world marketplace. (47)

In Chapter I, the writer raised the issue of standardization. The Science Council Workshop regarded the adoption of different and not easily interchangeable CAI systems by various provinces as one of the major obstacles to full implementation of CAI, and an absence of national standards as another obstacle. (48) Different models of micros may have different capabilities.The following were news items from "ComputingCanada", Canada's Bi-weekly Data Processing Newspaper. Both news items were from Vol. 8 No. 4, February 18, 1982.

"ALBERTA GOVERNMENT ACCUSED OF MAKING BAD DEAL ON MICROS", the headline from Edmonton blared. The Alberta Department of Education has a warehouse filled with $4 million worth of microcomputers that nobody seems to want. The 1,000 Bell and Howell Ltd. educational micros were purchased by the government in an effort to expand and standardize its computer education program. However, critics of the deal claim that the province paid too much for the equipment, which is essentially repackaged APPLE II's with some minor enhancements.

Education Minister Dave King defended his decision, saying the Bell and Howell system represented a good mid-range standard and on the whole performed well in a wide variety of applications. "Local retailers can deliver the same item for $600 less than the government claims it paid for 1,000 of them," Gordon Booth, a computer science teacher in Edson said. "The

problem with the system is that while it may be fine for personal use, it lacks the ability to operate in a networking environment. The cost of having 24 Commodore system, each with its own printer and monitor hooked up to a central floppy, runs about $41,000, whereas with an Apple system it's necessary to go to a hard disk setup, which ends up costing you in the area of $110,000, nearly three times as much."

This dispute in Edmonton may be a case of "the blind men and the elephant". Different objectives of computers in education yield different perspectives. A family sedan may be used to haul gravel but is that the proper use of the sedan?

The headline from Waterloo stated, "UNIVERSITY OF WATERLOO GROUP HAS ALTERNATIVE MICRO IDEAS". "The Ontario education system cannot afford the cost of re-implementing computer applications every time a new computer becomes available for the educational sector," warns a paper published by the University of Waterloo Computer Science Department. It recommends that the proposed Canadian Educational Microcomputer (CEM) be oriented toward software, not hardware. The paper challenges previous recommendations to the Ministry of Education that called for manufacture of a family of microcomputers conforming to standard hardware specifications so that programs written on one machine could be run on other members of the family with little or no change. The disadvantage of this approach is that it would be almost impossible to incorporate any new technology into the system once it is designed and production is started, the paper says, and past experience suggests that such a design would quickly become non-competitive in world markets and the

specifications would likely block development of future innovative designs in Ontario.

The alternative is to design operating software that compensates for wide variations in hardware without incurring the cost of completely rewriting either the operating or application layers of the system. Such software is said to be portable, meaning there can be a wide variation in the type of computer used.

The Waterloo plan also calls for the government to make public its criteria for the CEM and to ensure that any candidate's equipment supports at least one of a family of portable systems programming languages and associated operating software.

Dale H. Bent is director of computing services at the University of Alberta in Edmonton. He noted that perhaps the greatest pitfall facing our public school administrations is a lack of understanding of the different ways in which computers can be used in education. It's especially important to recognize that EDP (Electronic Data Processing) is not computer-based education. No doubt many school boards think that because they have a data processing operation they are fully using computers in education. This is emphatically not the case and it's also a mistake to implement services such as CAI using computer systems that are designed for data processing. We need different kinds of technologies and, in many cases, the data processing department is inadequately equipped both in hardware and manpower to meet the technical requirements of CMI or CAI. Bent argued that our public school boards could profitably designate

a computer-based education specialist to assist them in planning and coordinating computer-based education activities in schools under their jurisdiction. (49)

In an AED '81 newsletter article discussing the impact of modern technology the author made the following observation:

> "Whether we like it or not, it is not possible to prevent our society from adopting the tools provided by technological progress... The calculator invasion has already hit our schools and has resulted in the end of log tables and slide rules... The question is not so much as to consider the advisability of introducing computer-aided education in public schools, but what to do about its inevitable introduction."

Darril Barstow, a respected author on the use of computers in education says,

> "... Teachers who take the time to learn to control and utilize the power of a microcomputer will realize the wonderful new ways in which his/her teaching will open up."

Since we are powerless to stop the inevitable, the writer suggests, "We may as well learn to roll with the punches." The writer has devised a plan which is less imposing than the Alberta plan but can be implemented right away to cater to the immediate needs of the educators of Manitoba.

Drawing from the findings of the Waterloo Report and the Science Council Proceedings, the writer thus makes the following recommendations:

1) Declare a moratorium on the purchase of microcomputers for the so-called CAI purposes until the schools concerned can come up with detailed and practical objectives for CAI.

For those schools that have purchased microcomputers for the purpose of Computer Science or Data Processing or Electronics, they can carry on with their missions but again try not to purchase more hardware until objectives for having computers are clarified. As noted before, the high school Computer Science curriculum was modeled for the decade-old business applications. These decade-old business applications were an attempt to use computers as number crunchers, as giant calculators. It is about time for the high school curriculum to get a major overhaul to prepare youngsters for the next century instead of preparing them for the past decade. Maybe we can avoid the syndrome of "least cost -- maximum productivity" as leaders in the computer field lament today.

2) Establish a CAI Branch under the auspices of the Department of Education. The function of this CAI Branch is to set guidelines for the CAI curriculum, to establish hardware and software specifications, and to outline CAI courseware modules. The staff of this CAI Branch will be drawn from the existing Computer Services Branch, the Curriculum Branch, the Correspondence Branch and from experts in the CAI field. They will then try to apply their original specialties towards the shaping of a CAI policy. The CAI Branch will then contract out the modules for teachers to develop, with strict quality requirement. All CAI courseware developed under contract shall become the properties of the government, minimizing the copyright hassles. The Minnesota MECC example proved that such an agency may not be costly in the long run. MECC's out-of-state sales of courseware covered an estimated 90 percent of

Minnesota's costs. (50)

For those schools that have purchased microcomputers for CAI purposes but haven't the haziest notion or plans as to what CAI is, the CAI Branch will have to perform rescue missions. "If you once forfeit the confidence of your fellow citizens, you can never regain their respect and esteem". (Abraham Lincoln) The proponents of CAI cannot afford to have their grand ideas rejected, especially when the decision is not based on the merits or demerits of CAI but on a misguided notion. (Referring to the benefits of CAI to students and the effects of the guidance of teachers, one respondent wrote, "Many have their own programs").

Before the first microcomputer is bought, educators should think ahead and plan for replacements. Planned obsolescence is no longer trendy in the auto industry, let alone the unplanned and unfathomable computer industry. The least cost product of today may ended up costing more in the long run if the manufacturer was to decide not to support that particular model any more. The cost/effective guideline should be measured in terms of a number of years. If the technological stability of a less expensive model is in doubt, shop for another model. (51)

This CAI Branch may have to start out by offering only one solid line of courseware for only one subject for only one grade level. Eventually, when CAI has achieved general acceptance, more lines of courseware will be offered. Like the Chinese journey of many miles, courseware development should be approached one step at a time.

This CAI Branch will have to expand and serve as the

support centre to offer direct and immediate assistance to school-based core teachers. Modifications which cannot be made at the school site will be referred back to the CAI Branch. Modifications because of different models may also be done at the CAI Branch.

When CAI in Manitoba is fully implemented, it will be more important for this CAI Branch to provide CAI project management assistance rather than programming support. This field is developing too rapidly to make definitive statements on what will be needed, or even practical, ten years from now. There should be means for a multiplicity of technologies to develop at a research center. A long-term view of total system expense will tend to favour the purchase of a more powerful system which has comprehensive programming and data collection aids. The most important characteristic of a general-purpose CAI microcomputer is technological stability. It should be usable for at least five years, because only in that length of time can one develop courseware of lasting value. Thus, just as in the planning of the purchase of a microcomputer, the role of the CAI Branch will have to be planned in terms of stages.

The advantages of having a CAI Branch of the Education Department, to take charge of Computer Assisted Instruction programs, are manifold.

1) With the constant changes in curricula in the school system, CAI users will be hard-pressed to keep up with the courseware changes, even on the divisional level. The CAI Branch will ensure that courseware is constantly updated.

2) The CAI Branch will minimize the duplication of

efforts. Most of the time, one courseware will suit the particular needs of a school with only minimal modification.

3) The quality of courseware will be uniform throughout the Province. Students who are transferred from school to school or even from division to division will not suffer.

4) Teachers will have a steady supply of the most updated versions of the courseware.

5) When the present batch of microcomputers becomes obsolete, which will happen in less than 5 years from now, CAI teachers will not have to go through the agonies of modifying the entire system of CAI courseware.

6) If and when further technology breakthroughs produce better and/or less expensive equipment, schools will not be stuck with their old models. They can replace their worn-out models with better equipment, without the fear of change-over "hangups" or the agony of complete re-implementation.

7) When the CAI Branch is staffed by professionals, full vision of CAI will be apparent. ("Referring to subject matter do you mean a complete program? That is, Science or Mathematics or one or two or more concepts in these areas. I don't believe you could learn a whole program on your own.", commented one respondent). There is no reason why a complete course such as Mathematics 300 or Physics 300 cannot be taught by CAI, with proper guidance from the teachers.

8) The CAI Branch will also serve as a clearinghouse to assist the exchange of courseware between Provinces. No matter who develops the courseware, a key point in their successful utilization is full explanation of the service to those who will

use it and careful training in the procedures to be followed. Suspicion or misunderstanding can render even the most advanced and sophisticated courseware ineffective.

9) The CAI Branch should be able to obtain documentations from established systems such as the PLATO or the TICCIT, and if the courseware is suitable, modify them to suit the needs of our Manitoba schools.

10) When opportunity beckons, CAI in Manitoba does not have to be restricted to microcomputers. The CAI Branch can offer mainframe CAI complete with TELIDON features. The microcomputers can then be used as dumb terminals to communicate with the host computer at the Branch, or serve as stand-alone systems for other purposes.

THE DILEMMA

Henry Kissinger has said that "the dilemma of any statesman is that he can never be certain about the probable course of events. In reaching a decision, he must inevitably act on the basis of an intuition that is inherently unprovable. If he insists on certainty, he runs the danger of becoming a prisoner of events. His resolution must reside not in 'facts' as commonly conceived but in his vision of the future." Our educational leaders may not be statesmen yet, but they are facing such a dilemma now. The writer has presented some facts, a few insights, and a dream of CAI in Manitoba. The burden rests squarely on the shoulders of our educational leaders.

APPENDICES

APPENDIX A

KNOWLEDGE OF MICROCOMPUTERS IN EDUCATION	Responses given in percent.
A. 1. Have you attended conferences regarding "Computers in Education"? _____	YES 84.95 NO 15.05
A. 2 Have you attended a demonstration showing what computers can do in the area of Education? _____	YES 88.17 NO 11.83
A. 3. Do you intend to attend a conference regarding "Computers in Education" within the next six months? _____	YES 81.72 NO 13.98 N.R. 4.3
A. 4. Do you intend to ask a computer vendor for a demonstration of what computers can do in the area of education within the next six months? _____	YES 58.07 NO 40.86 N.R. 1.08
A. 5. When did you last attend a conference regarding "Computers in Education"? 3.47 months ago.	
A. 6. When did you last attend a demonstration showing what computers can do in the area of education? 3.13 months ago.	
A. 7. Has CAL been placed on a staff meeting agenda in your school for discussion? _____ If the reply is "yes", when was it? 2.96 months ago.	YES 40.86 NO 52.69 N.R. 6.45
A. 8. If you have the authority, are you going to put CAL on the agenda for discussion at the next staff meeting? _____ If the reply is "yes, when? 1.58 months from now.	YES 38.71 NO 61.29
A. 9. If you have the authority, will you invest money in a microcomputer for CAL in the next term?	YES 63.44 NO 21.51 N.R. 15.05

N.R. - NO RESPONSE

YOUR PLANS FOR COMPUTER ASSISTED LEARNING

B. 1.	Do you have a plan to implement CAL in the next 12 - 24 months? _____	YES NO N.R.	58.07 36.56 5.08
B. 2.	If you have a plan to implement CAL, do you have available personnel resources to program the necessary courseware? _____	YES NO N.R.	32.26 52.69 15.05
B. 3.	If you have a plan to implement CAL, are you going to purchase commercial coursewares? _____ (yes, no, or not applicable)	YES NO N.A.	59.14 6.45 34.41
B. 4.	If you have a plan to implement CAL, are you going to have the necessary coursewares custom designed? _____	YES NO N.A.	22.58 43.01 34.41
B. 5.	Can you construct your own courseware? _____	YES NO N.R.	34.41 63.44 2.15
B. 6.	Can you modify an existing courseware to suit your particular needs? _____	YES NO N.R.	45.16 51.61 3.23

B. 7. Please list the programming language(s) you can write in the development of a courseware.

a) Basic 36.56 b) Basic & Other 3.23 c) Basic & 2 Others 4.3 d) Basic & 3 Others 3.23

B. 8. If you have purchased a microcomputer, why did you buy the model you did?

a)	Best buy for the money/the price was right.	( ) 8.6
b)	A friend knowledgeable in computers got a similar model.	( ) 2.15
c)	A salesperson convinced me it was the best choice.	( ) 1.08
d)	After objective comparison of various models, I arrived at this conclusion knowingly.	( ) 43.01
		NA 39.79

N.R. - NO RESPONSE

N.A. - NOT APPLICABLE

WHAT IS CAL (COMPUTER ASSISTED LEARNING)?	I strongly Agree	I Mildly Agree	I Don't Know	I Mildly Disagree	I strongly Disagree
C. 1. CAL will free the teaching staff from mundane chores, giving teachers more time for individualized teaching, guidance and counselling.	11.83	41.94	18.28	22.58	5.38
C. 2. With the implementation of CAL, machines will take over the work of teachers.	1.08	2.15	4.3	17.2	75.27
C. 3. CAL is an attempt to reduce the cost of education through efficient use of a new technology.	5.38	16.13	11.98	20.43	44.09
C. 4. In a traditional classroom, the teacher spends more than 60% of his/her teaching time in drill and practice (which is the forte of CAL)	10.75	37.63	7.53	34.41	8.06
C. 5. CAL cannot be used to teach new concepts.	3.28	17.53	11.83	43.03	33.33
C. 6. Having a microcomputer in a classroom can keep the students occupied in computer games, thus lightening discipline problems.	2.15	24.73	8.6	23.66	39.79
C. 7. Microcomputers can be used for classroom management as well as CAL, benefiting both students and teachers.	24.73	44.09	12.09	9.68	6.45
C. 8. Through CAL, students can learn the subject matter at their own speed without the fear of peer group pressure.	33.33	46.24	9.68	7.53	1.08

CHANGES WHICH MAY RESULT FROM CAL.	I Strongly Agree	I Mildly Agree	I Don't Know	I Mildly Disagree	I Strongly Disagree
D. 1. A student educated with the assistance of CAL may not be able to cope with life in the real world. He/she may be conditioned to the computer world of black and white, losing touch of different shades of gray in human interaction.	2.15	15.05	20.43	32.26	30.11
D. 2. An adolescent educated with the assistance of CAL may have trouble with the social structure of his world.	2.15	10.75	22.58	35.48	27.96
D. 3. Computers cannot be programmed to react with the emotional growth of the students.	9.68	24.73	33.33	25.81	4.3
D. 4. Computers may inadvertently serve as a greenhouse for adolescents, shielding them from problems which may arise from human interactions.	4.3	27.96	18.28	26.88	21.51
D. 5. Ideals, morals, and religion cannot be learned from CAL.	9.68	20.43	27.96	33.33	7.53
D. 6. Heterosexual interests and activities are some of the things that CAL is lacking.	4.3	21.51	47.31	21.51	2.15
D. 7. Intergroup relations and attitudes may be enhanced when students are educated with the assistance of CAL.	6.45	25.81	41.94	22.58	2.15
D. 8. Among teaching staff, intergroup relations and attitudes may be enhanced by CAL due to minimizing areas of conflict.	4.3	25.81	44.09	21.51	2.15
D. 9. When CAL is fully implemented, teacher-pupil relations will be improved.	8.6	37.63	35.48	11.83	5.38

RANGE OF SUBJECTS WHICH CAN BE TAUGHT BY CAL.	I Strongly Agree	I Mildly Agree	I Don't Know	I Mildly Disagree	I Strongly Disagree
E. 1. CAL can be used to teach any subject matter.	24.73	34.41	15.05	15.05	10.75
E. 2. CAL can minimize hazzards and dangers by "simulating" real life situations.	23.66	38.71	22.58	10.75	2.15
E. 3. A computer cannot set a moral, ethical or social model for students.	13.98	25.81	22.58	33.33	4.3
E. 4. Given factors affecting ecology, a teacher can simulate our environment in one teaching period which may not be evolved until the next century.	24.75	38.71	23.66	5.38	3.23
E. 5. A basketball coach can use a computer to plot strategy but he still has to give personal demonstrations to teach basic skills.	45.16	32.26	10.75	9.68	2.15
E. 6. For students who want to master a subject matter, CAL can be a bonus. They can practice to their heart's content without getting their classmates and teachers frustrated. At the same time, the teacher can monitor their progress at his/her leisure. This is an example of what CAL can do.	61.29	32.26	3.23	2.15	1.08
E. 7. Any teacher can use CAL to complement the classroom teaching.	39.79	33.33	7.53	10.75	8.60
E. 8. In order to take full advantage of CAL, a teacher has to learn something about computers and the programming techniques. After all, a computer can perform only as instructed. The quality of a CAL courseware directly reflects the capability of the teacher/programmer.	50.54	35.48	2.15	6.45	4.3
E. 9. Without the guidance and counselling of teachers, students may not benefit from CAL.	36.56	39.79	7.53	15.05	1.08

HOW SOON WILL CAL BE FULLY IMPLEMENTED?	I Strongly Agree	I Mildly Agree	I Don't Know	I Mildly Disagree	I Strongly Disagree
F. 1. Although CAL has been in existence for over two decades, complete implementation in Manitoba schools is still a dream.	27.96	36.56	4.30	26.88	4.30
F. 2. Although the rate of progress of Manitoba Schools participating in the CAL project has been slow full implementation is expected in most schools within the next twenty-four months.	3.23	10.75	27.96	18.28	39.79
F. 3. According to the sales figures of microcomputers, it seems that most schools will have microcomputers by the fall semester of 1982.	4.30	25.81	32.26	17.20	20.43
F. 4. CAL can never be fully implemented because industries lure away trained computer personnel and our Manitoba education system cannot compete with industries for fringe benefits and working conditions.	5.38	15.05	21.51	39.79	17.20
F. 5. CAL can never get beyond the experimental stage because there is not enough proficient teachers who can program courseware and there is not enough proficient computer programmers who can teach.	3.23	16.13	13.98	41.94	22.58
F. 6. CAL can achieve full implementation in Manitoba schools within three years, because we are training more and more people in Computer Education.	1.08	29.03	29.03	23.66	17.20
F. 7. Schools which have microcomputers will be in for a great disappointment if they are faced with insufficient software and/or few trained personnel to develop it.	29.03	49.46	3.23	16.13	1.08

AVAILABILITY OF TRAINED STAFF:

G. 1. In conjunction with the basic core-teaching, it is feasible to implement CAL in: (check one only)

12 months ( )	18 months ( )	24 months ( )	36 months ( )	never ( )
25.87	10.75	17.20	21.51	9.68

G. 2. You will have sufficient trained staff to implement Cal: (check one only)

now ( )	in 12 months ( )	in 24 months ( )	in 36 months ( )	Never ( )
12.9	19.36	19.36	16.13	12.9

G. 3. The concept of CAL was first learned from: (check one only)

a)	News media (i.e., newspapers, journals, etc.)	( )	21.51
b)	Informal discussion with fellow colleagues.	( )	24.73
c)	Formal discussion with fellow colleagues.	( )	9.68
d)	Conferences relating to education.	( )	37.63
e)	Sales persons from computer manufacturers.	( )	0.00
f)	Never heard of - until you mentioned it.	( )	1.08
		N.R.	5.38

G. 4. Your interest of CAL was first aroused by: (check one only)

a)	News media (i.e., news sources, journals, etc.)	( )	24.73
b)	Informal discussion with fellow colleagues.	( )	29.63
c)	Formal discussion with fellow colleagues.	( )	10.95
d)	Conferences relating to education.	( )	27.96
e)	Sales pitch by computer salesman.	( )	0.00
f)	Never aroused.	( )	3.23

G. 5. Have you discussed the concept of CAL with fellow colleagues?

YES	95.7
NO	4.3

G. 6. Have your teaching staff/colleagues discussed the concept of CAL with you?

YES	83.87
NO	16.13

G. 7. Are you and the teachers with whom you work with willing to give CAL a try if it is available now?

YES	93.55
NO	5.38
N.R.	1.08

G. 8. Do you have teaching staff in your school to serve as a core teacher in CAL now?

YES	69.89
NO	26.89
N.R.	3.23

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