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THE USE OF A COMPUTER ASSISTED
INSTRUCTION SYSTEM IN TWO
SECONDARY SCHOOLS

by

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B.Ed., University of British Columbia, 1960

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ABSTRACT

THE USE OF A COMPUTER ASSISTED
INSTRUCTION SYSTEM IN TWO
SECONDARY SCHOOLS

This study was an examination of the events which followed the addition of computer terminals to the instructional resource spectrum of two secondary schools in British Columbia. Of particular interest was the identification and description within staff and student body, of those who used and did not use the computing facilities. In the case of users it was also a matter of interest to determine how and why the computer was used. In the case of non users an effort was made to determine why the equipment was not used.

There is a growing body of opinion which suggests that the available technology can serve public education. One obvious element of this technology is the computer. A number of well funded studies have been reported which have suggested various ways in which the computer can be used for business routines, scheduling and pupil accounting. A lesser number of studies have reported on the instructional uses of the computer. Both types of study, however, have been atypical of what would likely occur in schools if

computers were introduced more widely. They have relied on very high levels of financial and human support and have focused on narrow objectives. Unlike the foregoing this study examined the instructional uses made of a minimal cai capability added to schools whose staffs, budgets and programs were not markedly modified to incorporate the new capability.

In the school year 1970-1971, two secondary schools in British Columbia were equipped with typewriter style terminals linked by telephone lines to the I.B.M. 360/50 computer at Simon Fraser University. One school, which received two terminals, was located in the Lower Mainland area while the other school, equipped with one terminal, was in the Okanagan Valley, several hundred miles distant. Appropriate programs were made available to the schools. In addition, a consultant was made available to the schools on a part time basis. His function was to solve logistical problems, provide liaison and offer instruction in the use of the equipment and programs.

The consultant also acted as an observer and data gatherer. Data on user and non user groups were gathered by means of observation, self administered questionnaires and interviews. These latter were conducted by persons not directly involved in the project.

The data warrant a number of tentative conclusions. First, it was not possible to identify factors that determined the placement of individuals in either the user or the non user group. Second, individual interest and enthusiasm seemed to be the most important factor affecting use by both teachers and students. Third, the greatest single use of the equipment was made by students who wished to author programs, rather than by those who wished to use already available programs. The underlying causes of use or non use could not be determined from the data within this study and important questions remain which should receive further investigation.

A number of suggestions were presented which might assist in making a second investigation of this topic more fruitful.

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Chapter I
SETTING OF THE STUDY

I Purpose

This study was an examination of the events which followed the addition of computer terminals to the instructional resource spectrum of two British Columbia secondary schools. Of particular interest was a determination of the characteristics of the groups who used and did not use the computer, (users and non users), as well as an examination of the ways in which the former groups used the facility. Also of interest was a determination of those factors which tended to inhibit or discourage use. Specifically, this study sought answers to the following questions:

1. Were there any discernable factors that would serve to differentiate between teacher users and teacher non-users?
2. Were there any discernable factors that would serve to differentiate between student users and student non-users?
3. What factors affected the use of the system by teacher users?
4. What factors affected the use of the system by student users?

5. Were there any suggestions derived from this investigation that would be useful in either refining subsequent similar investigations or assisting with any future implementation of such a system?

II Background

A substantial body of opinion in contemporary society sees public education as being backward, slow to change, and out of touch with present day affairs. In the same vein there is fairly widespread agreement that the technological advances that have had demonstrable effects upon practice within other professions have been noticeably lacking within education. More specifically there seems to be some desire for an application of technology to the methods of instruction so as to foster an improvement in educational process.

Drucker's views, (1968), seem to be rather typical of the frequently expressed concerns:

"...learning and teaching are going to be more deeply affected by the new availability of information than any other area of human life. There is great need for a new approach, new methods and new tools in teaching, man's oldest and most reactionary craft. There is great need for a rapid increase in the productivity of learning. There is, above all, great need for methods that will make the teacher effective and multiply his or her efforts and competence. Teaching is, in fact, the only traditional craft in which we have

not yet fashioned the tools that make an ordinary person capable of superior performance. In this respect teaching is far behind medicine, where the tools first became available a century or more ago." (page 26)

One aspect of technology which Drucker must have had in mind was the computer. While it is true that computers are having an increasing impact on many aspects of daily life, their utilization within education has been minimal.

There have been a number of studies which have examined various possible educational uses for the computer. These have tended to concentrate on two rather different computing applications. The first group of studies has attempted to apply the computer as an educational data processing tool for such matters as student scheduling, pupil accounting, report cards, exam marking and library acquisitions and cataloging as well as numerous applications in educational statistics.

The second category of studies, somewhat smaller in number, has reported on the instructional uses of the computer. Most of these studies, such as Hunka (1970) and Lagowski and Bunderson (1968), have focused on one or more of the various types of computer assisted instruction (cai). These include drill and practice, tutoring, simulation, information retrieval and calculation and problem solving.

It is understandable, but perhaps unfortunate, that most of the studies associated with the computer as a learning tool have been atypical of what would likely happen in schools if computers were introduced, on a larger scale, for instructional purposes. To illustrate, studies such as O'Neil's, (1970), have relied on very high levels of financial and human support or have focused on rather narrow educational objectives. (Suppes, 1969; Wilson and Fitzgibbon, 1970; Gilman, 1969a, 1969b) Interesting and informative as they have been, these studies have been conducted under conditions that made it unnecessary to consider the budgetary limitations with which schools are typically faced.

A number of events point to the likelihood that schools will shortly be making more intensive and extensive use of the computer. For example, computer equipment is already present in a number of schools as part of the new computer science programs. Also, there seems now to be general agreement that children can indeed learn from computers, even though there are a number of specific questions that remain to be answered. Furthermore, the recent startling advances in miniturization achieved with integrated circuits and the proliferation of computer services available through remote "time shared" terminals have started to have an effect on the heretofore very high

level of costs and thus are likely to hasten the day when educational computer use becomes more widespread.

Despite these factors, applications of computer services to schools will, of necessity, carry obvious constraints. As should be their responsibility, educational administrators will seek equipment and services that entail the minimum cost in both money and time.

Thus, artificial or rare situations demanding large scale commitments of funds and personnel, while contributing to our understanding of the processes of cai, do little to enhance our understanding of the operational utilization of cai systems in the normal school setting. This study attempts to address this problem by seeking to investigate a minimal or utilitarian approach to the introduction of instructional computing in schools and in this way assisting with the imperative task of gaining experience with practical systems so that future developments may have some basis for rational planning rather than relying solely on haphazard trial and error.

III Definition of Terms

A number of specialized words and expressions will be used throughout this study. The definitions that are

used are in accord with acknowledged sources such as Lapedes, (1971), but in addition make specialized reference to unique aspects of content and equipment within the current study.

COMPUTER ASSISTED INSTRUCTION (cai) - This refers to the set of procedures by which the capabilities of the computer are employed to facilitate instruction and learning. For the purposes of this study, cai will refer to a process in which instructional material is carefully sequenced and presented to students by means of an I.B.M. 2741 typewriter terminal controlled by programs stored in the memory of an I.B.M. 360/50 computer system.

PROGRAM - A program is the set of instructions which control the operations of an electronic computer. For the purposes of this study, however, the term will normally be used in the context "computer assisted instruction program" and thus will refer to a set of instructions which guide the computer to present material in a sequence which takes account of student responses. In the present case these materials were prepared by means of I.B.M.'s "Coursewriter III" programming language and were available on the Simon Fraser University computer system.

TERMINAL - A terminal is a point in a telecommunication system where information can either enter or leave the system. In the present case the terminals referred to will be I.B.M. 2741 typewriter terminals.

TIME SHARING - This expression refers to an arrangement whereby the computer can be in conversation with a large number of different terminals. Thus, when one user is idle, the computer can turn to another and either answer his question or perform some task for him.

IV Delimitations

This study will not attempt to determine the motivations of users and non users, rather, it will attempt to determine the characteristics of the two groups. This study will not attempt to relate computer use to organizational variables within the host schools. Also, no effort will be made to determine the amount of learning which took place among students taking the cai courses.

V Outline

In chapter two a review of the relevant literature will be presented. Chapter three will describe the implementation of the study. Chapter four will outline the conduct of the field investigation and present details concerning the various categories of users and non users identified within the study as well as presenting the data determined by the investigations of the selected categories. Chapter five will provide a summary, conclusions and a discussion.

Chapter II

LITERATURE REVIEW

I Introduction

It is the purpose of this chapter to provide a framework for the current study which as has been mentioned deals with the characteristics of computer use in a conventional school setting. In the course of the review, a number of related topics will be discussed briefly in order to show their relevance to the current study. First this section will proceed through an examination of the role of educational technology and educational data processing. Second, the literature as it relates to the computer as an instructional tool will be examined. Finally, and of greater importance, an effort will be made to extract the available information concerning the utilization of the computer for instruction in a normal school setting. Thus it is not the intention of this chapter to conduct an exhaustive review of all collateral literature. This will be treated only in sufficient detail to illuminate the wider context of the present study. However an effort will be made to describe in more detail the studies which have a direct bearing on the topic at hand.

Further, by way of introduction, it should be noted

that the ever increasing impact of technology on most aspects of daily life is obvious. As is evidenced by Drucker's comments about medicine, most of the professions have been quick to adopt appropriate technological advances. For some reason, education seems to be an exception. Although some aspects of today's technology can be found in schools, its utilization in the instructional process in general has been minimal. It is precisely here where, potentially at least, it can have the greatest impact.

Perhaps owing at least partly to this unfulfilled promise, technology's theoretical and practical role in education has been the object of considerable speculation and study. Examples of this would include the work of Ely (1972); Association for Educational Communications and Technology (1972); Heinich (1972); Mayer (1973) and Dettinger and Tapol (1972).

Obviously, the computer with its inherent versatility suggests a potential for wide spread applications in education. Thus, the educational role of the computer is worthy of particular scrutiny. The literature relating to computers in education breaks logically into two broad categories; the computer as an educational data processing tool and the computer as an instructional tool.

II Educational Data Processing

The administrative procedures of a modern school bear enough resemblance to standard business practices that the computer routines used for generalized data manipulation can be fairly readily adapted to the specialized requirements of education. Numerous studies have been conducted which have dealt with one or more of these applications such as:

Ftergiotis's (1972), study of an automated instructional materials management system; Young and Holder's (1972), automated recording system for individualization; Mulski and Levy's (1972) investigation of computerized student report cards and Morgan's (1974), report on student evaluation. Many other studies have been conducted which relate to this important educational utilization of computers. These will not be discussed here however, as they are not directly related to the current study.

III The Computer's Role in Instruction

Of somewhat more central concern to the current study is that body of literature which deals with the computer's role in instruction. This has been the object of considerable investigation and is generally referred to in

the literature as computer assisted instruction.

Although computer assisted instruction is often used as an all inclusive term it contains a number of sub-categories which include the following:

1. DRILL AND PRACTICE -

In this case the computer is utilized as a means of providing students with the necessary experience in the practical application of basic concepts. Mathematics is a subject often chosen for programming of this type, as is exemplified by the work of Suppes (1969), in California.

2. TUTORING -

In this application the system is used to provide the student with the basic information about a topic which may or may not have been previously introduced by a teacher. A typical tutorial program provides some information, questions students about the information, and then proceeds to present further textual material. Sophisticated tutorial programs can include provisions for "branching" and remedial material based on the student's response.

3. SIMULATION -

In this mode the computer is programmed to present a model or representation of an actual situation, such as aircraft flight, heart action, economic trends or historic events. The student can then manipulate this model, and the computer will respond in a manner corresponding to the

effects the student's actions would have had on the real situation. Hall (1970), reported on medical applications of computer simulations, while Lagowski and Bunderson (1968), have discussed simulated Chemistry experiments.

4. INFORMATION RETRIEVAL -

This use of the system most closely resembles the popular conception of the computer as a device that will answer questions. Programs of this type give access to information on selected topics which have been previously programmed into the various memory and storage devices of the computer. Computerized locations of curriculum resources by staff members falls into this category.

5. CALCULATION AND PROBLEM SOLVING -

Here the students use the computer in the mode with which the majority of computer users are familiar. Complex problems involving calculations which may be encountered in Science and Mathematics classes can be readily solved if the student has access to a suitable program. Student prepared programs are designed which not only solve the immediate problem but also provide considerable insight into the basic principles that underlie the question. This configuration is the most useful to schools that offer a computer science program. Jerman (1970), referred to this use as "student research", while Hall (1970), classified the computer in this sense as a "laboratory computing device".

Enough research and experimentation has already been conducted to allow us to make some preliminary generalizations about the computer as an instructional tool. Cai in its various forms can be utilized in a wide variety of curricular areas and at a wide range of grade levels. We now know that cai is an effective instructional medium. Children learn at least as well, and in some cases more rapidly, from cai as they do from traditional instruction. A number of studies confirming this conclusion have been cited in Hedges (1973).

Although we are just beginning our investigations, the majority of the studies that have examined the instructional uses of the computer have contributed useful insights into various aspects of cai. These include studies by Suppes (1969), and Wilson and Fitzgibbon (1970), which compared the results of cai taught and non cai taught classes; and Gilman's (1969), examination of the role played by sequence and format in the presentation of instructional material. Also of value have been the studies of student attitudes carried out by Mathis, Smith and Hansen (1970), Diamond (1969) and Hess and Tenezakis (1973). Multiple student use of individual terminals has been discussed by Bryan (1970). Off-line reading and audio visual assignments were an integral part of the system described by Kromhout, Edwards and Schwarz (1969).

It should be noted that the programming language used can to a certain extent structure the insights to be gained by a particular study. An example of this was Hunka's (1970) study which had several aspects in common with the current work. A few typical schools were selected, a minimum number of terminals were placed in each and the typewriter terminals were connected to a large, general purpose computing centre. The APL language used in Hunka's study is an extremely flexible problem-solving tool but, at least in its original form, is not as well suited to the production of cai courses as is the Coursewriter III language used in the current study. For this reason the teachers and students involved in Hunka's study tended to use the computer system to program powerful problem-solving sequences rather than the tutorial cai programs whose development and use were features of the current study.

IV Strengths and Weaknesses of the Previous Studies

Many of the studies cited and others such as O'Neill's (1970), which reported on the use of a sophisticated I.B.M. 1500 system to teach junior high school Mathematics and Science have relied on very high levels of financial and personnel support. This is atypical of what will happen in schools as computers are introduced for instructional purposes. Educators will seek equipment and services that entail the minimum cost in both money and time. The narrow objectives

of many of the above studies, while revealing important data, do not provide an adequate indication of the impact that the introduction of cai will have. As valuable as their insights undoubtedly are, they deal primarily with issues central to cai's role in specific instructional tasks, rather than with an overview of its utilization.

V Role of the Present Study

What is needed, then, is a general investigation of the ways in which the introduction of computing facilities will have an impact on the instructional procedures of normal schools. When cai becomes part of the broader instructional resource base of schools, how will teachers and students react to this new facility? This study, then, examined the instructional uses made of a minimal cai capability added to schools whose staffs, budgets and programs were not markedly changed. No attempt was made to predetermine the use to which the equipment was put, rather, staff and students were encouraged to make full use of all the capabilities of the computer facility. Thus this study attempted to simulate the way in which computers may well be operationally introduced into schools in the future. This is one way in which experience may be gained with practical systems so that future developments may have some basis for rational planning rather than relying solely on haphazard trial and error.

Chapter III

PROCEDURE

In this chapter the reader is presented with relevant background information regarding the physical setting of the study and its organization and preliminary design.

I Setting of the Study

This study was initiated at a time when a minimal computer assisted instruction capability had been realized at Simon Fraser University. This caI system used the facilities of the University's I.B.M. 360/50 computer and utilized material programmed in the I.B.M. "Coursewriter III" computer language. A number of instructional programmes, mostly designed for use by the University's Chemistry department, were already in use and were available at an on-campus location remote from the computer. This remote location was equipped with "type 2741 communications terminals" which enabled students to have access to the programs. The present study was an extension of the capabilities of the existing system just described.

When this project was first being discussed in the Spring of 1969, a number of teachers and administrators from

several British Columbia school districts expressed interest. Ultimately these included Gold River, Coquitlam and Burnaby as well as North Vancouver and Kelowna. The last two were among the first to be interested and indicated strong support.

Kelowna Secondary School in Kelowna and Handsworth Secondary School in North Vancouver provided a number of contrasts. Kelowna Secondary had a larger enrollment than Handsworth and had a rather typical program of class scheduling - i.e. a time table of the "rotating block" type in which students undertake a number of hours of instruction in various subjects within a five day or seven day module. The senior grades in Kelowna Secondary were organized on a semester basis - i.e. the students concentrate on four subjects for one half of the school year and four more for the second half rather than taking all eight subjects for the full year. Kelowna's setting, although not rural, was several hundred miles from the computer centre, and was therefore less accessible to technical and support assistance than the nearby suburban Handsworth location. Handsworth school, on the other hand, was a smaller secondary school with flexible modular scheduling, this meant that each student had an individual timetable with provision for free periods or "mods". Variations in course load under the Handsworth system tended to provide the

students with more daily free time to use for individual activities such as library study, recreation or class projects, than was the case with students working under other scheduling patterns.

In order to mount a project involving computing resources, it was necessary to seek financial assistance from a number of agencies. After protracted negotiations lasting from September, 1969 until Summer 1970, support was obtained from two corporations, two school boards, a department of Simon Fraser University, the University Computing Centre and a research institute.

The Canadian Laboratory of the International Business Machine Corporation provided the use of a 2741 Communications Terminal for the duration of the project, from September 1970 to June 1971. It also provided a \$3,000 grant to support the development of cai at Simon Fraser, which this project shared with several on-campus users. The British Columbia Telephone Company provided the six necessary "datasets" for the three school terminals and assumed the cost of the leased telephone lines between Simon Fraser University and the two schools.

The Kelowna School Board provided \$2,500 to support the rental of an I.B.M. 2741 terminal. In addition the

Board provided some release time for one teacher and arranged for the terminal to be placed in a book storage room at Kelowna Secondary School. The North Vancouver School Board did not provide direct financial assistance but allowed terminals to be placed in Handsworth Secondary School. In the school, a study area which was partitioned off from a Science preparation room was cleared and made ready for the two terminals.

The Computing Centre at Simon Fraser University provided computer time at no cost to the project. It also absorbed the expense of the more sophisticated communications unit, (I.B.M. model 2703), required to handle off-campus terminals, and provided the assistance of its csi co-ordinator and a system programmer. The Professional Foundations Department of Simon Fraser's Faculty of Education paid the stipends of two graduate students who worked on the project and contributed to the operational expenses.

The Educational Research Institute of British Columbia provided a \$3,000 grant toward the rental of one of the terminals placed in Handsworth School as well as miscellaneous operating and research expenses.

During the Spring of 1970, a small group from the

University and I.B.M. conducted an orientation workshop at Kelowna for some of the staff members of Kelowna Secondary, which was designed as a brief introduction to the computing system and the Coursewriter III language.

By September 1970, the preliminary work was completed and the study could begin. Two separate investigations were carried out. Mr. E. Wong developed criteria for school use of computers by studying slightly different aspects of the same field situation as the one under study in this paper.

II Preliminary Program Preparation

Even though an appreciable number of cai courses were in use at Simon Fraser University prior to the installation of the terminals in the two schools, not all courses were directly useable in the high schools. The majority of the programs had been designed for use by university undergraduate students. However, three Handsworth teachers had spent some time since the Autumn of 1969 learning the Coursewriter III language and preparing courses. By September 1970, these teachers had written six cai courses, (see Appendix 8).

III Conduct of the Study

From the beginning, the plan was to allow the utilization of the computer to develop as naturally as possible once the terminals had been placed in the schools. Thus no attempt was made to give specific direction to either the teachers or the students, other than to acquaint them with the facility and give them some idea of its capabilities. No detailed plan was proposed to the schools or developed by the schools. Rather, an instructional capability was placed in the schools and a preliminary awareness of that capability was created among certain of the Science and Mathematics teachers. Beyond that, the author attempted to capitalize on existing or emerging interests, to make sure that questions and requests for information were responded to and to assist with the developing computer utilization at the two schools. Obviously, throughout the enterprise he was also concerned with gathering data relating to the purposes of the study.

There might be some who would criticise the apparent looseness of the plan. However, as has already been stated in Chapter II, the purpose of the study was to examine the instructional uses made of a minimal cai capability added unchanged to fairly typical secondary schools. To have attempted to manipulate the situation further would have

placed the aims of the investigation in jeopardy. When the original design of this study was being considered, the author had two alternatives. First, he could have created a careful and precise plan which specified the operation of the study and its delimitations with extreme care. This alternative was rejected because, although it would probably have yielded more definitive results, these results would, in all likelihood, have been mere echoes of the results of some of the highly structured studies that have been conducted previously. Also, there were no obvious specifications of this sort to make under the circumstances. For these reasons the author chose to use the second alternative, that of conducting a much less structured study which allowed the users' initiative to operate and which could take advantage of events as they developed. Although lacking in precision and difficult to defend in terms of tightly controlled research, the author and his advisors were of the opinion that the second approach would have the potential for yielding more natural results.

IV Role of the Observer

The author's role was to visit the two schools on a regular basis in order to facilitate the use of the equipment. Specifically his function was to solve logistical problems, provide liaison, and offer instruction

in the use of the equipment and programs. As has been mentioned, this role was combined with that of observer and data gatherer. While the two roles would probably have been better separated, this was not possible for reasons of economics, distance and other factors. The possibility of contamination resulting from this dual role was minimized by utilizing a systematic log record of observations and by making the evaluation instruments either self administered or providing for their administration by outside personnel.

V Data Gathering Techniques

Several separate but related procedures were used to gather information concerning the users and non users. First, an effort was made to create an observational device that would yield useful information. In the absence of other related studies that might have explored this area it was decided to keep a log, (for a sample sheet see Appendix 1). This log was kept by the author and he made regular entries in it during his visits to the schools. While particular emphasis was given to factors associated with computer use and non use, the log was sufficiently open ended to permit the inclusion of observations which, in the opinion of the author, either bore upon the problem directly or indirectly or otherwise provided useful insights.

It was originally planned to use the computing system itself to maintain records of the users, the time they spent on the system and the amount of utilization of the various cai courses. However, when this proved to be impractical, two preliminary questionnaires, one for teachers and one for students (see Appendices 2 and 3), were prepared for administration approximately midway through the year. These questionnaires had two main purposes, first, to gather information judged to be useful and second to provide the author with a basis for the development of the final data gathering mechanisms. These subsequently proved to be three questionnaires and an interview schedule, (see Appendices 4, 5, 6 and 7), and they were administered at the end of the school year.

VI Method of Data Analysis

The data contained in the log (Appendix 1), and the results of the preliminary questionnaires (Appendices 2 and 3), were not extensively analyzed but rather were used as a subjective basis for the identification of the user groups and as an aid in the development of the final data gathering mechanisms. The results of the final questionnaires (Appendices 4, 5 and 6), were tabulated by optical mark sensing equipment and, with the results of the interview schedule (Appendix 7), were summarized and consolidated in

tabular form in order to draw attention to the various relationships. These tables appear in Chapter IV.

Chapter IV

CONDUCT OF THE FIELD INVESTIGATION AND RESULTS

I Conduct of the Field Investigation

From the first of September 1970, the author spent two or three days a week in Handsworth Secondary School and two or three days a month in Kelowna Secondary School in order to observe the development of use patterns and attitudes. He was identified to students and teachers as a combination of "project co-ordinator" and "research observer". He kept an observational log which was of assistance in noting events and recording the reactions of students and staff.

From the beginning of the project the author tried to maintain close contact with the teachers and students in order to facilitate their use of the system. Interested teachers in both schools assisted with the orientation process by contributing announcements for staff meetings and progress reports for staff information bulletins.

One terminal at Handsworth was installed and operational by school opening in September 1970. The second Handsworth terminal was not operational until October 20th because of problems encountered by the B.C. Telephone

Company. The Kelowna Terminal was operating by October 13, 1970.

The six courses written by Handsworth staff members and two others "triang", a mathematics course, and "space", a science course, (Appendix 8), which had been developed at Simon Fraser specifically for use in the schools were all available when the terminals became operational. But even with the addition of some of the Simon Fraser University courses, which were suitable for secondary school students, such as "baleqn", "gaslaw" and portions of "chemex" (Appendix 9), the useable material available could obviously serve only a limited number of classes over a small fraction of the school year.

In order to improve this situation, and in an effort to make cai applicable to curriculum areas other than Science and Mathematics, attempts were made to encourage the development of more courses. However, it soon became apparent that most of the teachers did not have sufficient time to become actively involved to the extent of learning the computer language and developing a course on their own. However, a number of students expressed interest in learning to program, and they were encouraged to learn the language by taking the "irlang" (Appendix 9), course on the computer and then to develop some ideas for possible courses. In one

or two instances a student was able to supply a large part of the information for the course, but, in most cases, they programmed material outlined for them by one of the teachers. As staff interest increased, the tendency seemed to be for more of the organization and preparation of material to be undertaken by teachers, leaving the students to do the actual cai programming.

In both schools several categories of student computer users emerged. "Student" or "formal" users were defined as students who were assigned by their teachers to attempt a particular course. These students were given priority during the school day. "Casual" or "informal" users were students who took a computer course on their own initiative. They were restricted to the half hour immediately following the conclusion of the school day. "Authors" were students who programmed cai sequences. Authors could use the system late in the afternoon, evenings, or at any time during the school day when the terminals were available.

To avoid overloading the space reserved for student registrations on the "disc storage" device at Simon Fraser University, students were not registered for courses until they presented themselves and asked to be given access to the material. These registrations were carried out by

student monitors. Each course also had "dummy" or fictitious students designated "skelo" and "shand" registered for it. This was done to allow "casual" student users, who did not need to be formally registered, to try any course they were interested in even though it was not assigned to them by one of their teachers.

Although several courses were developed and programmed by teachers prior to September 1970, after the beginning of the school year only one teacher did any programming. The course "expo" (Appendix 8), was completed and "debugged" during the Fall. Because it seemed necessary to expand the amount of available cai material, it was decided to capitalize on the initial enthusiasm of the students and allow some of them to begin authoring cai segments. Any student who was interested enough to learn the basic Coursewriter language and who could find a teacher willing to sponsor him, i.e. to assist him with the development of the material and to use the result with a class, was allowed to become an author.

However, student initiative was by no means the sole source of enthusiasm for this activity, in fact in several instances staff members encouraged students to undertake authoring activities and program instructional sequences based on material they thought useful. This approach was

exemplified by the development of the course "french" (Appendix 10).

Although definitive evidence is not available, it was the author's impression that the most successful programming occurred when a student and a teacher were intimately involved in the total process. Whether the initiative came from the teacher or the student did not seem to be so important as the fact that both were involved.

Each school did not have to rely solely on its own resources in the development of program materials. Both used Simon Fraser produced courses extensively. In addition, Kelowna Secondary also used several Handsworth courses. However, Handsworth did not use any material written in Kelowna, perhaps because the latter school operated on a two semester system, which meant that most of the courses were developed for a schedule that did not match Handsworth's.

Despite this, a number of the Kelowna courses aroused the interest of Handsworth staff members. One Handsworth course, "sigfig" (Appendix 8), was used by a Simon Fraser first year Chemistry laboratory instructor.

As the project progressed, it became evident to the writer that a "sorting" process was occurring naturally among the staff and students at the two schools. The limited number of courses available (Appendices 8, 9 and 10), automatically excluded large numbers of teachers and pupils who were concentrating their work in curriculum areas not covered by available cai programs. However, even among teachers who taught in subject areas where cai materials were available, some actively participated with students in preparing courses, others used the prepared courses but did not help to develop materials, while still others paid almost no attention to the system. Students showed similar patterns of use and non-use, to those demonstrated by teachers. After observing these patterns for some weeks, it was apparent that nine fairly distinct user and non-user groupings could be identified. These groups were considered as the most obvious categories which characterized the types of use or non-use of the available cai system.

The author's personal observations and contacts with students and staff led him to develop the categories as he observed the various individual responses to the cai system. The results of the teacher (Appendix 2), and student (Appendix 3), general questionnaires tended to confirm the author's observations of the wide variations in attitudes and usage which both students and staff exhibited toward the

computer system. This very diversity seemed to demand categorization before any attempt at further investigation was made. Although not mutually exclusive the groupings are an attempt to categorize a developing and fluid situation.

II The General Categories of Users and Non-Users

The nine categories recognized were:

A. Teacher Categories:

Category I Teachers using the existing cai programs, but not authoring new programs.

Those staff members who recommended at least one computer course to one or more of their classes made up this group.

Category II Teachers both authoring new cai programs and using existing cai programs.

This group included staff members who were not only recommending courses, but who also assisted in some way with the preparation of material for at least one of the computer courses. In some cases they programmed the course themselves but in most instances they were course developers working with student programmers.

Category III Teachers who did not use cai because there was no material available appropriate to their subject area or grade level.

At least fifteen teachers in each school fell into

this class. As the number of cai courses was limited, there were some curriculum areas which were unable to make use of the system. Examples of this were Home Economics and Physical Education. It should be emphasized that neither of these subjects should be considered as being outside the potential province of cai, but only that they were not involved in this particular application of cai.

Category IV Teachers whose students did not use the available material, even though they were enrolled in courses for which some cai programming was available.

In both schools there were examples of staff members at the same grade level not taking advantage of the identical materials that their colleagues in the same department were using. Although in some instances these teachers maintained that they were indeed assigning students to the courses, in comparison with the Category I and II teachers, very few of their students appeared as system users.

B. Student Categories:

Category V Students using programs assigned by a teacher.

In some instances individual students or small groups were assigned computer course work. In others, whole classes were encouraged to attempt various courses. Students who followed their teachers suggestions and "signed on" to the recommended courses comprise this category.

Category VI Students using programs on their own initiative.

This group consisted of students who sought out courses on topics that interested them, although they had not been formally assigned to the programs.

Category VII Students both authoring new cai programs and using existing cai programs.

This group of students contained those who learned the cai authoring language (Coursewriter III) and, with varying degrees of assistance from staff members in the selection and development of the material, programmed a cai sequence ("course").

Category VIII Students who did not use the system because they were attending classes not assigned cai related course work.

While the subject areas and grade levels that had course material available were diverse (Appendices 2, 3 and 4), some students were excluded from cai use because there was no material on the system for their courses. However, some of these students, on their own initiative, located material that was interesting to them individually. They were not, however, formally assigned any computer courses.

Category IX Students who did not use the system even though they were assigned one or more computer courses.

This group contained those students who did not try the courses although the material was recommended to them by

their teachers.

The above categories are not suggested as being necessarily all inclusive, nor should they be thought of as being particularly rigid or unchanging. As the categories are composed of individuals there are bound to be various individual exceptions to the groupings. Also, changes in the available material and in the attitudes of individuals would likely lead to migration among the categories. It is quite conceivable that some users might become non-users as well as the reverse situation. Differing organizational procedures in some other school situation would quite possibly also lead to changes in the observable characteristics of the groups. It should probably also be assumed that the categories would tend to change over time and as the cai system evolved. These nine categories were, however, the groupings that appeared to form among the staff and students exposed to the computer facility in the particular set of circumstances under study.

It should be emphasized that any attempt to categorize humans and their activities obviously results in, at best, only a rough approximation of reality. Some of the categorizations developed by the author are, perhaps, intuitively obvious or result from natural groupings dictated by the constraints of the experimental situation.

Even so, an element of arbitrariness is almost bound to result from any attempt to describe categories. An example of such an intuitively obvious category would be Category III which contains the teachers not using the system because of a lack of suitable material in their teaching areas.

Fortuitous circumstance played a large part in determining the placing of individuals in the various categories at the two schools. This was particularly true of the individuals in the non-author user categories, (I and V). For example, for a teacher to be included in Category I might depend on a number of chance events as well as on his or her personal interest. These could include the fact that someone at the University had happened to produce a program that was useful to that individual, a staff-room conversation with someone involved in the project or even enquiries from students. Similarly, the students in Category V were often more influenced by who their teacher for a particular subject happened to be or by the enthusiasm of a friend than by their own interest.

While it is obviously true that Categories I and V, the teacher and student users, represent important segments of the total population, the heaviest users of the computer system were not members of either of these groups. It is among the members of categories II and VII, the teacher and

student author/users, that the individuals making the heaviest use of the computer system will be found. Most of the teachers who were using computer programs extensively with their classes are included in Category II. Category VII contains students who, with few exceptions, made a point of sampling most of the already available cai programs as well as actively programming cai sequences of their own.

III The Categories Selected for Study

Rather than attempt a detailed analysis and description of all nine categories, with the attendant problems of differentiation, the author and his advisors chose an alternate plan. It was felt that it would be better to select the extremes of the use spectrum and concentrate on the most obvious intensive and extensive users on the one hand and on those who ignored the system despite opportunity on the other. A supplementary investigation of some individuals in Categories V and VI, the student users, was, however, carried out.

Thus, the four out of the original nine categories which were selected for the primary investigation were the following two teacher and two student groups:

Category II Teachers both authoring new cai programs
and using existing cai programs.

Category IV Teachers whose students did not use the available material, even though they were enrolled in courses for which some cai programming was available.

Category VII Students both authoring new cai programs and using existing cai programs.

Category IX Students who did not use the system even though they were assigned one or more computer courses.

As stated in chapter three, the original plan of using the computing system to store data on users etc. had to be abandoned. As an alternative, the various data gathering instruments referred to in chapter three were designed. More specifically, as events unfolded, the four selected categories were analyzed as follows.

The student author group, Category VII, which contained relatively few individuals, was examined by means of an interview schedule, (Appendix 6). The other student group and the two teacher groups were studied by means of questionnaires, (Appendices 4, 5 and 7), which were tabulated by optical mark sensing equipment. In an attempt to gain further insight into the composition of the selected groups several supplementary investigations were also carried out. The questionnaires issued to the two teacher groups and the large student group, Category IX, had been

designed to preserve the anonymity of the individuals involved. As the members of the two teacher categories in question were almost all known to the author he was able to obtain data which allowed him to examine the factors of sex, years of experience and educational background. Although the members of the student author group, Category VII, were also known to the author he did not know the individuals in the large student non user group, Category IX. For this reason, the group characteristics of this category were derived from the minimal computer records that did exist rather than from the group issued the questionnaire. The two student categories were then compared for the factors of sex, grade level and grade point average or I.Q.

Although Categories V and VI were excluded from the primary investigation, a secondary investigation of the records of a group of students from these categories were examined in an effort to investigate the possible interaction between the sex of the user and the utilization of the cai courses.

The results of some pertinent questions on a questionnaire issued independently by the Handsworth school administration were also included.

IV Results of the Investigations

A. Teacher Categories

1. Category II

As has been previously stated, Category II (Teachers both authoring new cai programs and using existing cai programs) contained those teachers who were involved to some extent in the preparation of course material for the computer. Information from the thirteen teachers in this group was collected by questionnaire. In addition, data regarding sex, teaching experience, and educational background was available for eleven of the thirteen teachers who completed the questionnaire. Of these eleven, seven were on the Handsworth staff and four were at Kelowna. A teacher at Handsworth was the only female in this group. All of the teachers in the group had Bachelor's degrees (in one case two), three had Master's degrees and one individual had two Master's degrees. Their teaching experience ranged from one year to over twenty years. (See Table II)

As no high school cai course was allowed on the system unless the material was at least reviewed by a specific teacher, identifying the members of this category was a simple task. A questionnaire (Appendix 4) was devised to survey the extent of their involvement with the system. The author gave the questionnaire form to each teacher in the group and was present while most of them were completed.

The results of the questionnaire survey of this user group are summarized in Table I:

Table I.

Summary of Responses

Category II

(Handsworth and Kelowna combined N=13)

1. Were you able to recommend any of the computer programs to your students this year?

	Number in category	%
A. Yes	11	84.6*
B. No	2	15.4
C. No response	0	0.0
	13	100.0

2. If so, how many programs?

A. One	4	30.8
B. Two	4	30.8
C. More than two	3	23.1
D. No response	2	15.4
	13	100.0

3. Did you participate in the development of any computer courses this year?

A. Yes	12	92.3
B. No	0	0.0
C. No response	1	7.7
	13	100.0

4. If so, how many courses?

A. One	7	53.8
B. Two	4	38.5
C. More than two	1	0.0
D. No response	1	7.7
	13	100.0

5. How much time did you spend working on the course(s)?

A. Less than one hour	1	7.7
B. 1 - 5 hours	8	61.5
C. 5 - 10 hours	1	7.7
D. More than 10 hours	3	23.1
E. No response	0	0.0
	13	100.0

6. Are you satisfied with the results?

A. Yes	8	61.5
B. No	4	30.8
C. No response	1	7.7
	13	100.0

7. If not, would you describe your courses as:

A. Completely unusable	1	7.7
B. Usable with major refinements	1	7.7
C. Usable with minor refinements	4	30.8
D. No response	7	53.8
	13	100.0

8. If the computer terminal is available next year, how many courses do you expect to be able to use with your students?

A. The same number as this year	3	23.1
B. Fewer than this year	1	7.7
C. More than this year	9	69.2
D. No response	1	0.0
	13	100.0

9. Would you like to be involved in the preparation of courses next year?

A. Yes	12	92.3
B. No	1	7.7
C. No response	0	0.0
	13	100.0

10. If so, how much time do you expect to spend on this activity?

A. The same as this year	3	23.1
B. Less than this year	2	15.4
C. More than this year	7	53.8
D. No response	1	7.7
	13	100.0

11. If you used student programmers to assist you with the course preparation were you pleased with their work?

A. Yes	9	69.2
B. No	2	23.1
C. No response	1	7.7
	13	100.0

12. Would you like to have the assistance of student programmers for any future course work in which you may be involved?

A. Yes	12	92.3
B. No	1	7.7
C. No response	0	0.0
	13	100.0

Judging by the responses to question one, Category II should perhaps have included only teachers contributing to the development of new program materials as two of the thirteen teachers, although at least interested enough to allow themselves to become involved with the efforts of a student author, did not satisfy the criteria for the second part of the category definition. This would indicate that there perhaps should have been a teacher sub-category "cai program author sponsors". Presumably any such category would be temporary because when the time came to make the decision to either use the program or abandon the attempt the teacher would enter one of the other categories.

With the possible exception of the one individual who made no response, the answers to question three confirmed that these individuals were correctly placed in this category. The variety of responses to question five would seem to reflect the fact that the extent of commitment to course development varied widely among the teachers in the category. Some did most of the preparation of material and, in one case, even some of the programming themselves. For others the commitment was merely to oversee the development of a student's ideas for course material. The majority (over 60%) were satisfied with their courses (question six). For those who were not satisfied and for one individual who wished to qualify his positive

response to question six, question seven allowed them to express their opinions as to the seriousness of their course's shortcomings.

Regardless of their attitude toward the courses under development during the experimental year, the teachers in all but one instance (question 8) felt that they would actually be using the same number or more courses with their students during the next school year. Questions nine and ten give further evidence of this favourable attitude, because only one teacher (question 9) did not want to repeat the experience while, in question ten over fifty percent expected to increase their involvement.

The following table will serve to summarize the personal data for the members of this group:

Table II

Comparison of Sex, Teaching Experience
and Educational Background of
Category II

Teachers: (Handsworth and Kelowna)

School	Sex	Years Experience*	Educational Background
Handsworth	M	3	Bachelor's degree
	M	3	Bachelor's degree
	M	2	Bachelor's degree
	M	1	Bachelor's degree
	M	5	Master's degree
	M	1	Master's degree
	F	2	Master's degree
Kelowna	M	2	Bachelor's degree
	M	2	Bachelor's degree
	M	5	2 Master's degrees
	M	2	2 Bachelor's degrees

* The numbers in the "experience" column refer to the following scale: 1-5 years = 1; 6-10 years = 2; 11-15 years = 3; 16-20 years = 4; and 21 years or over = 5.

A member of this group, then, was typically a male with a Bachelor's degree and less than ten years of teaching

experience. It would seem that the majority of the members of this group were very interested in the system and, though hampered by lack of time, were anxious to continue and further increase their involvement with cai

2. Category IV

As previously stated, Category IV, (Teachers whose students did not use the available material, even though they were enrolled in courses for which some cai programming was available), contained those teachers who did not appear to be utilizing the cai programs unlike their Category I or II colleagues who were teaching the same courses.

Identifying the members of Category IV presented some difficulties. In order to determine which of the eligible teachers were not actually using the computer system it was necessary for the author to rely on the somewhat fragmentary records available from the computer itself (see Appendix 11) and, particularly in the case of Kelowna, on the opinions of some of the Category II teachers as well as his own observations. There are then, a number of possible sources of error which could have led to some teachers who belonged in Category I being included in Category IV. For example, malfunctions within the computer hardware or the master operating program of the cai

system could easily have resulted in the records of that particular teacher's students being destroyed. It is also possible, but not likely, that either the author, or some of the teachers whose opinions he sought on this matter, were unaware of a particular teacher's involvement.

Accepting these ambiguities, twenty-two teachers were assigned to this category and a questionnaire survey (Appendix 5), designed to identify possible reasons for their non-use, was administered in an identical manner to the Category II questionnaire.

Personal data was available for eleven of the twenty-two Category IV teachers. Of the eleven, five were from Handsworth and six from Kelowna. Three of the Handsworth and two of the Kelowna teachers were female. All of these teachers had Bachelor's degrees, one individual had two Bachelor's degrees and there were two holders of Master's degrees. Their years of experience ranged from less than five to over twenty (see Table IV).

The results of the questionnaire survey of this user group are summarized in Table III:

Table III

Summary of Responses

Category IV

(Handsworth and Kelowna combined N=22)

1. Were you able to recommend any of the computer programs to your students this year?

	No. in	%
	Category	
A. Yes	10	45.5*
B. No	12	54.5
C. No response	0	0.0
	22	100.0

2. If so, how many?

A. One	4	18.2
B. Two	2	9.1
C. More than two	3	13.6
D. No response	13	59.1
	22	100.0

3. If you did not make use of the computer, which, if any of the reasons listed best describes your reason for not using the computer?

A. I didn't think computer-assisted instruction should be used in my subject area.	2	9.1
B. I had no time	8	36.4
C. There were no programs in my subject	2	9.1
D. I did not like the programs which had been prepared for my subject	1	4.5
E. I did not like the idea of my students using the computer	0	0.0
F. I felt my student's time could be better spent in other ways	0	0.0
G. I did not have enough information about the computer	4	18.2
H. None of the above	2	9.1
I. No response	3	13.6
	22	100.0

4. Do you plan to use the computer with your students if it is available next year?

A. Yes	14	63.6
B. No	7	31.8
C. No response	1	4.5
	22	100.0

5. Which of the following changes would be the most likely to encourage you to make some use, or more use, of the computer?

A. More courses for your subject area	6	27.3
B. A better opportunity to influence the content of the courses	2	9.1
C. More free time to become involved with the computer system	6	27.3
D. More information about what is available	1	4.5
E. Some in-service material on cai and the programming language	4	18.2
F. None of these	3	13.6
G. No response	0	0.0
	22	100.0

6. Do you regard the computer as a teaching aid that could be used with a whole class rather than just selected individuals?

A. Yes	7	31.8
B. No	14	63.6
C. No response	1	4.5
	22	100.0

7. Do you think its use is limited to outstanding pupils with initiative for independent work?

A. Yes	5	22.7
B. No	16	72.7
C. No response	1	4.5
	22	100.0

8. Would you like to see the computer terminal left in the school for a further year?

A. Yes	21	95.5
B. No	0	0.0
C. No response	1	4.5
	22	100.0

* Percentage figures refer to percent of number of respondents

The responses to question one illustrate the problems, discussed earlier in the chapter, of identifying the members of this category. Although over half, (54.5%), of the group confirmed that they had not been making use of the system, 45.5% claimed that they had. Of the reasons for non-use explored by question three only two of the eight reasons given attracted more than 10% of the responses. "I had no time" with 36.4% was the most important reason given. Of secondary significance was "I didn't have enough information about the computer" at 18.2%. It is possibly

significant that only three of the twenty-two teachers did not respond to this question whereas, theoretically, all ten of the teachers who replied in the affirmative to question one should not have responded. This may indicate that some of these teacher's use of the system was minimized by the same difficulties encountered by the teachers who made no use of the computer. In question five more free time and more courses were identified as the major requirement which might lead to higher utilization by this group. With the exception of one teacher who didn't reply even this "non-user" group expressed interest in having the computer terminal remain in the school for a further year.

The following table will serve to summarize the personal data for the members of this group:

Table IV

Comparison of Sex, Teaching Experience
and Educational Background of
Category IV
Teachers (Handsworth and Kelowna)

School	Sex	Years Experience*	Educational Background
Handsworth	M	2	Bachelor's Degree
	F	3	2 Bachelor's Degrees
	F	5	Bachelor's Degree
	F	5	Master's Degree
	M	3	Master's Degree
Kelowna	M	5	Bachelor's Degree
	F	2	Bachelor's Degree
	M	2	Bachelor's Degree
	M	2	Bachelor's Degree
	M	1	Bachelor's Degree
	F	2	Bachelor's Degree

* The numbers in the "experience" column refer to the following scale: 1-5 years = 1; 6-10 years = 2; 11-15 years = 3; 16-20 years = 4; and 21 years or over = 5.

A member of this group was typically an individual with a Bachelor's degree and less than ten years of teaching

experience. Both sexes were well represented in this category. The two categories did not differ systematically with the possible exception of the variable of sex.

B. Student Categories

1. Category VII

As previously stated, Category VII (Students authoring programs), contained those students who were registered as the authors of one of the high school courses (Appendix 10). This group was also very readily identified because of their association with a particular course. Seventeen students were assigned to this category and an interview schedule (Appendix 6) was designed in an attempt to gain some insight into this group of students and their motivations. The interviews were carried out by two Simon Fraser University students who were not directly involved with the project. Of the seventeen Category VII students, two female and nine male students were from Handsworth and two female and four male students were from Kelowna. The intelligence quotient and either letter grade achievement (Kelowna) or grade point average (Handsworth) was available for sixteen of the seventeen students. With one exception the letter grade and I.Q. ratings were all above C. The Kelowna students were generally achieving at a level consistent with their I.Q. ratings. Several of the Handsworth students, however, were apparently

"underachieving" (see Table VII).

The results of the personal interview with the members of this group are summarized in Table V:

Table V

Summary of Responses

Category VII

(Handsworth and Kelowna Combined N=17)

1. Who first told you about the Computer?

	NO.	%
A. Teacher	6	35.3
B. Friend	4	23.5
C. Other sources	7	41.2
	17	100.0%

2. What attracted you to the computer after you first heard about it?

A. "Sounded interesting"	3	15.8
B. "Something new"	5	26.3
C. "Curiosity"	2	10.5
D. "Interest in machinery"	6	31.6
E. "Sounded like fun"	3	15.8
	19	100.0%

3. What made you decide that you wanted to author a course?

A. Interest	6	35.3
B. Wanted to be able to use or program a computer	5	29.4
C. Teacher request	2	11.8
D. Friends authoring	3	17.6
E. Learn more	1	5.9
	17	100.0%

4. How did you learn Coursewriter III (the programming language)?

A. I.B.M. manuals	10	45.5
B. irlang	7	31.8
C. Other authors	5	22.7
	22	100.0%

5. How many courses did you work on as an author this year?

A. One	15	88.2
B. Two	2	11.8
	17	100.0%

6. How many courses did you complete?

A. One	3	18.8
B. Incomplete	13	81.2
	16	100.0%

7. When did you start authoring your first course?

Variable dates from October to June.

8. How much time do you think you have spent on cai during the year in total, including terminal time, time spent preparing material away from the terminal, and student supervisor monitor time?

100 + hours	17	100.0%
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9. Why were you willing to spend so much of your time working with cai?

A. Interesting	10	40.0
B. New	2	8.0
C. Enjoyable	7	28.0
D. What else	5	20.0
E. Worthwhile	1	4.0
	25	100.0%

10. Do you think you will find the experience helpful to you after you leave Secondary school?

A. Yes	14	82.4
B. No	3	17.6
	17	100.0%

11. In what way - or why not?

A. For future computer work	5	38.5
B. Experience	2	15.4
C. University	4	30.8
D. Teaching	2	15.4
	13	100.0%

12. If the computer is available to you next year, would you like to author any more courses?

A. Yes	16	94.1
B. If time	1	5.9
	17	100.0%

13. If so, in what subject?

A. Any	2	14.3
B. Science	4	28.6
C. Science and Math	2	14.3
D. Social Studies	3	21.4
E. Spanish	1	7.1
F. Industrial Arts	1	7.1
G. Electricity	1	7.1
	14	100.0%

14. Did any of your teachers suggest that you take any courses on the computer this year?

A. Yes	14	82.4
B. No	3	17.6
	17	100.0%

15. If so, what courses?

A. Chemistry	9	36.0
B. English	1	4.0
C. Other Science	8	32.0
D. Math	7	28.0
	25	100.0%

16. Did you complete them?

A. Yes	16	94.1
B. No	1	5.9
	17	100.0%

17. If not, why did you not complete the courses?

"Bored with code"*

*"Code" - a grade nine Science course.

18. Did you like the courses?

A. Yes	11	78.6
B. Partly	2	14.3
C. No	1	7.1
	14	100.0%

19. What one major improvement would you like to see in the courses?

A. Flexibility	6	22.2
B. No change	3	11.1
C. More imaginative and interesting	13	48.1
D. Various operational improvements	2	7.4
E. More audio visual courses.	1	3.7
F. More branching	1	3.7
G. More difficult material	1	3.7
	27	100.0%

20. A number of students, who were asked to take courses, did not do so. Why do you think this was so?

A. They were not interested	8	38.1
B. No time	4	19.0
C. Lazy	3	14.3
D. The courses were compulsory	2	9.5
E. Too much "down time" and crowding	2	9.5
F. They were afraid of the computer	2	9.5
	21	100.0%

21. What was the main difficulty you encountered as an author?

A. Lack of time	5	31.3
B. Various operational problems	7	43.8
C. Learning the language	3	18.8
D. Lack of a sponsor	1	6.3
	16	100.0%

22. Would you like to see the computer terminal in the school next year?

A. Yes	17	100.0
B. No	0	0.0
	17	100.0%

* Percentage figures refer to percent of total responses rather than percent of number of respondents.

The responses to a number of related questions (numbers two, three and nine) indicated that personal interest and enthusiasm for new experiences played an important role in attracting these students to the computer terminal. Question eight revealed just how much time these students reported they spent working with the computing system; without exception they reported spending in excess of 100 hours. In most cases, much of this time was accumulated after regular school hours.

The answers to question twelve indicated continuing enthusiasm for the activity, all members of the group wished to continue as authors although one individual had some reservations about the amount of time available. Question sixteen revealed that a high percentage of these students said that they had completed computer courses which they had been assigned by their teachers. Without exception the students in Category VII wished to see the terminal remain in the school for a further year. (Question twenty-three).

The following tables will serve to summarize the personal data and achievement for the members of this group:

Table VI

Summary of Personal Data for
Category VII

School	Sex	Grade Level	Letter Grade Achievement or G.P.A.	I.Q.
Hands- worth	M	11	2.97	B-
	M	11	2.05	B
	M	11	2.28	C+
	M	11	.50	C
	M	11	2.93	A
	F	12	2.37	C+
	F	12	3.78	A
	M	12	Incomplete	N/A
	M	12	1.41	C+
	M	10	2.37	C+
Kelowna	M	9	2.87	B
	M	11	=B	B
	M	12	=B	B
	F	11	=B	B
	M	11	=A	B
	F	11	=C+	B
	M	12	=C+	B

Mean Hansworth G.P.A.	= 2.35
Mean Kelowna Letter Grade	= B
Mean Hansworth I.Q.	= B-
Mean Kelowna I.Q.	= B

Table VII

Category VII

Summary

Sex: M = 13 F = 4

G.P.A. or letter grade achievement - Mean:

Hansworth = 2.35 Kelowna = B

I.Q. Mean

Hansworth = B- Kelowna = B

Modal Grade Level:

Hansworth = 11 Kelowna = 11

Were recommended courses completed?

Yes = 94.1% No = 5.9%

Attitude toward retention - 100% in favour
of C.A.I. system

Administrative Procedures:

Hansworth - modular schedule

Kelowna - non-modular schedule

A member of this group was typically a male in grade eleven with a "B" I.Q. rating. Many of the student authors at both schools engaged in extra-curricular activities. For example, five of the six Kelowna authors were either on the Student Council or were involved with the graduating class committee, while five of the eleven Handsworth authors were involved in their school's music program. One member of this group plus three of the remaining Handsworth authors were very interested in electronics.

2. Category IX

As previously stated, Category IX (students who did not use the system even though they were assigned one or more computer courses) contained those students who were not using the system, even though they had been assigned computer programs by their teachers. Identification of individuals was again a problem with this category. As the school year continued and the demand for courses increased it was no longer possible to register whole classes on the system. Therefore, it became necessary to register students only when they reported to the terminal room. Thus, year end "student status" data on students defined as "non-users" was not available. For this reason, when the questionnaire for this category was devised (Appendix 7), it was determined that the instrument itself would sort the non-users from the users. Accordingly, the author

administered the questionnaire to the Science and Mathematics classes known to have been assigned computer courses by the teacher user group. The 228 individuals investigated by this questionnaire, therefore, included both student users and non-users. The questions themselves attempted to ascertain some of the reasons why certain students did not make use of the system. No personal data was available for this group, however, so when comparisons between Categories VII and IX were made it was necessary to use the available computer records. Fortunately, the records of some class groups that had been registered early in the year for Science and Mathematics cai courses had been retained in the system for most of the year. Records from April were therefore used to identify individual non-users in the two schools. Of the 380 non-users so identified 170 males and 154 females were from Handsworth and 22 males and 34 females were from Kelowna. Some of these individuals were most likely also members of the group of 228 students investigated by the Category IX questionnaire. Grade point average records were available for the Handsworth group and average letter grade achievements for the Kelowna group. Neither group exhibited either above or below average achievement (see Table X).

The questionnaire results for this category are summarized in Table VIII:

Table VIII

Summary of Responses

Category IX

(Handsworth and Kelowna Combined N=228)

1. Did any of your teachers mention the computer to you at any given time during the year?

	No.	%*
A. Yes	217	95.2
B. No	9	3.9
C. No response	2	.9
	228	100.0%

2. If so, did they?

A. Mention only the computer itself	19	8.3
B. Mention a specific course	40	17.5
C. Recommend a specific course	66	28.9
D. Recommend a specific course several times	93	40.8
E. No response	10	4.4
	228	100.0%

3. Did you do any work on the computer courses that your teacher recommended?

A. Yes	107	46.9
B. No	111	48.7
C. No response	10	4.4
	228	100.0%

4. Did any of the students in your classes mention the computer to you?

A. Yes	193	84.6
B. No	31	13.6
C. No response	4	1.8
	228	100.0%

5. If so, were their comments mainly:

A. Favourable	149	65.4
B. Unfavourable	3	1.3
C. Neutral	34	14.9
D. You can't summarize their remarks	21	9.2
E. No response	21	9.2
	228	100.0%

6. If mainly favourable, were they referring to:

A. The idea of C.A.I.		
in general	84	36.8
B. To one or more specific		
C.A.I. courses?	59	25.9
C. Neither applies	41	18.0
D. No response	44	19.3
	228	100.0

7. If mainly unfavourable, were they referring to:

A. The idea of C.A.I. in		
general	7	3.1
B. To one or more specific		
courses?	11	4.9
C. Neither applies	54	23.7
D. No response	156	68.4
	228	100.0%

8. If you didn't do any work on the course that your teachers recommended, was the reason related to:

A. The material in the particular		
C.A.I. course	6	2.6
B. C.A.I. in general	7	3.1
C. Other personal reasons	104	45.6
D. No response	111	48.7
	228	100.0%

9. If you answered "A" in question #8 did you think that this particular computer course would be:

A. Too hard	2	.9
B. Too easy	1	.4
C. Not interesting	2	.9
D. Something you already knew	4	1.8
E. Something not worth knowing	1	.4
F. No response	218	95.6
	228	100.0%

10. If you answered "B" for #8, was it because:

A. You didn't know how to use the computer	4	1.8
B. The computer terminal was already busy	5	2.2
C. The computer wasn't working when you tried to use it	2	.9
D. There was no one in the terminal room to help you when you tried to use the computer	1	.4
E. No response	216	94.7
	228	100.0%

11. If you answered "C" for #8, was it because:

A. You didn't think you would like using the computer	4	1.8
B. You had no time	63	27.6
C. You weren't interested	15	6.6
D. Felt it was an impersonal way of teaching	1	.4
E. Felt that I wouldn't be able to operate the computer	12	5.3
F. No response	133	58.3
	228	100.0%

12. Do you think that the computer terminal should be kept in the school for another year?

A. Yes	211	92.5
B. No	13	5.7
C. No response	4	1.8
	228	100.0%

* Percentage figures refer to percent of number of respondents.

It is shown in question one that 95.2% of this group claimed that their teachers had mentioned the computer. Indeed, in question two, 40.8% recalled that a specific course had been mentioned several times. In spite of this, 111 or 48.7% admitted that they had not worked on the

recommended courses. In question eight the majority of those responding cited "other personal reasons" for not working on the courses. When this was explored further in question eleven, the largest group of those responding to this question indicated lack of time. Even though a large number of individuals in this group had not used the computer, 92.5% felt that it could be retained in the school.

The following tables will serve to summarize the personal data and achievement or I.Q. rating for the members of the two school groups in this category:

Table IX

Summary of Personal Data for
Category IX

Handsworth Achievement G.P.A.	Grade Level			Totals	
	9	10	11		
	F= 0	F= 1	F= 1	F= 2	
4.0	M= 0	M= 0	M= 1	M= 1	3
	F=15	F= 3	F= 4	F=22	
3.5 - 3.9	M= 2	M= 2	M= 4	M= 8	30
	F=22	F= 9	F= 3	F=34	
3.0 - 3.4	M= 5	M= 4	M= 5	M=14	48
	F=27	F= 7	F= 6	F=40	
2.5 - 2.9	M=27	M=12	M=11	M=50	90
	F=25	F= 7	F= 8	F=40	
2.0 - 2.4	M=27	M=14	M= 5	M=46	86
	F= 8	F= 4	F= 0	F=12	
1.5 - 1.9	M=11	M= 9	M= 6	M=26	38
	F= 2	F= 0	F= 0	F= 2	
1.0 - 1.4	M= 4	M= 4	M= 6	M=14	16
	F= 0	F= 0	F= 1	F= 1	
.5 - .9	M= 4	M= 1	M= 2	M= 7	8
	F= 1	F= 0	F= 0	F= 1	
0 - .4	M= 2	M= 1	M= 1	M= 4	5

Total M = 170' Mean = 2.47

Total F = 154

N = 324

Kelowna

I.Q.

Grade Level

Letter Grade	11	12	Totals	
	F= 0	F= 0	F= 0	
A	M= 0	M= 0	M= 0	0
	F=11	F= 0	F=11	
B	M= 4	M= 4	M= 8	19
	F=10	F= 2	F=12	
C+	M= 3	M= 2	M= 5	17
	F= 5	F= 2	F= 7	
C	M= 5	M= 1	M= 6	13
	F= 3	F= 0	F= 3	
C-	M= 1	M= 1	M= 2	5
	F= 0	F= 1	F= 1	
D	M= 0	M= 1	M= 1	2
	F= 0	F= 0	F= 0	
E	M= 0	M= 0	M= 0	0

Total M = 22 Mean = C+

Total F = 34

N = 56

Table X

Category IX

Summary

Sex M = 192 F = 188

G.P.A. MEAN:

Handsworth = 2.47

I.Q. MEAN:

Kelowna = C+

MODAL GRADE LEVEL

Handsworth = 9 Kelowna = 11

Were recommended courses completed?

Yes = 46.9% No = 48.7% No response = 4.4%

Attitude toward retention - 92.5% in favour of

C.A.I. system

Administrative Procedures:

Handsworth - modular schedule

Kelowna - non-modular schedule

A student in this group is difficult to categorize. On the whole the members of the non-user category were younger and had a lower G.P.A. or I.Q. rating than the members of the student author category. This comparison is

found to have no substantial basis, however, when the disparities in sample size and survey techniques are considered.

V. Supplementary Observations

A "student status" compilation of a portion of the registered student users (Categories V and VI) was available from the computer records at the end of June 1971. A summary tabulation of this data now comprises Appendix 11.

It should be noted also that most students spent over twenty minutes on the courses. With two exceptions fewer girls than boys used the individual courses. A Chemistry Course, c101, and a Mathematics Course, sigfig, with over forty registered students each, were the two courses with the highest utilization in this sample.

The administration of Handsworth School devised two sets of questionnaires at the end of the school year, one given to the students and one to their parents. This Handsworth study was completely independent of the Simon Fraser work but the results of the following questions from the school questionnaires have a direct bearing on the current study:

A. Student Questionnaire

Question No. 32

"Have you used the Handsworth computer assisted instruction this year?"

A. Yes	31.2%
B. No	61.8%
C. No response	7.0%

Question No. 33

"If so, how many times?"

A. One	9.2%
B. Two	6.8%
C. Three	6.1%
D. Four	4.3%
E. Five or more	8.6%
F. No response	65.0%

B. Parent Questionnaire

Question No. 30

"Has your son or daughter used the Handsworth computer assisted instruction this year?"

A. Yes	21.1%
B. No	60.0%
C. No response	12.8%

Chapter V

SUMMARY AND CONCLUSIONS

I. Conclusions

The results of the investigations discussed in Chapter IV allow for further comment concerning the questions posed in Chapter I:

1. Were there any discernable factors that would serve to differentiate between teacher users and teacher non-users?
2. Were there any discernable factors that would serve to differentiate between student users and student non-users?
3. What factors affected the use of the system by teacher users?
4. What factors affected the use of the system by student users?
5. Were there any suggestions derived from this investigation that would be useful in either refining subsequent similar investigations or assisting with any future implementation of such a system?

It was found that there were no apparent differences between the teachers in the two categories. When a general comparison of the responses to the items on the two

questionnaires is made, however, it may be observed that there is a difference in enthusiasm for the computer course work and particularly in the willingness to devote time to cai activities. The category II teachers were spending considerable amounts of time on cai: 30% reported more than five hours spent on course preparation alone. With one minor exception, none of these teachers was given any special consideration in terms of free time, that would make their situation different from any of the eight teachers in Category IV (36.4%) who "had no time". This in spite of the fact that fellow staff members and Simon Fraser personnel under-took to inform them, by means of personal conversations and printed information sheets, about the courses available and the procedures for registering their pupils at the computer terminals. Had they wished to prepare their own material, teachers could have relied on the available student programming assistance: 61% of the Category II teachers were satisfied with the courses developed with the aid of these same student assistants and 30% thought that their courses would be usable "with minor refinements". "Interest" and "enthusiasm" would seem to be one of the key determining factors. Teachers, who were sufficiently interested, found the time to devote, while others apparently used "lack of time" partly as an excuse for ignoring the system. There are, of course, many possible complex reasons for such interest other than simple

fascination with something new, for instance the attitude of the teacher towards innovation per se, or his concept of himself as a teacher.

To summarize the results of the investigations of the various factors for the teacher categories:

(A) Experience

No significant differences were detected among the two groups in either school. Within the size limitations of this sample, experience can be disregarded as a factor. The modal years of experience fell in the 6-10 year range.

(B) Sex

Although not significant there does seem to be a slight tendency for more females to be found in the Category IV (Non-users) than in Category II (Users). For both Handsworth and Kelowna there was only one female in Category II whereas five were in Category IV.

It should be noted that the ratio of male to female teachers is not constant. This ratio is influenced to some extent by the curriculum area under consideration. Science was one portion of the curriculum where there was a concentration of cal material and there tend to be more males than females teaching Science; there were only three

female Science teachers at the two schools in total and at Handsworth only two of the eight Science teachers were women. As further evidence of this trend, a study by Black (1973, unpublished) found that in a sample of non-department head teachers from 37 schools in eight British Columbia school districts only three of the twenty-six Science teachers were women.

(C) Educational Background

Again there is no evidence that this factor materially affected the average patterns. It should perhaps be noted, however, that all members of Category IV at Kelowna were teachers holding a single Bachelor's degree. The modal Educational Background was the attainment of a Bachelor's degree.

(D) Number of Department Heads in Group

Again no difference is apparent, in fact the two schools exhibited the exact reverse situation from one another. Handsworth had one department head in Category II and two in Category IV, while Kelowna had two in Category II and one in Category IV. Both user and non-user groups contained department heads.

(E) Other Factors

With one minor exception, the teachers in both

groups at both schools had no release time available and information about the system was equally available to all members of both groups.

Although no significant differences were found between the students in the two categories (VII and IX), there are some general comments that can be made.

As can be seen from their questionnaire responses the Category VII students, in their role as student authors, were interested in the computer and willing to spend large amounts of time working with the system. At both Handsworth and Kelowna, some of the student authors consistently worked after school, in some instances frequently returning in the evenings.

Their reasons for working with the system and devoting so much time to the activity included a number of comments which can be paraphrased as: "Computers were new, different, interesting and fun to work with". With this motivation the student authors, with varying degrees of dedication, spent many hours learning the Coursewriter III Language and programming course material. In addition, they actively searched for interesting cai courses, already extant, which they could try as students.

In contrast to the obvious interest and enthusiasm of the members of Category VII, the Category IX students claimed among other reasons for non-use, lack of time or lack of interest in over 30% of cases. This is a much larger total than that for any comparable group of stated reasons.

Not only could the courses themselves have been completed in an average of one half to one hour but also 95% admitted that their teachers had at least mentioned the computer to them and 65% had favourable comments made to them by fellow students.

Although not significant in terms of comparisons between the groups, it is interesting to note that the achievement records of the author group (Category VII), illustrated in Table VI, show that a larger percentage of the Handsworth authors were under achieving than was the case in Kelowna. It should be noted that "under achieving" here refers to discrepancies between scores obtained by particular students on standardized tests and their school grades.

The schedule was more formal at Kelowna than it was at Handsworth. Handsworth's modular scheduling provided the students with more free time than at Kelowna. The room

containing the Handsworth terminals was dedicated solely to cai, unlike the Kelowna location, a book room. This fact plus the greater amount of free time may partly account for the greater number of under achievers among Handsworth authors. The terminal room was an attractive almost "clubby" situation and may have had more appeal to students who, while of fairly high ability, were possibly not relating fully to the school situation.

A possible effect of this difference in the amount of free time available may be seen in the fact that the use of the cai system was higher at Handsworth than at Kelowna. Unlike the relative freedom at Handsworth, it was not unusual for senior students at Kelowna to have a semester without study blocks which would have allowed time out of classes.

The student status data reported on in Table XII underlines this difference in usage patterns by revealing that the total number of Kelowna males (19) and females (29) was markedly lower than the corresponding Handsworth figures (173 males and 71 females) for users in the sample. There is a possibility that the "club" atmosphere at Handsworth, while attracting some might have discouraged other potential student users through a perceived inability to co-operate with the "in-group" of student authors.

There is even a possibility that some students may have subconsciously perceived the terminal room as "territory" staked out by the aggressive behaviour of the student authors. This would tend to negate any advantage that might be gained by giving the under-achievers a point of identity. It should also be pointed out that these same under-achievers were also often the individuals who contributed the least in the way of useful programme materials. The decision to locate the Kelowna terminal in a text-book storage room may have tended to reduce the utilization because the room was always locked to prevent book pilferage and students had to locate a staff member with a key before they could use the terminal.

To summarize the results of the investigations of the various factors for the student categories:

(A) Sex

Although there were more boys than girls in both categories, the differences were not significant.

(B) Grade Level

Although most of the students in both categories were registered in grades 11 or 12 rather than grades 8, 9, or 10 this was attributable to various factors peculiar to this study and not to a preference for cai shown by one

grade over another. Grade 11 was the mode for both categories at Kelowna and for Category VII at Handsworth. Grade 9 was the mode for Handsworth's Category IX.

(C) I.Q.

No apparent differences were detected although not all the records were available. Mean I.Q.: Kelowna, Category VII = B; Kelowna, Category IX = C+; Handsworth, Category VII = B-; Handsworth, Category IX = N/A.

(D) Achievement

The investigation of the student categories, hampered as it was by various sampling difficulties, did not yield much highly meaningful material. Although it is quite possible, even probable, that the observed use categories will appear, at least initially, in most schools equipped with a cai facility, the use of the programme materials is almost certain to vary. The case of the course "cellif" (concerning cells, their structure and function, and the history of their discovery) offers a good illustration. All of the formal assigned use of this course was at Kelowna, the Handsworth teachers made no use of it at all. The reason for this is not hard to determine: it was completed in time for use during the second semester at Kelowna, well after all of Handsworth's unsemestered Biology classes had finished their consideration of the concepts dealt with by

the course. This is merely an obvious example of a general tendency. For one reason, or another, the usage of individual courses, as illustrated by Table XII, varied widely between the two schools. One important causal factor should, however, be examined further. With one exception of a few courses which attracted a large amount of "casual" student use, the single most important factor influencing the utilization of any course was, apparently, teacher interest. Although the importance of this factor is obscured by differences in sample size, Appendix 11 shows how some courses, such as c101 (Chemistry), while presumably equally applicable to both schools, in fact only received significant use at Handsworth where the students were under the guidance of an interested staff member. With some exceptions, most of the active interest and support for the system came from the Science and Mathematics departments. The preponderance of courses used and developed by the schools in these two areas might have been more striking if some of the initiative for course development had not come from the students.

"Lack of time," which was the factor identified most often as being responsible for non-use by category IV teachers, also severely restricted the involvement of Category II individuals who had lots of enthusiasm but little opportunity to carry out their plans. Although

several Handsworth teachers had programmed material during the previous Summer (July-August, 1970), only one found any time to program during the school year. The situation was alleviated somewhat because of the availability of student programming assistance but time for even the essential course design tasks was in very short supply. The lack of a visual display capability on the school terminals was another factor which severely limited program development, even by the Category II teachers. The attempts at producing Biology programs for example suffered from this technical deficiency.

The interest and involvement of the teachers was central to the effective utilization of the computer courses. If, indeed, a teacher is convinced of the efficacy of a certain innovation he likely will, as occurred in the present study, find the time to devote to it. Conversely, woe betide the innovation, no matter how excellent, that fails to gain this support. Jennings (cited in Miles, 1964) had this to say about teachers and innovation:

"...It is the rare good teacher who is not hospitable to the educational gadget - at first, anything that will help him help his students will get a hearing or a trial run. It is equally rare for even the least resourceful teacher not to be able to find a way to isolate, hide or ignore whatever is useless or harmful, no matter how official the sanction or instruction for its use. In short, teachers are no less resourceful nor a whit less responsible than members of other professions in

their alertness to novelty, in their willingness to experiment, and in their readiness to cast aside what does not work. One of the consequences of this attitude, however, is that the storerooms and basements of schools become cluttered with cast-offs of past programs, with books that didn't quite make it, with monster sliderules, plaster Parthenons, antique phonographs, and the viscera of AM radios." (page 566)

A similar fate could easily descend on cai if we fail to involve the classroom teachers in course development and implementation, because, no matter what the intrinsic worth of cai, if teachers perceive the "presence" of the computer in the classroom as a threat that is imposed from above they will be unlikely even to afford cai a fair trial. This could be particularly true if the imposition comes complete with pre-packaged programs over which the individual teacher has little or no control.

As far as student program utilization is concerned, this was limited by sheer problems of access to the three terminals, which were often in heavy demand, as well as by the time and enthusiasm of individual students in the two schools. Variation in student enthusiasm is also evident in the results of the student user (Categories V and VI) survey reported on in Table XII. Although 189 of the 292 students spent in excess of twenty minutes working at the courses, some of the students (43) spent five to ten minutes or less on the material. As it would be physically impossible to

complete the courses in five to ten minutes, these students, whatever their reasons, were not interested enough to do more than briefly look at the material. There were also no obvious sex differences observed in the student user group survey results.

The student and parent questionnaire devised by Handsworth school reveal that 31.2% of the students used the computer as against 61.8% that did not and 7.0% that did not reply to the question. Of the students who did use the computer, 9.2% used it once while the rest used it more than once. It is also interesting to note the similarity in the figures 31.2% of students who used the computer and the 27.1% of parents who were aware of their child's use of the system.

II. Limitations

This study has a number of limitations and weaknesses which are, at least in part, attributable to the conditions under which the investigations were pursued. The equipment and techniques themselves placed a number of important constraints on the experimental situation. The master Coursewriter III cai operating system itself was still in a developmental stage which led to a large number of very annoying malfunctions and in-operative periods.

This fact may have severely limited the effectiveness and appeal of the system to many teachers and students. The situation of attempting to study an on-going situation being influenced by a complex collection of electronic hardware and operating programs which were themselves, to a great extent, still experimental, meant that the investigator did not have available to him the large volume of accurate data one normally expects from a computer system. The accuracy of some of the available data on users and use patterns was questionable because of the various changes and malfunctions which took place during the experimental period. As has already been indicated substantial numbers of staff and students were not involved in the project because of a lack of suitable programs in their curriculum areas. It is also possible that the system was less attractive than it might have been because it lacked the capability of presenting visual materials. Although attempts were made to overcome this problem, the solutions were elaborate, only marginally effective, and not available in time to have much influence on the situation. This meant that many possible courses concerned with concepts demanding a visual component were not developed.

Some of these weaknesses could have been overcome by alternative procedures if the weaknesses could have been foreseen. That they were not is indicative of one of the

major difficulties encountered in the study, the fact that an innovative system such as cai capability evolves rapidly, in many directions, and produces a situation in the school which has to be followed to see where it leads rather than isolated and defined so its parameters can be controlled. In such a case, impressions are many and concrete results scarce.

Some other possible sources of error are associated with the time factor, as it was not possible for the principal investigator to spend full time in the schools his observations were necessarily somewhat fragmentary. As has already been pointed out this time factor also led him to seek, particularly at Kelowna, the assistance of interested teachers in determining some of the results. Although it should be stated emphatically that there was absolutely no evidence of it, this is an obvious source of error in analyzing the various reactions to the system. It was quite possible for example, that a number of staff members expressed favourable opinions about the computer simply because their school had been selected for the experiment and not because of any other positive attitude on their part. The presence of the observer probably affected the situation to some extent, however, as the observer also acted as co-ordinator and liason with the University but had no direct administrative authority over the teachers or

students it is unlikely that the users were particularly intimidated by his presence.

III Discussion and Suggestions for Further Study

There are a number of questions which arise from this initial year which merit further study:

(1) More research needs to be conducted upon the various categories of users and non-users in an attempt to understand the dynamics which cause such diversity. In particular an "interest inventory" is needed to help establish the basis for use or non-use.

(2) Is there any correlation between: (a) cai use and a teacher's previous experience with innovation? and (b) cai use and the individual's self-concept as a teacher or innovator?

(3) What place should be assigned to cai among the spectrum of resources available to the school? What is the relative value of cai within this spectrum?

(4) What constitutes the best mixture of student-teacher personnel for the efficient development of cai courses within the school?

(5) More information needs to be gained about the configuration of student terminals. What combinations of media inputs and outputs need to be provided to afford an optimum learning experience for the student?

(6) What is an optimum "package" of computing

services which a computer centre should offer to a school or school district? How many different "language" and operational modes should be available?

The year's experience suggests some operational changes which might help to improve utilization in future. Because of the limited time allotted to the study, the pressures of students anxious to programme, and a desire to involve as many people at the school as possible, course development activities tended to be spread rather thinly over the curriculum. In any future on-going program it might be wise to identify the most interested staff member in any particular department first and then work with that teacher to develop ideas for courses. Thus when a new computer course is developed specifically for the school a staff member is responsible for the concept of the course and its evolution from the beginning. In this way, also, in-service work could be keyed to the needs of a particular department and thus be made more intensive and meaningful than the mix of introductory overviews and individual trial and error that characterized the situation during this year of observations.

Some suggested criteria for establishing school computer facilities can be found in Appendix 12 but, generally, any school considered for the implementation of a

cai system should contain both teachers and students who are enthusiastic about the program and willing to devote time to its operation.

During the course of the study the school terminals were utilized in several varying ways:

1. As a means of presenting basic concepts. This showed promise in reducing teacher work loads as routine factual material could be presented in this fashion.

2. As a source of supplementary enrichment material. Above average students were given access to some university level courses which allowed them to progress beyond the basic curriculum in some areas. Grade nine students had available programs on space science which was an optional unit in their science course, not formally taught in either school during the school year.

Both uses 1 and 2 can be considered to be sub-sets of the "tutorial" utilization mode discussed in Chapter 2.

3. As a method of providing drill in material requiring repetition. Some of the programs were used to present practice sessions to students needing remedial work. This is an example of the "Drill and Practice" mode discussed in Chapter 2. The "simulation" modes were also represented, but the limitations of the system and the

available programs as they existed during the period precluded their extensive use.

None of the factors that were examined, such as educational background and experience of teachers and sex and achievement of students appeared to have a significant bearing on an individual's placement in a particular category. Some other factors were apparently responsible for the observed differences. Personal interest, initiative and enthusiasm on the part of teachers and students may be some of the unstudied responsible parameters. Others might be individual teacher and student role perception, attitude and self-concept.

It was found that, as well as utilizing pre-programmed courses designed at Simon Fraser University, the students and teachers were quite capable of developing new materials of their own which were shared by both schools, and in at least one case, even used by the University.

The indications are that Computer Assisted Instruction can be a valuable addition to the educational technology serving our schools. It is not too complicated to be used by students and staff but it is a complex enough system that it demands careful preparation and well planned

utilization. For a cai course to be used in a meaningful way it must attract the interest and support of a dedicated, well informed teacher. The same is true of course development: when a course is being developed for use in a specific school, it is more likely to be successfully completed and used if a staff member is actively rather than passively involved in its design and construction. It would seem, therefore, that an in-school cai system will be most viable when the programs are concentrated in subject areas having the largest number of interested staff members. As teachers from other curriculum areas become interested, the library of available materials can be expanded. This study found that active support from the students can also be a valuable asset. If some students are interested enough to volunteer as computer terminal monitors and others are willing to learn the programming language and assist the teachers with the design and programming of new courses the operation of the system in the school will be enhanced.

The complexity of the system is such that the school staff need outside assistance particularly during the initial phase of the operation. In systems like the one investigated in this study where the computer is at a remote location, it is essential to have someone to co-ordinate activities between the computer center and the terminal

locations. The constant attendance of this person at any school with a computer terminal would not be necessary but someone who could devote his time to the efficient functioning of a total school district cai operation would seem to be required.

The value of such a team approach to educational innovation is supported by Fox and Tippitt in Miles (1964, p. 297).

The studies by Hunka (1970) and O'Neil (1970) warrant further examination because of their relevance to this study. Two features of Hunka's study which are particularly notable in the light of the findings of the current study are: (1) The comments made concerning the ability of students as well as teachers to construct useful programs: "an interesting sidelight developed in the elementary school in that the students of the higher grades were able to write functions for drill work which were used by students at lower grades." (Hunka 1970 p.3) (2) Hunka (1970 p.6) also commented that: "There is no doubt that well trained and enthusiastic teachers who will find time to develop functions is a prime requisite."

O'Neil's Kansas City experiment found that reliance on regular classroom teachers was justified because they

proved capable of handling the new cai medium. O'Neil and his colleagues set out to develop an experimental group composed of a "mix" of experienced and novice teachers. In the present study, this mix developed naturally as teachers with over twenty and under ten years of experience were both attracted to the computer. As was the case with the studies of O'Neil and Hunka, the current study found that a cai system is compatible with a standard secondary school situation and does not require any extensive departure from normal routines to assure its success. The modular schedule at Handsworth Secondary was, however, slightly more compatible with cai in terms of numbers using the computer than was the semester system at Kelowna Secondary.

One of O'Neil's concluding statements: "cai programs can be implemented now by personnel available to public school districts." (p.10) is certainly supported by this study.

The present study has been undertaken within the context of the physical, material, and human resources outlined above. The study has focused on the patterns of use which developed in staff and students as the cai system was made available in the two secondary schools which have been described. In the final analysis, it is probably fair to state that the success or failure of any technical

innovation depends upon its use (or misuse) by human beings, and on their attitudes toward it.

IV Summary

This study was an examination of the events which followed the addition of a minimal cai capability to the instructional resource spectrum of two normal British Columbia secondary schools.

Of particular interest was the identification and description within staff and student body, of those who used and did not use the computing facilities. In the case of users it was also a matter of interest to determine how and why the computer was used. In the case of non-users an effort was made to determine why the equipment was not used. Data on user and non-user groups were gathered by means of observation, self-administering questionnaires and interviews.

The data warrant a number of tentative conclusions. First, it was not possible to identify factors that determined the placement of individuals in either the user or the non-user groups. Second, individual interest and enthusiasm seemed to be the most important factor affecting use by both teachers and students. Third, the greatest single use of the equipment was made by students who wished

to author programs, rather than by those who wished to use already available programs. The underlying causes of use or non-use could not be determined from the data within this study and remain important questions which should receive further investigation.

Appendix 1
OBSERVER'S LOG - SAMPLE SHEET

Monday, November 9th, Kelowna

Kelowna is now in the process of finding student proctors to keep the room open and ready for use through the school day. Student interest is high, authoring will probably take place after school, as at Handsworth.

I have trained three students to handle course registrations. SKELO being registered for all courses. All student nos. will probably contain a "K" to avoid confusion with Handsworth.
eg. A.0001 - "Student already registered!"

"Decorations" turned over to students to-night. There may be a hangup with allowing students to stay after school past about 5 p.m. Initial administration reaction to after hours authoring without supervision by adults was negative. Jane recognizes the problem this may cause, partic. when student use for courses gets heavy. He is going to work on it.

A call for potential authors after school brought about 8-10 students.

They already want to get some author space to use for testing. Should there be a "retest" course or some such?? Advised them to get individual courses reg. like Handsworth.

Appendix 2

GENERAL QUESTIONNAIRE
 Teacher Form
 (Total=80 Kelowna=24, Handsworth=56)

- Blank or
Invalid
1. Did you use cai (Computer Assisted Instruction) during the period September, 1970 - January, 1971 as part of your teaching program?
 FREQUENTLY (A) 2 (K 0 H 2) (2.5%)
 OCCASIONALLY (B) 16 (K 3 H 13) (20%)
 NEVER (C) 57 (K 17 H 40) (71.25%)
6 (K 4 H 2)
(6.25%)

 2. Did you try out a cai Program or Programs yourself (as a user) during the period September, 1970- January, 1971, even if you didn't use it as an instructional device?
 YES (A) 19 (K 3 H 16) (23.75%)
 NO (B) 55 (K 17 H 38) (63.75%)
6 (K 4 H 2)
(7.5%)

 3. Did you author any cai programs during September, 1970 - January, 1971?
 YES (A) 4 (K 1 H 3) (5%)
 NO (B) 72 (K 20 H 52) (90%)
4 (K 3 H 1)
(5%)

 4. Had you had any experience with cai before it was introduced to the school?
 YES (A) 11 (K 2 H 9) (13.75%)
 NO (B) 64 (K 18 H 46) (80%)
5 (K 4 H 1)
(6.25%)

 5. How would you asses your familiarity with the IBM cai Programming Language: (Coursewriter III)
 FLUENT (I have used it as an author to write a program.)
 SOME KNOWLEDGE (I have had a course in it, but have never actually written a complete program.)
 NO KNOWLEDGE OF IT
 (A) 2 (K 0 H 2) (2.5%) (B) 17 (K 3 H 14) (21.25%) (C) 57 (K 18 H 39) (71.25%)
4 (K 3 H 1)
(5%)

6. If a cai Program Language Course were offered at the school in 1971, Spring, would you take it?
 YES (A) 38 (K 13 H 25) (47.5%)
 NO (B) 35 (K 8 H 27) (43.75%)

7 (K 3 H 4)
 (8.75%)

7. How would you personally rate cai under the following categories:
- (A) AN IMPORTANT EDUCATIONAL TOOL WHICH I HAVE AND WILL USE, WHERE AVAILABLE.
 13 (K 1 H 12) (16.25%)
- (B) AN IMPORTANT EDUCATIONAL TOOL, WHICH I HAVEN'T HAD AN OPPORTUNITY TO USE.
 20 (K 7 H 13) (25%)
- (C) AN INTERESTING EXPERIMENTAL DEVELOPMENT.
 19 (K 6 H 13) (23.75%)
- (D) AN EDUCATIONAL EXPERIMENT WHICH HAS LITTLE PRACTICAL APPLICATION NOW IN MY SUBJECT AREA.
 20 (K 3 H 17) (25%)
- (E) AN EDUCATIONAL DEVICE WHICH IS OF DOUBTFUL SIGNIFICANCE.
 3 (K 3 H 0) (3.75%)

5 (K 4 H 1)
 (6.25%)

8. If you did not use cai, or were not able to make full use of it, in the Fall of 1970, which of the following would you identify as causes:
- A. I HAD NO TIME
- B. I DIDN'T KNOW HOW TO DEVELOP A CAI COURSE
- C. I DIDN'T FEEL THAT IT COULD BE APPLIED TO MY SUBJECT AREA
- D. I WASN'T INTERESTED IN IT
- E. I AM OPPOSED TO USING CAI OR EDUCATIONAL TECHNOLOGY TO TEACH STUDENTS
- F. I FELT THAT THE PRESENT SYSTEM IS TOO LIMITING

Which of the above was the most important cause?

- A. 33 (K 7 H 26) (41.25%)
 B. 10 (K 3 H 7) (12.5%)
 C. 21 (K 9 H 12) (26.25%)
 D. 1 (K 1 H 0) (1.25%)
 E. 0
 F. 1 (K 0 H 1) (1.25%)

14 (K 4 H 10)
 (17.5%)

9. Which was the next most important cause?
- A. 12 (K 6 H 6) (15%)
 B. 22 (K 6 H 16) (27.5%)
 C. 7 (K 1 H 6) (8.75%)
 D. 6 (K 1 H 5) (7.5%)
 E. 2 (K 1 H 1) (2.5%)
 F. 10 (K 4 H 6) (12.5%)
- 21 (K 5 H 16)
(26.25%)
10. Which was the third most important cause?
- A. 14 (K 6 H 8) (17.5%)
 B. 8 (K 3 H 5) (10%)
 C. 15 (K 4 H 11) (18.75%)
 D. 7 (K 0 H 7) (8.75%)
 E. 1 (K 1 H 0) (1.25%)
 F. 5 (K 3 H 2) (6.25%)
- 30 (K 7 H 23)
(37.5%)
11. How would you assess student interest and/or use of cai?
- HIGH THROUGHOUT THE FALL BY MANY STUDENTS
 (A) 3 (K 2 H 1) (3.75%)
 SPORADIC OR OCCASIONAL: SOME INTERESTED STUDENTS OTHERS INDIFFERENT OR UNAWARE
 (B) 41 (K 6 H 35) (51.25%)
 LOW: GENERAL LACK OF INTEREST OR AWARENESS
 (C) 17 (K 9 H 8) (21.23%)
- 19 (K 7 H 12)
(23.75%)
12. Do you feel that you had enough information about cai and its possible application to your teaching area?
- YES (A) 17 (K 3 H 14) (21.25%)
 NO (B) 57 (K 18 H 39) (71.25%)
- 6 (K 3 H 3)
(7.5%)
13. In your opinion is the cai Program:
- (A) A SIMON FRASER PROJECT
 14 (K 2 H 12) (17.5%)
 (B) A JOINT PROJECT OF SIMON FRASER, HANDSWORTH AND KELOWNA
 52 (K 16 H 36)
 (C) A HANDSWORTH OR KELOWNA PROJECT
 4 (K 1 H 3) (5%)
- 10 (K 5 H 5)
(12.5%)
14. In your opinion should this project be continued in the school year 1971/72?
- YES (A) 66 (K 19 H 47) (82.5%)
 NO (B) 3 (K 1 H 2) (3.75%)
- 11 (K 4 H 7)
(13.75%)

Appendix 3

GENERAL QUESTIONNAIRE
 Student Form
 N=332

Blank or
 Invalid

1. Did you use the computer terminals in the Fall?
 (A) REGULARLY, 12 (3.61%)
 (B) OCCASIONALLY, 119 (35.84%)
 (C) NEVER, 201 (60.54%) 0
2. In which way did you use the computer most?
 (A) To do calculation, 2 (.60%)
 (B) To take a course, 303 (91.14%) 27 (8.13%)
3. How many cai (Computer Assisted Instruction) Courses did you use?
 (A) One, 102 (30.07%)
 (B) More than one, 65 (19.58%) 165 (49.69%)
4. How would you rate the C.A.I courses you used?
 (A) Generally helpful, 74 (22.41%)
 (B) Some were good, some less helpful, some poor, 31 (9.34%)
 (C) Generally of little value, 27 (8.13%) 200 (60.24%)
- Here is a list of the cai courses which were used by students last Fall.
- | | |
|------------|-----------|
| a. Chemex | e. Watfor |
| b. Code | f. Sigfig |
| c. Geom 10 | g. Expo |
| d. Matheq | |
5. Which course did you find of most value?
 A. 21 (6.32%) E. 3 (.90%)
 B. 12 (3.61%) F. 25 (7.53%)
 C. 0 G. 14 (4.22%)
 D. 3 (.90%) H. 5 (1.39%)
 I. 8 (2.41%) 241 (72.59%)

6. Which course did you find of least value?
- | | | |
|--------------|---------------|--------------|
| A. 7 (2.11%) | E. 2 (.60%) | |
| B. 8 (2.41%) | F. 21 (6.32%) | |
| C. 4 (1.20%) | G. 8 (2.41%) | |
| D. 3 (.90%) | H. 0 | |
| | I. 5 (1.39%) | 274 (82.53%) |

Here is a list of problems that you might have encountered as a computer user, which would hinder you, annoy you or perhaps prevent you from using the system as much as you might have liked.

- A. The computer wasn't working when I wanted to use it.
 B. There was no space at the terminals
 C. I didn't have enough time on the terminal to complete the course, before I was asked to leave because somebody else wanted it.
 D. There were too few programs of interest or use to me.
 E. There were too many people standing around.
 F. The computer stopped working while I was taking a course.
7. Which of the above was the worst problem to you?
- | | | |
|----------------|---------------|--------------|
| A. 40 (12.05%) | D. 9 (2.71%) | |
| B. 37 (11.14%) | E. 8 (2.41%) | |
| C. 18 (5.42%) | F. 23 (6.93%) | |
| | | 197 (59.34%) |

8. Which was the next worst problem?
- | | | |
|----------------|---------------|--------------|
| A. 40 (12.05%) | D. 10 (3.01%) | |
| B. 25 (7.53%) | E. 12 (3.61%) | |
| C. 19 (5.72%) | F. 21 (6.32%) | |
| | | 205 (61.75%) |

9. Which was the third worst problem?
- | | | |
|---------------|---------------|--------------|
| A. 9 (2.71%) | D. 21 (6.32%) | |
| B. 21 (6.32%) | E. 22 (6.63%) | |
| C. 28 (8.43%) | F. 9 (2.71%) | |
| | | 222 (66.87%) |

10. If you didn't use the computer at all why was this?
- | | | |
|----------------|----------------|--------------|
| A. 54 (16.27%) | E. 3 (.90%) | |
| B. 36 (10.84%) | F. 42 (12.65%) | |
| C. 43 (12.95%) | G. 11 (3.31%) | |
| D. 0 | H. 15 (4.52%) | |
| | | 128 (38.55%) |
- A. I didn't have enough time.
 B. I was not interested.
 C. I didn't know what to do.
 D. I didn't think I would do very well at the cal courses.
 E. I didn't want to bother the students who were already in the computer room.
 F. There was no room at the terminals
 G. The computer wasn't working.
 H. There wasn't any course I wanted to take.

11. Did you like using the computer?
A. Yes, 127 (38.25%)
B. No, 12 (3.61%) 193 (58.13%)
12. Would you like to see the computer used more often and in other subjects as well?
A. Yes, 291 (87.65%)
B. No, 34 (10.24%) 7 (2.11%)
13. Would you like to find out how to program the computer the way some of the students are doing?
A. Yes, 241 (72.59%)
B. No, 76 (22.89%) 15 (4.52%)
14. Would you like to have the computer terminals at the school next year?
A. Yes, 304 (91.57%)
B. No, 20 (6.02%) 8 (2.41%)

Appendix 4

TEACHER QUESTIONNAIRE N = 13
Category II

		No Response
1.	Were you able to recommend any of the computer programs to your students this year? A. Yes, 11 B. No, 2	0
2.	If so, how many programs? A. One, 4 B. Two, 4 C. More than two, 3	2
3.	Did you participate in the development of any computer courses this year? A. Yes, 12 B. No, 0	1
4.	If so, how many courses? A. One, 7 B. Two, 5 C. More than two, 0	1
5.	How much time did you spend working on the course(s)? A. Less than one hour, 1 B. 1 - 5 hours, 8 C. 5 - 10 hours, 1 D. More than ten hours, 3	0
6.	Are you satisfied with the results? A. Yes, 8 B. No, 4	1
7.	If not, would you describe your course as: A. Completely unusable, 1 B. Usable with major refinements, 1 C. Usable with minor refinements, 4	7
8.	If the computer terminal is available next year, how many courses do you expect to be able to use with your students? A. The same number as this year, 3 B. Fewer than this year, 1 C. More than this year, 9	0
9.	Would you like to be involved in the preparation of courses next year? A. Yes, 12 B. No, 1	0

10. If so, how much time do you expect to spend on this activity?
A. The same as this year, 3
B. Less than this year, 2
C. More than this year, 7 1
11. If you used student programmers to assist you with the course preparation were you pleased with their work?
A. Yes, 9 B. No, 3 1
12. Would you like to have the assistance of student programmers for any future course work in which you may be involved?
A. Yes, 12 B. No, 1 1

Appendix 5

TEACHER QUESTIONNAIRE N = 22
Category IV

- | | | No Response |
|--|-----------|-------------|
| 1. Were you able to recommend any of the computer programs to your students this year? | | |
| A. Yes, 10 | B. No, 12 | 0 |
| 2. If so, how many? | | |
| A. One, 4 | B. Two, 2 | |
| C. More than two, 3 | | 13 |
| 3. If you did not make use of the computer, which, if any of the reasons listed best describes your reason for not using the computer? | | |
| A. I didn't think cai (Computer Assisted Instruction) should be used in my subject area, 2 | | |
| B. I had no time, 8 | | |
| C. There were no programs in my subject, 2 | | |
| D. I did not like the programs which had been prepared for my subject, 1 | | |
| E. I did not like the idea of my students using the computer, 0 | | |
| F. I felt my student's time could be better spent in other ways, 0 | | |
| G. I did not have enough information about the computer, 4 | | |
| H. None of the above, 2 | | 3 |
| 4. Do you plan to use the computer with your students if it is available next year? | | |
| A. Yes, 14 | B. No, 7 | 1 |
| 5. Which of the following changes would be the most likely to encourage you to make some use, or more use, of the computer? | | |
| A. More courses for your subject area, 6 | | |
| B. A better opportunity to influence the content of the courses, 2 | | |
| C. More free time to become involved with the computer system, 6 | | |
| D. More information about what is available, 1 | | |
| E. Some in-service material on cai and the programming language, 4 | | |
| F. None of these, 3 | | 0 |

6. Do you regard the computer as a teaching aid that could be used with a whole class rather than just selected individuals?
A. Yes, 7 B. No, 16 1
7. Do you think its use is limited to outstanding pupils with initiative for independent work?
A. Yes, 5 B. No, 16 1
8. Would you like to see the computer terminal left in the school for a further year?
A. Yes, 21 B. No, 0 1

Appendix 6

STUDENT INTERVIEW SCHEDULE N = 17
Category VII

1. Who first told you about the computer?
2. What attracted you to the computer after you first heard about it?
3. What made you decide that you wanted to author a course?
4. How did you learn Coursewriter III (the programming language)?
5. How many courses did you work on as an author this year?
6. How many courses did you complete?
7. When did you start authoring your first course?
8. How much time do you think you've spent on cai during the year in total, including terminal time, time spent preparing material away from the terminal, and student supervisor monitor time?
9. Why were you willing to spend so much of your time working with cai?
10. Do you think you will find the experience helpful to you after you leave secondary school?
11. In what way - or why not?
12. If the computer is available to you next year, would you like to author any more courses?
13. If so, in what subject?
14. Did any of your teachers suggest that you take any courses on the computer this year?
15. If so, what courses?
16. Did you complete them?
17. If not, why?
18. Did you like the courses?
19. What one major improvement would you like to see made in the courses?
20. A number of students, who were asked to take courses, did not do so. Why do you think this was so?
21. What was the main difficulty you encountered as an author?
22. How do you think this difficulty might be overcome in future?
23. Would you like to see the computer terminal in the school next year?

Appendix 7

STUDENT QUESTIONNAIRE N = 228
Category IX

No Response

- | | | | |
|----|---|------------|-----|
| 1. | Did any of your teachers mention the computer to you at any time during the year? | | |
| | A. Yes, 217 | B. No, 9 | 2 |
| 2. | If so, did they: | | |
| | A. mention only the computer itself, 19 | | |
| | B. mention a specific course, 40 | | |
| | C. recommend a specific course, 66 | | |
| | D. recommend a specific course several times, 10 | | 10 |
| 3. | Did you do any work on the computer courses that your teacher recommended? | | |
| | A. Yes, 107 | B. No, 111 | 10 |
| 4. | Did any of the students in any of your classes mention the computer to you? | | |
| | A. Yes, 193 | B. No, 31 | 4 |
| 5. | If so, were their comments mainly: | | |
| | A. favourable, 149 | | |
| | B. unfavourable, 3 | | |
| | C. neutral, 34 | | |
| | D. you can't summarize their remarks, 21 | | 21 |
| 6. | If mainly favourable, were they referring to: | | |
| | A. The idea of cai in general, 84 | | |
| | B. To one or more specific cai Courses, 59 | | |
| | C. Neither applies, 41 | | 44 |
| 7. | If mainly unfavourable, were they referring to: | | |
| | A. The idea of cai in general, 7 | | |
| | B. To one or more specific cai courses, 11 | | |
| | C. Neither applies, 54 | | 156 |
| 8. | If you didn't do any work on the course that your teacher recommended, was the reason related to: | | |
| | A. the material in the particular cai course or programs, 6 | | |
| | B. cai in general, 7 | | |
| | C. other personal reasons, 104 | | 111 |

9. If you answered "A" in question No.8 did you think that this particular computer course would be:
- A. too hard, 2
 - B. too easy, 1
 - C. not interesting, 2
 - D. something you already knew, 4
 - E. something not worth knowing, 1
- 218
10. If you answered "B" for No. 8, was it because:
- A. you didn't know how to use the computer, 4
 - B. the computer terminal was already busy, 5
 - C. the computer wasn't working when you tried to use it, 2
 - D. there was no one in the terminal room to help you when you tried to use the computer, 1
- 216
11. If you answered "C" for No.8, was it because:
- A. you didn't think you would like using the computer, 4
 - B. you had no time, 63
 - C. you weren't interested, 15
 - D. felt it was an impersonal way of teaching, 1
 - E. felt that I wouldn't be able to operate the computer, 12
- 133
12. Do you think that the computer terminal should be kept in the school for another year?
- A. Yes, 211
 - B. No, 13
- 4

Appendix 8

CAI COURSES PREPARED EXPRESSLY
FOR HIGH SCHOOL USE BY
TEACHERS OR UNIVERSITY STUDENTS

*code	Basic Chemistry concepts for grade 9 Science
equ 9	Equations for grade 9 Chemistry
*expo	Exponents for grade 11 Chemistry
*hands	Basic concepts of acceleration, velocity, etc., for grade 9 Science
*logar	Grade 8 Mathematics
*mathed	Equations for grade 8 Mathematics
*sigfig	Significant figures for grade 11 Chemistry
space	Space Science for grade 9
triang	Triangles for mathematics students

* Prepared by Handsworth teachers before September, 1970.

Appendix 9

SIMON FRASER UNIVERSITY COURSES
USED EXTENSIVELY BY HIGH SCHOOL STUDENTS

baleqn	Balancing equations - Mathematics and Physics
chemex	Chemistry
gaslaw	Physics
irlang	How to program in Coursewriter III
skill	Study skills
stock	Stock market simulation
watfor	"Whatfour" programming

Appendix 10

DESCRIPTIVE LIST AND STATUS OF CAI COURSES
DEVELOPED BY TEACHER-STUDENT TEAMS

Course Name	Description and Status
astron	Introductory Astronomy, Grade 9 complete
bio 11	Mitosis and Meiosis for Biology 11 Mitosis section complete
cangov	Canadian Government for Grade 11 complete
cellif	Cells, their structure and function, and the history of their discovery. Grade 11 complete
elec 10	Work on this course was halted when the student author began to develop material too specialized for High School
engram	Material on case, tense, agreement of verb, etc. for English students, complete
explor	Renaissance Explorers for Grade 8. This course did not develop beyond the initial preparation stage - was to have been programmed by a grade 8 student.
factor	The concept of factoring for senior mathematics - work still in progress but useful sections completed by year's end.
french	Indirect and direct object pronouns for Senior French - work still in progress, but useful sections completed by year's end.
geog	The Geography of the St. Lawrence Lowlands - work still in progress, but useful sections completed by year's end

linequ Linear Equations for Senior Mathematics
- work still in progress at year's end.

mole 11 The Concept of Molarity for Senior
Chemistry - work still in progress,
at year's end.

musbac Introductory Musical Theory - work
suspended when student author left
school

naplon The Napoleonic Era - initial pre-
paration stage only.

roteq Material on Forces for Senior Physics
- work still in progress at year's end

shakes A course consisting of two sections:
1. "Caesar" - questions on Julius
Caesar for Grade 10, complete.
2. "Macbeth" - questions on Macbeth
for Grade 11 and Grade 12, complete.

shorst Questions on the Short Stories in the
Grade 11 curriculum. Work suspended -
this was an unsuccessful attempt to
assign programming to a student in
lieu of regular class work.

urban Urban Geography for Grade 12 - work
still in progress, but useful
sections completed by year's end.

Appendix II

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CATEGORIES V AND VI
"Student Status" Summary

Name of Course	Sex	min. <5		min. 5-10		min. 11-20		min. 21-30		min. >30		Total		Course Total	
		H	K	H	K	H	K	H	K	H	K	H	K		
gaslaw	M	1		3		4		2		13		23		M	26
	F			1				1		1		3		F	
matheq	M			1				1		3	2	5		M	13
	F		1			2				1	2	3	3	F	
balegn	M									11		11		M	21
	F					1		1		8		10		F	
mathop	M							2		3	1	5	2	M	7
	F		1											F	
sigfig	M	1		3		12		9		1		26		M	42
	F	1		1		10		2	1	1		15	1	F	
code	M												1	M	4
	F		1							1	1	1	2	F	
cellif	M						3				6		11	M	30
	F						7		2		4		19	F	
shakes	M	1		1						2	1	4	1	M	6
	F							1				1		F	
expo	M	2		4		5		5		8		24		M	34
	F	2		2		3		1		1	1	9	1	F	
watfor	M					1				5		6		M	8
	F									2		2		F	
space	M									9		9		M	11
	F					1				1		1	1	F	
engram	M										1	1	1	M	2
	F													F	
french	M					1		1		3		5		M	7
	F							1		1		2		F	
astron	M					1		1		7		8		M	17
	F			1				2		5		8		F	

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Name of Course	Sex	min. < 5		min. 5-10		min. 11-20		min. > 30		Total		Course Total		
		H	K	H	K	H	K	H	K	H	K			
C 101	M F	4		4		6 1		4		18 6	1		M F	44
triang	M F	2 3			1	2				8 3	1	2	M F	20
		H	K	H	K	H	K	H	K	H	K			
		M=11 F=6 <u>17</u>	M=2 F=2 <u>4</u>	M=16 F=5 <u>21</u>	M=0 F=1 <u>1</u>	M=30 F=19 <u>49</u>	M=3 F=8 <u>11</u>	M=2 F=9 <u>31</u>	M=91 F=32 <u>123</u>	M=12 F=9 <u>21</u>				
		<u>21</u>		<u>22</u>		<u>60</u>				<u>144</u>				

Total Handsworth males = 173
 Total Kelowna males = 19
 Total males = 192

Total Handsworth females = 71
 Total Kelowna females = 29
 Total females = 100

Total males and females = 292

The modal time frame was the greater than 30 minute category in all cases except "sigfig" where it was the 11-20 minute category and "code" and "cellif" where no clear mode could be established.

Appendix 12

SUGGESTED CRITERIA FOR ESTABLISHING
SCHOOL CAI FACILITIES

On the basis of the experience with the two schools during the school year 1970/71 it would appear that the following are the minimal operational criteria for establishing cai services on a remote access "time sharing" basis in a typical British Columbia secondary school:

1. The system to which the school is connected should have access to a core of program materials which are usable at the secondary school level. This will afford the opportunity for the system to be used while the school prepares its own materials, which can take from a week to a year depending on the amount of time and degree of dedication available to the author or authors of the course, and the length and complexity of the program.

2. The operators of the system to which the school is connected should be able to give reasonable assurances that both the system "hardware" and the particular cai "software" in use will give reasonable service with an absolute minimum of "crashes" or maintenance downtime, particularly between the hours of 9 A.M. and 4 P.M. on school days.

3. The school should assure itself that all the costs of the operation are identified and assigned on a definite basis. This will prevent any of the notorious "hidden" costs of computing from giving any future unpleasant surprises.

4. As it takes some time before computer assisted instruction can be integrated with a large number of curriculum areas, a viable cai system can be developed with only one terminal in the school. It might conceivably be a number of years before such expedients as close scheduling of terminal access become insufficient and further terminals are necessary.

Another factor which supports the sufficiency of one terminal is the discovery that, in many instances, a small group of students, up to about five, could go through a course together. With some courses this was found to be an excellent alternative to the individual mode as high quality discussion and group interaction was frequently engendered. This was particularly noticeable in some courses such as "shakes" and "space" where the answer was not always obvious from the textual material presented, but rather required thought and interpretation.

5. Close liason between the school and the central computing centre is essential. The staff at the computing centre must be willing to take the time to co-operate fully with the school staff and answer any questions that might arise. For this purpose the telephone link between the school terminal location and the computer should provide the facility for allowing the school to originate calls to at least one or two regular telephones.

6. It would seem to be essential that a full time person be assigned to the task of co-ordinating the work of the school with the operation of the computer centre. Such a person could readily deal with a number of schools or even school districts but should be free to visit the various schools and assist the staff members in assuring smooth operation and optimal utilization of the terminal facilities. The encouragement of a dedicated person can be of great assistance in keeping the interest in cai at a high level. Such a person could be in the employ of the institution housing the computing facilities or the school boards controlling the schools equipped with the terminals.

7. Each school with a terminal should contain at least one staff member who is, or can quickly become, fully conversant with at least the rudiments of the system. It is not absolutely essential that this person be given released time. He must, however, be willing to accept the fact that the terminal will make substantial demands upon him and he must be prepared to deal with interruptions and the co-ordination of the student monitor corps. He should certainly be relieved of most, if not all, of his extra-curricular activities.

8. It is extremely important that there be someone always available at the terminal who understands at least the routine operation of the system. For this reason, a corps of student monitors should be set up and assigned to specific duty times which cover the whole day, during which the terminal is available to students.

9. Most schools connected to a cai system, even one with an extensive "library" of courses, would probably wish to prepare some of their own materials. To take the burden away from staff members, interested students should be encouraged to learn the appropriate programming language and assist staff members with the preparation of suitable materials. The extent to which the student will need guidance and help with the course will vary widely with the individual.

10. Teachers need to have the system interpreted to them and they need assistance in discovering ways in which computing can be integrated with their teaching situation. For this reason steps should be taken to make sure that all staff members are informed and given samples of course materials that relate to their part of the curriculum.

11. It is essential that programs be flexible. All programs must be open to regular updating and improvement. A sense of proprietary over a program should not become an excuse for it to become stale and outdated.

12. The terminals should be housed in a room where the students have reasonably free access to the equipment and where the noise which is generated will not disturb other students in their work.

The following criteria can be considered desirable additions to the minimal conditions listed. They could possibly be instituted at a later date. Although they are not essential to the initial phase of cai installations, they should contribute greatly to the efficiency of the overall system.

1. The staff member most involved with the system at the school level should be given a lighter teaching load than some of his colleagues so that he can devote more time to the co-ordination of cai

2. A means of rewarding a teacher financially for the development of programs and/or time spent on cai should be found. Such an incentive would likely increase staff commitment to in-school computing.

3. A good student with an outstanding knowledge of the programming language could very well be paid a small sum for maintaining and updating the school-produced programs - this prevents the programs from getting stale and allows any "bugs" which creep in to be rectified even though the original authors may be unavailable.

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