INTERMEDIATE COMPUTER USE:
a survey of the nature and extent of computer use in Intermediate classrooms in British Columbia

by

James Atley Bruce Beairsto

B. Sc. (Honours Physics), The University of Calgary, 1970
M. Sc. (Physics), The University of British Columbia, 1972
P.D.P., Simon Fraser University, 1973

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in

THE FACULTY OF GRADUATE STUDIES

DEPARTMENT OF CURRICULUM AND INSTRUCTION

We accept this thesis as conforming

to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

October 1986

95

Department of CURRICULUM AND INSTRUCTION

The University of British Columbia
1956 Main Mall
Vancouver, Canada
V6T 1Y3

Date 14 OCT 86

ABSTRACT

The use of computers at all levels in the educational system in British Columbia has been expanding rapidly despite a noticeable lack of provincial direction and support. With increasing funding this expansion can be expected to continue and even to accelerate. As computer-based instruction becomes more prevalent the need for programs of in-service training becomes increasingly important.

This study reports the results of a survey of the nature and extent of computer use in intermediate classrooms in British Columbia. It was conducted to collect the descriptive baseline data necessary to design an in-service program. The study also examines the educational motivations for computer-based instruction cited by teachers.

Data was collected using a province-wide mail questionnaire distributed in December 1985 and a series of telephone interviews in April, May and June of 1986. The results indicate that:

a) There is great diversity in the availablity of hardware and software across the province.

b) There is great diversity in the experience and training level of teachers across the province.

c) In general, computer access is severely limited.

d) In general, intermediate teachers have minimal training in the educational use of computers.

e) In general, intermediate teachers have very limited experience with computers.

f) The most widely used programs in intermediate classrooms are Bank Street Writer, Logo, typing training programs, mathematics programs and various materials from the Minnesota Educational Computing Consortium (MECC).

g) The respondents ranked computer-based strategies superior to traditional strategies in teaching language arts and problem solving.

h) The educational motivations cited by the respondents fell into seven major categories characterized, in descending order of frequency of citation, by the following key words: utility, interest, literacy, drill, enrichment, reinforcement and individualization.

i) There is little evidence of any developmental pattern, associated with an increase in experience, in the educational motivations for computer use cited by the respondents.

j) The correlations which do exist indicate that with increased training and increased length of time using computer-based instructional strategies teachers tend to devalue the objectives of promoting computer literacy and inflate the objectives of reinforcing traditional instruction, individualizing instruction and using the computer as a productivity tool for text editing.

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to express my gratitude to a number of people who have been instrumental, in various ways, in helping me to complete this thesis.

First, my heartfelt thanks to my wife who has been so consistently patient and accommodating over the past year and my children who have been understanding when Daddy had to work and could not play.

Second, my gratitude to Dr. C. J. Anastasiou, my thesis advisor, for his wise counsel, patience and friendly encouragement. Thanks also to the other member of my committee, Dr. M. Westrom, for help in defining the thesis topic and for valuable editorial comment and proofreading; and to Dr. H. Ratzlaff for his very useful criticism of my research instruments and instruction in the techniques of statistical analysis.

And lastly my thanks to all of the respondents to the questionnaire and the participants in the telephone interviews. Their consistently willing response and affable manner made light of an arduous task.

Chapter 1

THE PROBLEM

1.1 INTRODUCTION

The introduction of microcomputers into education was neither planned nor coordinated and continues to be essentially a grassroots movement. Very few jurisdictions have had the foresight and the resources to rationalize the process. Nonetheless, the use of computers is growing rapidly across the continent as well as in British Columbia and the public demand for their introduction into classrooms continues to be strong.

The broad public support behind the computer's infusion into the educational system gives a unique status to this particular innovation. Certainly there was no corresponding lobby for open area classrooms, continuous progress or overhead projectors. The general increase in awareness of and interest in educational matters among the public is not the only explanation for the high profile of computer-based education which was revealed in the Let's Talk About Schools (1985) report. Surely the fact that the computer has generated a societal revolution as well as educational innovations must contribute to its topicality.

This societal revolution has not only contributed to the public interest in computer-based education but has guaranteed that the importance of this innovation will not wane. The computer is here to stay and its presence will continue to have significant implications for education in one way or another for the indefinite future. Even if one could foresee the passing of interest in its instructional applications the computer would remain an important object of study in its own right. In fact, interest in the instructional use of computers continues to be strong and there is no reason to foresee any decline. As hardware power increases, costs decrease, and the sophistication of software designers develops, the importance of the computer in the classroom should grow. Clearly this is not just another educational fad.

However, we must recognize in the rapid emergence of computer-based education some of the unfortunate characteristics of many educational movements. As is all too typical in education, initial expectations were inflated by naivete while appreciation of the long-term consequences of this innovation was largely lacking. From massive early projects such as Plato on mainframe computers to the plethora of more recent one-shot software packages designed for microcomputers we find an apparent absence of the understanding that the impressive technological capabilities of the computer are wasted unless we can harness them with sound pedagogy. Consequently, unrealistic goals have frequently been set and the resources required to meet these goals have been drastically underestimated. The misguided software which has resulted is responsible for retarding the development of computer-based education and for creating a certain backlash of skepticism on the part of many teachers and educational organizations.

The computer "revolution" in education has survived despite these pitfalls because the machine has become of such central importance in our society and because its accessibility to individuals has allowed the emergence of a powerful grassroots computer movement. In schools, hardware financed by bake sales and software hatched in basements has kept the movement alive through the period of reaction to unrealized expectations. Now, however, we are seeing a re-emergence of institutional interest and support on a large scale. The lessons of the past decade are forming the foundation for a new wave of support for the educational applications of the computer.

However, while the lessons of the past have been learned by many there is still a distinct lack of clear vision for the future. We are beginning to do the things we previously failed to do more successfully but there does not seem to be a lively and informed forum for the development of new directions. The educational community as a whole seems poised for a second foray into the jungle of computer innovations but we possess neither a map nor a compass. We need a clear set of goals, a definite vision of the future, and techniques for measuring our success in achieving the goals. Without these navigational aids our high-tech adventures stand little chance of success.

1.2 THE PROBLEM STATEMENT

One consequence of the desultory development of computer-based education is a distinct lack of common vision and goal concensus among teachers. While there is ample enthusiasm, sincere concern and abundant optimism in schools there is frequently a lack of sophistication and critical analysis. Teachers have evolved their instructional applications with little supervisory assistance in developing a mature and informed conception of the role of the microcomputer in their classroom. The energetic leaders of the computer movement have often been hardware enthusiasts. The emergence of the microcomputer postdates most teachers' preservice training and inservice opportunities have normally focussed on simple software sampling. District and provincial direction has usually been limited to fiscal and purchasing guidelines.

In order to consolidate the gains which have been made to the present time and build a solid foundation for the future development of computer-based education we must begin to provide effective inservice. This will require a sophisticated understanding of the process of innovation and change, a mature vision of the appropriate use of microcomputers in education and a realistic analysis of the existing state of affairs. One aspect of this analysis must be a survey of the state of development of teachers in their emerging understanding of the role of the microcomputer in their classrooms. This "what is" knowledge is the necessary first step in any inservice needs analysis. Teachers may have valuable insights into the educational use of the computer or they may be completely at sea. In the first case a knowledge of their attitudes may provide useful direction and in the latter case this knowledge is an essential foundation for badly needed inservice.

There is at present, however, insufficient reliable data to know precisely how the microcomputer is actually being used or even the true extent of its use. Without such a well-developed snapshot of the classroom situation we cannot devise strategies for improving and expanding computer-based education. Particularly at the provincial level there is a need for a thorough reconnaissance of the classroom. One might expect the provincial specialists association of the BCTF to provide this information but in fact the membership of the Computer Using Educators of British Columbia (CUEBC) is not representative of teachers as a whole and, in any event, this body has not conducted any systematic survey of classroom uses of the computer. There is a profusion of individual experience and opinion available but an absolute dearth of hard data.

1.3 THE PURPOSE OF THE STUDY

This present study will attempt to provide some of the "what is" knowledge required to develop a realistic understanding of the nature and extent of computer use in British Columbia classrooms. It will specifically address the question:

> How do intermediate teachers in British Columbia use the microcomputer in classrooms at the present time: that is, in which curricular areas is the computer employed and with what software?

The organizational strategies of teachers will be examined as a secondary focus but the main objective is to identify those items of software which are most widely used. Intermediate classrooms were chosen because software is probably more plentiful at this level than at any other. Since there is no curricular direction from the ministry, computer use at this level is motivated by teacher and community beliefs about the importance and efficacy of computer-based instruction.

Once the primary applications of the computer are determined the study will examine the question:

> What applications do intermediate teachers in British Columbia perceive to have the most educational merit?

Finally, the study will also attempt to determine the reason for the popularity of the most common applications. Since it would be difficult to eliminate obviously important factors such as the availability and price of various software packages, the study will focus on the question:

> What educational motivations do intermediate teachers in British Columbia profess for the most popular classroom uses of the microcomputer?

An effort will be made to determine the effect which the length (years of use), breadth (number of programs used) or depth (workshops and courses taken) of the teacher's experience may have on the motivations professed for computer use. In order to eliminate computer hardware as a variable the study will focus exclusively on Apple computer users.

1.4 THE METHOD OF THE STUDY

The latter two questions clearly cannot be answered until the actual classroom uses of the microcomputer have been determined. Consequently, the study was divided into two parts: a broad preliminary survey of the nature and extent of computer use in intermediate classrooms across the province and a more focussed examination of the latter two questions in light of the answer to the first.

The preliminary survey took the form of a mailed questionnaire intended to identify the most popular curricular applications of computers and the second half of the study involved structured telephone interviews of a sample of intermediate computer users.

1.4.1 The Preliminary Survey

The preliminary survey was designed to collect data on the number and type of microcomputers in intermediate classrooms or otherwise accessible to intermediate teachers, the training and experience of teachers, the software programs actually used in the classroom and the reported motivation for these applications.

The questionnaire was developed in consultation with several colleagues, piloted in two Richmond schools, revised, and distributed to 500 intermediate teachers in December of 1985. The subjects included all 29 intermediate level members of CUEBC and a randomly selected sample of 471 of the 620 members of the Intermediate Provincial Specialists' Association (PSA) of the British Columbia Teachers' Association (BCTF). There were 198 responses by April. Of these, 167 represented valid data. The response rate was 100% from members of CUEBC and 36% from members of the Intermediate PSA giving an overall rate of 40%.

The results of this questionnaire were analyzed to identify the computer hardware used, the most frequently used software programs and the types of educational motivations cited by teachers for their use of these programs.

1.4.2 The Structured Interviews

The structured telephone interviews focussed on rating the seven most common educational motivations for the five most popular types of computer applications. Subjects were asked to rank the five most popular classes of software identified in the preliminary survey. They were then asked to select in priority order the three most important motivations for the use of each class of software with which they had experience in the classroom. The motivations were to be selected from a list of seven identified in the preliminary survey and read to the subject in random order.

Subjects included the 16 most experienced teachers identified in the first province-wide survey and 28 others of varying experience who were identified by computer coordinators in two metropolitan districts.

The results were analyzed to determine the importance of the seven major motivations for each of the five classes of software and to identify any effect which training or experience might have on the motivations reported by teachers.

1.5 BACKGROUND INFORMATION

British Columbia has a population of 2.9 million including 1.4 million in the metropolitan Lower Mainland and 250,000 in the city of Victoria. The remainder of the population is thinly distributed over a large area along the coast and in the mountainous interior. There are 75 school districts.

The provincial Ministry of Education is responsible for establishing curriculum and providing funding. At the time of the survey there was no branch of the Ministry specifically responsible for guiding or supporting computer-based instruction. In 1980 the Ministry did establish a specific agency, J.E.M., to investigate the potential for computers in the classroom and conduct a pilot study involving the purchase of 100 Apple II+ computers in various districts across the province. However, the agency was disbanded in 1982 and no further specific funding was provided. The introduction of computers into classrooms proceeded entirely at the expense and direction of individual districts from that time on. Despite the lack of provincial coordination and support, progress was rapid if somewhat uneven.

A BCTF survey in October of 1984 (Flodin) found that only 8 districts (13%) had no district-wide implementation of microcomputers and that there were 5317 computers in use. Of these 48% were Apple II and 11% were Apple compatibles. The student-computer ratio ranged from 22-154 to 1 among the districts reporting and averaged 76 to 1. Districts reported plans to purchase a minimum of 772 more computers in the 1984-85 school year for an increase of 15%. Since that time there has been considerable activity but there is no data to indicate the precise level of hardware acquisition.

In recognition of the rapidly expanding base of computers and locally developed courses the Ministry undertook to introduce a provincial Computer Studies 11 course in September 1984 and a Computer Science 12 course in September 1985. An existing course called Introductory Data Processing has entirely changed focus since the advent of microcomputers and is now computer-based but has not yet been revised. Thus, the only two provincial courses relating to computers at the present time are the two senior secondary computer courses. Whatever influence the Ministry has had on the direction of computer-based instruction has been through these two courses and the personnel involved in their development.

In January of 1985 the Ministry initiated a province-wide survey titled Let's Talk About Schools. Among other things this report revealed a wide-spread belief among the public that it was important to increase the level of computer use in the school system. Subsequently, and presumably in response to this survey, the Ministry announced a special fund to which districts could apply for funding for special projects including computer projects. At the time of writing these funds had not been fully dispersed but it would seem that a significant portion of the money which found its way into the hands of local school boards would be for computer related projects. There is still no department of the Ministry providing funding, policy or assistance to local boards in their efforts to expand the use of computers in the intermediate classroom.

1.6 THE SIGNIFICANCE OF THE STUDY

A 1983 study by Jones, Porter and Rubis found that computer literacy was the primary educational use of the computer in the elementary grades and computer science studies was the most important use in the secondary grades. While the latter has almost certainly not changed, the use of the computer in the elementary grades has begun to shift considerably and will continue to do so. The emphasis on computer literacy during the early years of computer use in British Columbia is a reflection of the fact that the educational community had no clear understanding of what might be appropriate and effective uses of the computer in the classroom despite their strong belief that its introduction to students was important. The BCTF study of 1984 (Flodin) found that "the most vital issue facing computers in education today" was "the need to integrate computers into the classroom as means rather than end."

This current study confirms what observers of the educational scene already knew. Teachers are growing beyond a vague belief that the computer is somehow important towards a more sophisticated understanding of how and where it can be effectively used in the curriculum. This shift towards specific curricular applications has strengthened the computer movement and made it demonstrably educational. Districts which may have been reluctant or skeptical are now beginning to appreciate the importance of funding computer-based instruction and increase its priority in their limited budgets. Increased provincial funding for computers via the Fund for Excellence in Education creates the potential for a dramatic acceleration in the computerization of the intermediate classroom.

If an increase in computer accessibility does occur, it will be essential to accompany this increase with expanded opportunities for appropriate inservice activities. The results of the present study should be useful in guiding such inservice efforts. The results may provide a clear picture of the present state of affairs from a provincial perspective and give some indication of the effects of inservice efforts to date. If coupled with a mature image of what computer-based instruction should be the information obtained in this study will be of great value in designing inservice for the next phase of the computer movement in British Columbia.

Chapter 2

A REVIEW OF THE LITERATURE

2.1 INTRODUCTION TO THE ISSUES

Before beginning any exploration of the literature the author would like to examine some basic vocabulary. There is a plethora of terms in use which are intended to describe the educational uses of computers: computer-assisted instruction (CAI), computer-assisted learning (CAL), computer-enriched instruction (CEI), computer-integrated instruction (CII), computer-managed instruction (CMI), computer-based training (CBT), and computer-based education (CBE) to name a few. While some of these terms are intended to imply specific styles of use and shades of difference do exist between them, for the most part their profusion is simply due to a lack of standardization on the part of various authors. This author can find no commonly accepted term which would subsume all of the various classroom level applications of the computer.

The issues which surround the young but surging field of educational computing are at least as diverse as the terms which describe it. In order to make this amorphous mass manageable, a unifying taxonomy is proposed. Attention is concentrated on questions which are specifically educational, fundamental and enduring: issues relating to appropriate hardware selection and equity of access are not addressed. These issues will decrease rapidly in importance as the inevitable "shakedown" in the computer industry and computer access for students increases. What remains may be divided into five major categories: identification, adoption, software evaluation and development, implementation and process evaluation.

2.2 ISSUES OF IDENTIFICATION

The first logical issue is the identification of potential areas of application for the computer in education. Consideration of this issue has been intense and some concensus has been reached. That is not to say, however, that the question is answered. As with any radically new tool or process it will take time to appreciate the full range of potential application for the computer in education. Consider, for instance the continuing process of change initiated by the introduction of the microwave oven. The eating patterns of an entire hemisphere are in the process of changing and the effects on our health and lifestyle, although they cannot be accurately predicted, may be considerable. As the process continues, new products are being designed especially for a device which was originally used only to warm left-overs. Whole new industries are emerging to exploit the potential of this device. While the example is inconsequential in comparison to the scale and importance of the computer, it does serve to illustrate the point that the potential areas of application of any technological innovation in any area of human endeavour will be revealed only over time. Our first thought is to use a new tool for an old job. It is only as our sophistication grows through use that we begin to develop fundamentally new applications and the true impact of the innovation begins to become evident.

This tendency has certainly been present during the introduction of computers into education. Predictably, one of the first areas of application to be exploited has been in administration. This has occurred not only because the administrators control the finances but also because the application is easy to conceptualize. Similarly, in the classroom many of the earliest applications consisted of the proverbial 'electronic page-flippers'; programs which emulated a text book by presenting endless screens of textual information which can be 'flipped' by pressing the spacebar. The next generation of software attempted to emulate the process of instruction by incorporating some questionning of the student in order to reinforce the instruction and control the rate of progress. Finally, there emerged applications such as Logo which were qualitatively different from traditional strategies and genuinely novel. As new technologies such as compact disks join the computer in the classroom this slow process of recognizing and exploiting the potential of the hardware in creative and radically different ways should continue. However, if past experience is any guide we can expect the majority of applications to be simply adaptations of old strategies for some time to come.

The presently recognized areas of curricular application may be conveniently organized according to a taxonomy first proposed by

Taylor in The Computer in the School: Tool, Tutor, Tutee (1980). The great virtue of this scheme is its simplicity but, as with any other such classification strategy, it is important that the taxonomy itself not be reified. There will always be applications which cut across the artificial distinctions we impose or which lie entirely outside the range of our nomenclature. Others, such as Cohen (1983) and Senn (1983), have proposed alternative schemes but this tripartite framework seems to possess a good combination of simplicity and insight.

To function as a tool, the computer must have some useful capability such as text editing, graphics generation or music synthesis programmed into it. This use "can pay off handsomely in saving time and preserving intellectual energy by transferring necessary but routine clerical tasks of a tedious, mechanical kind to the computer" Taylor, 1980, p. 3). The tool applications of the computer have been developed extensively for business and scientific applications. Some of these, such as text editing, have been adapted for educational use with great success. Others, such as testing and classroom management, are being developed specifically for educators.

To function as a tutor, the computer must be programmed so that:

> The computer presents some subject material, the student responds, the computer evaluates the response, and, from the results of the evaluation, determines what to present next. At its best, the computer tutor keeps complete records on each student being tutored; it has at its disposal a wide range of subject detail it can present; and it has an extensive and flexible way to test and then lead the student through the material. (Taylor, 1980, p. 3)

The term computer-assisted instruction (CAI) is approximately synonymous with this classification. Tutor applications have the potential to accommodate individual differences but have been criticized because they do not allow for spontaneous improvisation and can, if used improperly, decrease the human content of instruction with all of its adventitious personal and social benefits.

The tutor category is the most diverse in this taxonomy and is, consequently, often divided into various subcategories. These may include, in addition to the tutorial style previously described, drill and practice, educational gaming, simulation and modelling, problem-solving, and inquiry and dialogue. Moreover, the various types of software may be used in standard instruction or as a supplemental technique of reinforcement for the general population; or in various individualized modes for specific students such as remediation, enrichment or special education. It is this class of computer application, the tutor category, which is the area of the greatest activity in terms of software development but not necessarily the area of greatest impact or success.

To use the computer as a tutee is to reverse the roles of the computer and the student in the tutor applications; hence the derived term "tutee". For that, the student doing the tutoring must learn to program. In most cases, this type of application implies the use of Logo. Proponents of this application contend that "because you can't teach what you don't understand, the human tutor will learn what he or she is trying to teach the computer...[and, more importantly] learners gain new insights into their own thinking through learning to program" (Taylor, 1980, p. 4). Neither of these beliefs is uncontested.

2.3 ISSUES OF ADOPTION

The taxonomy of applications which has been presented is not congruent with the existing curricular framework. This creates the possiblity of applications which cannot be conveniently subsumed by any existing content area. Consequently, educators need to be concerned with examining the areas of potential application to determine whether they are appropriate for the educational system to adopt. Tetenbaum and Mulkeen (1984) suggest, for example, that "before tens of thousands more children are taught Logo, it seems advisable to give serious consideration to its purpose" (p. 19).

Even those applications which have a clearly defined and appropriate purpose may be problematic, however, since whenever we introduce new topics and activities into the school system we must inevitably displace some existing activity. For example, if intermediate teachers begin to spend time and energy using computers to promote "computer literacy" or teach "problem-solving" skills then they must necessarily modify or curtail some other teaching activity. Every issue of adoption involves a comparison of the relative merits and importance of two activities and when we embrace one topic or strategy we must simultaneously discard another. An example of such comparative analysis is given by Levin and Meister (1986) who found that "CAI..was more cost-effective than adult tutoring, reducing class size, or increasing instructional time...[but] considerably less cost-effective than peer tutoring in mathematics and slightly less cost-effective than peer tutoring in reading" (p. 749).

There are, of course, also human costs as well as financial costs. Bourque and Ramage (1984) point out that:

> In education we assume that teachers have the right to experiment with the teaching/learning process....But there are risks: a failed experiment may result in more or less severe damage to the learning situation...[and] new technological developments such as the microcomputer present an escalation of the risks, both in number and severity, and may therefore require greater caution in our approach to classroom experimentation. (p. 36)

DeKoven (1984) indicates other human costs in commenting that "although learning admirably, the kid playing with the computer is playing alone...[moving] further away from social awareness, becoming less and less responsive to the outside world" (p. 64). Carmichael, Burnett, Higginson, Moore and Pollard (1985) support this contention in their two-year study of children from Kindergarten to Grade 8.

> It was found that social interaction did not only facilitate a socializing process but was also a critical component in the furthering of cognitive development and of creative expression. This strong need for social contact expressed by children would suggest that any future scenario that sees only the singular child happily engaged in front of a computer over extended periods of time away from any human contact, is either unrealistic or, if it is forced on children, will lead to serious dislocations in their normal development. (p. 365)

On the other hand, they found that the teaching of Logo could contribute to creating an environment which encouraged exploration and led to increased social interaction and willingness to share, refine and revise ideas if the teacher managed the situation skillfully.

These studies are, however, the exceptions to the rule. In general the literature on computers in education seems to be so caught up with the exciting potential for their use and so frenzied to keep up with the pace of technological change that fundamental issues have been overlooked. The computer is changing not only our style of instruction but the very nature of the school system and a lot of the changes seem to be taking place without specific direction and with the blind faith that the changes represent progress. There seem to be some important issues related to the use of computers in education which have been given only cursory consideration in the literature to this point.

2.4 ISSUES OF SOFTWARE EVALUATION AND DEVELOPMENT

2.4.1 Software Evaluation

Once we identify areas of potential application for computers and adopt these as part of the educational system we must concern ourselves with the problem of developing these applications to be effective and efficient.

The first educational software was developed on mainframe computers for small projects directed by educational researchers. However, with the advent of the microcomputer the process became much more decentralized. Hardware began to become available in a large number of classrooms and with this change the educational software industry blossomed. Educational software began to be produced by relatively small companies and by individual entrepreneurs. Although the traditional publishing houses have now become involved, the educational software industry is still characterized by its diversity and by small-scale development. The result is a flood of one-shot software of highly variable quality.

In order to cope with the initial rush of software and to remove the overburden of poor material in order to expose any vein of valuable software various projects such as MicroSIFT were initiated. These projects were intended to evaluate software but in fact they were barely able to cope with the volume of material which was being produced and, consequently, were content to catalog and describe as much of it as possible. Evaluation was confined to identifying software which did not run without crashing and was not manifestly inappropriate. In fact, according to Lathrop, in 1982 less than 5 percent of the available educational software had been reviewed in print.

There is a large body of literature which examines this process of "sifting" through software and suggests variations to the checklist of qualities which should be employed (Steffin, 1983; Cohen, 1983; Senn, 1983; Gorth, 1984; Thomas, 1984; Wallace and Rose, 1984; Klopfer, 1984; Schug, 1984.) Wager (1982) suggests four major concerns from which software evaluation practices may be usefully derived: technical quality, content accuracy, instructional quality, and learner type. Cohen (1983) points out that two types of attributes need to be considered: those that are generic to all types of media and those that are unique to computer software. Rothe (1983) reminds us that the "social implications of the software have not yet received high priority in educational literature" (p. 9) and proposes that we consider language usage, knowledge selection, ideology, cultural assumptions and value assumptions. After surveying current thinking on design and evaluation, Kearsley (1985) concludes with the observation that "courseware is often instructionally sound but fails because it lacks the touches of the creative mind - spontaneity, humor, variety, and pizazz" (p. 217). Chomsky (1984) comes to a similar conclusion when reviewing software for language arts.

> It's relatively easy to find programs that work effectively for isolated subskill training or repetitive practice. It's another matter to find programs that help with such intangibles as comprehension, inference and appreciation of style, and that inspire students to interact imaginatively with sentences, paragraphs and plot. (p. 61)

Good checklist evaluations can touch on most of the important qualities mentioned by the various authors and even account for the intangibles through the subjective judgement of the reviewer. All of this presumes, of course, the existence of a pool of trained, experienced and talented reviewers.

The <u>Evaluator's Guide For Microcomputer-Based Instructional Packages</u> (1983) presently used by the Provincial Educational Media Centre (PEMC) is derived from the original MicroSIFT materials and is typical of such review instruments. The process it defines is primarily descriptive. Although there is a checklist of attributes such as clarity, accuracy, appropriate level of difficulty and effective use of feedback, the actual evaluation is confined to a personal judgement on the part of the reviewer as to whether the package should be recommended for purchase, recommended with changes or not recommended. There is no component which requires actual classroom use although this may occur if the reviewer wishes. There is no component which calls for student reaction. There is no component which specifically examines the details of the instructional design. There is a single checklist item which asks if "the content presents a balanced view of any social consideration" (p. 12) but no detailed review of the social, cultural or ethical implications of the material. It would, of course, be unrealistic to expect a more detailed review for the thousands of small-scale packages which are being produced yearly. The best that an agency such as PEMC can do is to catalogue some of the more common materials as an aid for teachers who are charged with the selection of software.

Not all evaluative efforts are of the checklist variety however. In reviewing three British case studies related to reading development and comparing them to checklists, Harrison (1985) used Stake's matrix of evaluative concerns. He found "a heavy emphasis on antecedents in the checklists and on transactions in the case studies...[but] neither checklists nor case studies devoted great attention to empirically measured outcomes" (p.221). In the case of checklists, Harrison found the emphasis on antecedents hardly surprising since teachers usually have to select software without the opportunity to acutally use it beforehand. In addition he noted that the apparent inattention to empirically-determined outcomes even in the case studies might be explained by the fact that:

> ...when teachers evaluate material, their attention is directed by the exigencies of the classroom towards immediate and pragmatic concerns. In such conditions, concerns such as time on task, student motivation and cooperation are likely to be much more dominant than either long-term pedagogical or philosophical issues. (p. 231)

Empirically-determined outcomes will inevitably require student input and Signer (1983) has observed that "students and teachers have different perceptions of quality software, with the students being the stronger critics" (p. 35). Her interpretation of this fact supports Harrison's speculation.

> Teachers, as content specialists, are more critical of the specific content of a program....Students, not cognizant of these intricacies, evaluate programs on the basis of interest, clarity and their level of participation.
> (Signer, 1983, p. 35)

We must conclude, therefore, that meaningful evaluation should involve actual classroom trial, empirically-determined outcomes and student input. Such an extensive and expensive process of evaluation is entirely impractical for the immense volume of small packages currently being produced and used. We are left with a cataloging system which is managing to keep up with only a small percentage of the available material. All is not lost however, for as the editorial column in Educational Technology for June, 1984, so cogently observes:

> It would appear, then, that we have anarchy in the schools when it comes to software selection. It's every teacher for himself. But...does anyone really believe that the majority of teachers select their other classroom materials based on careful, logical, detailed analysis of alternative media?... You will find that the largest single criterion, so-called, is simply "gut reaction", with "recommendations of a friend" a close second. Reading of software reviews published in

> respected journals? Come now! Teachers don't read such journals. (TECHnically Speaking, 1984)

2.4.2 Software Development

If the evaluative efforts of the past few years have not been successful in actually assisting classroom teachers to make intelligent software decisions they have not been entirely wasted either. If nothing else, they have made the role of instructional theories in evaluation a topic of discussion in the literature. Criswell and Swezey (1984) point out that "the topic which appears to be omitted from previous nonexperimental courseware evaluations is an assessment of the learning principles, derived from behavioural learning theory" (p. 43). Four months later in the same journal Margaret Bell (1985) notes that:

> Unfortunately, the evaluation of microcomputer courseware has proceeded in much the same manner as the earlier evaluations of programmed (instruction) materials (during the sixties). That is, descriptive checklists, employing a variety of often overlapping criteria, abound. The irony in this present effort is that, unlike the first technology revolution (after Sputnik), a knowledge base now exists from which to develop sound evaluative criteria. That knowledge base, referred to as instructional theory or instructional psychology, emerged in part as a result of the earlier teaching machine emphasis and the curriculum design efforts of the sixties. (p. 36)

Although instructional theory may have started in the sixties, one of the earliest applications to educational computing was made by Gagne, Wager and Rojas in 1981 and again by Gagne in 1982. The application of Gagne's theory of instruction to computer-based materials has been followed by further articles on "The Cognitive Approach to Computer Courseware Design and Evaluation" (Jay, 1983) and "What Communication

Theories Can Teach the Designer of Computer-Based Training" (Larsen, 1985). In this latter article Larsen admits that "while few would dispute the desirability of a unified and coherent theory of CBT design, we have yet to achieve it" (p. 17). Still, he contends that while there is much to be learned, much is already known and that too often "we simply neglect to apply some fundamental principles of readily available learning and communication theories" (p. 16).

Margaret Bell (1985) has surveyed the currently available educational theories and considered their implications for CBI.

> At the present time, instructional psychology includes several theories that address different issues in classroom learning. B. F. Skinner's technology of teaching, for example, emphasizes the role of reinforcement in behavioural change, while information-processing theories delineate important cognitive stages in the learning process. Some other current approaches are Robert Gagne's conditions of learning, Jean Piaget's cognitive development theory, Albert Bandura's observational learning theory, and Bernard Weiner's attribution theory. (p. 36)

She goes on to suggest which of these theories is most relevant to the various types of educational software. Vargas (1986) also contends that "many CAI programs contain serious instructional flaws...[although] A large body of literature exists in which basic principles of instructional design have been researched and articulated" (p. 738).

In addition to learning theory there are articles in the literature which concern themselves with the factors which make computer use attractive to students whether they learn anything or not. Kearsley (1985) suggests a set of such guidelines and in <u>Down</u>

with Green Lambs: Creating Quality Software for Children (1983) Ann White Lewin suggests that "if we can make games which are compelling, it should be a trivial task to integrate facts into these games" (p. 275). She identifies the characteristics of such games as including singleness of purpose, attractiveness, flexibility, challenge, performance feedback and autotelism. (An activity is "autotelic" if it is rewarding for its own sake and does not require external motivation to elicit and sustain interest.)

The most comprehensive and coherent software development project in Canada is being conducted by the Ontario Educational Software Service (OESS). That agency has produced A Formative Evaluation Plan for Exemplary Software (Gillis, 1984). In that publication there is a set of criteria for identifying effective software.

1. The instruction is suited to a computer presentation...
2. The software accomplishes the purpose(s) for which it was designed.
3. The program has a sound instructional design influenced by theoretical and practical knowledge of how people learn...
4. The content of the program is accurate, well organized, appropriate for its intended users, and appropriate to the Ontario school curriculum.
5. The software is technically reliable under normal conditions of use.
6. The software is easy to use for individuals with a minimum of computer expertise.
7. The intended users (teachers, counsellors, or librarians) perceive the program as worthwhile. In other words, the benefits derived from the program more than justify the amount of time and effort the educator must invest to use it.
8. The documentation and support materials meet the needs of its users.

Aside from the comprehensive nature of these criteria, it strikes the author that they are approximately in reverse order to those on the early evaluative checklists - with the difference that items 1,2 and 3 seldom if ever appeared. The existence of such a document would indicate that the lessons of the literature have in fact been learned, at least in Ontario. Unfortuanately, that is apparently not true elsewhere. Futrell and Geisert (1985) claim that:

> Although a large and robust body of research on the use of the computer in the classroom show it to be an effective instructional tool at all levels of instruction, vendors continue to stress the "bells and whistles" approach... (p. 13)

2.5 ISSUES OF IMPLEMENTATION

As the use of computers in education continues to grow, it will not be enough to identify areas of potential application and develop effective software. We must also concern ourselves with the process of change itself. One of the fundamental lessons in the literature is provided by the Rand study which points out that "innovation is more a learning process than a systems design problem" (McLaughlin and Marsh, 1978, p. 93) and the literature on the process of change suggests that it is unrealistic even to expect change to proceed in any well-ordered way for "it must reflect an activity which thrives on flexibility and redundancy" (Reid, 1975, p. 256). An understanding of this complicated human process begins with Hall and Loucks' observation that "at the individual user level, implementation of innovations...is not a bipolar use/nonuse phenomenon" (Hall and Loucks, 1977, p. 265) and "represents a process rather than a decision-point" (Hall and Loucks, 1975, p. 52). Consequently, they have identified, after extensive case studies, eight Levels of Use in the developmental growth continuum. These are: non-use, orientation, preparation, mechanical use, routine use, refinement, integration and renewal. While different individuals may start at different points and progress through the levels at different rates - perhaps even in a non-linear fashion - we should note Huberman's caution that "saving time by short-cutting the trial phase is a catastrophic strategy" (Huberman, unpublished).

Besides the process of change itself, the literature tells us something about its impact on teachers. In this regard, the conservative nature of teachers described by Lortie (1975) and Reid's observation that "change involves the abandonment of practices as well as their adoption" (Reid, 1975, p. 247) are crucial. In order to embrace and use CBI teachers must not only be convinced of its efficacy but they must also abandon some of their present instructional strategies and approach a foreign technology which they may well find confusing and even threatening. If we neglect this fact then it will be a long time before computer applications are implemented whether we succeed in supplying sufficient hardware and effective software or not. One key to effective implementation is the observation by Cicchelli and Baecher (1985) that "attention must be given to the involvement of individuals in the change process for change will occur only when individuals change" (p. 56).

The vehicle for promoting and supporting change is inservice. This inservice must be designed in the knowledge that the teacher and not the hardware is the appropriate focus of attention, that change is a potentially threatening process, that change will only occur with the cooperation and commitment of the teacher, and the change will, of necessity, take time to occur.

There is also considerable evidence in the literature that while the indivdual is the central issue, the school is the unit of change. That is, change will be greatly facilitated if the entire school community is involved cooperatively rather that as individuals. Consequently, inservice activities should be organized around that unit rather than individual teachers (McLaughlin & Marsh, 1978).

2.6 ISSUES OF PROCESS EVALUATION

If in fact we do provide sufficient hardware and effective software for appropriate curricular applications, and if we further realize significant change through carefully designed inservice then it will become important that we evaluate the consequences of this process. We must know ultimately whether computer-based strategies are having the desired consequences.

In a meta-analysis of 42 controlled evaluations Bangert-Drowns et al. found that "computer-based education (CBE) has had positive effects on achievement of students in junior and senior high schools" (Bangert-Drowns, Kulik, J., & Kulik, C., 1985, p 59). They also found that "more recent studies found stronger effects on student achievement" (p. 66) which may indicate that the quality of software is improving. An earlier study by Bright (1983) had not found such a positive effect but did conclude that CBI resulted in "equivalent learning in less total student time" (p. 146). He concluded that this may be due to the fact that CBI "activities increase both the absolute engaged time as well as the rate of engagement...[and] the ratio of high success within the engaged time" (p. 149).

These results are encouraging but in other areas there are some doubts emerging about computer-based strategies. The Bangert-Drowns (1985) study found, for instance, that "programs of computer-assisted instruction and computer-managed instruction were generally quite effective ... (but) programs of computer-enrichment, on the other hand, did not add anything substantial to student learning" (p. 65). By "computer-enrichment" the authors meant programming in languages such as BASIC and Logo. They found that "the children who taught computers undoubtedly learned to write computer programs, but mastery of this activity did not seem to affect other aspects of their cognitive functioning" (p. 66). This is a severe blow to the large body of Logo boosters who "view LOGO as a cognitive amplifier (Pea calls it the 'Wheaties of the Mind')...[and believe] that it is a language for learning how to think" (Tetenbaum & Mulkeen, 1984, p. 17). Tetenbaum and Mulkeen (1984) have called for a moratorium on the teaching of Logo as a general problem-solving model until such claims can be substantiated. They point out that "in general, theory and research in the field of cognitive science suggest that there is not a single homogeneous set of skills that can be identified as the important skills of problem solving...[and that] learned problem-solving skills are, in general, idiosyncratic to the task" (p. 17).

While this favourite son of the computer revolution is taking some licks there is emerging some respect for the Rodney Dangerfield of software: drill and practice programs. Merrill and Salisbury (1984) contend that "there is much evidence today, arising from recent research, in modern cognitive theory, which suggests that the role of drill and practice in learning has been unwarrantably downgraded" (p. 19). They point out that "in order for a learner to be able to efficiently perform many complex tasks, performance of lower level subskills must become automatic" (p. 19) and contend that well-designed drill and practice activities can be of considerable help in promoting this automaticity of sub-skills.

It would seem, therefore, that there is much yet to be learned about the effects of computer-based instruction and that ongoing research and evaluation will be crucial. Until the results of that research are known we might do well to heed the warning of John Ohles (1985).

> A high-powered computer industry is over-selling its merchandise to a degree that makes the hucksters of film, radio, television, language laboratories and teaching machines look like amateurs...The literature on the computer in the classroom has easily surpassed the rhetoric of the past...But what a waste, what a tragedy if another highly useful (even if not miraculous) educational tool is misunderstood,

over-bought, under-used, and eventually largely discarded. To those of you with your fingers on the keyboard, introduce the microcomputer to education and educators, but please don't love it to death. (p. 53)

Chapter 3

THE METHOD OF STUDY

3.1 INTRODUCTION

This study represents descriptive research. It is intended to provide objective data which can be used in the design of inservice activities for intermediate teachers on the use of the microcomputer in the classroom.

The study was conducted as two separate surveys: a province-wide survey through the mail, and telephone interviews with a smaller selected sample of teachers. The preliminary survey was intended to answer the following questions:

a) What is the nature and extent of computer access for intermediate teachers?

b) What is the nature and extent of the experience of intermediate teachers with computer-based instruction?

c) Which specific programs are used in intermediate classrooms?

d) Which programs are favoured by intermediate teachers?

e) In which subject areas do teachers feel that the available programs are most effective relative to traditional strategies?

f) Other than the fact that students generally like to use computers and parents applaud their introduction, why do intermediate teachers use computers in the classroom?

The telephone interviews were conducted with a selected sample of intermediate teachers representing a broad range of experience. This survey focussed on the five classes of software identified as most popular and the seven educational motivations for computer use identified as most common in the preliminary questionnaire. The follow-up survey was intended to determine:

a) How do intermediate teachers rank order the educational merit of the five classes of software identified as being most popular in the provincial survey? The software categories were word processing, Logo, math skills, science skills, and three simulations from the Minnesota Educational Computing Consortium (MECC).

b) How do intermediate teachers rank order the seven most popular educational motivations for the use of this software as identified in the provincial survey? The motives referred to the computer's value for utility use as a word processor, interest generation, computer literacy, drill and practice, enrichment, reinforcement and individualization.

3.2 THE PRELIMINARY PROVINCIAL SURVEY

3.2.1 Development of the Questionnaire

The questionnaire was developed in consultation with Dr. C. J. Anastasiou and revised over a series of meetings. It was then critically reviewed by Dr. H. Ratzlaff and significantly revised on the basis of his observations.

One component of the questionnaire was a checklist of software. This list was developed by extracting all the programs relevant to the intermediate grades contained in The 1985 Educational Software Preview Guide developed by the Educational Software Evaluation Consortium of which PEMC is a member. This software list was composed in December of 1984.

In its initial form the questionnaire was given to three teaching colleagues on an interactive basis to test for clarity. Minor revisions resulted.

Finally, the questionnaire was distributed to 6 intermediate teachers in two different schools with the invitation to comment on the time required to complete the instrument and the clarity of its questions. As a result of this pilot the questionnaire was significantly shortened by combining two of the major sections and eliminating an open-ended concluding question.

3.2.2 Application of the Questionnaire

In December of 1985 the completed questionnaire (Appendix B) along with a covering letter (Appendix A) and a stamped self-addressed envelope was mailed to 500 intermediate teachers across the province. This sample included all 29 intermediate level members of the Computer Using Educators of British Columbia (CUEBC) and 471 of the 620 members of the Intermediate Provincial Specialists' Association (PSA) of the British Columbia Teachers' Federation (BCTF). The 471 members were selected by omitting every fourth name from an alphabetical mailing list.

There were 175 responses before the reopening of school in January and 198 before April of 1986. These included all 29 members of CUEBC and 169 (36%) from the Intermediate PSA. Of these, 167 represented valid data. The remainder were from individuals who were retired, unemployed, still in training, not classroom teachers, had moved or were otherwise inappropriate.

3.2.3 Analysis of the Responses

The items on the questionnaire were analyzed through the calculation of means, medians and standard deviations. Teacher training was rated according to the following arbitrary scale for the purpose of numerical analysis.

0 - no specific training at all
1 - up to 5 days of training in total
2 - more than 5 days and up to one semester
3 - more than one semester and up to two semesters
4 - more than two semesters

This training coefficient was based purely on time and may include any combination of local in-service activities, education courses or computer programming courses. No attempt was made to determine the relevance or value of the training to actual intermediate classroom practice. Only four respondents reported more than two semesters of training.

Since both training and actual experience in the classroom are important factors in developing expertise, an additional coefficient of expertise which combines the three component measures was calcuated as follows:

expertise = (yrs of use + training coeff) * (# of programs used / 5)

In essence this coefficient equates one week of inservice, one year of classroom contact and actual experience with five different programs in terms of developing expertise. A teacher who had attended two days of local in-service and used five different programs in her classroom over the period of one year would have an expertise coefficient of 2.0. Two years of use involving ten different programs combined with a one semester course would yield a coefficient of 8.0. (See Appendix F for a more complete explanation of the expertise coefficient.)

Respondents were asked to rate the computer as an instructional tool in comparison to more traditional media using a Likert scale on which 4 represented rough equality and 7 a significant superiority. The rest of the questionnaire involved checklists and open-format questions.

The final item asked what reasons the respondent had for using computers in the classroom "other than the fact that students generally like to use computers and parents applaud their introduction". There was room for three different responses. These were listed in full for the first thirty questionnaires. At that time an abbreviated system for recording the common reasons was adopted and non-standard responses were recorded in full. The data was summarized by counting the number of occurences of the common responses and listing the non-standard responses. This system of classification required interpretation on the part of the author but in most cases this interpretation seemed clear. The purpose of the question was to identify the most common responses and therefore the procedure was deemed to be logically defensible and reliable.

A summary of the results was mailed to the 23 persons who had requested such a summary when returning their questionnaire.

3.3 THE TELEPHONE INTERVIEWS

3.3.1 Development of the Interview Schedule

The interview protocol was developed, reviewed and revised over a series of meetings with Dr. C. J. Anastasiou. It was then reviewed by

Dr. H. Ratzlaff and revised according to his recommendations. Finally, the interview was piloted with three teachers and revised slightly to make the explanations by the interviewer more succinct.

3.3.2 Conduct of the Interviews

The sixteen most experienced respondents on the preliminary survey were all sent a summary of the results (Appendix C) and a letter (Appendix D) requesting their assistance in providing more information through a brief telephone interview. A similar request (Appendix D) was sent to 18 intermediate teachers from School District Number 38 (Richmond) and 10 intermediate teachers from School District Number 45 (West Vancouver) who were not part of the preliminary survey. These teachers were selected by the computer coordinator in each district to represent a cross-section of the intermediate staff and a variety of experience.

The telephone interview followed a detailed outline (Appendix E) and examined only the five classes of software identified in the preliminary survey as being most popular with intermediate teachers. In order that the correlation between the responses and the experience of the teacher might be examined, those respondents who had not been part of the original survey were mailed a checklist of software extracted from the original questionnaire. The number of programs which they reported having used was one factor in determining their expertise as described in connection with the original questionnaire.

Some difficulty was encountered securing return of this checklist and it was necessary to follow up with a telephone request for its return in several cases. A number of subjects never did return the checklist and were consequently not interviewed or the interview was discarded. The coincidence of the survey with the Stanley Cup hockey championships was a significant factor in protracting the time required to complete the survey.

3.3.3 Analysis of the Results

The results were analyzed to rank order the five applications surveyed and the listed motivations for the use of the computer in the intermediate classroom. An attempt was also made to determine whether there was any correlation between the significance of each motivational category to an individual and that individual's background. Specifically, the correlation with years of use, the training coefficient, the number of programs from the checklist reported as having been used, and the expertise coefficient was examined.

In an attempt to account for the importance attached to a particular motivation by its being the primary motivation for the use of a respondent's favourite program as opposed to a secondary motivation for a less popular program or the final motivation for the least favoured program a weighting system was devised. Each motivation was given a weight as follows:

weight = (6 - program rank) * (4 - motivation rank for program)

Thus, the primary motivation for the top ranked program out of the five received a weight of 15, whereas the second motivation for the third ranked program received a weight of 6 and the final motivation for the last ranked program received a weight of 1. (See Appendix F for a more complete explanation of the weighting algorithm.)

In addition, a scheme was devised to account for the fact that not all respondents had experience with all programs. In fact, 23% of the data matrix was left blank due to a lack of experience with a particular program on the part of the respondents. In order that each respondent's motivational perspective should rate equally the frequency of each motivation reported was normalized as follows:

$$\begin{matrix}\text{normalized frequency} \\ \text{or reporting for} \\ \text{a motivation}\end{matrix} = \begin{matrix}\text{actual frequency} \\ \text{of reporting for} \\ \text{a motivation}\end{matrix} * 5 \; / \begin{matrix}\text{number of} \\ \text{programs} \\ \text{reported on}\end{matrix}$$

The effect of this adjustment is to give each motivation a weight equal to its percentage frequency in a subject's responses. Thus, if a teacher had experience with only 3 of the 5 categories and reported "literacy" as being a motivation twice in the survey of those 3 programs then the normalized frequency for that motivation would be 3.3. (See Appendix F for a more complete explanation of the normalization algorithm.)

The frequency of occurrence of each motivation was then calculated for each respondent according to a straight frequency, a normalized straight frequency, a weighted frequency and a normalized weighted frequency.

Scattergrams were plotted showing the frequency of each motivation as a function of the experience of the respondent. Frequency was calculated using each of the four techniques just described and experience was calculated as years of use, the training coefficient, the number of programs from the checklist reported as having been used and the expertise coefficient. This gives a total of sixteen different plots for each motivational category. In addition, a correlation coefficient was calculated for each relation. Both the scattergrams and the calculations were produced from the raw data using a computer program written by the author for that purpose and executed on an Apple IIe microcomputer.

The normalized weighted frequency was judged to give the best indication of a respondent's motivation on logical grounds and consequently only this measure of frequency is reported here. However, the four measures of experience were judged to have the potential for revealing different effects and thus all four are reported.

Chapter 4

THE RESULTS OF THE STUDY

4.1 INTRODUCTION

The purpose of this study was first to provide an objective description of the nature and extent of computer use in intermediate classrooms and second to examine the reasons reported by teachers for the use of computers in intermediate classrooms. The main results of the study are presented in this chapter.

4.2 RESULTS OF THE PRELIMINARY QUESTIONNAIRE

The overall response rate was 39.6% of a sample of 500. It is reasonable to assume that the respondents are on average more enthusiastic about and involved with computers than those who did not respond so that the results reported may be skewed in favour of their school situations.

Apple computer users represented 63% of the respondents, Commodore 64 users 25% and various other models the remainder.

The number of computers available to the class was not reported by 19% of the respondents. Of those reporting, 11% had no access of any kind, 29% had access to a single computer, 16% to two and 11% to three. The results ranged up to nineteen. However, the actual number of computers available to the average classroom is difficult to guage since they are often shared between classes or organized into labs which rotate throughout a district over the course of the year and consequently the numbers reported do not represent permanently resident machines in all cases. The results can still be seen to indicate that the "typical" classroom contains one computer or no computers on a regular basis.

Teachers reported no specific training of any kind whatsoever in 33% of the cases and a further 38% had 5 days or less. There were four respondents with more than two semesters of computer training of one type or another. The average value was 1.2 and the median value was 1 on the ordinal scale previously described.

When asked how long they had been using a computer in the classroom and how long they had been using it outside of class the vast majority of teachers reported less personal use than professional use. This probably indicates that their first introduction to computers came through the classroom. The average of the two indicators of length of computer experience ranged from 0.0 years (14%) to 5.5 years (one person) with an average of 1.8 years and a median of 1.5 years.

The number of computer programs actually used at least once in the classroom ranged from 1 to 43 with a median of 7, an average of 9.8 and a standard deviation of 8.6 among the respondents reporting classroom use of the computer.

Since both training and actual experience in the classroom are important factors in developing expertise, an additional coefficient of expertise which combines the three component measures of experience was calculated as follows:

expertise = (yrs of use + training coeff) * (# of programs used / 5)

The results ranged from 0.0 up to 48.0 with an average of 8.4 and a median of 2.4 for 95 individuals. This median value would, for example, be assigned to a teacher with one year of in-class computer experience who also used the school's computer for the occasional bit of word processing, had attended two or three district workshops and had used six different programs with his class.

Respondents were asked to rate the computer as an instructional tool in comparison to more traditional media using a Likert scale on which 4 represented rough equality and 7 a significant superiority. The most frequently rated areas were language arts and mathematics and the highest rated areas were problem solving and language arts as shown in Table 1.

The most frequently reported titles from the software checklist are listed in Table 2 and the programs which enjoyed the best combination of frequency of use and reporting as a "favourite" program are listed in Table 3. The application area is that within which the respondents included the program most frequently.

Table 1

Rating of Computer-Based Instruction in Comparison to

Traditional Strategies in Various Curricular Areas

Instructional Area	respondents	average rating
Problem solving / Logic	25	5.3 (s = 1.15)
Language Arts	46	5.1 (s = 1.11)
Mathematics	48	4.6 (s = 1.43)
Social Studies	22	4.5 (s = 1.44)
Science	22	4.5 (s = 1.44)

Table 3

Teachers' Favourite Software

Program Name	Application Area
Logo Moptown Hotel	Problem Solving
Bank Street Writer	Language Arts
Oregon Trail	Social Studies
Fay, That Math Woman Milliken Math Sequences Math Blaster Math Activities 5	Mathematics
Odell Lake	Science

Table 2

Most Frequently Reported Titles From The Software Checklist

Frequency	Software Title	Category
64	BANK STREET WRITER	WP
46	APPLE LOGO	CP,PS
45	THE PRINT SHOP	CA,GG
38	APPLE PRESENTS APPLE	SI,TU
31	TERRAPIN LOGO	CP,PS
29	TYPING TUTOR	DP,TU
27	FAY THAT MATH WOMAN	DP
24	ELEMENTARY V.1: MATH	DP,EG,PS,SI
20	ELEMENTARY V.4: MATH/SCI	DP,EG,SI
20	ROCKY'S BOOTS	CA,PS,SI
19	ELEMENTARY V.3: SOC ST	EG,SI
19	ELEMENTARY V.6: SOC ST	EG,SI
19	MASTERTYPE	DP,EG,TU
18	ALLIGATOR MIX	DP,EG
18	DRAGON MIX	DP,EG
17	MOPTOWN HOTEL	EG,PS
16	MATH BLASTER	DP,EG
14	ALIEN ADDITION	DP,EG
14	BASIC NUMBER FACTS	DP,EG
13	MATH SEQUENCES	DP
12	CROSSWORD MAGIC	CA,EG,IM
12	DEMOLITION DIVISION	DP,EG
12	GERTRUDE'S PUZZLES	EG,PS
12	METEOR MULTIPLICATION	DP,EG
11	EZ LOGO	CP,PS
11	SHELL GAMES	DP,EG,SH
10	APPLE WRITER IIE	WP
10	CHESS	EG
10	FACTORY	EG,PS,SI
10	GERTRUDE'S SECRETS	EG,PS

Note. Software Category Abbreviations:

CA Creative Activity
CP Computer Programming
DP Drill and Practice
EG Educational Game
GG Graphics Generator
IM Instructional Materials Generator
PS Problem Solving/Logic
SH Shell/Mini-authoring System
SI Simulation
TU Tutorial
WP Word Processor

The author would caution that the presence of a program in Table 2 does not necessarily imply that it is of particular instructional value but only that it is widely distributed and fairly well received. This data reflects the pattern of use in classrooms as it now exists but does not constitute either an evaluation or an endorsement of the software.

Finally, respondents were asked what reasons they had for using computers in their classroom "other than the fact that students generally like to use computers and parents applaud their introduction". The results were widely varied but several distinct categories of response were evident. These are listed below along with their frequency of appearance.

28 valuable as a word processor
22 useful for motivation / fun / generates interest
19 promotes "computer literacy"
13 useful for drill and practice
10 useful for enrichment
9 useful for reinforcement of instruction
9 allows student to control pace / allows individualization

There were 37 other responses of various types ranging from the fact that computer use "promotes neatness and precision" and "encourages careful reading and following instructions" to "promotes small group sharing" and "builds self esteem".

4.3 RESULTS OF THE TELEPHONE INTERVIEWS

Only Apple computer users were interviewed. Otherwise the teachers were chosen to give a cross-section of the population rather than a representative sample. In order to obtain information from subjects with a relatively even distribution over a wide range of training and experience the author chose a group whose average expertise was much greater than the population as a whole. The expertise coefficient calculated as previously explained ranged from 3 to 78 with a median of 25.2 and an average of 26.5 compared to the average of 8.4 and median of 2.4 in the preliminary survey.

The teachers interviewed reported such a wide variety of hardware situations involving combinations of permanently assigned machines, mobile machines, school labs and rotating district labs that no numerical summary of the hardware availability would be meaningful. The situation can only be characterized by two facts: the shortage of adequate hardware and software, and the commendable flexibility and ingenuity evidenced in teachers' attempts to make the best possible use of what was available.

The average time per student per week in interaction with a computer either individually or in a group of two ranged from less than 15 minutes to more than 4 hours. This includes both in-class and out-of-class use. In many situations the students were making extensive use of time before and after school, at recess and during lunch in order to obtain access to a computer laboratory. The distribution of times reported is shown in Table 4 for those teachers who were prepared to make such an estimate. The effect of rotating labs which are in the school for a few weeks a year has not been included in this time estimate.

Table 4

Students' Computer Contact Time

time per week (min)	0-15	15-30	30-45	46-60	60 +
number of reports	9	12	9	1	7

The author would caution that this table is not representative of the provincial situation. The teachers interviewed are far more experienced than average and it is reasonable to assume that their students have far more computer access than the average. The preliminary survey showed that 11% of the respondents had no computer access at all and 56% had access to three or less computers for their class. With this degree of access it is unlikely that an individual student would have more than 15 minutes of computer time.

The respondents ranked five classes of computer software in descending order according to their opinion of its educational merit. In cases where a respondent did not have experience with all five classes of software the rankings were shifted so that the highest rank was a five. This was done so that a teacher's rankings did not carry undue weight as a result of limited experience. The results are shown in Table 5.

Table 5

Relative Merit of Selected Software

(as ranked by respondents to the survey)

Software Category	n	average
Word Processing - Bank Street Writer, Magic Window, Magic Slate or Milliken	41	2.59
Logo - any version	33	3.09
Math Skills - Math Blaster, Milliken, Fay That Math Woman, Mathematics Activities Courseware or Demolition Division	39	3.56
Science Skills - Gertrude's Secrets, Moptown Hotel, Moptown Parade, The Factory	18	3.72
Simulations - Odell Lake, Odell Woods, or Oregon Trail	36	4.67

Note. The five software categories were identified as the most common classroom applications in the preliminary survey. In the telephone interviews respondents were asked to rank-order these five categories according to their "educational merit".

The value "n" is the number of teachers who reported a rating for each software category.

After they had ranked the software according to preference the respondents were asked to "imagine that you are writing a brief for your board requesting more time and money for the use of [software name] in your school". The three educational motivations which they would cite in support of their request were chosen in order of priority from the list in Table 6.

Table 6

Motivational Categories

1) DRILL: Computers are very good for mechanical drill and practice activities. They are patient and non-threatening, and can adjust the level and pace of the drill to the students demonstrated progress.

2) ENRICHMENT: Computers make extra information and activities available to students who have mastered core topics. They can explore new ideas and activities while the teacher continues to work with the rest of the class.

3) INDIVIDUALIZATION: The computer can make a wide variety of information and instruction available to students. Moreover, they can select these materials according to their needs and proceed at their own pace.

4) INTEREST: Students like to undertake computer-based tasks and consequently are motivated to participate actively in the educational activities presented by the software. It arouses interest and holds attention.

5) LITERACY: Computers are an important item of modern technology. Students need to become familiar enough with their use that they are comfortable with them and can realistically assess their power and their limitations.

6) REINFORCEMENT: Computer software is another way to illustrate and reinforce the curriculum. It offers the opportunity to practice skills and apply concepts learned through classroom instruction.

7) UTILITY: The computer is a powerful tool and students should learn to use it for the same reason that they learn to use a calculator or a telephone. It enhances their ability to explore, to reason and to communicate.

<u>Note</u>. The categories are listed in alphabetical order.

The motivations in Table 6 were read to the respondents in random order with the instruction to write down the key word for the category. The order of presentation to the respondent was determined from a randomized list generated on an Apple IIe computer by the author. The frequency of citation of each motivation is shown in Table 7 in raw form as well as the normalized and normalized weighted forms previously explained.

Table 7

Overall Relative Importance of Motivational Categories

Motivational Category	Frequency of Citation		
	Raw	Normalized	Weighted and Normalized
Enrichment	106	147.0	894.6
Interest	107	153.7	842.6
Reinforcement	70	92.5	537.1
Literacy	52	79.3	530.1
Utility	42	62.0	523.2
Individualization	67	91.2	460.0
Drill	23	34.3	172.5

In interpreting the results shown in Table 7 it is important to remember that they are not the opinions of a representative sample of intermediate teachers. Rather these results represent the opinions of a much more experienced group. (The opinions of a representative sample on this issue were presented in discussing the preliminary survey.) One must also bear in mind that the respondents were restricted to a selection from the seven motivational categories under consideration. Also, the respondents were required to cite a motivation for each of the classes of software with which they had had experience. The data has been weighted to account for the teachers' perceived importance of each program but the previous data may better represent the actual time spent in pursuing each goal or activity. As a particular example we may note that the computer's importance as a word processor was clearly the major reason for its use in the classroom according to the preliminary survey but this motivation is relegated to fifth spot in the present ranking. This is probably due to the fact that word processing was only one of the five software categories considered and the only one for which "utility" would be a common motivation.

The relative importance of each motivation for the use of the various software groups may be seen in Table 8. The results shown represent the frequency of citation weighted to indicate the relative importance of each motivation to an individual respondent by assigning a score of 3 for the primary motivation, 2 for the second motivation and 1 for the last motivation of the three requested. Again, these results are not representative of the population as a whole but do indicate the relative importance of the motivational categories in each software category for this experienced sample of teachers.

Table 8

Relative Importance of Motivational Categories

With Reference to Selected Software

Motivational Category	Percentage of Weighted Citation Frequency				
	text editor	Logo	math process	science process	MECC simulation
Enrichment	12.8	32.0	21.5	38.7	22.8
Interest	16.1	24.2	19.3	22.6	35.3
Reinforcement	12.0	8.2	26.6	4.7	15.8
Literacy	18.6	13.4	3.4	12.3	10.9
Utility	33.9	4.6	1.3	0.0	3.8
Individualization	6.6	17.5	9.4	20.8	10.9
Drill	0.0	0.0	18.5	0.9	0.5

The correlation between the various measures of experience and the normalized weighted frequency of citation is given in Table 9. Since the "years of use" and "programs used" data is measured on a ratio scale while the "training level" is measured on an ordinal scale, Pearson's product moment correlation coefficient has been used for the two former sets of data while a rank correlation has been calculated for the latter data and both combined measures. The "product" measure is just the experience coefficient previously defined while the "sum" measure is a simple sum of the three individual measures of experience.

Table 9

Correlation Between Measures of Experience

and Frequency of Citation of Various Motivational Categories

Motivational Category	Experience Measure				
	training level	years of use	programs used	combined measure	
				sum	product
Enrichment	+0.06	+0.21	+0.02	+0.10	+0.11
Interest	-0.06	-0.27	-0.07	-0.03	-0.03
Reinforcement	+0.03	+0.33*	+0.25	+0.37*	+0.37*
Literacy	-0.34*	-0.38*	-0.23	-0.37*	-0.35*
Utility	+0.30*	+0.18	+0.05	+0.20	+0.16
Individualization	+0.35*	+0.31*	+0.06	+0.19	+0.18
Drill	-0.10	-0.38*	-0.06	-0.16	-0.15

*$p < 0.05$

Note. The normalized weighted frequency of citation has been used.

Chapter 5

DISCUSSION OF THE RESULTS

5.1 INTRODUCTION

The results of this study confirm the conventional wisdom that computer-based education in British Columbia is still in its infancy. There is great diversity in the availability of computer hardware and software across the province and in the experience and training of teachers. It is probably fair to assume that the relative scarcity of computer resources is a significant contributing factor in retarding the development of expertise in the teaching force. As the availability of computer resources increases the experience of the teaching force will automatically increase.

However, it would be naive to assume that broader experience automatically ensures greater sophistication. A closer look at the results indicates that there is little evidence for a developmental pattern associated with increases in either training or experience.

The descriptive results up to and including Table 7 probably speak for themselves. Tables 8 and 9, on the other hand, require some interpretation.

5.2 THE EFFECT OF EXPERTISE

Detailed interpretation of the results in Table 8, which shows the relative importance of the various motivational categories for each of the software categories, would be largely speculative. However, the author will venture a couple of observations. First, we may see that the motivation for using Logo and the various science processes programs is primarily "enrichment" and "interest" while "reinforcement" is only weakly cited. In the case of Logo this is probably due to the fact that the value of the activity in promoting logical analysis and problem solving skills does not find any convenient curricular label and thus teachers may hesistate to claim to be reinforcing instruction. In the case of the science processes programs such as Gertrude's Secrets and Moptown Hotel the author would suggest that most intermediate teachers do not associate the processes of classification and deduction contained within these programs with science and therefore are without a convenient curricular label once again. The author can, however, offer no explanation for the strong showing of the "individualization" motivation for this class of software which would seem inconsistent with this line of argument.

The correlation between the various measures of experience and the normalized weighted frequency of citation is given in Table 9. The most striking feature of the data is the absence of strong correlations between any of the variables. Some are statistically significant in that they exceed the minimum threshold but none are strong. This absence of developmental patterns is indicative of a situation where concensus is weak and leadership is sporadic. The casual observer of the provincial scene would certainly perceive a rather eclectic and ad hoc approach to computer-based education and the data reflects that lack of strong direction.

There is, however, a statistically significant positive correlation between "reinforcement" and overall experience and a significant negative correlation between "literacy" and overall experience. There is no significant correlation between overall experience and any other motivational category. Among the component measures we find a positive correlation between "utility" and "training", "individualization" and "training", "reinforcement" and "years of use", and "individualization" and "years of use". There is a negative correlation between "literacy" and "training", "literacy" and "years of use", and "drill" and "years of use".

The strongest and most consistent correlation is between "literacy" and the various measures of experience. The importance attached to the promotion of computer literacy decreases with both training and length of use. This developmental pattern can probably be attributed largely to the fact that computer literacy is a poorly defined concept. There is not even a commonly accepted definition of the term let alone empirical evidence that incidental contact with computer-based activities will promote such literacy. It is essentially an unsubstantiated article of faith among members of the educational community that students will gain some meaningful and empowering knowledge of computer technology and its impact on their lives simply by virtue of exposure to computers. None of the programs involved in this survey has the promotion of computer literacy as a primary goal. Consequently, the belief that any one of them promotes computer literacy must come from the teacher. The evidence here is that as they acquire training or as the length of their experience increases teachers tend to devalue this motivation. This may be because they move on from this rather vague global goal to more specific objectives in their use of computers.

This possibility is substantiated by the presence of significant positive correlations between several other goals and the various measures of experience. It would seem that their training shows teachers the potential of the computer for individualizing instruction and its importance as a tool in the writing process. (Analysis of the data shows that 76% of the times "utility" was cited it was in connection with word processing.) As the length of their exposure to computer-based education increases teachers show a heightened appreciation of the use of the computer for individualizing instruction and for reinforcing the curriculum. As the potential of the computer for these more specific educational goals increases the importance of promoting the vague and more global goal of computer literacy decreases. There is also a decreased importance attached to the use of the computer for drill and practice. This shift in emphasis is probably also due to a dawning recognition of other areas of potential application.

One final pattern of interest in the data is the absence of correlation between some motivational categories and particular measures of experience where a correlation does exist with another measure of experience. For example, teachers tend to attach increased significance to the ability of the computer to provide reinforcing educational experiences in general and less to drill and practice activities in particular as the length of their exposure increases. However, there is no such correlation with training. Are the various courses and workshops available to teachers failing to assist them in discovering the specific curricular applications of computers? It is also striking to note the complete absence of any correlation between the number of programs used and the various motivations. The data shows that teachers' perspectives on computer-based education do in fact change through training and over time but they do not change purely as a result of increased exposure. This is probably due to the fact that the various educational motivations are closely related to a teacher's classroom behaviours and beliefs. It takes time to reconceptualize and to shift either behaviour or beliefs. A course of instruction may be useful in initiating or accelerating such a change but it will still take time to accomplish.

Interpretation of the correlation data should be mitigated by recognition of the possibility that the subjects may have been responding in the manner that they felt they should respond rather than in a purely personal manner. For instance, more importance was attached to the goal of enrichment than to any other but there was no developmental pattern associated with it. Does this indicate that the term represents a bit of educational apple pie which teachers feel bound to cite as an important motivation whether or not they truly use the computer for this purpose? The necessity to attach a single descriptive key word to each motivational category in order to conduct the telephone interview may possibly have introduced such a confounding factor into the data. Such a factor should, however, apply uniformly across the spectrum of experience and should not seriously affect any trends which exist in the data.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

The following general conclusions concerning the nature and extent of computer use in intermediate classrooms in British Columbia are drawn from the data:

a) There is a great diversity in the availability of computer hardware and software and in the expertise of teachers across the province. The number of computers available to a class ranged from 0 to 19 and the number of programs on a standard list reported as having been used ranged from 0 to 43.

b) There is great diversity in the experience and training of teachers. Classroom experience varied from none to more than 6 years and a variety of educational backgrounds were reported ranging from no training at all up to an undergraduate degree in Computer Science.

c) In general, computer access in intermediate classrooms is severely limited. Among the respondents (40% of the sample), 11% reported no access at all, 29% reported access to a single computer, 16% reported access to two and 11% reported access to three computers.

d) In general, intermediate teachers have minimal training in the use of computers. Among the respondents, 33% reported no specific training at all, and 38% reported less than five days of in-service training.

e) In general, intermediate teachers have had only brief experience in using computers. The median value for the length of the respondents' experience with the computer was 1.5 years.

The following conclusions concerning the particular types of computer use in intermediate classrooms in British Columbia are drawn from the data:

f) The most widely used programs on the standard software list were Bank Street Writer, Logo (various versions), typing training programs, mathematics programs and various materials from the Minnessota Educational Computing Consortium (MECC).

g) The respondents ranked computer-based strategies superior to traditional techniques in teaching language arts and problem solving.

The following conclusions concerning the factors which motivate intermediate teachers in British Columbia to apply computer-based instructional strategies are drawn from the data:

h) The educational motivations most commonly reported by the respondents for using the computer in the classroom fell into seven major categories. These may be characterized, in descending order of frequency of citation, by the following key words: utility, interest, literacy, drill, enrichment, reinforcement and individualization. (These motivations are defined more fully in Appendix E.)

i) The educational motivations cited by the respondents show little evidence of any clear developmental pattern associated with an increase in experience. The importance attached to the seven motivations identified is only dependent on overall expertise in two cases: literacy and reinforcement. The correlation in these two cases is statistically significant but not strong.

j) The correlations which do exist indicate that with increased training and increased length of time using computer-based instructional strategies teachers tend to devalue the objective of promoting computer literacy and inflate the objectives of reinforcing traditional instruction, individualizing instruction and using the computer as a productivity tool for text editing. An increase in the number of programs which a teacher uses does not seem to have any effect in modifying the importance attached to the seven educational motivations examined.

6.2 LIMITATIONS OF THE CONCLUSIONS

6.2.1 Selection of the Sample

The return rate, although typical of mail questionnaires, was not high. This creates the possibility that the data is not representative of the population as a whole. The subjects were randomly selected from members of two PSAs but membership in these organizations represents a selection criterion in itself. Moreover, since the respondents have demonstrated a greater than average interest in the topic of educational computer use through the very act of responding it is likely that the data derived from the questionnaire is somewhat skewed by this *de facto* selection criterion. These two factors may tend to create a somewhat inflated impression of the degree of activity and interest in the educational use of computers.

6.2.2 Extrapolation of the Results

Since the selection process may be flawed and the data displays great variability, the results of the questionnaire may not be generalizable to the province as a whole. In particular, any numerical extrapolation to a larger population should be done with caution.

Moreover, the entire field of edcuational computing is in a state of great flux. The amount of computer hardware available to teachers is probably increasing rapidly, particularly with the recent awards from the Fund for Excellence in Education. This complicates the process of generalizing any of the specific numeric data. In addition, the quality of the available software is changing. Introduction of a single package of high technical quality and educational merit could create a significant change in the pattern of use quite quickly. A previous example of such a shift would be the introduction of Logo. The very youth and vigour of educational computer use makes it necessary to extrapolate into the future with caution.

6.3 RECOMMENDATIONS FOR FURTHER RESEARCH

The results of this study to examine the nature and extent of computer use in intermediate classrooms in British Columbia suggest that the following further studies may be of value.

a) Replicate the mail questionnaire or otherwise determine the rate of growth in the use of computers in education.

b) Conduct a survey of the courses and workshops offered by the various professional and educational institutions in the province of British Columbia to determine whether the content is designed to promote development of the participant's appreciation of and proficiency in the educational use of computers. The results of the present study would tend to indicate that the training being received by teachers is having a minimal effect on their perspective.

c) Conduct a more detailed study of the beliefs held by teachers concerning the motivations for and consequences of educational computer use with specific reference to a particular application such as text editing or instruction in Logo to determine the degree to which they are focussing on a global concern for computer literacy or more specific curricular objectives. The study should specifically attempt to identify any developmental pattern which may exist.

REFERENCE LIST

Bangert-Drowns, R. L., Kulik, J. A., & Kulik C. C. Effectiveness of Computer-Based Education in Secondary Schools. Journal of Computer-Based Instruction, Summer 1985, 12(3), 59-68.

Bell, M. E. The Role of Instructional Theories in the Evaluation of Microcomputer Courseware. Educational Technology, March 1985, 25(3), 36-40.

Bourque, J. H., & Ramage, K. The Hidden Costs of Computer Innovation. Educational Technology, November 1984, 24(11), 36-39.

Bright, G. W. Explaining the Efficiency of Computer Assisted Instruction. Association for Educational Data Systems Journal, 1983, 16(3), 144-152.

Carmichael, H. W., Burnett, J. D., Higginson, W. C., Moore, B. G., & Pollard, P. J. Computers, Children and Classrooms: A Multisite Evaluation of the Creative Use of Microcomputers by Elementary School Children. Ontario: Ministry of Education, 1985.

Chomsky, C. Finding the Best Language Arts Software. Classroom Computer Learning, January 1984, 4(6), 61-63.

Cicchelli, T., Baecher, R. Introducing Microcomputers into the Classroom: A Study of Teacher's Concerns. Journal of Educational Computing Research, 1985, 1(1), 55-65.

Cohen, V. B. Criteria for the Evaluation of Microcomputer Courseware. Educational Technology, January 1983, 23(1), 9-14.

Criswell, E. L., & Swezey, R. W. Behavioural Learning Theory-Based Computer Courseware Evaluation. Educational Technology, November 1984, 24(11), 43-46.

DeKoven, B. Technolust and What To Do About It. Popular Computing, Mid-October 1984, 3(13), 61-64.

Evaluator's Guide for Microcomputer-Based Instructional Packages (original draft developed by Northwest Regioanl Educational Laboratory's Computer Technology Program with the assistance of the Research on Evaluation Program of NWREL). British Columbia: Provincial Educational Media Centre, 1983.

Flodin, N. B.C. Public Schools Microcomputer In-Service Survey. British Columbia: British Columbia Teachers' Federation, October 1984.

Futrell, M., & Geisert, P. Selecting Computer Software - We Take It Seriously. The Computing Teacher, 1985, 12(2), 63-64.

Gagne, R. M. Developments in Learning Psychology: Implications for Instructional Design; and Effects of Computer Technology on Instructional Design and Development. An Interview. Educational Technology, 1982, 22(6), 11-15.

Gagne, R. M., Wager, W., & Rojas, A. Planning and Authoring Computer-Assisted Instructional Lessons. Educational Technology, 1981, Vol. 21, pp. 17-26.

Gillis, L. A Formative Evaluation Plan for Exemplary Software. Ontario Educational Software Service (distributed by TVOntario), 1984.

Gorth, W. P., & Nassif, P. M. A Comparison of Microcomputer-Based, Computer-Managed Instruction (CMI) Software. Educational Technology, January 1984, 24(1), 28-32.

Hall, G. E., & Loucks, S. F. et al. Levels of Use of the Innovation: A Framework for Analyzing Innovation Adoption. Journal of Teacher Education, 1975, 26(1), 52-56.

Hall, G. E., & Loucks, S. F. A Developmental Model for Determining whether the Treatment is Actually Implemented. American Educational Research Journal, 1977, 14(3), 263-276.

Harrison, C. Criteria for Evaluating Microcomputer Software for Reading Development: Observations Based on Three British Case Studies. Journal of Educational Computing Research, 1985, 1(2), 221-234.

Huberman, M. Microanalysis of Innovation Implementation at the School Level. unpublished.

Jay, T. B. The Cognitive Approach to Computer Courseware Design and Evaluation. Educational Technology, January 1983, 23(1), 22-25.

Jones, R. S. D., Porter, D., & Rubis, R. A Survey of Microcomputers in B.C. Schools. Burnaby: Simon Fraser University, 1983.

Kearsley, G. Microcomputer Software: Design and Development Principles. Journal of Educational Computing Research, 1985, 1(2), 209-220.

Klopfer, L. E., et al. Microcomputer Software Evaluation Instrument Version 1983. Science Teacher, January 1984, 51(1), 95-98.

Larsen, R. E. What Communication Theories Can Teach the Designer of Computer-Based Training. Educational Technology, July 1985, 25(7), 16-19.

Lathrop, A. Microcomputer Software for Instructional Use: Where Are the Critical Reviews? The Computing Teacher, 1982, 9(6), 22-26.

Let's Talk About Schools: a discussion paper on British Columbia schools. British Columbia: Ministry of Education, 1985.

Levin, H. M., & Meister G. Is CAI Cost-Effective? Phi Delta Kappan, June 1986, 67(10), 745-749.

Lewin, A. W. Down With Green Lambs: Creating Quality Software for Children. Theory Into Practice, Fall 1983, 22(24), 272-280.

Lortie, D. School: A Sociological Study. Chicago: University of Chicago Press, 1975.

McLaughlin, M., & Marsh D. Staff Development and School Change. Teachers College Record, 1978, 80(1), 69-94.

Merrill, P. F., Salisbury, D. Research on Drill and Practice Strategies. Journal of Computer-Based Instruction, 1984, 11(1), 19-21.

Ohles, J. F. The Microcomputer: Don't Love It to Death. Technological Horizons in Education Journal, August 1985, 13(1), 49-53.

Reid, W. A. The Changing Curriculum: Theories and Practice. In Reid & Walker (Eds.), Case Studies in Curriculum Change, Boston: Routledge and Kegan Paul, 1975, pp. 240-259.

Rothe, J. P. Critical Evaluation of Educational Software from a Social Perspective: Uncovering Some Hidden Assumptions. Educational Technology, September 1983, 23(9), 9-14.

Schug, M. C., & Kepner, H. S. Jr. Choosing Computer Simulations in Social Studies. Social Studies, September-October 1984, 75(5), 211-215.

Senn, P. R. Six Checklists to Prepare Your Classroom for Technology. Social Education, May 1983, 47(5), 317-320.

Shostak, R., & Golub, L. S. A Guide to Producing Educational Software. The Computing Teacher, March 1984, 11(7), 26-27.

Signer, B. How do Teacher and Student Evaluation of CAI Software Compare? The Computing Teacher, March 1983, 11(7), 34-36.

Simpson, N. A Research Study of School Computer Use. Educational Computer, 1983, 11(3), pp. 15-16; 37.

Steffin, S. A. A Suggested Model for Establishing the Validity of Computer-Assisted Instruction Materials. Educational Technology, January 1983, 23(1), 20-22.

Taylor, R. P. The Computer in the School: Tutor, Tool, Tutee. Teachers College Press, 1980.

TECHnically Speaking (Editorial Column). Educational Technology, June 1984, 24(6), 6.

Tetenbaum, T. J., & Mulkeen, T. A. LOGO and the Teaching of Problem Solving: A Call for a Moratorium. Educational Technology, November 1984, 24(11), 16-19.

Thomas, D. A High School Evaluates Software (with an Evaluation Form). Educational Technology, September 1984, 24(9), 21-24.

Van Dijk, T. A. M., Gastkemper, F., & Romeijn, W. Motives for CAI in Post-Secondary Education. Journal of Computer-Based Instruction, 1985, 12(1), 8-11.

Vargas, J. S. Instructional Design Flaws in Computer-Assisted Instruction. Phi Delta Kappan, June 1986, 67(10), 738-744.

Wager, W. Design considerations for instructional computing programs. Journal of Educational Technology Systems, 1982, Vol. 10, pp. 261-269.

Wallace, J., & Rose, R. M. A Hard Look at Software: What to Examine and Evaluate (with an Evaluation Form). Educational Technology, October 1984, 24(10), 35-39.

APPENDIX A

COVERING LETTER FOR THE PRELIMINARY QUESTIONNAIRE

December 1985

Re: INTERMEDIATE COMPUTER USE QUESTIONNAIRE

Dear Colleague,

The enclosed questionnaire is part of my Master's thesis work at the University of British Columbia.

The purpose of this questionnaire is to determine the nature and extent of computer use in intermediate classrooms throughout British Columbia. It is intended for both experienced and inexperienced computer users. In fact, if you have no access to computers or simply have not had the time to use whatever resources may be available this fact in itself constitutes useful information. I am interested in what, if anything, is happening in all classrooms across the province but have chosen you as part of a sampling of these teachers. Please do not fail to respond just because you feel that you are not very experienced.

The questionnaire has been field-tested and will take you less than 15 minutes to complete. Please try to find a little time in your busy schedule to assist me in this study.

A stamped self-addressed envelope is enclosed for your convenience in returning the completed questionnaire. If you are interested in receiving a summary of the results, including a list of the most popular software, please indicate this by enclosing your own stamped self-addressed envelope with your return.

Thank you for your valuable assistance.

J. A. B. Beairsto

APPENDIX B

THE PRELIMINARY QUESTIONNAIRE

INTERMEDIATE COMPUTER USE

A REVIEW OF THE NATURE AND EXTENT OF COMPUTER USE IN INTERMEDIATE CLASSROOMS IN BRITISH COLUMBIA
DECEMBER 1985

A) BACKGROUND INFORMATION

+Optional completion

School District No: _____ School name: ______________________________

Teacher's name (please print): ____

Grade(s) you teach: _______ Do you use Apple computers? yes: ____ no: ____

If you do not use Apples, what other make do you use? ____________________

Number of computers available to your class: II+: ____ IIe: ____ IIc: ____

What is the usual size of your class when you are using the computers? _____

How are the computers in your school distributed?
in separate classrooms: ____ in a designated "lab": ____ mobile: ____

If the preceding questions cannot be answered unambiguously please explain the special circumstances in your school below.

____

____

How long have you been using computers with students in the classroom?

1 yr: ____ 2 yr: ____ 3 yr: ____ 4 yr: ____ 5 yr: ____ 6 yr +: ____

How long have you been using computers yourself for non-instructional purposes such as private or professional word processing?

1 yr: ____ 2 yr: ____ 3 yr: ____ 4 yr: ____ 5 yr: ____ 6 yr +: ____

Are you a member of the Computer Using Educators of British Columbia (CUEBC), which is the BCTF PSA for computer users? yes: ____ no: ____

Have you had any specific training in the use of computers? yes ____ no ____

If yes, please explain. ____

____

If you do not use Apple computers or if you do not teach students in grades 4, 5, 6 or 7 then the rest of the questionnaire need not be completed. However, I would appreciate your returning even this much. Thankyou.

B) SOFTWARE YOU HAVE USED AT LEAST ONCE

Please indicate the programs you have used at least once in the classroom by placing a tick in the appropriate box.

	TITLE	PUBLISHER
[ ]	ADDITION MAGICIAN	TLC
[ ]	ADVENTUREWRITER	CODEWRITER
[ ]	ALIEN ADDITION	DLM
[ ]	ALLIGATOR ALLEY	DLM
[ ]	ALLIGATOR MIX	DLM
[ ]	ALPHABETIC KEYBOARDING	SW PUB
[ ]	ALPHABETIZE	JMH
[ ]	ANALOGIES	PRO DESIGN
[ ]	APPLE LOGO	APPLE
[ ]	APPLE LOGO II	APPLE
[ ]	APPLE PRESENTS APPLE	APPLE
[ ]	APPLE SPRITE LOGO	LCSI
[ ]	APPLE SUPER PILOT	APPLE
[ ]	APPLE WRITER IIE	APPLE
[ ]	ARCHON	ELECTR ART
[ ]	ARISTOTLE'S APPLE	STONEWARE
[ ]	ARITH-MAGIC	QED
[ ]	ARITHMETIC-TAC-TOE	EDUTEK
[ ]	BANK STREET SPELLER	SCHOLASTIC
[ ]	BANK STREET WRITER	SCHOLASTIC
[ ]	BASIC ARITHMETIC	MECC
[ ]	BASIC NUMBER FACTS	CNTRL DATA
[ ]	BATTLING BUGS/CONCENTRATN	MILLIKEN
[ ]	BLAZING THE BASIC TRAIL	SUNBURST
[ ]	BUMBLE GAMES	TLC
[ ]	BUMBLE PLOT	TLC
[ ]	CAUSE & EFFECT	LEARN WELL
[ ]	CDIM LEVEL A	SRA
[ ]	CDIM LEVEL B	SRA
[ ]	CDIM LEVEL C	SRA
[ ]	CHALLENGE MATH	SUNBURST
[ ]	CHARACTRSTCS OF A SCNTST	CYGNUS
[ ]	CHECKERS	ODESTA
[ ]	CHESS	ODESTA
[ ]	CODE QUEST	SUNBURST
[ ]	COMMUNITY SEARCH	MCGRAW HIL
[ ]	COMP LIT ADV OF LOL DRAGN	SVE
[ ]	COMP-U-SOLVE	ED'L ACTV
[ ]	COMPREHENSION POWER	MILLIKEN
[ ]	COMPU-POEM	SCWRIP
[ ]	COMPUTER GENERATD MTH V.2	MECC
[ ]	CONPUTER LIT INST PRGM	ED'L ACTV
[ ]	CREATIVE PLAY	LAWR HALL
[ ]	CROSSWORD MAGIC	MINDSCAPE
[ ]	CRYPTO CUBE	DESIGNWARE
[ ]	CUT AND PASTE	ELECTR ART
[ ]	DARK CRYSTAL	SIERRA
[ ]	DECIMAL SKILLS	MILT BRAD
[ ]	DELTA DRAWING	MECC
[ ]	DEMOLITION DIVISION	DLM

	TITLE	PUBLISHER
[ ]	DISCOVERY LAB	MECC
[ ]	DISCRIM ATRB & RULES	SUNBURST
[ ]	DIVIDE FRACTIONS	CBS
[ ]	DIVISION SKILLS	MILT BRAD
[ ]	DRAGON MIX	DLM
[ ]	DRAGON'S KEEP	SIERRA
[ ]	EASY GRAPH	GROLIER
[ ]	ELEM MATH CLSRM LANG SYSTEM	STER SWIFT
[ ]	ELEMENTARY LIB MEDIA SKL	COMBASE
[ ]	ELEMENTARY V.1: MATH	MECC
[ ]	ELEMENTARY V.3: SOC ST	MECC
[ ]	ELEMENTARY V.4: MATH/SCI	MECC
[ ]	ELEMENTARY V.6: SOC ST	MECC
[ ]	ENERGY SEARCH	MCGRAW HIL
[ ]	EXPEDITIONS	MECC
[ ]	EXPLORER METROS	SUNBURST
[ ]	EXPLORING LOGO	SUNBURST
[ ]	EZ LOGO	MECC
[ ]	FACT AND FICTION TOOLKIT	SCHOLASTIC
[ ]	FACTORY	SUNBURST
[ ]	FANTASY LAND	LEARN WELL
[ ]	FAY THAT MATH WOMAN	DIDATECH
[ ]	FRACTIONS PRACTICE	CNTRL DATA
[ ]	FRENZY/FLIP FLOP	MILLIKEN
[ ]	FRIENDLY COMPUTER	MECC
[ ]	FRIENDLY FILER	GROLIER
[ ]	FUN HOUSE MAZE	SUNBURST
[ ]	FUNDAMENTAL MATH II	RANDOM
[ ]	GALAXY MATH FACTS GAME	RANDOM
[ ]	GENETICS	TIES
[ ]	GEOLOGY SEARCH	MCGRAW HIL
[ ]	GEOMETRIC CONCEPTS: AREA	JOSTENS
[ ]	GEOMETRIC CONCEPTS: PERIMETER	JOSTENS
[ ]	GERTRUDE'S PUZZLES	TLC
[ ]	GERTRUDE'S SECRETS	TLC
[ ]	GLOBAL PROGRAM LINE EDTR	BEAGLE BRO
[ ]	GOLF CLASSIC/COMPUBAR	MILLIKEN
[ ]	GRAND PRIX	RANDOM
[ ]	GREAT CREATOR, THE	GESSLER
[ ]	GULP!!ARROW GRAPHICS	MILLIKEN
[ ]	HEY, TAXI!	MILT BRAD
[ ]	HIGH RISE	MICRO LAB
[ ]	HINKY PINKY	22ND AVE
[ ]	HOMEWORD	SIERRA
[ ]	HOT DOG STAND	SUNBURST
[ ]	IDEA INVASION	DLM
[ ]	IN SEARCH OF MOST AMAZING	SPINNAKER
[ ]	INCREDIBLE LABORATORY	SUNBURST
[ ]	INTERPRETING GRAPHS	CONDUIT
[ ]	INTRO TO MICRO COMPUTERS	MCGRAW HIL

Please indicate the programs you have used at least once in the classroom by placing a tick in the appropriate box.

	TITLE	PUBLISHER
[_]	INTRO TO MICROCMP KEYBD	ED AUDIO
[_]	ISLE OF MEM	GROLIER
[_]	JIGSAW	ISL SOFTWR
[_]	JINX/WELTER	ISL SOFTWR
[_]	KAREL SIMULATOR	CYBERTRON
[_]	KING'S RULE	SUNBURST
[_]	LEARNING ABOUT NUMBERS	C & C SOFT
[_]	LIBRARY USAGE SKILLS	JMC
[_]	LONG DIVISION	MIC WRKSHP
[_]	M-SS-NG L-NKS, ENGLISH ED	SUNBURST
[_]	M-SS-NG L-NKS, YG PPLS LT	SUNBURST
[_]	MAGIC SLATE	SUNBURST
[_]	MANAGING LIFESTYLES	SUNBURST
[_]	MASTER MATCH	ADV ID
[_]	MASTER MATCH (DLM)	DLM
[_]	MASTERTYPE	SCARABOROU
[_]	MATH ACTIVITIES 4	HOUGHTON
[_]	MATH ACTIVITIES 5	HOUGHTON
[_]	MATH ACTIVITIES 6	HOUGHTON
[_]	MATH ACTIVITIES 7	HOUGHTON
[_]	MATH BASEBALL	ED'L ACTV
[_]	MATH BLASTER	DAVIDSON
[_]	MATH CONCEPTS I & II	HARTLEY
[_]	MATH SEQUENCES	MILLIKEN
[_]	MATHWARE	ESSERTIER
[_]	MEDALISTS: BLACK AMERICANS	HARTLEY
[_]	MEDALISTS: CONTINENTS	HARTLEY
[_]	MEDALISTS: WOMEN IN HISTORY	HARTLEY
[_]	MEMORY CASTLE	SUNBURST
[_]	MEMORY: THE FIRST STEP	SUNBURST
[_]	METEOR MISSION	DLM
[_]	METEOR MULTIPLICATION	DLM
[_]	METRIC & PROBLEM SOLVING	MECC
[_]	MILLIKEN WORD PROCESSOR	MILLIKEN
[_]	MINUS MISSION	DLM
[_]	MIX AND MATCH	APPLE
[_]	MOPTOWN HOTEL	TLC
[_]	MOPTOWN PARADE	TLC
[_]	MOUSE PAINT	APPLE
[_]	MULTIPLYING FRACTIONS	MIC WRKSHP
[_]	MUSIC THEORY	MECC
[_]	NUMBER WORDS-LEVEL 1&2	HARTLEY
[_]	OH, DEER!	MECC
[_]	PIC.BUILDER	WEEK READ
[_]	PINBALL CONSTRUCTION SET	ELECTR ART
[_]	POND, THE	SUNBURST
[_]	PRINT SHOP, THE	BRODERBUND
[_]	PROFESSIONAL SIGN MAKER	SUNBURST
[_]	PUZZLE TANKS	SUNBURST
[_]	PUZZLER, THE	SUNBURST

	TITLE	PUBLISHER
[_]	PUZZLES AND POSTERS	MECC
[_]	QUILL	DC HEATH
[_]	READ & SOLVE MATH PROBS	ED'L ACTV
[_]	ROCKY'S BOOTS	TLC
[_]	SARGON III	HAYDEN
[_]	SCHOOL UTILITIES V.2	MECC
[_]	SCIENCE V.3	MECC
[_]	SENSIBLE SPELLER IV	SENSIBLE
[_]	SHELL GAMES	APPLE
[_]	SKILLS MAKER	LIB SOFT
[_]	SNOOPER TROOPS #1	SPINNAKER
[_]	SNOOPER TROOPS #2	SPINNAKER
[_]	SONGWRITER	SCARBOROUG
[_]	SPECIAL NEEDS V.1	MECC
[_]	SPOTLIGHT	APPLE
[_]	SQUARE PAIRS	SCHOLASTIC
[_]	STORY TREE	SCHOLASTIC
[_]	SURVIVAL MATH	SUNBURST
[_]	TEASERS BY TOBBS	SUNBURST
[_]	TEMPERATURE LAB	HAYDEN
[_]	TERRAPIN LOGO	TERRAPIN
[_]	THAT'S MY STORY	LEARN WELL
[_]	THREE R'S OF MCROCMPTNG	MECC
[_]	TIC TAC SHOW	ADV ID
[_]	TRAFFIC JAM	ISL SOFTWA
[_]	TROLL'S TALE	SIERRA
[_]	TURTLE TRACKS	SCHOLASTIC
[_]	TUTORIAL COMPR; MN ID	RANDOM
[_]	TYPE ATTACK	SIRIUS
[_]	TYPING TUTOR	MICROSOFT
[_]	VOYAGE OF MIMI:MPS&NVGTN	HOLT, R&W
[_]	WHATSIT CORPORATION	SUNBURST
[_]	WHOLE NUMBERS: PRACTICE	CNTRL DATA
[_]	WIZ WORKS	DLM
[_]	WIZARD OF WORDS	ADV ID
[_]	WORD ATTACK	DAVIDSON
[_]	WORD MAN	DLM
[_]	WORD SPINNER	TLC
[_]	WRITE CHOICE	ROGER WAGN
[_]	WRITE STUFF	HARPER ROW
[_]	ZORK I & II	INFOCOM

C) YOUR FAVOURITE SOFTWARE

Professional use **IN CLASS**

Rate the value of the computer software which you have actually used in the classroom in each of the following application areas by comparing it to more traditional instructional techniques. If you have not used any software in an application area simply skip over it.

Example of how to complete the table

	much inferior			roughly equal			much superior
1) Artificial intelligence	1	2	3	4	5	(6)	7
circle number of programs actually used:	0	1	2	(3)	4	5	6

favourite(s): 1) SARGON 2) ____________________

	much inferior			roughly equal			much superior
1) Art	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6

favourite(s): 1) ____________________ 2) ____________________

	much inferior			roughly equal			much superior
2) French	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6

favourite(s): 1) ____________________ 2) ____________________

	much inferior			roughly equal			much superior
3) Language Arts	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6

favourite(s): 1) ____________________ 2) ____________________

	much inferior			roughly equal			much superior
4) Mathematics	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6

favourite(s): 1) ____________________ 2) ____________________

	much inferior			roughly equal			much superior
5) Music	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6
favourite(s): 1) ____________________ 2) ____________________							

	much inferior			roughly equal			much superior
6) Physical Education	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6
favourite(s): 1) ____________________ 2) ____________________							

	much inferior			roughly equal			much superior
7) Problem Solving/Logic	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6
favourite(s): 1) ____________________ 2) ____________________							

	much inferior			roughly equal			much superior
8) Science	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6
favourite(s): 1) ____________________ 2) ____________________							

	much inferior			roughly equal			much superior
9) Social Studies	1	2	3	4	5	6	7
circle number of programs actually used:	0	1	2	3	4	5	6
favourite(s): 1) ____________________ 2) ____________________							

If there are any other items of software which you have found particularly useful in the classroom please list them below.

1) name: ____

application: ____

2) name: ____

application: ____

Professional use **OUTSIDE OF CLASS**

Please list one or two of your favourite programs for each of the following non-instructional applications. Do not feel obligated to fill in all the boxes. Only list programs <u>you have personally used</u> and found to be worthwhile.

	program names
1) word processing........................ (eg. preparing handouts)	1)
	2)
2) mark book..............................	1)
3) instructional materials generation..... (eg. math drills, crosswords, tests)	1)
	2)
	3)

If there are any other items of software which you have found particularly useful outside of class please list them below.

1) name: ______________________________

application: ______________________________

2) name: ______________________________

application: ______________________________

3) name: ______________________________

application: ______________________________

D) STYLES OF USE

Rank the following alternative styles of computer use in descending order of educational value in your actual experience by placing one of the digits from 1 to 4 in the space provided opposite each description.

REGULAR INSTRUCTION: the use of the computer to communicate knowledge or concepts to students as an alternative to other methods of instruction. **Implies use with all students.** ....____

SUPPLEMENTAL INSTRUCTION: the use of the computer to enhance or supplement regular classroom instruction. **Implies use with all students.** ....____

REMEDIATION: the use of the computer to provide extra help as necessary for students who require assistance beyond the bounds of regular instruction. **Implies occasional use with some students only**, not supplemental instruction for all. ......____

ENRICHMENT: the use of the computer to provide additional learning experiences for students beyond the bounds of regular instruction. **Implies occasional use with some students only**, not supplemental instruction for all. ..____

E) REASONS FOR USING THE COMPUTER IN THE CLASSROOM

Other than the fact that students generally like to use computers and parents applaud their introduction, why do you use computers in your classroom. What educational advantages do they offer? Please list the three most important ones with a brief explanation if necessary.

1) ____

____

____

2) ____

____

____

3) ____

____

____

APPENDIX C

SUMMARY OF QUESTIONNAIRE RESULTS FOR RESPONDENTS

INTERMEDIATE COMPUTER USE: a review of the nature and extent of computer use in Intermediate classrooms in British Columbia with summary conclusions.

In order to define the nature and extent of computer use in Intermediate classrooms in British Columbia as a part of his Masters' thesis work the author recently undertook a province-wide mail survey.

In December 1985 a seven-page questionnaire was sent to 471 randomly selected members of the 620 strong Intermediate PSA of the BCTF and all 29 members of the Computer Using Educators PSA with an intermediate-level interest. There were 198 responses. Of these, 167 were valid and 31 were invalid because the addressee was not an intermediate teacher, retired, still at University, unemployed, a non-teaching supervisor or had moved. The responses came from across the province and represented grade levels 4 through 7 equally.

Results of the Questionnaire

Apple computer users represented 63% of the respondents, Commodore 64 users 25% and various other models the remainder.

The number of computers available to the class was not reported by 19% of the respondents. Of those reporting, 11% had no access of any kind, 29% had access to a single computer, 16% to two and 11% to three. The results ranged up to nineteen. However, the actual number of computers available to the average classroom is difficult to guage since they are often shared between classes or organized into labs which rotate throughout a district over the course of the year and consequently the numbers reported do not represent permanently resident machines in all cases. The results can still be seen to indicate that the "typical" classroom contains one computer or no computers on a regular basis.

Teachers were asked both how long they had been using a computer in the classroom and how long they had been using it outside of class. The vast majority indicated less personal use than professional use which probably indicates that their first introduction to computers came through the classroom. The average of the two indicators of length of computer experience ranged from 0.0 years (14%) to 5.5 years (one person) with an average of 1.8 years and a median of 1.5 years.

Teacher training was analyzed using an arbitrary coefficient assigned as follows:

0 - no specific training at all
1 - up to 5 days of training in total
2 - more than 5 days and up to one semester
3 - more than one semester and up to two semesters
4 - more than two semesters

This training coefficient was based purely on time and may include any combination of local in-service activities, education courses or computer programming courses. No attempt was made to determine the relevance or value of the training to actual intermediate classroom use. The results showed that 33% of the respondents had no specific training of any kind whatsoever and a further 38% had 5 days or less. There were four respondents with more than two semesters of computer training of one type or another. The average value was 1.2 and the median was 1.

Since both training and actual experience in the classroom are important factors in developing expertise, an additional coefficient of expertise was calculated as follows:

expertise = (yrs of use + training coeff) * (# of programs used) / 5

In essence this coefficient equates one week of inservice, one year of classroom contact and actual experience with five different programs in terms of developing expertise. A teacher who had attended two non-instructional days concerning computers and used five different programs in her classroom over the period of one year would have an expertise coefficient of 2.0. Two years of use involving eight different programs combined with a one semester course would yield a coefficient of 6.4. The results ranged from 0.0 up to 48.0 with an average of 8.4 and a median of 2.4 for 95 individuals.

Respondents were asked to rate the computer as an instructional tool in comparison to more traditional media using a Likert scale on which 4 represented rough equality and 7 a significant superiority. The most frequently rated areas were language arts and mathematics and the highest rated areas were problem solving and language arts as shown in the following table.

Instructional Area	respondents	average rating
Problem solving / Logic	25	5.3 (s = 1.15)
Language Arts	46	5.1 (s = 1.11)
Mathematics	48	4.6 (s = 1.43)
Social Studies	22	4.5 (s = 1.44)
Science	22	4.5 (s = 1.44)

The programs which enjoyed the best combination of frequency of use and reporting as a "favourite" program were:

Logo	Problem Solving
Moptown Hotel	
Bank Street Writer	Language Arts
Oregon Trail	Social Studies
Fay, That Math Woman	Mathematics
Milliken Math Sequences	
Math Blaster	
Math Activities 5	
Odell Lake	Science

The author would caution that the presence of a program in the preceding list does not necessarily imply that it is of particular instructional value but only that it is widely distributed and fairly well received. This data reflects the pattern of use in classrooms as it now exists but does not constitute either an evaluation or an endorsement of the software.

Finally, respondents were asked what reasons they had for using computers in their classroom "other than the fact that students generally like to use computers and parents applaud their introduction". The results were widely varied but several distinct categories of response were evident. These are listed along with their frequency of appearance.

28	valuable as a word processor
22	useful for motivation / fun / generates interest
19	promotes "computer literacy"
13	useful for drill and practice
10	useful for enrichment
9	useful for reinforcement of instruction
9	allows student to control pace / allows individualization
8	useful for remediation

Summary of the data

First, it is startling to see just how rare computers really are in the intermediate classroom. Despite the fact that much is made of the "computer revolution" and the potential for this new educational tool we see that the typical BC classroom has one computer or no computer. This fact in itself precludes useful application of any potential which the computer may possess. Moreover, it effectively prevents expertise from developing in the teaching force. The computer is, consequently, still an essentially unknown entity in our intermediate classrooms.

Few teachers had received specific training in the use of computers before they entered the profession and most have had very little useful in-service. Given the dearth of computers and the generally poor quality of software this is hardly surprising. The net result is a median experience coefficient of 2.4 which indicates less than 5 days of in-service, less than one and one-half years of use and experience with approximately 5 different programs. This indicates that despite some startling counter-examples the teaching force is practically devoid of expertise with computer-based education.

There is little variety in the software available and most of it is of poor instructional quality. The computer is used most successfully as a tool for word processing but seldom with any success as a tutor. Of the few CAI packages which teachers find useful by far the predominant use is for drill and practice in mathematics or language arts. The one innovative application seems to be Logo which teachers ranked extremely highly for its value in teaching problem solving skills. However, the literature has recently begun to question the validity of even this previously treasured article of faith. (journal citations to be inserted here)

...continues with personal observations...

File: software
Report: POPULAR SOFTWARE

FREQ	TITLE	PUBLISHER	DESCRIPTION
64	BANK STREET WRITER	SCHOLASTIC	WORD PROCESSOR
46	APPLE LOGO	APPLE	STUDENTS LEARN STRUCTURED PROGRAMMING CONCEPTS THROUGH GRAPHICS
45	PRINT SHOP, THE	BRODERBUND	CREATES POSTERS, GREETING CARDS, LETTER HEAD ETC.
38	APPLE PRESENTS APPLE	APPLE	SIMPLE INTRODUCTION TO APPLE KEYBOARD AND COMPUTER
31	TERRAPIN LOGO	TERRAPIN	A VERSION OF M.I.T. LOGO
29	TYPING TUTOR	MICROSOFT	INSTRUCTION ON FINGER PLACEMENT, DRILL ON SPEED AND ACCURACY
27	FAY THAT MATH WOMAN	DIDATECH	PRACTICES BASIC NO FACTS THROUGH 19, MISSED PROB GRAPHICALLY ILLUS
24	ELEMENTARY V.1: MATH	MECC	INCLUDES HURKLE, BAGELS & TAXMAN
20	ELEMENTARY V.4: MATH/SCI	MECC	INCLUDES ESTIMATE, MATH GAME, ODELL LAKE, ODELL WOODS & SOLAR DIST
20	ROCKY'S BOOTS	TLC	ANALYZE & BUILD SIMPLE ELECTRNIC CIRCUITS WITH COMPONENTS GIVEN
19	ELEMENTARY V.3: SOC ST	MECC	ECONOMIC SUMULATNS INCLUDING SELL APPLES, PLANTS, LEMONADE & BIKES
19	ELEMENTARY V.6: SOC ST	MECC	WELL-KNOWN GAMES NOMAD & OREGON TRAIL
19	MASTERTYPE	SCARABOROU	ARCADE-STYLE KEYBOARDING DRILL, CAN CREATE OWN LESSONS
18	ALLIGATOR MIX	DLM	ADD AND SUB DRILL IN ARCADE FORMAT GAME
18	DRAGON MIX	DLM	DIFFICULT MULTIPLICATION & DIVISION PROBLEMS IN ARCADE GAME FORMAT
17	MOPTOWN HOTEL	TLC	USERS CREATE ATTRIBUTE PATTERNS IN A COMPETITIVE LOGIC GAME
16	MATH BLASTER	DAVIDSON	600 PROBLEMS IN THE 4 BASIC ARITHMETIC OPERATIONS
14	ALIEN ADDITION	DLM	ADDITION DRILL USING GRAPHICS IN ARCADE FORMAT
14	BASIC NUMBER FACTS	CNTRL DATA	PRACTICE IN BASIC WHOLE NO OPERATIONS (0-10) IN GAME FORMAT
13	MATH SEQUENCES	MILLIKEN	NUMBER READINESS & 4 ARITHMETIC OPERN WITH INTEGERS, FRACT & DEC
12	CROSSWORD MAGIC	MINDSCAPE	GENERATES CROSSWORD PUZZLES FROM USERS WORDS
12	DEMOLITION DIVISION	DLM	DIVISION DRILL IN ARCADE GAME FORMAT
12	GERTRUDE'S PUZZLES	TLC	STUDENTS SOLVE PUZZLES INVOLVING RECOGNTN OF COLOR & SHAPE PATTERN
12	METEOR MULTIPLICATION	DLM	BUILDS SKILLS IN MULTIPLYING WHOLE NUMBERS, ARCADE GAME FORMAT
11	EZ LOGO	MECC	TWO PROGRAMS FORM A SUBSET OF LOGO COMMANDS
11	SHELL GAMES	APPLE	DRILL STRUCTURES INTO WHICH TEACHERS CAN ENTER INFORMATION
10	APPLE WRITER IIE	APPLE	FULL-FUNCTION WORD PROCESSOR
10	CHESS	ODESTA	PLAY CHESS AT 17 LEVELS OF DIFFICULTY, WITH BOOK ON STRATEGY
10	FACTORY	SUNBURST	CREATE GEOM PRODUCTS: TEST A PROG, BUILD A FACTRY & MAKE A PRODUCT
10	GERTRUDE'S SECRETS	TLC	STUDENTS DEVELOP CRITICAL THINKING SKILLS AS THEY FIND PATTERNS
9	APPLE LOGO II	APPLE	IMPROVED VERSION OF APPLE LOGO
9	SCHOOL UTILITIES V.2	MECC	READABILITY ANALYSIS PROGRAM
9	WORD ATTACK	DAVIDSON	4 ACTIVITIES USING VOCABULARY WORDS IN CONTEXT, CAN ADD, MANY LANG
8	EXPLORING LOGO	SUNBURST	PRACTICE DIVIDING PROBLEMS INTO COMPONENT PARTS
8	GULP!!ARROW GRAPHICS	MILLIKEN	BASIC MATH FACTS DRILL FOR ADDITION & MULTIPLICATION
8	MATH ACTIVITIES 5	HOUGHTON	15 PROG REINFORCE A VARIETY OF MATH & PROBLEM SOLVING SKILLS
8	MOPTOWN PARADE	TLC	7 GAMES TEACH LOGICAL THINKING, STRATEGY AND PATTERN RECOGNITION
8	POND, THE	SUNBURST	DISCOVER PATTERNS & IMPROVE PERCEPTION BY ANALYZING FROG JUMPS
8	SNOOPER TROOPS #1	SPINNAKER	DETECTIVE PLAYERS INTERVIEW, MAP, STUDY CLUES & COMPUTE TO SOLVE
7	BANK STREET SPELLER	SCHOLASTIC	SPELLING CHECKER FOR BANK STREET WRITER
7	BASIC ARITHMETIC	MECC	BASE TEN, MATH GAME, SPEED DRILL, ROUND, ESTIMATE, CHANGE
7	DRAGON'S KEEP	SIERRA	PRACTICE READING SKILLS WHILE SEARCHING DRAGON'S TERRITORY
7	M-SS-NG L-NKS, ENGLISH E	SUNBURST	READING GAMES TO DEVELOP USE OF CONTEXT CLUES, CAN ADD PASSAGES
7	OH, DEER!	MECC	SIMULATES THE 5-YR MANAGEMENT OF A LARGE HERD OF DEER
6	ALLIGATOR ALLEY	DLM	MATH DRILL PROGRAMS WITH TEACHER CONTROL OF PARAMETERS
6	DELTA DRAWING	MECC	STUDENTS PROGRAM BY USING SIMPLE COMMANDS TO CREATE COLORED DESIGN
6	FRENZY/FLIP FLOP	MILLIKEN	GAME FORMAT FOR PRACTICING ADD & SUB/SLIDES,TURNS & FLIPS
6	MUSIC THEORY	MECC	DRILL ON TERMS AND NOTATN, RHYTHM, PITCH, INTERVALS, SCALES & CHRD
6	SCIENCE V.3	MECC	PROG FOR EARTH SC & LIEF SC: FISH, MINERALS, ODELL LAKE
5	BUMBLE PLOT	TLC	PRACTICE PLOTTING AND GRAPHING SKILLS (-5 TO +5 ON GRID)

APPENDIX D

COVERING LETTERS FOR THE TELEPHONE INTERVIEWS

NOTE: The templates in this appendix were merged with a mailing list to create personalized letters. The labels "$$STATUS", "$$FIRST", "$$LAST", "$$SCHOOL", "$$ADDRESS", "$$CITY", and "$$POSTAL" refer to the contents of that data base.

Letter for Subjects from School District No. 38 (Richmond)

1986/04/07

$$STATUS $$FIRST $$LAST
$$SCHOOL

Dear $$FIRST,

Re: Survey of Intermediate Computer Use

I am conducting some research into the use of computers in intermediate classrooms throughout British Columbia. Part of this research involves interviewing teachers from across the province whose experience varies from a bare minimum to extensive. It has been suggested to me by Doug Super that I might be able to gain valuable information by talking to you.

I would like to telephone you at a convenient time and ask you to give me approximately five minutes of your time to answer a few further questions. I will be phoning your school during the week of April 7th to ask the office staff when might be a convenient time to contact you. If there is some particular time you would like me to call perhaps you could leave that information with the person most likely to answer the office telephone.

The purpose of this interview is to solicit your opinions with respect to the value of certain educational software. I am trying to determine both what programs are most widely used and why these programs are popular.

In addition to the interview I would like to ask your assistance in completing the enclosed checklist and returning it to me using the self addressed envelope enclosed. (You may simply put this envelope in the school board mail pouch at your school.)

Thank you in advance for your kind assistance with this project.

Yours truly,

Bruce Beairsto,
Richmond Senior Secondary

Encl. "Software You Have Seen" checklist

B) SOFTWARE YOU HAVE SEEN

Please indicate the programs you have used at least once in the classroom by placing a tick in the appropriate box. The programs listed are those contained in the 1985 Educational Software Preview Guide.

	TITLE	PUBLISHER
	ADDITION MAGICIAN	TLC
	ADVENTUREWRITER	CODEWRITER
	ALIEN ADDITION	DLM
	ALLIGATOR ALLEY	DLM
	ALLIGATOR MIX	DLM
	ALPHABETIC KEYBOARDING	SW PUB
	ALPHABETIZE	JMH
	ANALOGIES	PRO DESIGN
	APPLE LOGO	APPLE
	APPLE LOGO II	APPLE
	APPLE PRESENTS APPLE	APPLE
	APPLE SPRITE LOGO	LCSI
	APPLE SUPER PILOT	APPLE
	APPLE WRITER IIE	APPLE
	ARCHON	ELECTR ART
	ARISTOTLE'S APPLE	STONEWARE
	ARITH-MAGIC	QED
	ARITHMETIC-TAC-TOE	EDUTEK
	BANK STREET SPELLER	SCHOLASTIC
	BANK STREET WRITER	SCHOLASTIC
	BASIC ARITHMETIC	MECC
	BASIC NUMBER FACTS	CNTRL DATA
	BATTLING BUGS/CONCENTRATN	MILLIKEN
	BLAZING THE BASIC TRAIL	SUNBURST
	BUMBLE GAMES	TLC
	BUMBLE PLOT	TLC
	CAUSE & EFFECT	LEARN WELL
	CDIM LEVEL A	SRA
	CDIM LEVEL B	SRA
	CDIM LEVEL C	SRA
	CHALLENGE MATH	SUNBURST
	CHARACTRSTCS OF A SCNTST	CYGNUS
	CHECKERS	ODESTA
	CHESS	ODESTA
	CODE QUEST	SUNBURST
	COMMUNITY SEARCH	MCGRAW HIL
	COMP LIT ADV OF LOL DRAGN	SVE
	COMP-U-SOLVE	ED'L ACTV
	COMPREHENSION POWER	MILLIKEN
	COMPU-POEM	SCWRIP
	COMPUTER GENERATD MTH V.2	MECC
	COMPUTER LIT INST PRGM	ED'L ACTV
	CREATIVE PLAY	LAWR HALL
	CROSSWORD MAGIC	MINDSCAPE
	CRYPTO CUBE	DESIGNWARE
	CUT AND PASTE	ELECTR ART
	DARK CRYSTAL	SIERRA
	DECIMAL SKILLS	MILT BRAD
	DELTA DRAWING	MECC
	DEMOLITION DIVISION	DLM
	DISCOVERY LAB	MECC
	DISCRIM ATRB & RULES	SUNBURST
	DIVIDE FRACTIONS	CBS
	DIVISION SKILLS	MILT BRAD
	DRAGON MIX	DLM
	DRAGON'S KEEP	SIERRA
	EASY GRAPH	GROLIER
	ELEM MATH CLSRM LANG SYSTEM	STER SWIFT
	ELEMENTARY LIB MEDIA SKL	COMBASE
	ELEMENTARY V.1: MATH	MECC
	ELEMENTARY V.3: SOC ST	MECC
	ELEMENTARY V.4: MATH/SCI	MECC
	ELEMENTARY V.6: SOC ST	MECC
	ENERGY SEARCH	MCGRAW HIL
	EXPEDITIONS	MECC
	EXPLORER METROS	SUNBURST
	EXPLORING LOGO	SUNBURST
	EZ LOGO	MECC
	FACT AND FICTION TOOLKIT	SCHOLASTIC
	FACTORY	SUNBURST
	FANTASY LAND	LEARN WELL
	FAY THAT MATH WOMAN	DIDATECH
	FRACTIONS PRACTICE	CNTRL DATA.
	FRENZY/FLIP FLOP	MILLIKEN
	FRIENDLY COMPUTER	MECC
	FRIENDLY FILER	GROLIER
	FUN HOUSE MAZE	SUNBURST
	FUNDAMENTAL MATH II	RANDOM
	GALAXY MATH FACTS GAME	RANDOM
	GENETICS	TIES
	GEOLOGY SEARCH	MCGRAW HIL
	GEOMETRIC CONCEPTS: AREA	JOSTENS
	GEOMETRIC CONCEPTS: PERIMETER	JOSTENS
	GERTRUDE'S PUZZLES	TLC
	GERTRUDE'S SECRETS	TLC
	GLOBAL PROGRAM LINE EDTR	BEAGLE BRO
	GOLF CLASSIC/COMPUBAR	MILLIKEN
	GRAND PRIX	RANDOM
	GREAT CREATOR, THE	GESSLER
	GULP!!ARROW GRAPHICS	MILLIKEN
	HEY, TAXI!	MILT BRAD
	HIGH RISE	MICRO LAB
	HINKY PINKY	22ND AVE
	HOMEWORD	SIERRA
	HOT DOG STAND	SUNBURST
	IDEA INVASION	DLM
	IN SEARCH OF MOST AMAZING	SPINNAKER
	INCREDIBLE LABORATORY	SUNBURST
	INTERPRETING GRAPHS	CONDUIT
	INTRO TO MICRO COMPUTERS	MCGRAW HIL

Please indicate the programs you have used at least once in the classroom by placing a tick in the appropriate box. The programs listed are those contained in the 1985 Educational Software Preview Guide.

	TITLE	PUBLISHER
[ ]	INTRO TO MICROCMP KEYBD	ED AUDIO
[ ]	ISLE OF MEM	GROLIER
[ ]	JIGSAW	ISL SOFTWR
[ ]	JINX/WELTER	ISL SOFTWR
[ ]	KAREL SIMULATOR	CYBERTRON
[ ]	KING'S RULE	SUNBURST
[ ]	LEARNING ABOUT NUMBERS	C & C SOFT
[ ]	LIBRARY USAGE SKILLS	JMC
[ ]	LONG DIVISION	MIC WRKSHP
[ ]	M-SS-NG L-NKS, ENGLISH ED	SUNBURST
[ ]	M-SS-NG L-NKS, YG PPLS LT	SUNBURST
[ ]	MAGIC SLATE	SUNBURST
[ ]	MANAGING LIFESTYLES	SUNBURST
[ ]	MASTER MATCH	ADV ID
[ ]	MASTER MATCH (DLM)	DLM
[ ]	MASTERTYPE	SCARABOROU
[ ]	MATH ACTIVITIES 4	HOUGHTON
[ ]	MATH ACTIVITIES 5	HOUGHTON
[ ]	MATH ACTIVITIES 6	HOUGHTON
[ ]	MATH ACTIVITIES 7	HOUGHTON
[ ]	MATH BASEBALL	ED'L ACTV
[ ]	MATH BLASTER	DAVIDSON
[ ]	MATH CONCEPTS I & II	HARTLEY
[ ]	MATH SEQUENCES	MILLIKEN
[ ]	MATHWARE	ESSERTIER
[ ]	MEDALISTS: BLACK AMERICANS	HARTLEY
[ ]	MEDALISTS: CONTINENTS	HARTLEY
[ ]	MEDALISTS: WOMEN IN HISTORY	HARTLEY
[ ]	MEMORY CASTLE	SUNBURST
[ ]	MEMORY: THE FIRST STEP	SUNBURST
[ ]	METEOR MISSION	DLM
[ ]	METEOR MULTIPLICATION	DLM
[ ]	METRIC & PROBLEM SOLVING	MECC
[ ]	MILLIKEN WORD PROCESSOR	MILLIKEN
[ ]	MINUS MISSION	DLM
[ ]	MIX AND MATCH	APPLE
[ ]	MOPTOWN HOTEL	TLC
[ ]	MOPTOWN PARADE	TLC
[ ]	MOUSE PAINT	APPLE
[ ]	MULTIPLYING FRACTIONS	MIC WRKSHP
[ ]	MUSIC THEORY	MECC
[ ]	NUMBER WORDS-LEVEL 1&2	HARTLEY
[ ]	OH, DEER!	MECC
[ ]	PIC.BUILDER	WEEK READ
[ ]	PINBALL CONSTRUCTION SET	ELECTR ART
[ ]	POND, THE	SUNBURST
[ ]	PRINT SHOP, THE	BRODERBUND
[ ]	PROFESSIONAL SIGN MAKER	SUNBURST
[ ]	PUZZLE TANKS	SUNBURST
[ ]	PUZZLER, THE	SUNBURST

	TITLE	PUBLISHER
[ ]	PUZZLES AND POSTERS	MECC
[ ]	QUILL	DC HEATH
[ ]	READ & SOLVE MATH PROBS	ED'L ACTV
[ ]	ROCKY'S BOOTS	TLC
[ ]	SARGON III	HAYDEN
[ ]	SCHOOL UTILITIES V.2	MECC
[ ]	SCIENCE V.3	MECC
[ ]	SENSIBLE SPELLER IV	SENSIBLE
[ ]	SHELL GAMES	APPLE
[ ]	SKILLS MAKER	LIB SOFT
[ ]	SNOOPER TROOPS #1	SPINNAKER
[ ]	SNOOPER TROOPS #2	SPINNAKER
[ ]	SONGWRITER	SCARBOROUG
[ ]	SPECIAL NEEDS V.1	MECC
[ ]	SPOTLIGHT	APPLE
[ ]	SQUARE PAIRS	SCHOLASTIC
[ ]	STORY TREE	SCHOLASTIC
[ ]	SURVIVAL MATH	SUNBURST
[ ]	TEASERS BY TOBBS	SUNBURST
[ ]	TEMPERATURE LAB	HAYDEN
[ ]	TERRAPIN LOGO	TERRAPIN
[ ]	THAT'S MY STORY	LEARN WELL
[ ]	THREE R'S OF MCROCMPTNG	MECC
[ ]	TIC TAC SHOW	ADV ID
[ ]	TRAFFIC JAM	ISL SOFTWA
[ ]	TROLL'S TALE	SIERRA
[ ]	TURTLE TRACKS	SCHOLASTIC
[ ]	TUTORIAL COMPR; MN ID	RANDOM
[ ]	TYPE ATTACK	SIRIUS
[ ]	TYPING TUTOR	MICROSOFT
[ ]	VOYAGE OF MIMI:MPS&NVGTN	HOLT, R&W
[ ]	WHATSIT CORPORATION	SUNBURST
[ ]	WHOLE NUMBERS: PRACTICE	CNTRL DATA
[ ]	WIZ WORKS	DLM
[ ]	WIZARD OF WORDS	ADV ID
[ ]	WORD ATTACK	DAVIDSON
[ ]	WORD MAN	DLM
[ ]	WORD SPINNER	TLC
[ ]	WRITE CHOICE	ROGER WAGN
[ ]	WRITE STUFF	HARPER ROW
[ ]	ZORK I & II	INFOCOM

APPENDIX E

TELEPHONE INTERVIEW PROTOCOL

PART ONE:

OBJECTIVES:

a) I will verify specific details.
   - use of Apples
   - years of experience with computers in the classroom
   - nature and extent of training

TEXT:

Hello, _____. This is Bruce Beairsto calling. Did you receive my letter concerning the Intermediate Computer Use survey? (If appropriate ... Thankyou for completing and returning the questionnaire for the first part of my research. As my letter explained, you were one of the most experienced respondents and I would like to get further information from you.) Can you spare me about five minutes? Good.

Do you have paper and a pencil handy? (If not ... Can you get both? I'll wait.)

I would like to confirm that you do use Apple or Apple compatible computers?

And how long have you been using computers in the classroom in one way or another? Do you use the computer yourself outside of class? How long have you been doing that?

...verify nature and extent of training..

(If necessary...Please remember to return the checklist of programs to me as is forms an important part of my research and will help me to analyze the responses I receive during these interviews.)

PART TWO:

OBJECTIVES:

a) The subject will be asked to describe how he/she uses computers.
- what is the student/computer ratio in actual use
- how much time does each student have with the computer in one week
- how is the use distributed through a week

TEXT:

Now I wonder if you can help me to understand how you use computers by answering the following questions.

What is the typical size of your class when you are using the computer?

How many computers do you have available for that class?

How much time would each student spend in class in interaction with a computer in an average week?

15 min or less
15 min to 30 min
30 min to 45 min
45 min to 60 min
more than 60 min

How is this time distributed through the week, a little every day or one or two specific times?

PART THREE:

OBJECTIVES:

a) I will verify experience with the specific programs of interest.
- Bank Street Writer, Magic Window or equivalent
- Logo (any version)
- Math Blaster, Milliken Math, Fay, MAC or Demolition Division
- Getrude's Secrets, Moptown Hotel or Factory
- Odell Lake, Odell Woods or Oregon Trail

b) I will ask the subject to rank order the programs above in terms of their educational value, in descending order of merit.

TEXT:

I would like to consider some specific items of software. Which of the following have you actually used with your class(es)?

Bank Street Writer?
Logo
Math drill program __________
Science processes program __________
MECC simulation program __________

If you had to identify one of these programs as having the most educational merit which one would you choose? I'll repeat their names.

Which one of the other four programs do you consider to have the least educational merit? I'll repeat the four remaining names.

So you find ___ to have the most educational merit of the programs in this group and ___ to have the least merit. Which one of the remaining three would you rank second in terms of educational merit? I will list the remaining names.

Of the remaining two, which one have you found to have the most educational merit?

PART FOUR:

OBJECTIVES:

a) The seven major educational motivations for the use of computers as reported in part one of the survey will be revealed to the respondent and he/she will be asked to rank order these motivations.

TEXT:

In conclusion, I would like to find out what it is that you particularly value about each of these programs.

In the first part of my research I asked what educational advantages teachers felt computers had to offer. I have collected the responses into groups and I would like you to rank order the seven most common categories or reasons for me. I will read them to you and then ask you to select the most significant reason, the second most significant and so on. Perhaps you could make a note of the categories on a piece of paper as I read them to you.

(Read categories in random order.)

Now, if you were preparing a brief requesting more funds for computers in your school which one of these educational advantages would you stress above all the others? (Read category names in same random order.)

Which would you rank second in importance?

And which would you rank third?

(Repeat the preceding battery of questions for each program.)

Note: I will thank the subject for his/her participation.

Motivational Categories

The respondents were read the following list of the seven motivations identified in the preliminary questionnaire and asked to make a note of the keywords. The list was presented in an order dictated by a random list of the digits 1 through 7.

---

1) UTILITY: The computer is a powerful tool and students should learn to use it for the same reason that they learn to use a calculator or a telephone. It enhances their ability to explore, to reason and to communicate.

2) INTEREST: Students like to undertake computer-based tasks and consequently are motivated to participate actively in the educational activities presented by the software. It arouses interest and holds attention.

3) LITERACY: Computers are an important item of modern technology. Students need to become familiar enough with their use that they are comfortable with them and can realistically assess their power and their limitations.

4) DRILL: Computers are very good for mechanical drill and practice activities. They are patient and non-threatening, and can adjust the level and pace of the drill to the students demonstrated progress.

5) ENRICHMENT: Computers make extra information and activities available to students who have mastered core topics. They can explore new ideas and activities while the teacher continues to work with the rest of the class.

6) REINFORCEMENT: Computer software is another way to illustrate and reinforce the curriculum. It offers the opportunity to practice skills and apply concepts learned through classroom instruction.

7) INDIVIDUALIZATION: The computer can make a wide variety of information and instruction available to students. Moreover, they can select these materials according to their needs and proceed at their own pace.

DATA SHEET

for

NAME: ______________________________ PHONE: __________

PART ONE:

Uses Apples : Y N

Using computers in the classroom for ______ years

Training coefficient: ______________________________

____

PART TWO:

Class size : ______ Number of computers : ____

____

____

____

Student time per week : 0-15 15-30 30-45 45-60 60+

Distribution : spread concentrated

PART THREE:

Rank order : Language Arts ______________ : ___

Logo ______________ : ___

Math ______________ : ___

Science ______________ : ___

MECC ______________ : ___

Motivational Rating Scale

The following data sheet was used to record the educational motivations reported by the respondents. A rank ordered list of three motivations was sought but if the respondent found it difficult to quote three meaningful responses from the list provided then less than three motivations were accepted.

Motivation Ranking	Software Category Ranking				
	Word Process. 1 2	Logo	Math Drill 1 2 3 4 5	Science Process 1 2 3	Simulat'n 1 2 3
1) most important motivation	1a	1b	1c	1d	1e
2)	2a	2b	2c	2d	2e
3) least important motivation	3a	3b	3c	3d	3e

APPENDIX F

EXPLANATION OF THE EXPERIENCE MEASURES AND WEIGHTING PROCEDURE

F.1 EXPLANATION OF THE EXPERIENCE MEASURES

One goal of this study was to determine whether or not the educational motivations reported by teachers for their use of computers in the classroom showed any developmental pattern. This was done by looking for a correlation between the importance attached to each of the motivations identified in the preliminary survey and the teacher's expertise.

Measuring expertise is, however, somewhat problematic. Expertise may be the result of actual experience, or training or both. Moreover, experience may be measured as the length of time over which the teacher has used computers in the classroom or the number of educational programs with which he/she has had experience. It was not clear at the outset which one of these measures of expertise would be the most important, and in fact it seemed likely that they would all have some effect.

Consequently, it was determined to record all three measures:

- degree of training in computer-based instruction,
- years of computer use, and
- number of programs actually used.

The degree of training was measured on an ordinal scale ranging from 0 to 4 as described in Chapter 3. The years of use was recorded as the average of the teacher's use in the classroom and his/her years of personal use, either with the school computer or a personal computer. The number of programs actually used was determined through the use of a standard checklist of programs derived from the 1985 Educational

Software Preview Guide developed by the Educational Software Evaluation Consortium.

In addition, an attempt was made to develop a coefficient of expertise which might summarize the net effect of these three separate measures. The coefficient was calculated as follows:

expertise = (yrs of use + training coeff) * (# of programs used / 5)

The two factors involved in the coefficient are both necessary components of expertise and were therefore multiplied. Thus, a low value for either would result in a low value for the coefficient. The first factor is the sum of two of the measures which are logical alternatives, since the insight gained over time through one's personal reflection can yield the same results as instruction.

An attempt was made to give each of the component measures an appropriate weight. The arbitrary values assigned to the training coefficient were defined in a way that the author felt gave approximately equal significance to a period of use and a degree of training which might lead to equivalent insight. Similarly, the number of programs actually used was divided by 5 in an attempt to give this factor a weight approximately equivalent to the first.

The coefficient of expertise being a purely arbitrary creation it was determined to record each of the component measures independently in addition. A correlation coefficient was calculated between the significance attached to a particular educational motivation and each component measure as well as the combined measure in case there were some symbiotic effect between the individual components of expertise. In the event, no clear developmental pattern emerged using any of the measures.

F.2 EXPLANATION OF THE WEIGHTING PROCEDURE

As part of the telephone interviews, respondents were asked to rank order their three primary motivations for the use of each of five different categories of educational software. These motivations were chosen from a list of seven identified in the preliminary survey.

In order to assign a numerical value to the importance which each respondent attached to each of the seven educational motivations, the frequency of citation was recorded for each. This frequency could range between 0 and 5. In many cases, however, the respondents did not have experience with all five categories of software and were therefore unable to offer a ranking of their motivations in some categories. This meant that the straight frequency of citation of a motivation was not a reliable indicator of its relative importance; especially when the results from different respondents were collated and analyzed. In order to compensate for this incomplete reporting the reported frequencies were normalized: that is, they were adjusted to represent the frequency of citation which would have been recorded if the respondent had reported on all the software categories in the same manner as he/she had reported on a subset. This normalization was accomplished by converting each frequency to a percentage of the total of all motivations reported and multiplying that percentage by 15. The result was that the cumulative normalized frequency was 15 for all respondents whether or not they actually reported on all five software categories.

It was also recognized that the rank ordering of the software categories and the motivations within each software category may be significant. To convert this information into a numerical form, a system of weighting was devised. The weighted value assigned to a particular citation of a motivational category was determined by multiplying the inverse rank order of the software category and the inverse rank order of the three motivations within that category. The result was that the primary motivation for the use of the most favoured software category received a weight of 15 and the least significant motivation for the use of the least popular software category received a weight of 1. The weights are summarized in the following table.

Matrix of Weightings

Motivation Ranking	Software Category Ranking				
	1	2	3	4	5
1	15	12	9	6	3
2	10	8	6	4	2
3	5	4	3	2	1

These weighted frequencies were also normalized using an algorithm similar to that for the raw frequencies with the effect that each respondent's normalized weighted frequencies totalled 90.

The reason for recording all these variations on the raw frequency was the same as the reason for recording the four different measures of experience: it was not clear at the outset which would be the most meaningful measure. Consequently, frequency data was recorded for the motivational categories in each of the four possible forms:

- raw frequency of reporting,
- normalized frequency,
- weighted frequency, and
- normalized weighted frequency.

In the event, the four measures seem to have conveyed the same information within the limitations of this study.