CANADIAN JOURNAL OF EDUCATIONAL COMMUNICATION

Volume 16, No. 3, Summer 1987
ISSN 0710-4340

An AMTEC Publication

Canadian Journal of Educational Communication

Volume 16, Number 3
Summer 1987

ISSN 0710 - 4340

The *Canadian Journal of Educational Communication* is published quarterly by the Association for Media and Technology in Education in Canada; 500 Victoria Road North; Guelph, Ontario N1E 6K2; Canada; Attention: Mr. Ron Eyre, Secretary/Treasurer. Notification of address change should be sent to the above.

Second Class Mail Registration No. 6956

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Typeset Facilities: McGill Instructional Communication Center.

Printing: McGill Printing Services.

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Developing Interactive Videotape in a University Setting

Michael Palmer
Mariela Tovar

Abstract: This article describes the work of an interactive video development group in the Graduate Programme in Educational Technology at Concordia University. It discusses the design and development of an interactive videotape system which will be used to teach contamination assessment and decontamination of radioisotopes to biochemistry students. The paper concludes with a discussion of relevant issues concerning the development of interactive video in an academic setting.

As part of their curriculum, undergraduate students studying biochemistry at Concordia University often carry out laboratory experiments involving the use of radioactive isotopes. The risk of radioactive body contamination and the potential for damage to the sensitive equipment used for detecting radioactivity are important concerns to the teaching staff of these students.

Traditionally, a series of manuals, slide-tape presentations and in-class demonstrations have been used to train students in correct laboratory procedures. Upon evaluating the effects of these instructional strategies, technicians in both the Chemistry and Biology Departments were not entirely satisfied with the results of the training. In a continuing attempt to improve instruction and training within the faculty of biochemistry, training needs were identified and potential solutions were identified through a series of discussions. As a result of these discussions, an interactive videotape training

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program was produced through the cooperative efforts of Concordia's Chemistry, Biology and Education Departments. The program teaches the correct procedures for carrying out contamination assessment and decontamination of radioisotopes. The courseware was developed by a team which included faculty and students from the Graduate Programme in Educational Technology. The purpose of this paper is to describe the development of the training system and to reflect upon what we have learned while carrying out this project in our academic setting. We believe that the challenges that we faced — working under time and monetary constraints — are common in many settings and that our experiences will be useful for developers working under similar conditions.

Gayeski and Williams (1983) define an interactive video system as "microprocessor control of a video playback device (either videotape or videodisc), which allows individuals to view one program in different ways according to their response" (p.54). Floyd (1982) proposes a more general definition: "Any video program in which the sequence and selection of messages are determined by the user's response to the material" (p.2). A more recent definition by Schwier (1987) adds several elements that are missing from previous definitions: "Interactive video is a program intentionally designed in segments, in which viewer responses to structured opportunities (menus, questions, timed responses) influence the sequence, size and shape of the program" (p. 36). Interactive video is the combination of computer-assisted learning and linear video. It can offer the computer capabilities of interactivity and learner control as well as the visual expository qualities of video.

The merging of these two technologies has brought together computer and video specialists and they tend to see interactive video from their own particular perspectives. Video specialists see interactive video as a way of giving the learner more control over linear video, while computer specialists see it as a way of providing the computer with powerful visual capabilities. Interactive video, however, is more than video plus CAL or CAL plus video. It is a unique medium which presents designers with new possibilities of optimizing learning outcomes (Gayeski &Williams, 1985; De Blois, 1982).

The instructional potential of interactive video has been enthusiastically endorsed (Butcher, 1986; Clark, 1984; Howe, 1985; Manning, Ebner, Brooks & Balson, 1983; Pawley, 1983; Wilson, 1983). This is due to the fact that this technology opens up a number of instructional possibilities which were not previously feasible. The medium can integrate many different media, such as video, slides and computer graphics, as well as provide a wide range of feedback options and maintain a record of students' responses and choices. Furthermore, the rapid access and storage capabilities of the videodisc give designers the possibility of exploring different levels of learner control.

In spite of the potentials of interactive video, there have been problems associated with its implementation. One of the major drawbacks has been the perceived cost of the hardware and the larger variety of human resources necessary for development. Another problem, closer to the concern of educational technologists, is that little is known about design and evaluation strategies for producing interactive video materials. If interactive video is indeed a unique medium, then instructional designers, and linear video and computer-assisted learning specialists will be required to think in new ways.

Background

Academic programs in educational technology are ideally suited to experiment with instructional innovations which offer the potential for optimizing learning. Faculty in the Graduate Programmme in Educational Technology at Concordia University perceived a need to provide interested students with the opportunity to carry out development and research projects dealing with interactive video. We wanted to gain experience with this technology by getting involved in all the phases of design, production and development. It was thought that beginning with a practical development project that involved selecting appropriate design strategies and formulating evaluation questions would eventually lead to interesting research hypotheses. An interactive video interest group was formed in October of 1985 to serve as a forum for exchanging information, as a mechanism for establishing links with other groups interested in interactive video and for requesting support for development projects.

It was because of this group that we became aware of the need to develop new materials to teach undergraduate biochemistry students the procedures of radioisotope assesment and decontamination. After discussions were held with the appropriate parties, we submitted a proposal to replace their existing training materials with an interactive video system. The impetus for proposing interactive video courseware was the tremendous potential of the medium to teach procedures. Applying contamination assesment and decontamination procedures involves carrying out a number of steps in a sequential order. Using interactive video, the procedures could be presented using a series of demonstration, review, practice and test segments. Furthermore, the ability of the system to provide remediation, visual demonstration and feedback would facilitate the retention and transfer of learned procedures from the classroom to the laboratory.

The development team, consisting of four graduate students and one faculty member, was assembled in January of 1986. There were two video specialists, one software development specialist and the present authors who served as project manager and design and production coordinator. The financial resources were obtained from the Committee for Aid to Scholarly Activity in the form of a $2500 grant. The following section describes the content and structure of the courseware.

Courseware Content and Structure

The overall objective of the courseware is to teach radiation contamination assessment and decontamination procedures to biochemistry students who experiment with radioisotopes. Within the courseware, six separate sections are offered to the learner (see Figure 1 on page 199). The first two sections are purely informational. They can be accessed in order to obtain supplemental information pertaining to radioisotopes in general (i.e., Introduction) or to obtain information pertaining to a specific isotope (i.e., Isotope Information). The remaining four sections are instructional lessons which offer information describing the equipment and the steps that must be followed in order to carry out specific procedures and exercises which provide practice and feedback. Each of the sections is accessible from the main menu and they may be viewed in any sequence. What follows is a brief description of each section.

1) *Introduction:* The introduction section consists of a brief video presentation

which describes the characteristics of radioisotopes and how they are caused. This section was designed in order to refresh entry level knowledge and skills.

2) ***Isotope Information:*** This section consists of a short data base which presents textual information pertaining to radioisotopes which are commonly used for experimentation at Concordia University. The information presented is technical in nature and serves as an option for the learner to obtain background information related to the radioisotope with which they are working.

3) ***Direct Check Method:*** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out contamination assesment of high energy radioisotopes.

4) ***Swipe Check Method:*** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out contamination assesment of low energy radioisotopes.

5) ***Decontamination Procedures:*** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out decontamination of areas where the presence of radioisotopes has been detected.

6) ***Body Decontamination Procedures:*** This instructional section describes the proper tools and illustrates the correct procedures necessary to carry out decontamination of clothing and skin surfaces in the event of a spill of radio isotopes.

Instructional Section Structure

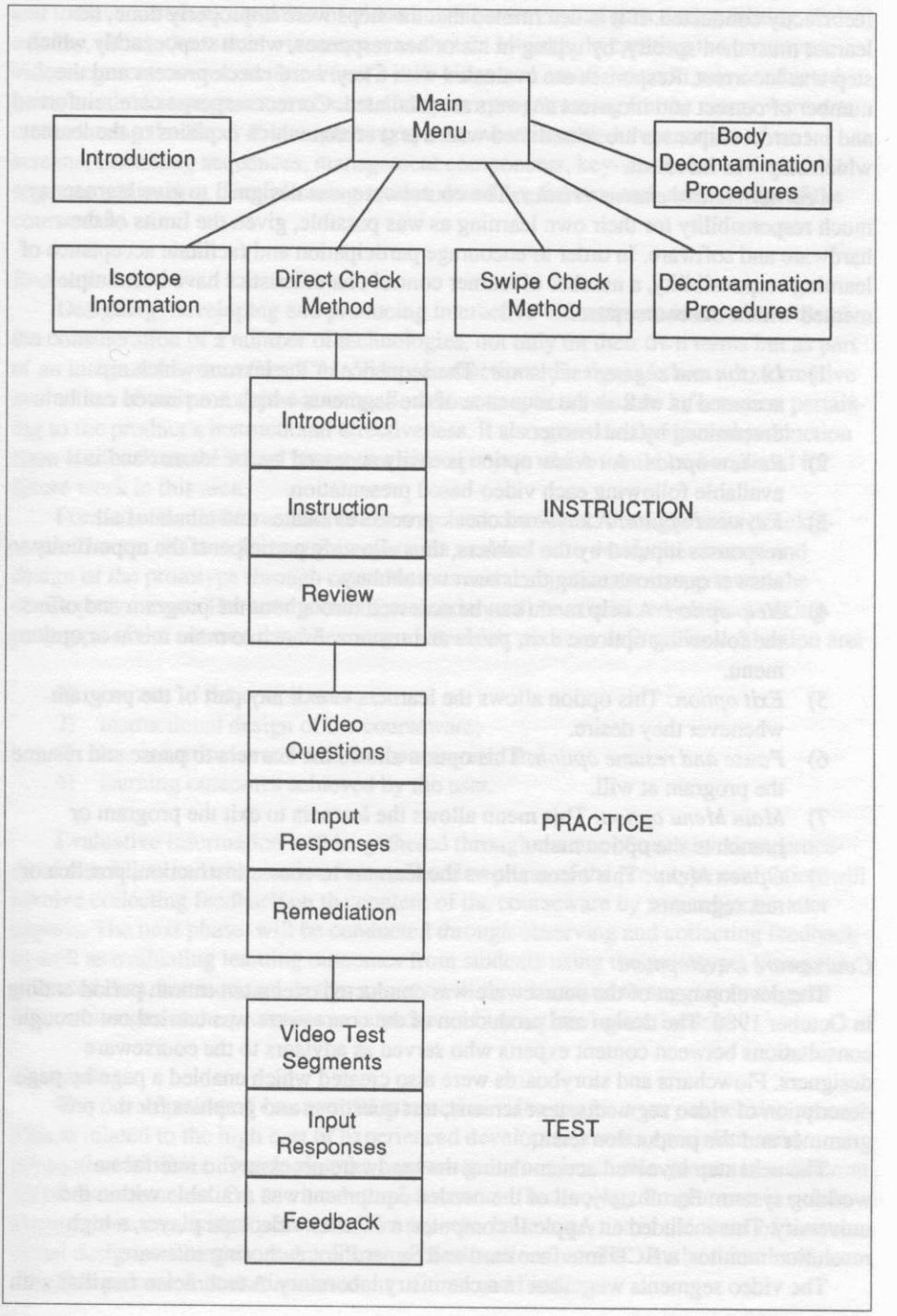
Each instructional section consists of three segments which are accessed from the *option menu* presented at the beginning of each lesson. The three segments are entitled *1) Instruction, 2) Practice, and 3) Test* and can be viewed randomly, or in sequence, depending upon the learner's choice. A brief explanation of each segment follows.

Instruction. The instructional segments consist of a four to seven minute video presentation which includes a brief introduction to the procedure and a description specifying the situations which demand its application (Advanced Organizer). This is followed by an explanation of the tools and a demonstration of the steps which are to be carried out when applying the procedures. The segment concludes with a brief review which emphasizes the important steps to be remembered.

Practice. The practice segment consists of four video-based questions which pertain to the lesson procedures. Through questioning, the learner is prompted by the demonstrator to specify, in sequence, the procedures which were demonstrated in the instruction segment. The learner is asked to answer each question by typing in his/her responses following each question. Responses entered by the learner are evaluated with a key word check process which allows learners to respond to questions using their own vocabulary. At the end of the segment, correct and incorrect responses are automatically tabulated. In the situation where the learner incorrectly answers any of the questions, he or she is advised of this and is then branched to a video based remedial segment which again explains and demonstrates the procedures.

Test. The test segments consist of between four and six video based-demonstrations of the lesson procedure being carried out. The task of the learner is to view the

Figure 1. *Courseware Structure.*



demonstration and determine whether the steps of the procedure were correctly or incorrectly conducted. If it is determined that the steps were improperly done, the learner must then specify, by typing in his or her responses, which step, exactly which step was incorrect. Responses are evaluated with a key word cheek process and the number of correct and incorrect answers are tabulated. Correct responses are reinforced and incorrect responses are remediated with a text screen which explains to the learner which step was incorrect.

Learner control characteristics. The courseware was designed to give learners as much responsibility for their own learning as was possible, given the limits of the hardware and software. In order to encourage participation and facilitate acceptance of learning responsibility, a number of learner control characteristics have been implemented within the courseware.

1) ***Lesson and segment sequence:*** The sequence of the lessons which are accessed as well as the sequence of the segments which are viewed can be determined by the learner.
2) ***Review option:*** A review option is easily accessed by the learner and is available following each video-based presentation.
3) ***Keyword option:*** A keyword check process evaluates and tabulates all responses inputed by the learners, thus allowing participants the opportunity to answer questions using their own vocabulary.
4) ***Help option:*** A help menu can be accessed throughout the program and offers the following options: exit, pause and resume, branch to main menu or option menu.
5) ***Exit option:*** This option allows the learners to exit any part of the program whenever they desire.
6) ***Pause and resume option:*** This option allows the learners to pause and resume the program at will.
7) ***Main Menu option:*** This menu allows the learners to exit the program or branch to the option menu.
8) ***Option Menu:*** This menu allows the learners to access instruction, practice or test segments.

Courseware Development

The development of the courseware was conducted over a ten-month period ending in October 1986. The design and production of the courseware was carried out through consultations between content experts who served as advisors to the courseware designers. Flowcharts and storyboards were also created which enabled a page by page description of video segments, text screens, test questions and graphics for the programmer and the production team.

The next step involved accumulating the hardware necessary to interface a working system. Fortunately, all of the needed equipment was available within the university. This included an Apple II computer, a Pioneer videotape player, a high resolution monitor, a BCD interface card and Super Pilot authoring software.

The video segments were shot in a chemistry laboratory. A technician familiar with

the procedures was used as our demonstrator. In order to obtain a good quality video and to have access to a number of video enhancement techniques during editing (fades, overlay, titles), the master videotape was shot in 3/4 inch. In creating the prototype, video segments were transfered to l/2 inch video and an off-line edit was conducted using available equipment at no cost. Computer programming for the courseware was created using the Super Pilot authoring system which enabled the creation of text screens, branching sequences, management components, key-word checks and video segment addressing. The following section describes the structure and content of the courseware.

Evaluation

Designing, developing and producing interactive videotape courseware involved the consideration of a number of technologies, not only on their own terms but as part of an integrated system (i.e., CAI, Video, Instructional Design). As a result, formative evaluation of our prototype not only allowed us to solicit valuable information pertaining to the product's instructional effectiveness, it also gave the design and production team feedback on their first interactive video project which would be beneficial for future work in this area.

Formative evaluation of the courseware was conducted throughout its development. The use of flowcharts and storyboards enabled us to verify the content and design of the prototype through consultations with subject matter experts and the development team. The next phase of evaluation will be conducted on the working prototype of the courseware. The categories which we have defined for evaluation are:

1) content of the courseware;
2) instructional design of the courseware;
3) learner attitudes towards the courseware; and
4) learning outcomes achieved by the user.

Evaluative information will be gathered through the use of questionaires, procedural checklists and observation forms. The fiit phase of the prototype evaluation will involve collecting feedback on the content of the courseware by two subject matter experts. The next phase, will be conducted through observing and collecting feedback as well as evaluating learning outcomes from students using the prototype. Using the collected data, instructional design experts will then be asked to suggest strategy or format changes to the prototype to improve its instructional effectiveness.

Conclusion

The development of commercial interactive video can be a very expensive process. This is related to the high cost of experienced developers. media specialists, and production facilities. Developing the courseware in our institution presented a different set of circumstances. On one hand, the Educational Technology Programme is rich in human resources, with students and faculty who have expertise in the areas of instructional design, evaluation, and production of educational media. On the other hand, our situation presented limitations in terms of time and funding.

Regarding our time limitation, it was important to consider that the individuals involved could not afford to give the project exclusive dedication. Team members could not ignore their professional and other academic commitments. This situation is quite different from the work environments described by Bork (1985), where development team members give a substantial part of their time to develop projects. In order to facilitate involvement, internship credits were allocated to students who participated in the project. This allowed individuals to integrate this activity with their academic requirements.

Regarding our funding limitations, our experience shows that it is possible to produce useful interactive video courseware without an enourmous budget. Unfortunately, some of the literature on interactive video suggest that unless you have access to great sums of money, and can incorporate all the 'bells and whistles' available into your system, you should forget about it. We believe that this type of thinking produces two basic problems.

1) You spend all your time dreaming about fancy gadgets and overlook the possibility of simpler solutions to your instructional problem. We do not deny that some instructional situations could require costly systems and that their production represents a great contribution to our field. However, based on our experience, we would like to address the concerns of people who have been scared away from the technology because of this limiting assumption. Consideration of the problem from an instructional point of view rather than merely from a hardware perspective may indicate that, for a given situation, the problem can be solved with interactive videotape or even with video and a workbook. Cost effective solutions have been reported in the literature. They include modifications of existing materials (Laurillard, 1984; Branch, Robertson, & Moore, 1987) and production of 'generic' discs that could be customized by users. The conclusion is simple: if we carefully consider the instructional requirements of a given problem, *more is not necessarily better.*
2) A second problem involves forgetting that, although hardware facilitates interactivity, it is ultimately the design of the program which determines it. Interactive video can be seen as a very flexible medium which has the potential of being highly interactive. Unfortunately, too much emphasis has been given to the hardware without realizing that ultimately it is the pedagogical design of the program which determines interactivity. The most commonly cited taxonomy of interactive video systems classifies them in terms of hardware. The levels of interactivity proposed vary from level one (linear presentations with traditional playback mechanisms), to level two (videodisc with response device) to level three (systems with a videodisc linked to an external computer). A more useful classification of interactive video has been proposed by Gayeski and Williams (1985). These authors offer seven levels of interactivity which integrate program design and hardware considerations. With its emphasis on program design in addition to hardware aspects, this taxonomy is clearly more appropriate for instructional designers. It is not limited to videodisc, and provides a wider range of options for interactivity

from more traditional methods (self-evaluation, pause, use of workbooks) to sophisticated systems with touch screens and computer control. Consequently, this taxonomy opens up more possibilities for selecting an appropriate level of interactivity for a given instructional problem.

The production of radioisotope courseware provided us with valuable insights into designing interactive video materials. Given our resources, we found that the production of an interactive videotape was a feasible initial solution. The videotape was structured while keeping in mind one of its most critical limitations, namely access time. In an attempt to minimize the effects of this limitation, steps were taken to reduce as much as possible the time needed to rewind or fast forward to a particular segment. This included editing instructional sections and segments according to expected student choices and sequences. All of the video segments which were designed to branch with one another were closely edited together thereby minimizing access to four or five seconds. Computer generated messages were also built into the courseware and these appear while a search is being conducted.

A further advantage to our courseware will be our ability to obtain formative data and carry out modifications at a minimum cost. The value of interactive videotape as an inexpensive training tool and prototype for formative evaluation has been suggested in the literature (Cambre, 1984; Gayeski & Williams, 1986).

The development of the interactive video system provided us with a valuable learning experience. It allowed us to bring together people with different expertise in a team setting. Although all team members had backgrounds in instructional design and production, none had actually participated in the development of interactive video courseware. As instructional designers, we had to become familiar with the problems of integrating video and interactivity into the design. The design requirements of interactive video required production and editing techniques that were different from those appropriate for linear video. In collaboration with our computer specialists, we became familiar with the flowcharting and storyboarding techniques appropriate for interactive video. Furthermore, the evaluation will provide us with some interesting insights into our selection of instructional strategies and learner control options.

The experience we acquired in developing the interactive video addressed in this paper, along with the evolution of our design and production team into a cohesive unit, will hopefully serve as a basis from which we may proceed to undertake further projects in this area, including work based in videodisc technology.

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Communications Technology in Higher Education in Alberta: Current Status and Policy Perspectives

D. G. Crawford
Gail C. Crawford

Abstract: The infusion of communications technologiesthroughout an existing educational system is made complex by a variety of conditions including the costs and complexities of electronic and computer devices. Perhaps more importantly, such a process requires the organization, coordination and often, the cooperation of people from various sectors of society.

This paper describes some of the specific activities, mechanisms, processes and outcomes of attempts made in Alberta to deal with technologically based communications for instruction in the post-secondary educational system. The mechanisms and processes outlined are intended to facilitate the application of electronic technologies for instruction and are viewed as necessary but not sufficient conditions to achieve that end. A number of unanswered questions are identified and additional solutions are sought.

INTRODUCTION

Current economic and political contexts in conjunction with continuing technological change and the realities of population demographics are all exerting pressures on post-secondary institutions to change the ways in which they provide educational services. The autonomous, monolithic institutions of the 1980's providing multi-faceted services will likely give way in the 1990's to collaborative ventures and decentralized services. To help achieve this end, greater use could be made of communications technologies.

This paper describes some of the uses of communications technologies in developing collaborative ventures and providing for decentralized instructional services in Alberta. Some of the barriers to these developments and strategies for overcoming them are described. Finally, the paper concludes by identifying a number of issues that remain to be addressed as the use of computer communications technologies accelerates.

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CURRENT USES OF THE NEW INFORMATION TECHNOLOGIES FOR INSTRUCTION IN ALBERTA

Communications technologies for instructional purposes are used in two primary ways in Alberta: for delivery of distance education courses; and, for the individualization of instruction on campus.

Distance Education

Almost 700 credit and non-credit courses are offered by our post-secondary institutions using a variety of distance education methods during the 1986-87 academic year. These courses are described in a catalog entitled *Distance Education Courses in Alberta,* which is compiled each year by Alberta Advanced Education. This catalog provides the following information for each course: the name of the originating institution; the name of each course: the credit value assigned; the primary instruction medium or vehicle used for delivery: the type of tutorial support provided, and the grading method used.

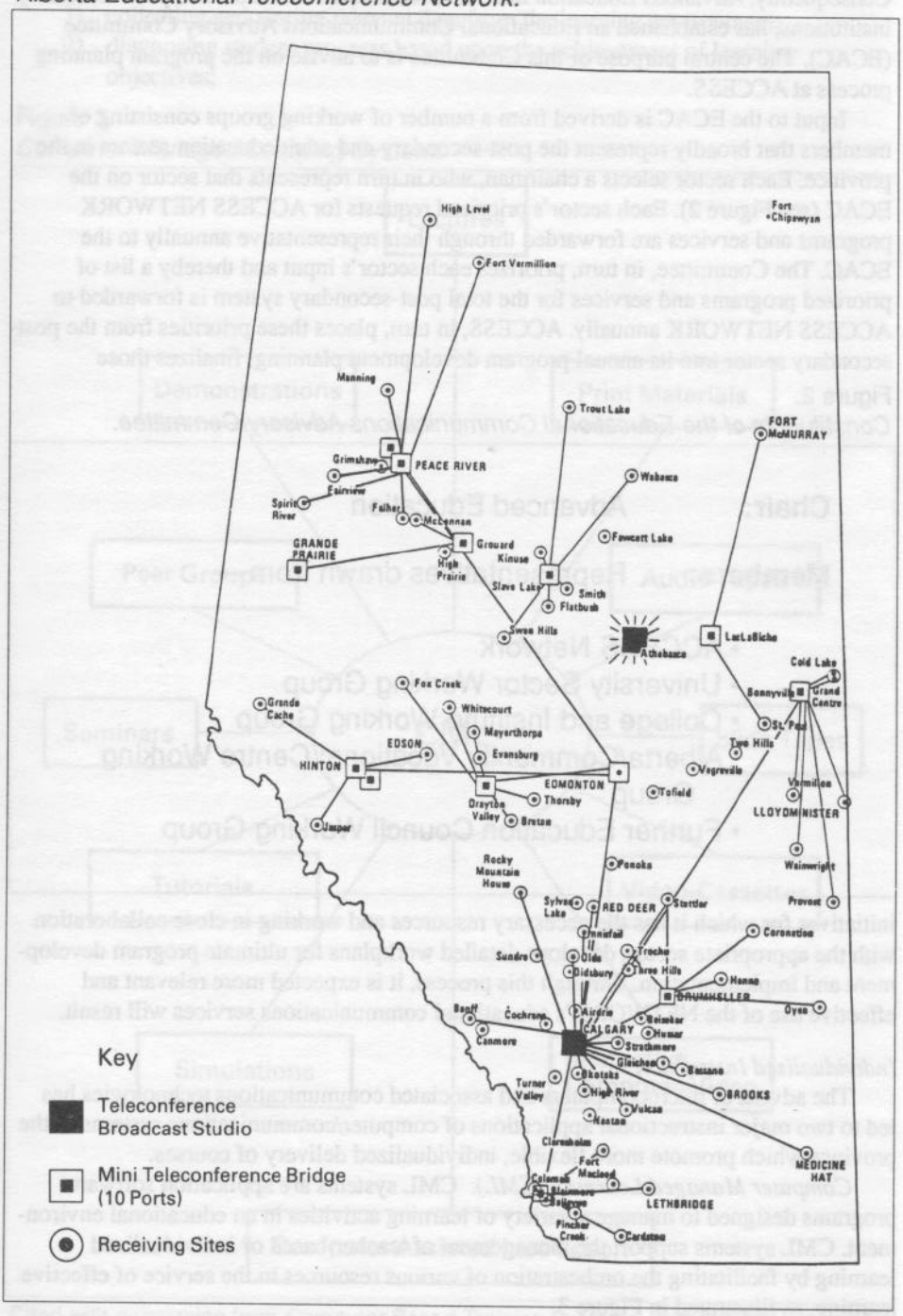
To date, print is the most common medium reported for the provision of distance education courses. However, electronic communications technologies are increasingly being cited as an element in the delivery systems. The telephone, either for tutorial support or for use in audio-teleconferencing, is the most widely used non-print communications technology.

A variety of audio-teleconference networks using existing government and public telephone services has emerged over a number of years. Figure 1 (see next page) displays the geographic dispersal of broadcast studios, bridges and receiving sites. These networks currently provide both credit and non-credit courses using audio-teleconferencing as the primary instructional vehicle. Additional courses are being offered using teleconferencing in conjunction with some other distance education delivery method. Expansion of the audio-teleconference networks is being planned for the 1987/88 academic year. While minor technical problems have occurred, the need for coordination of activities has been more significant. As a result, the users themselves have established the Alberta Educational Teleconference Council. This Council, along with a variety of planning, evaluation and steering committees, is addressing issues pertaining to course planning and scheduling. The Council also serves as a forum to facilitate discussion and resolution of technical and operational matters related to the expansion of these networks. The Council has established a teleconference network coordination planning group to prepare a three to five year strategic plan that is designed to coordinate all teleconference networks and services that they provide.

In addition to the teleconference-based distance education courses, a small number of video broadcast telecourses are being developed and delivered. However, 72 courses use either video broadcast or video cassettes along with other media in support of delivery. If courses require broadcasting, they are delivered on behalf of sponsoring post-secondary institutions using the Alberta ACCESS NETWORK satellite service. Additional learning resources for the courses are provided in part by ACCESS NETWORK.

In general, the services of ACCESS NETWORK, particularly in relation to its

Figure 1.
Alberta Educational Teleconference Network.



broadcast capability, have not been adequately used by the post-secondary system. Consequently, Advanced Education in collaboration with ACCESS and post-secondary institutions, has established an Educational Communications Advisory Committee (ECAC). The central purpose of this Committee is to advise on the program planning process at ACCESS.

Input to the ECAC is derived from a number of working groups consisting of members that broadly represent the post-secondary and adult education sectors in the province. Each sector selects a chairman, who in turn represents that sector on the ECAC (see Figure 2). Each sector's priorized requests for ACCESS NETWORK programs and services are forwarded through their representative annually to the ECAC. The Committee, in turn, priorizes each sector's input and thereby a list of priorized programs and services for the total post-secondary system is forwarded to ACCESS NETWORK annually. ACCESS, in turn, places these priorities from the post-secondary sector into its annual program development planning, finalizes those

Figure 2.
Constituents of the Educational Communications Advisory Committee.

Chair: Advanced Education

Members: Representatives drawn from —

ACCESS Network
University Sector Working Group
College and Institute Working Group
Alberta/Community Vocational Centre Working Group
Further Education Council Working Group

initiatives for which it has the necessary resources and working in close collaboration with the appropriate sector, develops detailed workplans for ultimate program development and implementation. Through this process, it is expected more relevant and effective use of the NETWORK's educational communications services will result.

Individualized Instruction

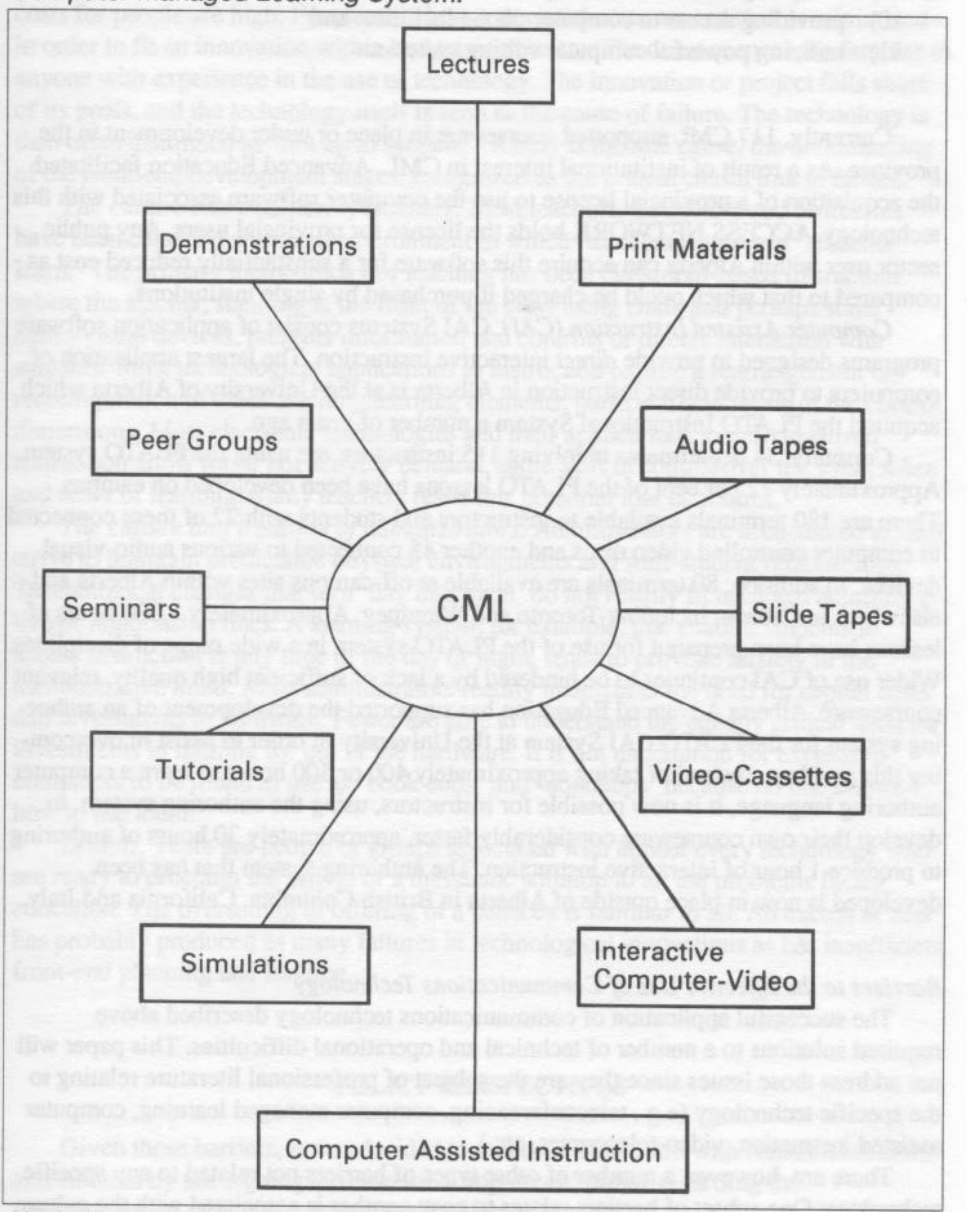
The advent of microcomputers and associated communications technologies has led to two major instructional applications of computer/communications systems in the province which promote more flexible, individualized delivery of courses.

Computer Managed Learning (CML). CML systems are application software programs designed to manage a variety of learning activities in an educational environment. CML systems support the management of teacher-based or individualized learning by facilitating the orchestration of various resources in the service of effective learning, as illustrated in Figure 3.

Most CML systems facilitate some or all of the following:

1) collecting and storing relevant data from the learning environment;
2) diagnosing student progress based upon the achievement of learning objectives;

Figure 3.
Computer Managed Learning System.



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3) providing practice by allowing students access to self-tests;
4) prescribing remedial learning activities when warranted;
5) maintaining secure instructor-prescribed tests:
6) displaying student and class progress records on demand;
7) providing student help on request;
8) permitting testbanking when necessary;
9) analyzing test items when specified;
10) providing access to computer phone facilities; and
11) utilizing powerful computer editing systems.

Currently, 117 CML supported courses are in place or under development in the province. As a result of institutional interest in CML, Advanced Education facilitated the acquisition of a provincial license to use the computer software associated with this technology. ACCESS NETWORK holds the license for provincial users. Any public sector user within Alberta can acquire this software for a substantially reduced cost as compared to that which could be charged if purchased by single institutions.

Computer Assisted Instruction (CAI). CAI Systems consist of application software programs designed to provide *direct* interactive instruction. The largest application of computers to provide direct instruction in Alberta is at the University of Alberta which acquired the PLATO Instructional System a number of years ago.

Currently, 54 departments involving 115 instructors, are using the PLATO system. Approximately 72 per cent of the PLATO lessons have been developed on campus. There are 180 terminals available to instructors and students with 22 of these connected to computer controlled video discs and another 45 connected to various audio-visual devices. In addition, 80 terminals are available at off-campus sites within Alberta and elsewhere in Canada, including Toronto and Winnipeg. Approximately 2,000 hours of lessons have been prepared for use of the PLATO system in a wide range of disciplines. Wider use of CAI continues to be hindered by a lack of sufficient high quality, relevant courseware. Alberta Advanced Education has supported the development of an authoring system for the PLATO CAI System at the University in order to assist in overcoming this problem. Instead of taking approximately 400 or 500 hours to learn a computer authoring language, it is now possible for instructors, using the authoring system, to develop their own courseware considerably faster, approximately 30 hours of authoring to produce 1 hour of interactive instruction. The authoring system that has been developed is now in place outside of Alberta in British Columbia, California and Italy.

Barriers to the Effective Use of Communications Technology

The successful application of communications technology described above required solutions to a number of technical and operational difficulties. This paper will not address those issues since they are the subject of professional literature relating to the specific technology (e.g., teleconferencing, computer managed learning, computer assisted instruction, video-telecourses, etc.).

There are, however, a number of other types of barriers not related to any specific technology. One subset of barriers relates to cost; another is associated with the culture

and traditions of educators; and a final barrier pertains to the beliefs of the proponents of technology.

Costs. Any educational change with substantial cost consequences can be expected to provoke resistance from a variety of sources. This is particularly difficult with the new information technologies since, while hardware costs are dropping, the investment is still substantial on a system-wide basis. More importantly, costs associated with planning, design, analysis and development of learning material and training costs for people are high. Frequently, these associated costs are reduced or minimized in order to fit an innovation within budget parameters. The consequences are familiar to anyone with experience in the use of technology. The innovation or project falls short of its goals, and the technology itself is seen as the cause of failure. The technology is then often dismissed as "not up to scratch." Rarely is the real cause, the underfunding of the front-end development stages, recognized as the critical causal link to failure.

The culture and tradition of teachers. Most teachers, instructors and professors have been educated within an environment in which 'teachers teach' and 'students learn. The primary methodology of teaching has been classroom-based instruction where the teacher, standing at the front of the class using chalk and perhaps some audio-visual devices, presents information and controls or directs interaction with students. Most technological applications to instruction require a rearrangement or reconfiguration of these teaching/learning elements, particularly in terms of the control dimensions. Most electronic technologies and their applications to individualized instruction allow for, if not actively demand, some shift in control over the *what, when* and *hows* of learning. Many teachers resist this potential loss of control.

The culture and tradition of administrators. Administrators are accustomed to, and strive to maintain predictable physical environments and staff-student relationships. Technological changes that turn 'day into night' do not readily fit accepted administrative or relationship lines. A learning system, for example, that enables students to access instruction at any time of the day or night, tends to provoke anxiety in the administrative mind. Most administrators readily understand the need for capital costs and investments in hardware. Fewer are able to understand the equally critical need for investments in training for use of the hardware. It is not uncommon for expensive computers to be found in use as 'book ends' and 'doorstops' because no one knows how to use them.

Zealots. There are people or groups associated with almost every technology who are ready to proclaim the arrival of a messianic solution to all the problems facing education. The overselling or offering of a panacea is familiar to all. An excess of zeal has probably produced as many failures in technological innovations as has insufficient front-end planning and funding.

POLICY PERSPECTIVES

Given these barriers, it was decided to avoid confrontation with resistant attitudes and cultures by not arguing the case for a 'top-down' policy regarding the implementation of new information technologies into higher education. Rather it was

decided to support initiatives that come from institutions on a project by project basis. Proposals are encouraged which, in addition to including the usual operational details, also include four other elements.

First, at least one senior administrator of the proposing institution is strongly encouraged to be involved throughout a project so that the participating institution is committed to continuing any successful innovation from its own resources. Second, initiatives are encouraged which involve more than one institution and, where possible, the private sector. Third, sufficient direct funding is required, along with necessary indirect support from all stakeholders in the early stages of a project — the analysis, planning, design and development components. Finally, government fiscal involvement diminishes as the institutions demonstrate successful implementation and move to continuation under their own control, as illustrated in Figure 4 (see *next page*). This strategy of infusing technology-supported innovation has emerged in Alberta over a number of years and will be described in more detail in what follows.

A PROCESS APPROACH TO THE ADOPTION OF TECHNOLOGY

The approach adopted by some of the staff of Advanced Education, briefly described above, could be referred to as a 'process' approach as contrasted to a 'product' centered approach when implementing an innovation. The product centered approach, more commonly associated with the introduction of new products form the manufacturing sector, typically is described as consisting of four stages: research, development, diffusion and adoption (RDDA) and assumes that resistance to new products or innovations is initially high and falls off in a linear fashion until the product is ultimately adopted. Innovation in the social/education sector however, does not appear to follow the RDDA model. Rather, the course of acceptance of innovation appears to be a non-linear relationship in which resistance may wax and wane throughout the time span of any innovative initiative. This comparison is shown in Figure 5.

Three strategies have been found to be particularly useful in introducing educational innovations using a process model in Alberta. First, care has been taken to ensure that all staff and administrators who will be affected by an innovation are *co-opted* into the process at the outset. Often, a project is initiated by one or two staff members and little communication occurs among colleagues and/or administrators. If this continues, at a later stage the non-involved parties tend to see the innovation as a potential threat or impediment. The activity can be construed as someone's 'pet project' or viewed as irrelevant to them and to the institution. Consequently, a concerted effort is made at the outset to bring more staff members into the activity, to make the innovation *ownership* more broadly based and to gain commitment from administrators to provide continued support from institutional funds when the project has successfully terminated and thereby facilitate the adoption of the innovation on an on-going basis.

Second, provision of expert support is important, not only in the early planning stages, but also throughout the project cycle, especially during those periods of frustration and anxiety that characterize the *process* model of innovation. As shown in Figure the adoption of innovation in social/educational contexts is not accurately

portrayed by a linear model. The process is rather more *bumpy* and is characterized by frequent points of resistance over the course of initiation through to project completion and ultimate adoption. Innovations in which expertise has been available at the front-end only may become *derailed* and collapse if expert support cannot be brought in to assist the project team through crisis periods.

Finally, a third strategy that facilitates adoption and diffusion can be likened to the reproduction of strawberry plants through runners. Staff from a successful innovation site are available to new receptive sites but maintain their link to the original site, like strawberry plants with the 'adventitious stems.' The staff member developing the new

Figure 4.
Relative Involvement/Support of Government and Institutions.

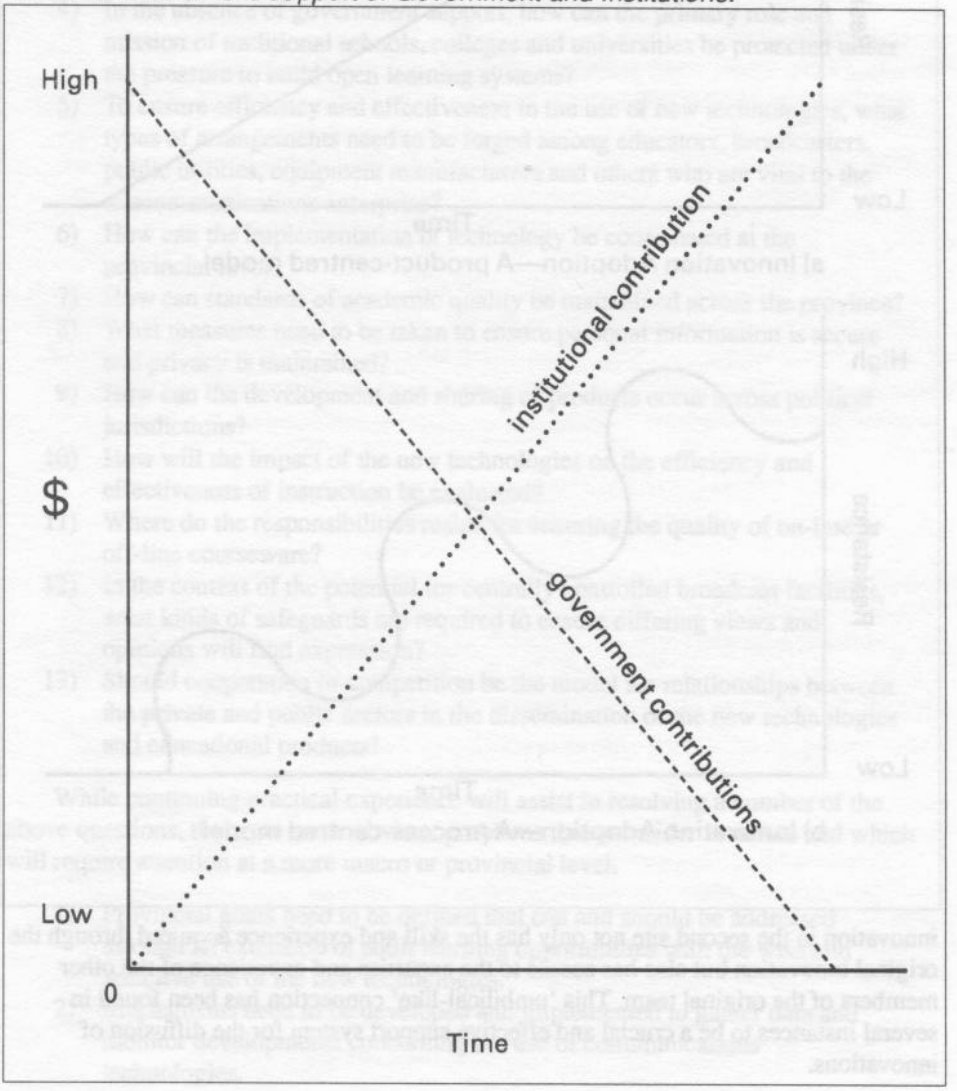
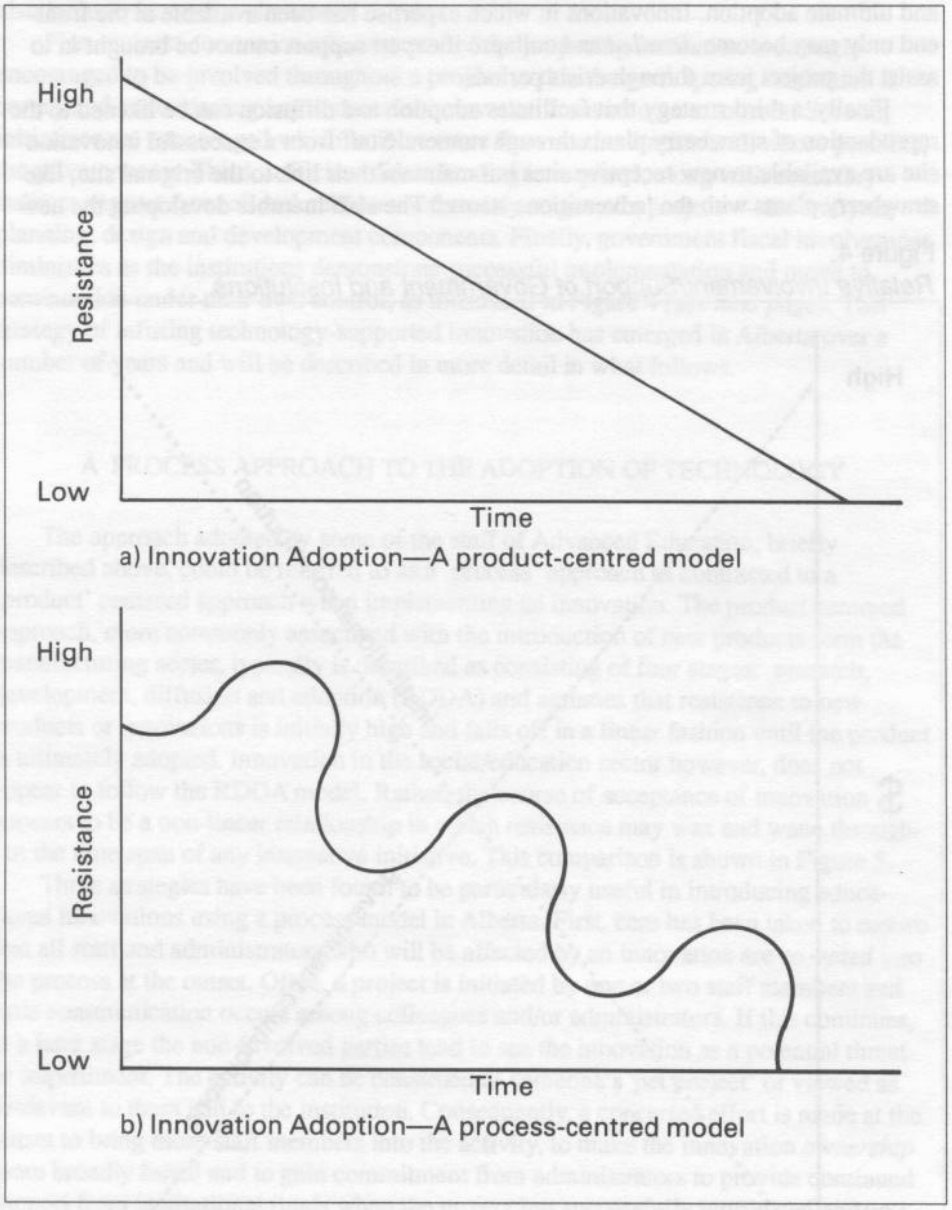


Figure 5.
Two Models of Innovation Adoption.



innovation in the second site not only has the skill and experience acquired through the original innovation but also has access to the expertise and experience of the other members of the original team. This 'umbilical-like' connection has been found in several instances to be a crucial and effective support system for the diffusion of innovations.

UNRESOLVED ISSUES

Through the use of communications technologies, Alberta educators are now going beyond their classrooms. As this process accelerates, the concerns described in the literature become real and demand attention. The following are a sample of the current issues which seem to be receiving priority treatment.

1) How should post-secondary accrediting agencies respond to the realities of inter-provincial distribution of courses?
2) How will the new technologies affect provincial funding formulae?
3) How will distant learners finance their studies?
4) In the absence of government support, how can the primary role and mission of traditional schools, colleges and universities be protected under the pressure to build open learning systems?
5) To ensure efficiency and effectiveness in the use of new technologies, what types of arrangements need to be forged among educators, broadcasters, public utilities, equipment manufacturers and others who are vital to the telecommunications enterprise?
6) How can the implementation of technology be coordinated at the provincial level?
7) How can standards of academic quality be maintained across the province?
8) What measures need to be taken to ensure personal information is secure and privacy is maintained?
9) How can the development and sharing of products occur across political jurisdictions?
10) How will the impact of the new technologies on the efficiency and effectiveness of instruction be evaluated?
11) Where do the responsibilities reside for ensuring the quality of on-line or off-line courseware?
12) In the context of the potential for centrally controlled broadcast facilities, what kinds of safeguards are required to ensure differing views and opinions will find expression?
13) Should cooperation or competition be the model for relationships between the private and public sectors in the dissemination of the new technologies and educational products?

While continuing practical experience will assist in resolving a number of the above questions, there are some obvious problems that are wider in nature and which will require attention at a more macro or provincial level.

1) hovincial goals need to be defined that can and should be addressed through an extension of adult learning opportunities with the wise and selective use of the new technologies.
2) Mechanisms need to be developed and implemented to gather data and monitor developments concerning the use of communications technologies.

3) Mechanisms need to be available for *buffering* and problem resolution in order to deal with conflict among and between institutions and agencies (e.g., telephone companies and post-secondary institutions).
4) Coordination of the delivery of training and educational services will likely be required among institutions in the public sector and between the public and private sectors.
5) Continuing information dissemination will likely be important in order to build and maintain public support for innovations, many of which affect the basic nature of education itself.
6) Because many of the new technologies substantially change both the cost structures and educational consequences, it is critical that continuing evaluation activities be in place to ensure neither feature is allowed to deteriorate.
7) Plans for effective resource utilization will probably be required at a variety of levels, for example, at the institutional, provincial, regional and national levels.
8) The complexities inherent in hardware acquisition and software development and implementation on a scale that 'will make a difference' will probably require some coordination at the provincial level.

The first of the above actions, provincial goal setting, is particularly important. It is possible to achieve greater economy in the use of these technologies by encouraging greater use of instructional approaches which are effective in terms of both cost and learning outcomes, in addition to careful selection of the instructional priorities required for public support.

CONCLUSION

If publicly supported higher education is to remain a key player in the emerging 'life-long learning society' then it is important that policy makers and educational leaders fully understand how the resources of advanced communications technologies can be most wisely used. The temptation to either adopt the most glamorous forms of these technologies, or not to adopt them at all, must be resisted.

Continual Response Measurement: Design and Validation

Jon Baggaley

Abstract: Computer-based measurement techniques are increasing the speed and precision of social science research methods. Using time-based polling techniques, advertising and political researchers gain rapid, second-by-second feedback concerning the impact of their media campaigns. The techniques of continual response measurement are also used in the development of educational communications, and in the 'formative evaluation' of their impact.

However, the validity and reliability of continual response data are open to question. They depend on sampling restrictions, on the complexity of the response task, and on the subjects' ability to cope with it. They require the criterion-referencing of data, and caution in the interpretation of results. The present paper discusses steps to be taken in these respects when continual response measurement is used in formative evaluation and research. Guidelines for the design of such studies are provided, examples are given typifying their deductive and inductive functions, and distinctions are made between formative evaluation and formative research on this basis.

CONTINUAL RESPONSE MEASUREMENT IN AUDIENCE RESEARCH

During 1985, an American sporting goods company announced the invention of the computerized running shoe. Following a run, the shoe is plugged into a home computer, and the runner is provided with immediate feedback regarding the distance he has covered, the time taken, and the amount of calories burned up. The concept behind the system is sound. Immediate feedback of results can be expected to increase the runner's ability to improve his skills the next time out. He no longer has to rely on

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intuition in order to gain the maximum return from his athletic efforts.

As indicated in the previous paper in this series, similar feedback devices have come on the market for the benefit of film and television producers. Since the development of portable microcomputing facilities in the 1980's, media producers no longer have to rely exclusively on questionnaire and interview techniques for information about their production's impact. These techniques were in any case largely unable to provide the specific information which producers require about the impact of particular production techniques. Precise moment-by-moment feedback of audience reactions to a production is now available, generated by a wide range of electronic facilities. The history of such research systems is discussed by Cambre (1981), Malik (1981), Clarke and Ellgring (1983), and Edel (1986).

Via the new systems, the audience's responses can be recorded continuously as they view a production, and fluctuations within them instantly analyzed (Baggaley, 1986a). When the continuous record of audience responses is synchronized with the production itself, the producer can inspect the momentary fluctuations in response which are associated with individual scenes and production techniques, in time to reshoot or reedit the programme for greater effect. The moment-by-moment responses may also be examined for individual differences among viewers, and insights gained from the reactions of different types of viewers to particular production techniques. Thus, reactions of viewers of different age groups and abilities to programme pacing and illustration techniques may be compared. For programme policy-makers, continual response measurement (CRM) can answer general questions concerning, for example, the reactions of different audience types to programme violence and stereotyping.

The value of research during the process of media production has been evident since the earliest days of educational film (see for example, Lashley &Watson, 1921; and Zirbes, 1924). In 1967 it was recognized formally by Scriven under the heading *formative evaluation* This term has proved most valuable for the purpose of drawing a distinction between the practical types of evaluation study conducted during the production process, and the more common forms of evaluation known as and conducted after production is completed. The latter type of study, with its tendency to expose production faults too late for producers to do anything about them, has hardly endeared the media evaluator to his or her production colleagues. In fact it has done much damage to their relationship.

The new computer-based measurement techniques promise to speed up the media evaluation process, and to create a more productive relationship between the producer and researcher. The techniques of CRM offer particular benefits. However, they are unlikely to be used widely until the data collection and analysis procedures on which they are based have been carefully reviewed. For, as the following article indicates, the reliability of continual response data are often questionable, and the validity of the results are thereby jeopardized. These problems must be carefully kept at a minimum in the design and interpretation of formative evaluation and research studies generally.

COMPARISON OF CONTINUAL RESPONSE METHODOLOGIES

Response analysis systems differ on a large number of bases: notably portability

and flexibility, speed and level of analysis, clarity of feedback, and the combination of these facilities relative to cost. In broadcasting research, of course, the common need is for multiple hand-units to record the responses of a whole audience. The *Program Evaluation Analysis Computer* (PEAC system) collects the responses of a potentially infinite number of people, via a set of remote battery-powered units. Reactions to a production may be collected simultaneously in a range of settings (e.g., viewers' homes) as well as in a central location (Nickerson, 1970; Baggaley, 1986a).

A typical system involves a series of hand-held response units via which observers' responses are collected, and transmitted to a computer for analysis. Changes in, for example, the frequency, average length and variability of behaviour can then be examined across time. To the designers of a TV or film production, of course, such feedback about its moment-by-moment impact can be irresistible. Programme segments can be adjusted or extended and camera angles altered — even during live presentations — in order to maintain and enhance programme appeal. However, the quality of such feedback is only as sophisticated as the research methods which were used to generate it; and impulsive interpretations of hastily gathered data can be highly suspect.

In educational media research, for instance, the extent to which a measure such as moment-by-moment appeal can actually predict overall learning is debatable. Similarly, little is known about the criteria by which a meaningful shift in response can be distinguished from a random one. Many media producers are rightly defensive about the introduction of continual response methods into their industry for such reasons. They suspect that audience researchers will use the methods to dictate aspects of production content on quite unjustified bases. Urgent attention must therefore be paid to the research methodology on which such systems depend, while the broadcasters are still willing to consider their benefits.

A comparison among three of the leading methodologies in North American broadcasting research was made by the Corporation for Public Broadcasting (1981). Programme pilot-test results obtained by two of the electronic methods (the PEAC system and the Percy Voxbox) were compared with those of a more conventional testing method, the discussion or focus group. The three approaches were judged in terms of a) response articulateness versus objectivity; b) sampling flexibility; c) practical benefits to programme producers; and d) long-term benefits to programme policy-makers and distributors.

The conclusions of the CPB study may be summarized as follows. While the openness of the focus-group situation usually allows discussants to be relatively flexible and uninhibited in their responses, it can also have inhibiting effects. Powerful group biases can affect the opinions expressed. The opinions of individual group members may be dominated by those of more assertive individuals. By the time the presentation is over and the discussion takes place, viewers may also have forgotten many of the critical but fleeting reactions they experienced whilst the presentation was in progress.

The availability to record one's responses to a programme simultaneously, via a hand-held response unit, can reduce these problems. Being nonverbal, responses are usually private and anonymous. Audience members have the opportunity to make a completely uninhibited assessment, and to change it as frequently as they choose. On

the other hand, an automated response task invariably restricts the range of available responses to a set of fixed options. The CPB study (1981) concluded that the most effective testing situation for the foreseeable future will probably be one featuring the electronic and focus-group methodologies simultaneously.

Certainly, the electronic techniques are the only current means whereby moment-by-moment fluctuations in audience impact can effectively be measured: one would hesitate to stop the programme every few seconds for a discussion! The imposition of a closed-ended response can be seen as a worthwhile price to pay for this extra information. On the other hand, the overall impact of a programme is unlikely to be established other than by post-test measures (e.g., questionnaire or discussion methods).

The strengths and limitations of CRM methods are indicated by the following case studies. The studies were conducted by the author between 1980 and 1984, initially at Memorial University of Newfoundland, and more recently at Concordia University, Montreal. Both universities had purchased, for their media research purposes, the Programme Evaluation Analysis Computer. The PEAC system was selected from the range of possible systems on the basis of its superior portability and flexability of operation, and its relative cost-efficiency.

SAMPLING RESTRICTIONS

Since electronic hand-units are more expensive to obtain than questionnaires or telephone calls, the samples of the population with which they can be used are usually more restricted. Unless an adequate sample can be amassed via several test sessions, the external validity of research results is likely to be restricted. The problem commonly arises in formative evaluation studies requiring rapid feedback of results to, for instance, a programme producer. It also occurs when audience reactions to a Iive, one-shot media presentation are studied, so that an immediate analysis may be obtained while the subject matter is still topical.

In November 1980, the PEAC system was used to assess public reactions to the televised debate between American President Jimmy Carter and the presidential challenger Ronald Reagan. In St. John's, Newfoundland, a panel of two dozen viewers watched the debate in their homes. As they did so, they used the portable PEAC hand-units to respond to the following question: "Who, from one moment to the next, is winning the most votes?". Three options were available to them, on buttons labelled CARTER, REAGAN and DON'T KNOW. Their continual responses were sampled at 4-second intervals. Although limited in its scope and generalizability, the study gave indications of the telling impact of nonverbal strategy in the debate, and of the speed with which the contender Reagan was able to dominate President Carter in the viewers' eyes. The study has been described in more detail in the preceding article in this series 1986a).

The rates of audience response during the first eight minutes of the Carter-Reagan debate are plotted graphically in Figure 1. The four graphs are divided into segments, according to the alternating question-and-answer format of the debate. The first four minutes is dominated by responses on the DON'T KNOW button (Fig. la) and the

CARTER button (Fig. lb). Viewers perceived the incumbent Carter as winning the most votes even before he spoke. During the fifth minute, however, votes began to accumulate for Reagan (Fig. lc), and in the subsequent course of the debate, Reagan's perceived *votability* increased dramatically, particularly in the 19th minute during his discussion of Carter's economic record. The peaks of response on the three buttons may be compared in the combined graph (Fig. 1d).

The problems of inferring overall impact from such data are obvious. Firstly, the panel of subjects used in the Newfoundland study was minimal in size, and any attempt to generalize from their responses to the larger American audience would be highly questionable. (One can sympathize with the accused in a court of law, for whom life and death depend on the reactions of a jury half this size.) If such a study is to be beyond reproach, therefore, it must clearly make use of *a representative and balanced sample of the audience for whom the programme is intended.* To demonstrate that care has been taken in this respect, the researcher should indicate the demographic and/or psychological bases on which the sample was selected. If rigorously controlled sampling is out of the question, the researcher must take care to *qualify the results accordingly.*

The sampling limitations of the Carter-Reagan study were stressed when its preliminary results were reported on CBC-Radio the morning after the debate. The external validity of its main findings was indicated eighteen months later by results obtained independently in the United States (Wingerson, 1982). Fortunately, the response task used in the Carter-Reagan study was a simple one, which the subjects were evidently able to fulfil with a high degree of reliability. Although the external validity of the study had been jeopardized by sampling restrictions, its internal validity was apparently high, each subject being considered as his or her own control in a series of multiple response comparisons.

Obviously, care must therefore be taken to ensure that the response task involved in a continual response study is within the intellectual and physical means of the subjects. As the following section shows, typical response tasks can often be too difficult for some viewers to handle.

COMPLEXITY OF THE CONTINUAL RESPONSE TASK

In common with other response analyzers, the PEAC system allows for the collection of continual responses on one of two bases:

1) nominal, categorical responses — such as CARTER, REAGAN, or DON'T KNOW, or
2) an interval, or quasi-interval scale of responses such as GOOD, FAIRLY GOOD, FAIRLY POOR, POOR.

It also provides two modes of push-button response: the *Reset* mode, in which the appropriate button must be depressed continuously in order for a response to be registered, and *the Latched* mode in which the current response is assumed to pertsist

Figure 1. *The Carter-Reagan Debate (Question: "Who, from one moment to the next, is winning the most votes?").*

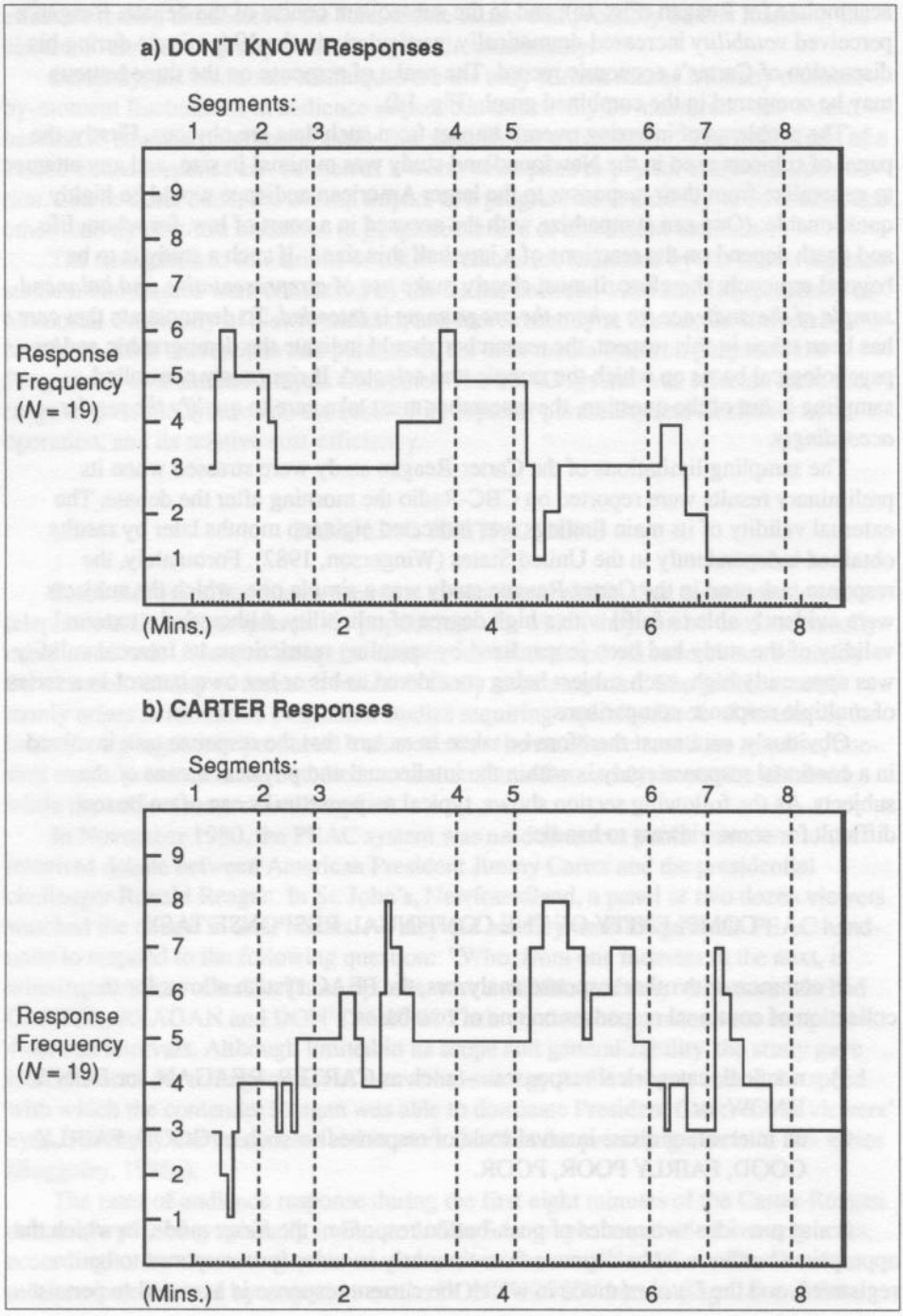
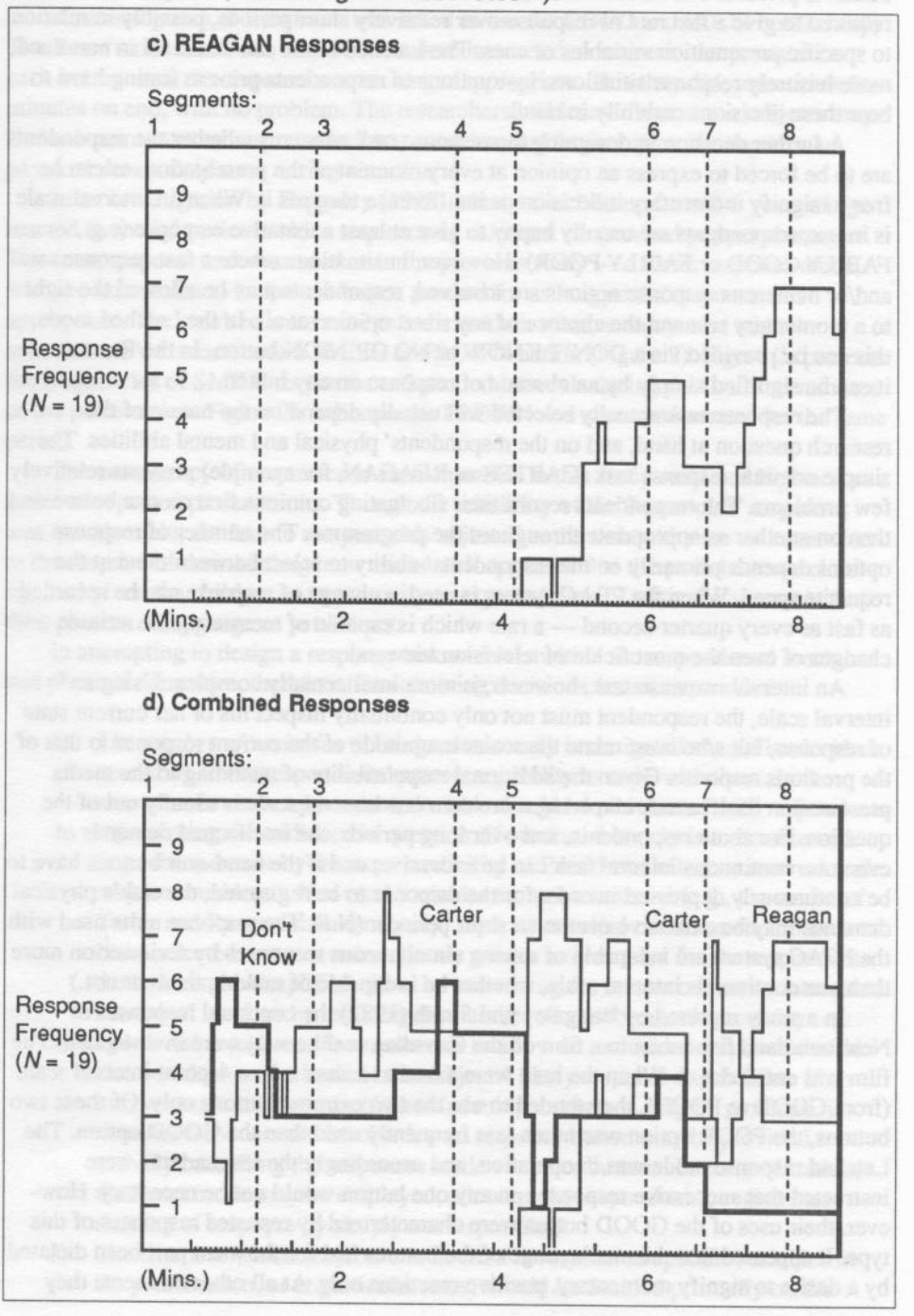


Figure 1, continued. *The Carter-Reagan Debate (Question: "Who, from one moment to the next, is winning the most votes?").*



— whether the appropriate button is currently being pressed or not — until a different button is pressed. The Reset mode can be useful in situations where subjects are required to give a fast rate of response over relatively short periods, possibly in relation to specific presentation variables or cues. The Latched mode can be useful in non-cued, more leisurely response situations. Instructions to respondents prior to testing have to bear these decisions carefully in mind.

A further decision in designing the response task concerns whether the respondents are to be forced to express an opinion at every moment of the presentation, or can be free to signify momentary indecision or indifference towards it. When an interval scale is in use, respondents are usually happy to give at least a tentative response (e.g., FAIRLY GOOD or FAIRLY POOR). However, in situations where a fast response rate and/or numerous response options are involved, respondents may be allowed the right to a momentary rest and the absence of any overt opinion at all. In the Latched mode, this can be provided via a DON'T KNOW or NO OPINION button. In the Reset mode, it can be signified simply by an absence of response on any button.

The response task actually selected will usually depend on the nature of the research question at hand, and on the respondents' physical and mental abilities. The simple nominal response task (CARTER or REAGAN, for example) presents relatively few problems. The respondents record their fluctuating opinions first on one button and then on another as appropriate throughout the programme. The number of response options depends primarily on the respondents' ability to select between them at the requisite speed. When the PEAC system is used. a change of response can be recorded as fast as every quarter-second — a rate which is capable of measuring the attitude changes of even the most fickle of television viewers!

An interval response task, however, is more intellectually complex. Using an interval scale, the respondent must not only continually inspect his or her current state of response, but s/he must relate the scalar magnitude of the current response to that of the previous response. Given the additional responsibility of attending to the media presentation itself, a task involving more than one interval scale is usually out of the question. For some respondents, and over long periods, the intellectual demands of even one continuous interval task can be excessive; and if the hand-unit buttons have to be continuously depressed in order for the response to be registered, the task's physical demands may be excessive over even short periods. (N.B. The response units used with the PEAC system are incapable of storing simultaneous responses by a viewer on more than one continuous interval scale, whether he is capable of making them or not.)

In a study reported by Baggaley and Smith (1982) the continual responses of Newfoundland fishermen to a film on the Canadian seal harvest were investigated. The film was entitled *A-I.* When the men were asked to assess it on a 4-point interval scale (from GOOD to POOR), they tended to use the two extreme buttons only. Of these two buttons, the POOR option was much less frequently used than the GOOD option. The Latched response mode was in operation, and accordingly the respondents were instructed that successive responses on any one button would not be necessary. However, their uses of the GOOD button were characterized by repeated responses of this type. It appeared that the men's usage of the buttons had for the most part been dictated by a desire to signify momentary, positive reactions only. At all other moments they

appeared to be either impartial about the film, or unwilling to register a negative reaction.

A second group of fishermen was asked to use the GOOD and POOR buttons only. The Reset mode was used, and the men were instructed to maintain the pressure on each button until the response was no longer appropriate. This they did, sometimes for minutes on end, with no problem. The researchers had learned that some subjects may find a 4-point interval response task too complex, and *to anticipate the mental and physical demands of each testing situation.*

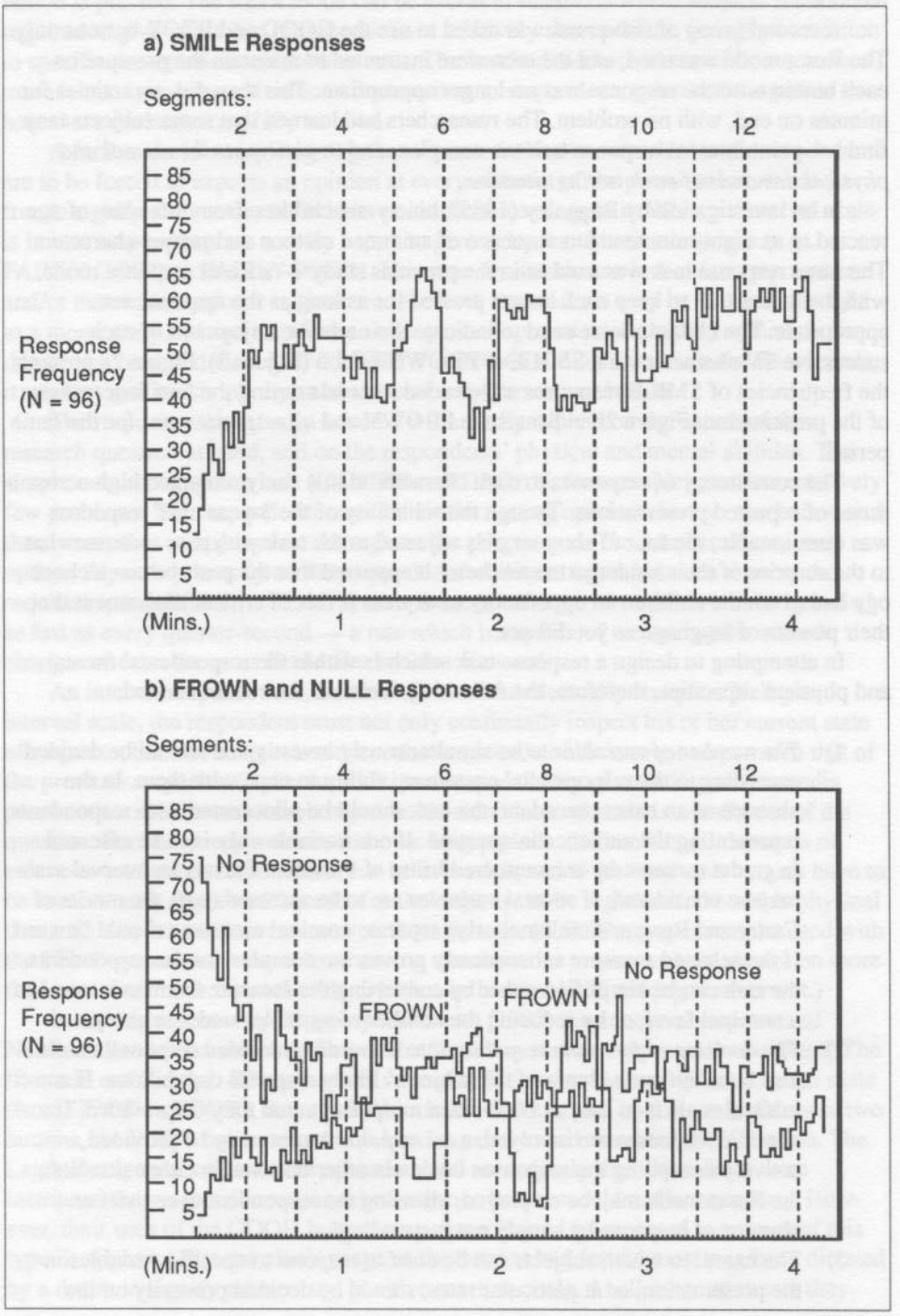
In an investigation by Baggaley (1985), ninety-six children from 3-6 years of age reacted to an eight-minute video sequence of animated cartoon and puppet characters. The same response task was used as in the previous study — a Reset response mode, with the instruction to keep each button pressed for as long as the response was appropriate. The children were cued to indicate their relative enjoyment of each successive TV character via a SMILE or FROWN button (Figure 2). Figure 2a presents the frequencies of SMILE responses at 2-second intervals during the first four minutes of the presentation. Figure 2b indicates the FROWN and *no response* rates for the same period.

The consistency of responses to each character in this study remained high across a series of repeated presentations. Though the reliability of the 3-year olds' responses was questionable, the four to six-year olds adjusted to the task with ease — somewhat to the surprise of their kindergarten teachers! It appeared that the push-button technology had given the children an opportunity to express levels of critical assessment that their powers of language as yet did not.

In attempting to design a response task which is within the respondents' mental and physical capacities, therefore, the following decisions are recommended.

1) *The number of variables* to be simultaneously investigated should be decided according to the respondents' customary ability to cope with them. In the absence of an exact precedent, the task should be pilot-tested with respondents representing the audience in question. If one variable only is to be assessed (e.g., the moment-by-moment credibility of President Carter) an interval scale may be considered. If several variables are to be assessed (e.g., the merits of Carter and Reagan simultaneously) separate nominal measures should be used. If the selected measure subsequently proves too complex for the respond&s, the task can be simplified either by converting the measure from an interval to a nominal level, or by reducing the number of variables under scrutiny.
2) *The decision to force rhe response* or to allow an undecided response should also be taken on the basis of the subjects' likely response capabilities. If an interval scale is in use, an *Undecided* midpoint button may be provided. If nominal responses are involved, a no *response* button may be provided, actively cancelling the responses made via other buttons. In either situation, the Reset mode may be employed, allowing the respondent to register an absence of response by simply not responding!
3) The extent to which subjects can be *cued* to *respond* to specific variables in the presentation, or at particular rates, should be decided primarily on the

Figure 2. *Preschool Children's Response to Cartoons and Puppets.*



basis of the presentation's length. At present, the tolerance of respondents for tasks of different lengths can only be judged intuitively. When the feasibility of a cued response task is in doubt, it should be avoided or the presentation shortened.

4) In all normal test situations, it is desirable for each respondent to be able to *refer to a visual display* of the most recent response on the hand-unit (as via the PEAC system). In this way, the respondent is reinforced in his or her efforts, and may also be reminded of the last response, as in Latched and interval situations.

SEQUENCE EFFECTS AND CONSTANT ERRORS

The data provided by continual response technologies can be both graphic and beguiling. Peaks and troughs in the moment-by-moment response profile invite instant interpretations of, for example, 'high visual interest', 'medium programme appeal', 'low presenter credibility' — and so on, depending on the response measure used. Such interpretations may be quite invalid. In one case, the writer had to restrain a TV producer from summarily firing the programme presenter in response to low rates of audience reaction that were observed during his appearances. It was pointed out that a low rating for visual appeal did not necessarily disqualify the presenter as a good educator. Conversely, a programme or programme presenter may receive a consistently high moment-by-moment rating, and yet be obviously failing in its attempt to fulfil the main programme objective.

Considered in isolation, the inferential value of continual response data is actually very low. In common with other forms of data gathered in sequence, they are subject to various types of psychometric error. When the continual ratings of a programme are generally positive, for instance, a momentary lapse in programme quality may not elicit the negative responses that it would otherwise: the segment will seem better in the sequential context than it would when judged on its own merits. When one programme segment follows others which are highly unpopular, on the other hand, its momentary ratings may suffer by association: it will seem worse than when judged on its own merits. These tendencies to over or under-estimate in a continual response task are identified as 'series' and 'time-order' effects (Woodworth & Schlosberg, 1961). The significance of sequence effects in PEAC system studies of reactions to advertising has been established empirically by Fenwick & Rice (1987): when advertisements were presented at the beginning of a test sequence, they were virtually always evaluated more positively than when screened later in the sequence.

The precise psychological meaning of CRM data is particularly difficult to interpret when the data are interval in nature. It is often unclear whether an interval response should more appropriately be interpreted as an absolute judgment on the scale, or as a relative one. A viewer's response on the FAIRLY GOOD button, for example, may be construed at its face value as representing an absolute judgment of 'fairly good'. But it might also represent a sudden, immense improvement in perceived quality to FAIRLY GOOD from VERY POOR, and a relative judgment whose correct

interpretation is identical to that of a shift from FAIRLY POOR to EXCELLENT. The viewer's current choice of buttons in a continual response task is dependent on relative as well as absolute judgmental forces in this manner.

Hand-units featuring a series of distinct buttons, as in the PEAC system, are actually less susceptible to psychometric error than other technologies demanding responses on an analogue dial. Dial-based systems allow the subjects to set their responses wherever they choose with the available range. The manufacturers of dial-based systems commonly suggest that this is an attractive feature of their technology. However, greater freedom of response and a potentially infinite response scale do not ultimately yield more reliable measures of psychological impact, for they are subject to constant over- and undershooting errors known as habituation and anticipation bias respectively (Woodworth & Schlosberg, 1961). Psychometric error of this type is minimized when the response task is button-based, and the fixed psychological meaning of each response on the scale is clear to the respondent.

On all systems, however, the psychological meaning of momentary responses is obscured when responses are averaged across a group of respondents. Clearly, the attempt must be made to validate continual response data by referring *them to general criteria for programme effectiveness.* Examples of criterion-referencing strategies are given in the next section.

CRITERION-REFERENCING OF CONTINUAL RESPONSES

Criterion-referencing of continual response data can typically be achieved by:

1) comparisons between the responses of different viewing groups; (it may be critical, for example, that the responses given by women to a programme are more positive than those given by men); or
2) comparisons between moment-by-moment responses and a measure of overall programme impact as yielded by a pre- and/or posttest.

Criterion-referencing related to between-group comparisons may be appropriate in situations where a producer requires evidence of the programme elements which are capable of interesting one particular audience sub-group as opposed to others. For example, in the study by Baggaley (1985) of preschool children's responses to TV cartoon and puppet characters (see previous section), particular comparisons were made between the reactions of the boys and girls, and between those of English and French speaking children. When the continual responses of the boys were compared with those of the girls, sex differences in their preferences for particular characters emerged. No such difference was observed on the basis of the children's cultural background. The sponsors of the study, the National Film Board of Canada, received feedback about the types of TV character most likely to appeal simultaneously to both boys and girls.

In the study reported by Baggaley and Smith (1982), on the other hand, a

continuous measure of audience response was compared with measures of overall programme impact derived from pre- and posttests. The film in question concerned the Canadian seal hunt, a controversial object of protest by international conservationist movements; it aimed to teach seal fishermen ways of relining their sealing techniques and of increasing their financial yield from the hunt. The continuous measure of response was one of general approval towards the film, on a scale from GOOD to POOR. The overall measures related to shifts in attitude towards the seal hunt, and in learning about it, as measured from immediately before the film to immediately after it. If a positive continual response in such a situation were to be accompanied by minimal, or even undesirable overall effects on attitudes or learning, it would be obvious that the overall responses had greater validity as an educational index. The high continual responses would be either 'not high enough' in relation to the overall effect; or they could actually be quite irrelevant to it. Only when used as complementary to overall criteria, can continual response data have predictive meaning.

Particularly vital information in this study was gained from the responses of a group of Newfoundland high-school students. At first glance, their data seemed to indicate the type of disapproval shown towards it by the seal hunt protesters. However, on closer examination of their data, a totally contrasting interpretation was found to be tenable.

At a particular moment in the film, the killing of a seal was shown. At the same moment, a sudden shift was observed in the audience's continual responses towards the negative end of the approval scale. When a nominal response scale is used, response fluctuations of this type are apparent in terms of the number of audience members shifting from one button to another at a given moment, as in Figures 1 and 2 above. When a series of buttons representing an interval scale has been used, the levels of response may be assessed in terms of either: a) the frequencies of response on each button individually; orb) the average response on all of the buttons at once.

The shift towards disapproval by the high-school students on seeing the seal killed is apparent in Figure 3a. The graph shows a 50% drop in the number of students pressing the GOOD button at that particular moment in the film (i.e., during the eighth minute). The figure may be compared with Figure 3b, in which the group's average response on all four of the interval-scale buttons is presented — a more precise profile based on far more information. Both graphs are, of course, totally ambiguous with regard to the meaning of any particular moment-by-moment response. In this case, the researchers decided that the sudden response shift signified either distaste for the killing of the seals, or disapproval of the film for showing it, or a combination of both. In an attempt to determine which of these three interpretations was the most probable, the responses at this moment in the film were referred to the information about each respondent collected via the pre- and posttests.

Individual differences in responses to the killing sequence could thus be related,

1) to demographic information about the respondents (their age, sex, family background); as well as
2) to their prejudices about the seal hunt; and
3) to changes in their attitudes after seeing the film.

FIGURE 3. *Highschool Students' Responses to a Film about Sealing.*

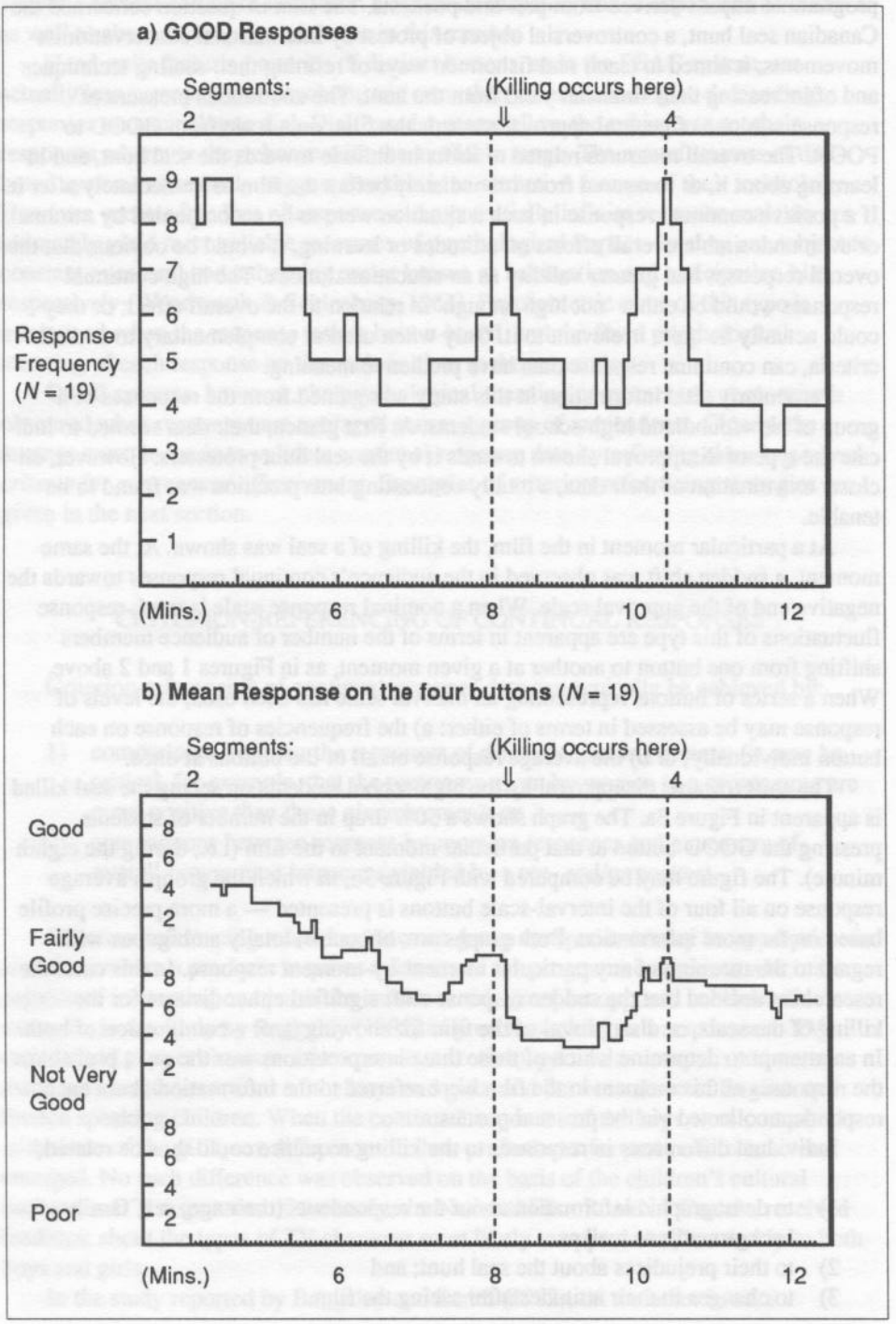
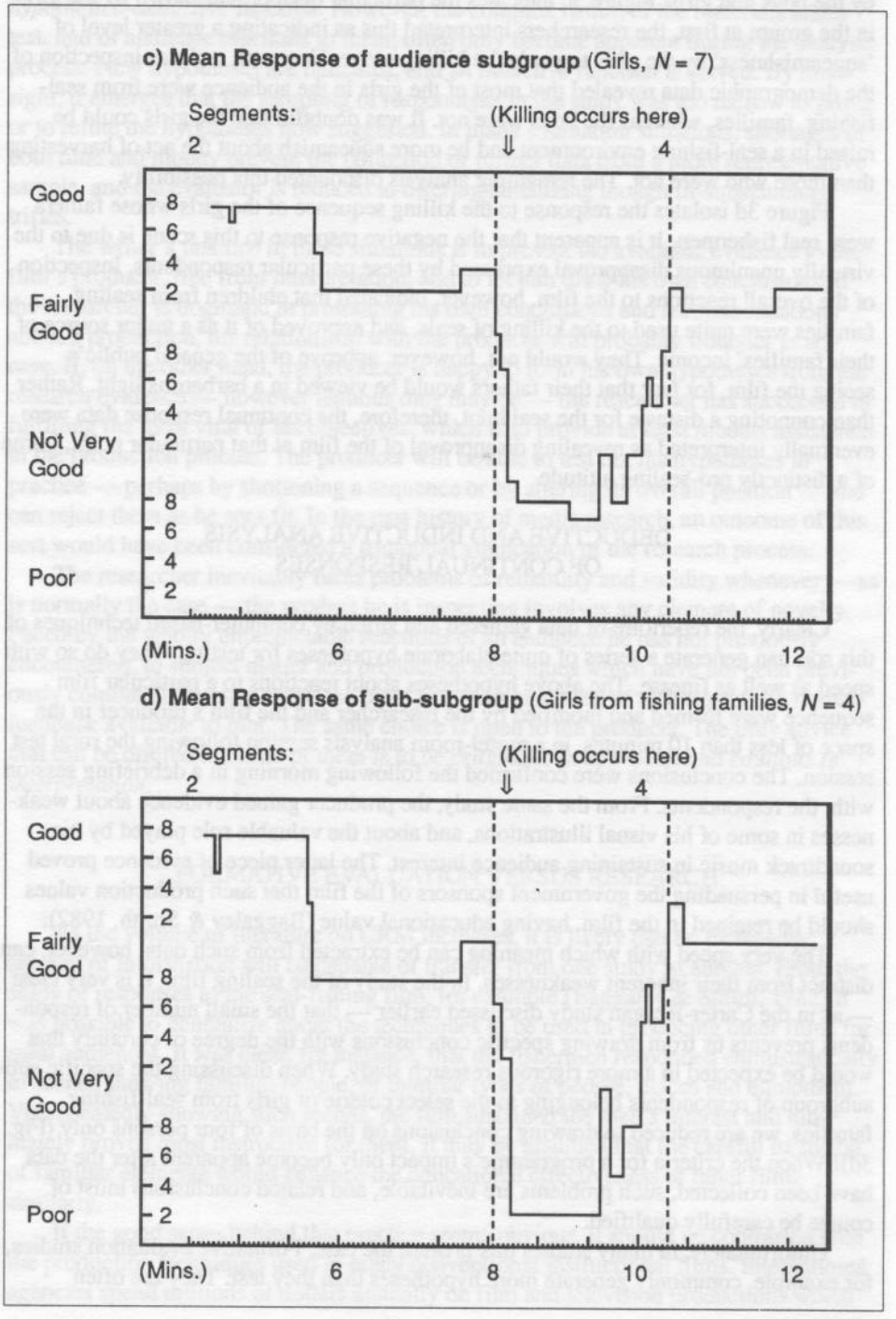


FIGURE 3, continued. *Highschool Students' Responses to a Film about Sealing.*



A marked difference was observed in the responses to the killing sequence given by the boys and girls. Figure 3c indicates the particular disapproval shown by the girls in the group; at first, the researchers interpreted this as indicating a greater level of 'squeamishness' by the girls towards the killing scene. However, a closer inspection of the demographic data revealed that most of the girls in the audience were from seal-fishing families, whereas the boys were not. It was doubtful that the girls could be raised in a seal-fishing environment and be more squeamish about the act of harvesting than those who were not. The remaining analysis discounted this possibility.

Figure 3d isolates the response to the killing sequence of the girls whose fathers were seal fishermen. It is apparent that the negative response to this scene is due to the virtually unanimous disapproval expressed by these particular respondents. Inspection of the overall reactions to the film, however, indicated that children from sealing families were quite used to the killing of seals, and approved of it as a major source of their families' income. They would not, however, approve of the general public's seeing the film, for fear that their fathers would be viewed in a barbarous light. Rather than connoting a distaste for the seal hunt, therefore, the continual response data were eventually interpreted as revealing disapproval of the film at that particular point, borne of a distinctly pro-sealing attitude.

DEDUCTIVE AND INDUCTIVE ANALYSIS OF CONTINUAL RESPONSES

Clearly, the repertoire of data gathered and sifted by computer-based techniques of this sort can generate a series of quite elaborate hypotheses for testing. They do so with speed as well as finesse. The above hypotheses about reactions to a particular film sequence were formed and modified by the researcher and the film's producer in the space of less than 10 minutes, in a motel-room analysis session following the rural test session. The conclusions were confirmed the following morning in a debriefing session with the respondents. From the same study, the producer gained evidence about weaknesses in some of his visual illustrations, and about the valuable role played by his soundtrack music in sustaining audience interest. The latter piece of evidence proved useful in persuading the government sponsors of the film that such production values should be retained in the film, having educational value (BaggaIey & Smith, 1982).

The very speed with which meaning can be extracted from such data, however, can distract from their inherent weaknesses. In the study of the sealing film, it is very clear — as in the Carter-Reagan study discussed earlier — that the small number of respondents prevents us from drawing specific conclusions with the degree of certainty that would be expected in a more rigorous research study. When discussing the specific sub-subgroup of respondents belonging to the select coterie of girls from seal-fishing families, we are reduced to drawing conclusions on the basis of four persons only (Fig. 3d)! When the criteria for a programme's impact only become apparent after the data have been collected, such problems are inevitable, and related conclusions must of course be carefully qualified.

Unfortunately, in many studies this is often the case. Formative evaluation studies, for example, commonly generate more hypotheses than they test. They are often

designed with specific hypotheses in mind, and may serve a hypothesis-testing, or *hypothetico-deductive* function. However, the complex nature of the materials under test, and of audience reactions to them, often only become apparent during the analysis process. New hypotheses are indicated, and *an inductive* function is served. By hindsight, it emerges that the sampling of respondents in the study was too narrow to prove or to refute the hypotheses now suggested. In many evaluation situations, shortages of both time and money prevent the collection of further data from a more representative sample, and the evaluator is reduced to offering tantalizing though ill-substantiated trifles.

The writer's practice in these situations is to present the available evidence to the film's producer, free from interpretation, and to let him draw his own conclusions. If the researcher is dogmatic in presenting his own conclusions and recommendations about a production, his relationship with the producer will probably flounder in any case. If, on the other hand, the producer is happy to form his own hypotheses from the research evidence — however tenuous they may be — the researcher has succeeded in fulfilling the most vital of his objectives, which is to provide at least modest assistance in the production process. The producer will be able to test out his hypotheses in practice — perhaps by shortening a sequence or by altering its overall position — and can reject them as he sees fit. In the past history of media research, an outcome of this sort would have been considered a triumphal vindication of the research process.

The researcher inevitably faces problems of reliability and validity whenever — as is normally the case — the product he is inspecting involves any element of novelty. Faced by the wholly unpredictable reactions of an audience he has not previously encountered, to subject matter and production techniques which have not been previously combined, he must make the most judicious sampling of techniques and human feedback available to him. The same choice is open to the producer. The only advice that can be offered to either of them is to be *pragmatic in approach and cautious in interpretation.*

FORMATIVE EVALUATION VERSUS RESEARCH

As the volume of literature on CRM increases, it is likely that an increasing amount of information will be capable of transfer from one study to another. From the study of responses to the seal-fishing film, for example (Baggaley Smith, 1982) it was possible to generalize about the techniques to be used in producing other films for rural audiences. It was clear, for instance, that the fishermen responded enthusiastically to scenes showing familiar people, or familiar types of people, places and equipment. Via repeatedly showing such scenes, the film sustained the men's interest and ultimately proved most instructive for them. It may be assumed that the careful inclusion of familiar elements would enhance the educational effectiveness of other films similarly.

If the good sense behind this practice seems obvious, it should be contrasted with the production techniques used in many conventional instructional films. International agencies spend millions of dollars annually on film and television productions which

are blithely assumed to meet the needs of their intended audiences. Lavish productions concerning health and work habits are released for a wide range of audiences, both educated and less educated. Rural audiences are constantly expected to identify with films centering around the unfamiliar activities and types of people found in urban communities; and the attention paid to pre- and pilot-testing of the films' educational impact is minimal.

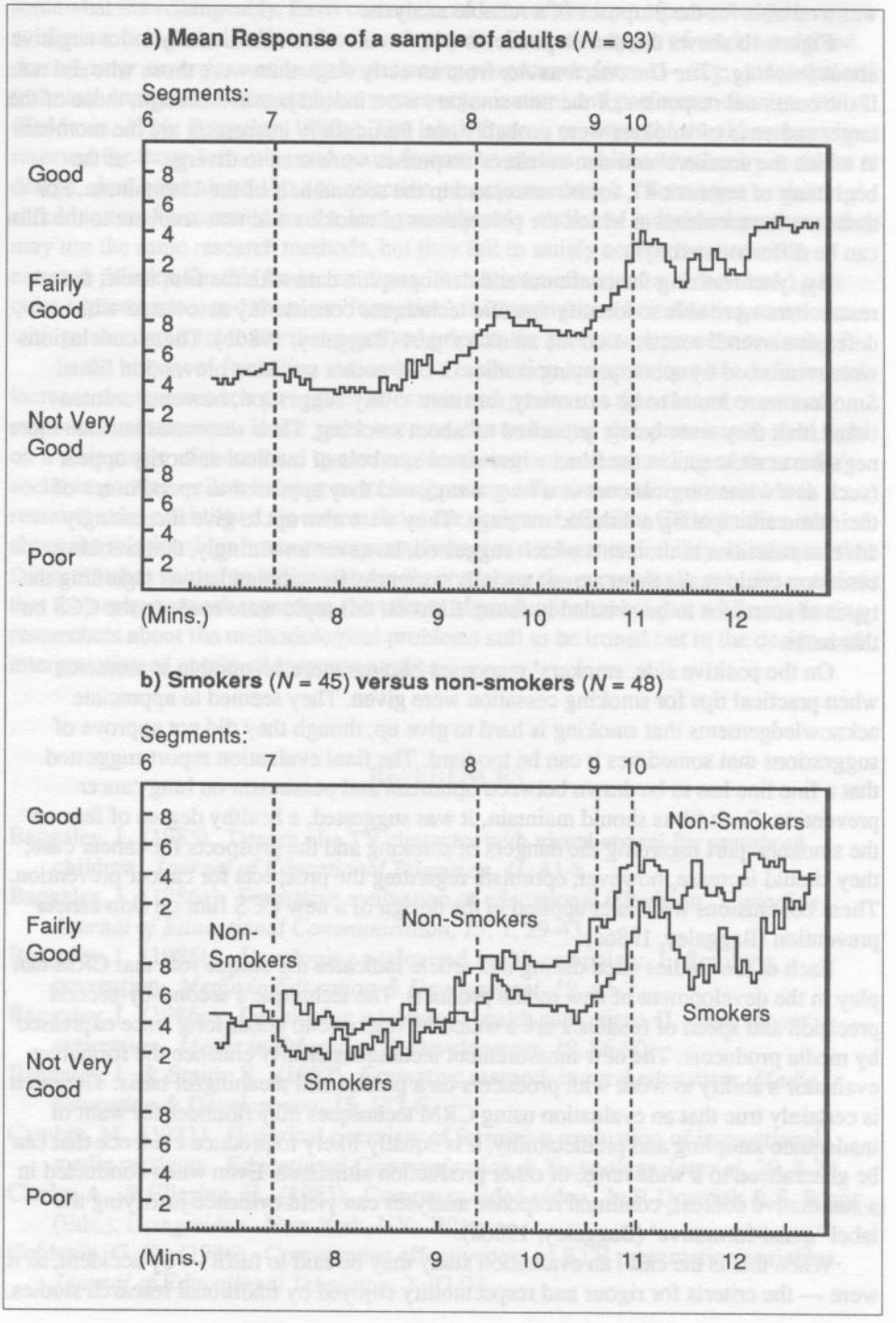
As the availability of funds for the production of educational media materials decreases, so the need for evaluation and improvement of their cost-effectiveness is intensified. In 1981, one national health agency was sufficiently concerned about the effectiveness of its educational media materials, that it embarked upon a detailed evaluation study of their impact upon a wide range of the intended audiences. The Canadian Cancer Society (CCS) had produced and distributed a wide range of cancer education films for all sectors of the Canadian public. It suspected that many of its educational materials — particularly those reliant on reading skills — were providing little or no benefit to the sectors of society with the most need for them. In areas such as lung and skin cancer prevention, the most needy sectors were perceived as the rural and 'functionally illiterate' communities.

The DEMO Project (Baggaley, 1986b, 1986c) was designed to investigate this possibility, and to recommend ways in which the impact of the CCS's public education programme might be improved. By evaluating the impact of specific films, the project aimed to derive generalizable research conclusions in this regard. In fact, the need for improvement of materials was found to be more severe than had been initially assumed. Male audiences generally were found to be defensive on cancer education matters. Their resistance to the types of film currently available to them transcended educational and social boundaries. The viewers receiving the least benefit from conventional smoking prevention films were those who smoke. Only the non-smokers were reinforced in the belief that smoking is unpleasant and should be avoided. After viewing some of the films — professionally produced by leading Canadian and American production houses — the smokers in the audience were more militant about their right to smoke than they had been beforehand.

Figure 4 reflects the responses of 93 people to one such film ***(Smoking: The Unconscious Act).*** In Figure 4a, a steadily increasing rate of approval is indicated by the average responses of the sample from one moment to the next on a 4-point scale. Particular segments of the film are seen as more or less effective on this basis. The usual problems of interpreting the graph are faced, of course. Although a high point in the film's perceived value is evident at the beginning of the 11th minute, there is no means of determining from the graph whether that moment is critical to the film's overall impact. The viewers' responses in general appear positive towards the film from the 11th minute onward, but one cannot tell from the graph alone whether they are *positive enough.*

Once the continual response data had been related to the independent demographic and attitudinal data, however, the meaning of the graph became gradually apparent. Breakdowns of the continual responses according to independent demographic data indicated few significant differences based on such factors as sex or age. The one variable which did affect the continual responses, however, was the audience's smoking

FIGURE 4. *Mean Responses to a Film on Smoking Prevention.*



behaviour; and in this case, fortunately, a statistically sufficient number of respondents was available for the purposes of a reliable analysis.

Figure 4b shows that the respondents who smoke were substantially more negative about Smoking: *The Unconscious Act* from an early stage than were those who did not. If the continual responses of the non-smokers were indeed *positive enough, those* of the target audience of smokers were probably not. Particularly interesting are the moments at which the smokers' and non-smokers' responses were seen to diverge — at the beginning of segment #7, for instance, and in the second half of the 1 lth minute. For these are the moments at which the perceptions of smokers and non-smokers to the film can be differentiated.

By synchronizing the continual and demographic data with the film itself, the researchers were able to identify specific techniques consistently associated with defensive overall reactions on the smokers' part (Baggaley, 1986b). These conclusions were reinforced by accompanying studies of three other smoking prevention films. Smokers were found to be extremely sensitive to any suggestion, however unintentional, that they were being 'preached to' about smoking. Their responses became more negative at moments in the films when visual symbols of medical authority appear (such as a white surgical coat or a lung x-ray), and they appeared to spend much of their time anticipating a didactic message. They were also apt to give increasingly adverse reactions at moments which suggested, however unwittingly, that smoking cessation could make them appear socially eccentric. Recommendations regarding the types of scenarios to be avoided in future films on this topic were made to the CCS on this basis.

On the positive side, smokers' responses became more favourable at moments when practical tips for smoking cessation were given. They seemed to appreciate acknowledgements that smoking is hard to give up, though they did not approve of suggestions that sometimes it can be too hard. The final evaluation report suggested that a fine line has to be drawn between optimism and pessimism on lung cancer prevention. Such films should maintain, it was suggested, a healthy degree of fear on the smokers' part regarding the dangers of smoking and the prospects for cancer cure; they should increase, however, optimism regarding the prospects for cancer prevention. These conclusions were later applied in the design of a new CCS film on skin cancer prevention (Baggaley, 1986c).

Each of the studies cited during this article indicates the unique role that CRM can play in the development of new media products. The technique's second-by-second precision and speed of feedback are a welcome response to needs long since expressed by media producers. The new measurement techniques clearly enhance the formative evaluator's ability to work with producers on a precise and meaningful basis. Though it is certainly true that an evaluation using CRM techniques may flounder for want of inadequate sampling and predictability, it is equally likely to produce evidence that can be generalized to a wide range of other production situations. Even when conducted in a summative context, continual response analyses can yield evidence justifying the label 'quasi-formative' (Baggaley, 1986a).

When this is the case, an evaluation study may be said to fulfil - by accident, as it were the criteria for rigour and respectability enjoyed by traditional research studies.

In previous literature, the terms 'formative evaluation and research' have been used somewhat interchangeably. Even conventional uses of the term 'formative' give rise to confusion, being used to describe the often quite distinctive types of work conducted *during programme formation* and *concerning programme format* — e.g., presentation/ technical variables; content/subject matter organization; and performer characteristics (Coldevin, 1976; BaggaIey, 1986a). The label 'formative research' should perhaps be reserved for those formative and quasi-formative studies which, whether by accident or design, shed generalized light on effective programme design. 'Formative evaluation' should in turn be reserved for the less generalizable studies of individual products; they may use the same research methods, but they fail to satisfy accepted criteria for external validity. On this basis, the terms 'formative evaluation' and 'research' gain quite separate uses, and the term 'formative' is unambiguous in indicating a concern with production format whether practised prior to the production process or during it.

In the history of formative research and evaluation, no technique has done more to increase the researcher's powers of inference and prediction than that of continual response measurement. In the years to come, the technique also promises to shed light on a wide range of theoretical questions, increasing our understanding of the media's social impact as well as helping us to design more effective media content. Much remains to be established, however, about the design of efficient CRM studies, and about the relationships between response behaviour and general ability. It is hoped that this article has helped to indicate to media producers the surprisingly specific questions that they may now ask regarding the effects of production technique, while cautioning researchers about the methodological problems still to be ironed out in the design and interpretation of continual response studies.

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Facilitating 'Extended Campus' Graduate Education Through Electronic Communication

T. Craig Montgomerie

Abstract: The Extended Campus Program is offered jointly bythedepartments of Educational Administration, Educational Foundations, and Elementary Education at the University of Alberta. This graduate program makes it possible for students in centers remote from the Edmonton campus to meet the residency requirements for a Master of Education degree while retaining their full-time jobs. After describing the Extended Campus Program in general, this paper concentrates on the use of electronic communication to provide access to central campus library resources, staff services, and computerized databases. The paper then discusses a number of evaluations of the Extended Campus Program and ends with a consideration of future plans.

BACKGROUND

During the past 15 years, strong pressure has been placed on universities to provide greater access to students who, for reasons such as geographic remoteness from a university campus or personal commitments to full-time jobs, have not had the opportunity to further their education at the university level. Rumble and Keegan (1982) explain the rationale for establishing distance teaching universities throughout the world:

> The foundation of distance teaching universities in the 1970s stemmed in part from an increased concern . . . for greater equality of opportunity of access to higher education. This led not only to an expansion of conventional universities to provide places for more school leavers, but to the feeling that higher education should be made available to those adults who had at an earlier stage in their careers missed the opportunity to attend a university. Coupled with this was an increasing belief . . . in the need for adults to have access to educational opportunities throughout their lives, in order to renew or update their knowledge. (p. 10)

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The University of Alberta is a traditional university, not a distance teaching university, but it does offer some distance courses as well as a few distance programs. This article is concerned with one of the distance programs: the Extended Campus Program (ECP). The ECP is an alternative residency program currently offered by the departments of Educational Administration, Elementary Education, and Educational Foundations. This program offers graduate students the opportunity to pursue their Master of Education degrees in locations remote from the central Edmonton campus of the University of Alberta, while maintaining their full-time jobs. Begun in 1981 as a five-year pilot project funded by Alberta Advanced Education, the Extended Campus Program has received a funding extension until 1991.

After briefly describing the Extended Campus Program, this paper focuses on the electronic communications and computer technology which are used to facilitate its delivery and reports on the evaluation of the program. The basic intent in the program was to use technology as a support system, rather than a delivery system per se, to provide ECP students with services as nearly equivalent as possible to those available to 'traditional' M.Ed. students in residency at the University of Alberta.

When planning was undertaken for a graduate program to be delivered at some distance from the University campus, the first decision which had to be made was to what extent this would be a true distance education program. According to Keegan (1980), distance education comprises the following six essential elements.

1) The separation of teacher and learner which distinguishes it from face-to-face learning.
2) The influence of an educational organization which distinguishes it from private study.
3) The use of technical media, usually print, to unite teacher and learner and carry the educational content of the course.
4) The provision of two-way communication so that the student may benefit from or even initiate dialogue, which distinguishes it from other uses of educational technology.
5) The teaching of students as individuals and rarely in groups, with the possibility of occasional meetings for both didactic and socialisation purposes.
6) The participation in a more industrialised form of education (based on view *[sic]* that distance teaching is characterised by division of labour; mechanisation; automation; application of organisational principles; scientific control; objectivity of teaching behaviour; mass production; concentration and centralisation). (cited in Keegan & Rumble, 1982. pp. 13-14)

Because Extended Campus is a graduate program, it differs in significant ways from the majority of distance education programs described in the literature especially the many high school, vocational or upgrading programs, but even those offered by universities, which are mainly at the undergraduate level. Since the University of Alberta is not a distance education university, members of the Department of Educational Administration had little experience with the preparation of a distance education course, not to mention a complete distance education program. While Holmberg

(1981) identifies prepackaged course materials as characteristic of most distance study programs, such prepackaged materials were considered inappropriate for use at the graduate level. It was therefore decided at the outset of the program that course material would be delivered in a face-to-face manner. While this would seem to remove this program from consideration as a distance education program as defined by Keegan, graduate education is much more than what occurs in the classroom. Two of Keegan's elements, specifically those concerned with dealing with students as individuals and establishing two-way communication, were considered primary areas for consideration of distance education techniques.

Graduate study is an individual pursuit requiring a great deal of independent study, with a need for access to a number of diverse resources (e.g., books, journals, expert consultants). Holmberg stresses that distance study has a special potential for developing 'academic socialization' through independence and training in autonomous study:

> This is concerned with the methods of unprejudiced search for truth, the use and recognitionof sources of knowledge, critical scrutiny of theories and arguments and similar habits and approaches. There is every reason to assume that academic socialization is adequately catered for [sic] by distance study. (1981, p. 14)

Holmberg's view of distance education is that "learning by the individual student is seen as the central aim of the educational process . . . as long as there are facilities for proper non-contiguous two-way communication" (1981, p. 19). Providing such two-way communication was essential in the Extended Campus Program, and providing adequate access to library services was equally important.

R.K. Fisher, in a major study of library services to university extension students in the United States (1978), points out that off-campus students require the same access to library resources as on-campus students:

> [The off-campus student] needs a focal point, preferably a learning centre with a library, audio-visual materials, and a counsellor to talk to. In other words an off-campus student needs his own 'local campus'. . . . Even if a student can survive without this, for most courses he cannot survive without books, and it is precisely here that he should not be disadvantaged in comparison with his campus counterpart. (p. 8)

Fisher goes on to stress that for graduate extension courses, "the demands on library services are likely to be particularly heavy, and such courses need special attention according to their subject and locality" (1978, p. 8). His comment on the special needs of graduate students in distance programs is particularly relevant to the needs of Extended Campus students. He says that graduate students

> are generally disadvantaged if they live some distance from the main campus or a major branch campus. At some universities there is evidence that courses needing library resources to any extent tend not to be held off-campus; but this seems to be denying one of the main principles of extension work, to extend the facilities of the university into the community, especially to those who cannot regularly attend on campus. At other universities there is a new thrust into

> [graduate] and professional education off-campus, and in some cases these new developments are going to put considerable strain on library facilities and may encounter difficulties with accreditation. . . . An easy way out is to base courses on textbooks and on pre-packaged material, but it cannot be claimed that this is a desirable method of teaching in a university context or a good way of encouraging students to read widely and to see their subject in a wider perspective. (Fisher, 1978, p. 36)

Fisher concludes that "library services to extension students in the USA are still in many respects inadequate, especially with regard to off-campus courses" (1978, p. iii). His recommendations focus on developing much better university extension library services to both American and British off-campus students. Likely because his research was conducted ten years ago, however, he does not discuss the possibilities of using computer technology to facilitate such services. In a current book, Bostock and Seifert (1986) encourage the use of computers as resources or 'convivial tools' in adult education. They conclude their article "Adult Learning With Microcomputers" with an interesting comment:

> In present and future learning environments where machines are the major knowledge resource for learners, thetraditionalrole of the teacher is undermined and therefore either teachers will recruit computers as their tools to maintain that authority or else they will adopt a new role of encouraging personal learning, the traditional method of liberal adult education. We strongly support the value of the latter in all education of adults. (Bostock & Seifert, 1986, p. 32)

Keegan stresses the need for two-way communication, Holmberg stresses that distance students have a special potential to become academically socialized, Fisher stresses the need for graduate students in distance programs to have access to information sources, and Bostock and Seifert identify the computer as a potential resource. Arguments such as these, plus our own experience in information retrieval and electronic messaging, led the developers of the Extended Campus Program to consider using the computer as central to the program in two ways: first, to facilitate two-way electronic communication; second, to facilitate library research and access to resources.

EXTENDED CAMPUS PROGRAM: RATIONALE AND PRIOR DEVELOPMENTS

The Extended Campus Program can be considered a hybrid, with some features of distance education programs, more features of traditional graduate education programs, and some unique features of its own. The basic philosophy of the program is to offer an 'equivalent residency experience' to students. The program is offered in conjunction with community colleges and adult education centers in locations as remote as 500 kilometers by air from the central campus.

Stakeholders' Demands

The demand for the program initially came from many different stakeholders in the

graduate education system, including prospective students, their employers, and the provincial government. Some prospective students had been promoted to administrative positions for the first time and felt the need for further training in educational administration, yet they were unwilling or unable to take a full year of academic leave from these new positions to attend classes. In rural areas, many prospective students suggested it was almost impossible to uproot a family and move to 'the big city' for a year of residency. Many institutions employing prospective students were and still are finding it increasingly difficult to justify and pay for a full year of academic leave for their employees. The government of Alberta had received complaints from many 'remote' communities that graduate university education was much more accessible to those who live in the large urban centers of Calgary and Edmonton. Some universities, both within and outside Alberta, had met such demands by removing the residency requirement and allowing students to complete a Master of Education degree by completing a number of courses and, possibly, a thesis or colloquium.

The Department of Educational Administration at the University of Alberta had received pressure to do away with the residency requirement for master's students, but Department members felt that simply offering a graduate degree to those who completed a specific number of courses would not provide an educational experience equivalent to that enjoyed by those in residency. To meet the needs of students, employers, and government, the Department developed two programs not requiring students to take a full year of leave from their jobs. To meet the needs of the Department, these programs had to be academically credible and equivalent to the traditional M.Ed.

Administrative Development Program

The first alternative to the traditional M.Ed. program was the Administrative Development Program (ADP), initiated in 1972. ADP students meet their residency requirement by attending classes on the University of Alberta campus one afternoon a week for two full academic years, completing their course work and an individual research project during spring, summer, and evening credit sessions. Basic requirements for ADP students are essentially the same as for students in the traditional M.Ed. program: completion of five required courses, nine optional courses, and a research project.

The Administrative Development Program was designed so that each class be kept together as a cohort while completing the residency requirements; in addition, the format included a core program with a primary emphasis on the design and management of educational research projects, rather than having students select their courses from all those available. In the second year of their program, each student cohort undertakes a joint research project (usually contracted by an outside agency) as part of the course load.

While the Administrative Development Program met the needs of students within about 100 kilometers of Edmonton (and a few students each year who commuted from much greater distances) there was an increasing demand for service from students and jurisdictions in more remote areas of Alberta. Community colleges, the provincial Department of Advanced Education, and a number of individual students made strong

representation to the Department of Educational Administration to develop a program which could be offered in remote local communities.

EXTENDED CAMPUS PROGRAM: DESIGN AND DESCRIPTION

In 1981, the Extended Campus Program was designed using, among other things, the experience gained from offering the Administrative Development Program. Two major observations of ADP students which were felt to have serious implications for any program delivered in a location remote from campus were that students found it difficult to access the library and library materials and to arrange to spend individual time with staff members.

Equivalency Criteria

The Extended Campus Program was designed with the primary condition that students should have 'equivalent experiences' to those in the full-time residency program at the University. Six specific conditions of equivalence were initially adopted (Ingram, Ward, Montgomerie, Peters & Dancik, 1984).

1) The opportunity for both formal and informal professor-student contact during the full regular academic year. Contact with advisors, instructors and other professors is essential.
2) The opportunity for student-student interaction as an integral part of the program for the full year. This interaction would be related to the student role as opposed to interaction as professional educators.
3) The opportunity for appropriate access to library facilities of the University of Alberta.
4) The opportunity to obtain access to computer technology and other instructional resources.
5) The opportunity to share in special lectures and other experiences similar, or identical to, those provided in Edmonton.
6) Teaching of courses by staff with qualifications similar to those of staff teaching Educational Administration courses on the Edmonton campus. Where possible, current professional staff of the department serve as course instructors, program advisors, and individual study project supervisors.

Four other criteria were added at a later date.

1) ***Time for Study.*** It is expected, although not required, that on-campus students work full time on their programs over a period of two University terms (e.g., September to April). During this period of time students usually register in from eight to ten half-courses. This consumes approximately 300 to 400 hours of instruction plus a further 300 to 400 hours of study and preparation. This works out to approximately 40 hours of instruction per half-

course, plus a further 40 hours for study and preparation. Therefore, an equivalent "time off' expectation for instruction for Extended Campus students would be . . .240 hours for the full residency requirement. This would amount to approximately 30 eight-hour days of release time for instruction for a core program of six half-courses.

2) ***Program Quality.*** The program quality in off-campus locations, as measured by indicators such as content, time devoted to courses, delivery mode, materials, resources, course experience and student achievement, should be equivalent to the quality of on-campus programs.

3) ***Program Requirements.*** Entry requirements, residency requirements (three courses in each of two terms), number and types of courses required, time limits, grade standards, etc. should be the same for off-campus and on-campus programs.

4) ***Costs.*** Total program costs should not be substantially more for either program. However, in calculating these costs both University and student costs should be taken into account.

Program Description

One of the reasons the Administrative Development Program has been judged successful is the primary emphasis on a single topic or core; the Extended Campus Program was designed to continue this primary emphasis on the design and management of educational research projects. The requirements are similar to those for the traditional M.Ed. and the ADP programs: 14 courses and a research project.

Students in the Extended Campus Program must have a letter from their employer releasing them from 30 full days of work during the first academic year of the program and 13 full days during the second. During their first year, Extended Campus students take six courses in or near their home community, three per semester in 10 three-day blocks. All students take all classes; hence a very strong cohort (including both students and staff) develops each year.

One of the equivalency criteria for the program is that both formal and informal interaction among students, and between students and professors, is essential. Classes are therefore scheduled so that students have extensive exposure to staff members and to each other. Courses are taught by full-time University of Alberta staff who travel to the local community college or adult education center to offer the seminars that are typical of traditional graduate education programs. The Extended Campus Program also takes the formal and informal socialization process that occurs in traditional graduate programs one step further: by design, the development of strong student cohorts is encouraged and has indeed taken place in each year that the program has been running.

During the second year of their program, students undertake their individual research projects. Staff from the Extended Campus Program travel to the Extended Campus site four times each year to meet with the students. During these meetings each student makes a short presentation to the total group on the current status of his or her individual project, and staff members meet with students for traditional project advising.

In the last two years, a large group research project has been introduced in addition

to the individual research project. Students are encouraged, however, to work in small groups (up to two or three) on the 'individual' research projects, hence gaining a much more realistic view of the kinds of projects undertaken in real life. The size and scope of the project are, naturally, increased when more than one student works on it.

During the first three years of the Extended Campus Program, only the Department of Educational Administration was involved, and students also took two 'practicum in educational administration' courses. In 1984 the Department of Educational Foundations joined the program and offered one of its courses in place of one of the practicum courses. In 1985 the Department of Elementary Education joined the Extended Campus Program, and the second practicum course was replaced by an Elementary Education course. All students, regardless of whether they are enrolled in Educational Administration, Elementary Education, or Educational Foundations, take the courses offered as the Extended Campus core, and all three departments have agreed to accept those courses as part of the student's M.Ed. program.

PROVISION OF SERVICES TO EXTENDED CAMPUS STUDENTS

Those who were planning services for Extended Campus students realized that the concept of equivalence would mean the use of quite different techniques to achieve the same end. Essentially, since each Extended Campus site was remote from Edmonton and many of the students lived away from the Extended Campus site itself, equivalent service depended upon fast, reliable, easy-to-use communications. Identified areas of equivalency included access to professors, the library, and other facilities (such as computer facilities) on campus.

Electronic Messaging

At the inception of the program, electronic messaging was instituted to allow staff and students to keep in touch. This was incorporated for two reasons: staff members travelled so much that it was often impossible to contact them by long distance telephone, and the automatic recording nature of the electronic messaging system made it possible to record the actual time a message was sent and received and to generate a 'hard copy' of the message and response. Staff and students have been extremely positive about the electronic messaging system. They can gain access to the electronic messaging system from anywhere in North America to read and respond to messages. Students know they can leave a message and be guaranteed a response, usually much more quickly than if they had left a phone message with a secretary.

Library Services

Another major concern was that Extended Campus students have reliable, fast access to library services. Copies of the University of Alberta Libraries' card catalogue and serials list on microfiche were purchased for each Extended Campus center. Microfiche readers were purchased for Extended Campus centers that did not have them. A number of bibliographic databases are maintained on the University of Alberta's computer system and are available for student searching. These include a

current awareness version (latest five years) of the ERIC database, the Alberta Education Index, the Government of Alberta Publications database, a database of all Education theses completed at the University of Alberta, and a database of materials held in the Educational Administration Laboratory. The databases are all held under the Stanford Public Information Retrieval System (SPIRES), a relatively user-friendly database management system. Students at Extended Campus centers are taught how to search SPIRES databases and are given exercises to develop their skills in searching bibliographic databases. The Education Librarian of the University of Alberta Libraries also travels to each Extended Campus site to offer a full-day seminar on the University library facilities and use of the catalogue and serials list on microfiche.

Extended Campus Assistants

While students could be given access to the catalogue and serials list of the University of Alberta Libraries, they were still unable to be on campus to check out books and read journal articles. To deal with this problem, a number of full-time graduate students were hired each year as Extended Campus Assistants (ECAs) to act as the embodiment of the student on the campus. Affectionately nicknamed 'gophers', these ECAs were given signing rights for each Extended Campus student. The services they provide for students include copying journal articles, checking out materials from the University of Alberta Libraries, obtaining materials from private collections (such as the Educational Administration Laboratory), arranging for materials through the interlibrary loan service, and acting as the students' advocate if there is an overdue book. A special service the ECAs provide is trying to act as the student's surrogate on campus; for instance, if the student says, "I need some general information in an area, but I'm not really sure where to start," the ECA will seek information by asking appropriate staff members or browsing library shelves to locate books or articles which might provide the student with a starting place for his or her investigation.

Students communicate with the Extended Campus Assistants by electronic mail. An ECA reads the electronic mail each day and, immediately upon receipt of a message, sends a 'positively reinforcing' message to the student acknowledging the request. The ECA then goes to the appropriate library, checks out books or copies the appropriate articles, and sends them via the Government of Alberta Courier Service to the Learning Resources Center (LRC) at the Extended Campus site or, where special arrangements have been made, to a government office in the student's locale. The ECA then sends an electronic message to the student reporting on the status of the request, for example, what was sent, materials not available, etc. ECAs attempt to have materials in the courier service within 24 hours of receiving the original request. In our experience, the materials are usually delivered to the local LRC within two to four days. The normal library loan period for graduate students is six weeks, with 'right of recall' after 2 weeks. The University of Alberta Libraries have agreed to recall books from Extended Campus students only under extreme need. To our knowledge, during the five years of the program, recalls were exercised only twice. Students return books directly to the Education Library at the University of Alberta via the Government Courier Service.

It has been our experience on reading some of the collected communications

between the ECAs and the Extended Campus students that, although they may never meet in person, they become quite friendly over time.

Computing Services

It is obvious that in the Extended Campus Program, a great deal of reliance is placed upon access to computer services. The contract with each Extended Campus center provides for the location of at least one computer terminal or microcomputer equipped with a modem and a telephone line at each center. All students and staff members are given an individual Computer Services Identification (CSID) and have their names registered on the User Directory on the computer system at the University of Alberta. All computing charges for Extended Campus students and staff, including communications charges, are paid for out of ECP funds.

The University of Alberta's computer system is a Datapac host, meaning that it has an address on Datapac (the Trans Canada Telephone System's packet switched network) and accepts calls originating from a terminal in a 'collect call' mode. Three Extended Campus centers are located in areas served by a public access Datapac node: Keyano College in Fort McMurray, Red Deer College, and Grande Prairie Regional College.

Alberta Government Telephones has provided low-cost access for digital (computer) traffic through a system called the Tele Information Network of Alberta (TINA). The computer at the University of Alberta is also a TINA host. Under TINA, any telephone in Alberta can be used to connect to a TINA host for the same cost: 11 cents per minute during prime time and 9 cents per minute during non-prime time. All TINA charges are directed to the originating telephone. Two Extended Campus centers are located in areas which do not currently have a public access Datapac node: the North Peace Adult Education Center (Peace River) and Lakeland College (Vermilion). In these locations the Extended Campus Program pays for the installation of a telephone for use by the program and for all TINA charges.

Students are taught how to connect the computer terminal or microcomputer to either Datapac or TINA and how to use the electronic mail system and database management system (SPIRES) available on the University of Alberta's computer system. They are also encouraged to locate microcomputers or terminals in their own community (or home) and to use them as much as possible. Individual instruction is given to students who have access to personal computers as to how they can be used to communicate with the University's computer.

Use of Computers in Courses

When the Extended Campus Program was begun in 1981, microcomputers had not evolved into the sophisticated, 'user-friendly' machines we have today. Student use of computers was limited to using the mainframe system for database searching, electronic messaging, statistical analysis using *the Statistical Package for the Social Sciences,* Version 8 (Nie et al., 1975), and demonstrations of network construction and critical path calculation. Over the term of the program, although the use of the mainframe for electronic messaging and database searching has been maintained and even increased, the use of microcomputers has steadily been incorporated in areas such as statistical analysis and project management.

The first use of the microcomputer in the program came with the announcement of MacProject™ (Apple Computer, Inc., 1984). Since project design and management are part of the Extended Campus Core, it was believed important to show students that a program such as MacProject, and an inexpensive and easy-to-use microcomputer such as the Macintosh, could be a powerful tool for the individual project manager. Such power was previously available only on large mainframe computers but now makes project management a realistic tool for educators.

The second use of microcomputers originated from a change in philosophy in the statistical analysis course. A more intuitive and graphic approach to data analysis called Exploratory Data Analysis (EDA), originally proposed by John Tukey (1977), was felt to be a better way of helping students grasp the basics of statistical analysis than the traditional inferential statistics approach used previously. Since the EDA approach is graphic in nature, an Exploratory Data Analysis program was developed by this author for the graphically oriented Macintosh computer. This program is used by the instructor for demonstrating EDA techniques on a large screen monitor, and each student is given a copy of the program for individual use in completing assignments and analyzing his or her own data.

With the inclusion in 1985 of programs which required the student to use the Macintosh computer, it was decided to place a Macintosh computer and modem in each new Extended Campus Program location, in place of a terminal. A number of programs (e.g., word processors, spreadsheets, communications) have also been placed with the Macintosh computers. Student response to the use of the Macintosh has been very positive. While no objective measures have been taken, a number of students have recently purchased Macintosh computers — a reasonable sign of acceptance.

One other sign of acceptance of microcomputers is the increase in the number of assignments being completed on word processors. For the past two years, students have written the majority of their group project final report on word processors. They have even learned how to transfer computer files from a word processor on one type of microcomputer to a different word processor on a second microcomputer in order to merge the various sections of their report.

EVALUATION OF THE EXTENDED CAMPUS PROGRAM

The Extended Campus Program has been reviewed and evaluated both internally and externally, and the results of these evaluations have been uniformly positive. External evaluators have confirmed the conclusions of internal evaluations, and Alberta Advanced Education has extended funding of the first five-year pilot program to 1991. Both evaluations have focussed mainly on program aspects rather than support services, but the following summary emphasizes aspects related to the use of electronic communications, computer technology, and library systems.

Internal Evaluation

Extended Campus staff have conducted an ongoing evaluation of the program by interviewing and observing students and by administering an extensive questionnaire to students in all three programs — traditional, ADP and ECP — at the end of each

academic year. In 1984 an internal evaluation of the first three years of the program (Ingram et al., 1984) was conducted. The key criterion used in the assessment was equivalency with the other graduate programs in the Department of Educational Administration with respect to the ten equivalency criteria listed earlier. Program documents, records of students in all three M.Ed. programs, questionnaires to all M.Ed. students, interviews with employers of Extended Campus and Administrative Development students, and interviews with departmental staff in both alternative programs were used to collect data for the assessment.

On the basis of the data collected, it was concluded that the Extended Campus Program was providing a viable alternative to the conventional program and the Administrative Development Program. Student satisfaction was found to be generally higher in both the ECP and ADP than in the conventional program. The Extended Campus Program was found to be equivalent to, or better than, the other programs on all ten criteria used, and it was concluded that the program was very successful in meeting its objectives. While some minor problems were identified, these were all concerned with issues apart from computer and electronic support services (e.g., ensuring that Extended Campus students had adequate release time for study, providing more supervisory time for students, integrating the program more fully into the operations of the Department of Educational Administration, bringing staff of other Faculty of Education departments into the program, and maintaining adequate funding). Modifications have since been made which address all of these issues.

One of the major concerns of the ECP, and of particular interest in this paper, is the amount and quality of student-staff interaction in the program. Students were specifically asked their perceptions of the degree to which their program was characterized by student-faculty interaction and their satisfaction with that interaction. Tables 1 and 2 (see ***next*** page) show the results of an analysis of these two questions. As can be seen from the tables, students in the Extended Campus Program both perceived more student-faculty interaction and were more satisfied with it than students in the other two programs ($p = .0001$).

In all three programs, no significant dependence was found between students' perception of the amount of student-student interaction and their satisfaction with it. However, students in the Extended Campus Program both perceived more student-student interaction and were more satisfied with that interaction than students in the other two programs.

Extended Campus students reported satisfaction with the support systems set up to provide access to library facilities at the University of Alberta and access to computer technology and other resources.

External Evaluation

The Extended Campus Program recently underwent an external review (Boberg & West, the results of which confirmed the conclusions of the internal review. The external evaluators used the same evaluation criteria and essentially the same data collection instruments as those used in the internal review. However, they collected additional data by the following means: group and individual interviews with both Extended Campus and Administrative Development students; observation of staff

TABLE 1
Student Perception of Degree to which Their Program was Characterized by Student-Faculty Interaction

Group	Response Categories					Total
	Not At All	Little	Some	Much	Very Much	
Administrative Development Program	0 ***0.3***	0 ***4.4***	11 ***12.0***	18 ***16.7***	24 ***19.7***	53
Extended Campus Program	0 ***0.3***	0 ***4.4***	4 ***12.0***	15 ***16.7***	34 ***19.7***	53
Traditional Program	1 ***0.5***	16 ***7.3***	29 ***20.0***	28 ***27.7***	14 ***32.7***	88

$x^2 = (8, N = 194) = 52.34, p < .0001$.

Note: Observed frequencies are in plain type, expected frequencies are in italics.

TABLE 2
Student Satisfaction with Student-Faculty Interaction in Their Program

Group	Response Categories				Total
	Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied	
Administrative Development Program	0 ***7.9***	2 ***4.9***	27 ***23.6***	24 ***22.6***	53
Extended Campus Program	0 ***1.9***	2 ***5.0***	18 ***24.7***	34 ***23.0***	54
Traditional Program	***7*** ***3.2***	14 ***8.7***	42 ***39.3***	25 ***37.5***	88

$x^2 = (6, N = 195) = 27.98, p < .0001$.

Note: Observed frequencies are in plain type, expected frequencies are in italics.

members in classrooms at two Extended Campus sites; interviews with faculty members in the Department of Educational Administration as well as four faculty members external to the Department; interviews with liaison staff at the off-campus sites; and evaluation of a sample of theses completed by traditional students and projects completed by students in the alternative programs.

The major conclusions of the external evaluators were as follows:

> In the opinion of the evaluators the Extended Campus Program provides a viable alternative form of graduate education for students living outside of the major centers. All of the stakeholders pointed out that the Program is of value and should be continued. Even though students in the first year noted that the workload was heavy, they enthusiastically endorsed the Program. . . . The employers also endorse the continuation of the Program. . . The evaluators conclude that the Program has met the ten equivalency criteria and that the findings corroborate the findings of the internal evaluations. (Boberg & West 1986, p. 39)

Boberg and West did make some recommendations for improvement, most of which had to do with providing more information to prospective students, adequacy of release time, increased supervision in the second year of the program, course choice and sequencing, and examination of the possibility of integrating the program more fully with the Department and the Faculty. But they concluded their evaluation report on a very strong note: "this Program could be a model for adult education. The logistics and the benefits to the individual, school boards, and to students should be carefully documented and published in the public domain" (Boberg & West, 1986, p. 41).

Two of their 13 recommendations are particularly relevant to this examination of electronic communications and computer support services — namely, that computer borrowing and lease time be extended and that new developments in distance education such as teleconferencing be examined. Plans are under way to deal with both of these concerns.

Some of their specific findings are also relevant to this paper. For instance, they found that the majority of Extended Campus students felt that the message/delivery service worked well, and they rated library services and holdings as good to excellent. As Table 3 shows, ECP students were as satisfied with their access to library materials as ADP and traditional students were. Students' comments in group interviews regarding these library services were extremely positive. They pointed out

> how beneficial it was being able to select their own materials by using the COM catalogue and Serial list. They also stressed the *[sic]* appreciation for those students who gathered, photocopied and packaged all information and citations to be sent through the courier service.. . .All of these services made the students feel as if they were using the University Library in-person. (Boberg West, 1986, pp. 13-14)

Table 4 (see next page) shows that ECP students were as satisfied with their access

TABLE 3
Student Ratings of Library Services in Their Program

Group	Response Categories					Total
	N/A	Poor	Fair	Good	Excellent	
Administrative Development Program	0 *0.6*	0 *1.3*	4 *5.5*	24 *21.5*	16 *15.1*	44
Extended Campus Program	1 *0.7*	*3* *1.5*	9 *6.2*	17 *24.5*	20 *17.2*	50
Traditional Program	1 *0.6*	1 *1.3*	4 *5.3*	26 *21.0*	11 *14.8*	43

$x^2 = (8, N = 137) = 11.12, p = .19$.

Note: Observed frequencies are in plain type, expected frequencies are in italics.
Source: Boberg & West, 1966, p. 12

to computer services as ADP and traditional students were. A common complaint of ECP students, however, was that they had to drive to the local LRC to check their electronic mail. Extended Campus staff indicated to the interviewers that "there was probably a higher use of technology and innovative methods in the Extended Campus Program than in the Conventional Program" (Boberg & West, 1986, p. 13).

It can thus be seen that Extended Campus students have turned the necessity of using computer and electronic communications technology into an advantage.

Evaluation of Library Services

Dancik (1984) undertook a study of the provision of the University of Alberta Libraries services to off-campus students, mainly in the Extended Campus Program but also in the post-RN Bachelor of Science program and the Compressed Vocational Educational Program (the latter, offered in conjunction with the University of Calgary, is no longer functioning). Her comparison of the provisions for library access in all three programs showed that the Extended Campus Program was the most innovative and comprehensive in this regard:

> A sizeable portion of this study, including a lengthy description of existing programs. the interviews with students and the evaluation of the use of collections and courier services, focuses on the Educational Administration M.Ed. Extended Campus Program. The service to this group was the most elaborate and therefore could stand as a bench mark. (Dancik, 1984, p. 6)

Dancik cited several reasons for the quality of library services provided to Extended Campus students: good liaison between Extended Campus staff and students and the librarians in both the University Libraries and the off-campus Learning

TABLE 4
Student Ratings of Computer Access in Their Program

Group	Response Categories					Total
	N/A	Poor	Fair	Good	Excellent	
Administrative Development Program	0 *1.3*	3 *4.7*	15 *12.6*	19 *17.7*	6 *6.6*	43
Extended Campus Program	1 *1.5*	9 *5.5*	11 *14.7*	18 *20.6*	11 *7.7*	50
Traditional Program	3 *1.3*	3 *4.7*	14 *12.6*	19 *17.7*	4 *6.6*	43

$x^2 = (8, N = 132) = 11.82.$, $p = .16$.

Note: Observed frequencies are in plain type, expected frequencies are in italics
Source: Boberg & West, 1986, p. 12

Resource Centers; additions to off-campus library collections, funded by ECP; seminars for students in using the computer searching and messaging systems; and use of Extended Campus Assistants.

As part of her thorough review of library services to Extended Campus students, Dancik interviewed a number of students in each Extended Campus location, as well as the local librarians in each Learning Resource Center. She found that almost all students used both the microfiche catalogues and electronic mail extensively. Most students searched the on-line databases, although some admitted they still felt a little uncomfortable and tried to get colleagues in the class to assist them in their computer searches. All students 'enthusiastically endorsed' the use of the electronic message system because it was efficient and low-cost, and because the paper copy from the terminal provided them with a date-stamped record of their own requests.

Because Dancik's ultimate purpose was to suggest ways in which university library services to off-campus students could be improved, her recommendations assumed this focus. But she prefaced them by saying,

> this assessment demonstrates both a need and desire for library service to off-campus students, and the programs that do exist, as described in the literature and demonstrated through the Alberta M.Ed. Extended Campus, have worked successfully to the benefit of students, faculty, and the library. (Dancik, 1984, pp. 41-42)

In other words, the Extended Campus Program was found to be exemplary in the way it has capitalized fully on the opportunities provided by computer and electronic communications technology to extend library access to off-campus students.

THE FUTURE

The Extended Campus Program offered by the University of Alberta seems to be very successful. The provincial government recently extended the program funding for a further five years. An announcement taken out in the Alberta Teachers' Association newspaper indicating that the program might be extended to other locations in Alberta met with a large number of responses both from individuals and jurisdictions requesting that their community be considered. The Extended Campus Program will also be offered on the Edmonton campus for the first time this fall, to meet the needs of those who prefer to attend classes in 10 three-day blocks for one academic year, rather than once a week for two academic years in the Administrative Development Program.

New challenges continue to appear. The University of Alberta Libraries is terminating the production of microfiche serials and catalogue and will be making an integrated database of the complete collection searchable by computer. Unfortunately, at this time it appears that the new integrated database will be mounted on a different computer system than the one now used by students. Negotiations have begun to find out how students in remote locations will be able to search this database. Since more students will be enrolled in programs other than in Educational Administration, it remains to be seen how students with greatly differing interests will act as a cohort At this time, all instruction is offered by direct face-to-face delivery. Consideration is being given to the use of technology in the delivery of instruction: work has begun on the development of computer-assisted instruction modules in statistics; the Apple Macintosh has become central in the delivery of both the Project Management and Statistics courses. Beginning in the 1987-88 academic year, staff will recommend to all ECP students that they arrange easy access to a microcomputer with a telephone modem. In addition, if students do not have a computer, they will be encouraged to purchase an Apple Macintosh for word processing, telecommunications, statistical analysis, and project management. Investigation has begun into remote instruction using teleconferencing, videoconferencing, and computer conferencing.

There is no doubt that the emphasis on the use of computer technology and the training of students to use computers has played an important supportive role in the success of the Extended Campus Program. Our challenge is to make sure that additional use of technology in the future does not reduce the quality of the program.

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Resistance to Planned Change: A Training Design Case Study

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Abstract: Giving in-service training to support an implementation plan which is not particularly popular can be fraught with difficulty. The major concern can probably be summed up in the following manner: what can one do to interest and motivate workshop participants who are feeling resistant to the proposed change? One response to this question is presented in the following case study.

INTRODUCTION: THE CONTEXT

This case study takes place in an organization in which one of the functions is the teaching of English as a second language to adult francophones in a number of affiliated schools. When an institutional plan was drawn up to implement major changes in the English as a second language program — changes in terms of scheduling, content, length of training and teacher control — a colleague and I were given four months to design a 'training package'. The training package, consisting of workshop and materials, was to prepare teachers to implement two of the new components of the student program. One component focussed on the use by the student of job-specific materials which would be worked on without direct teacher supervision, although the teacher would be responsible for the student's progress. The other component involved an interview with each student to be conducted by the teacher every six weeks, during which student progress was to be discussed and evaluated.

At the time of the proposed implementation, most of the teachers in the system had at least ten years teaching experience and some had as many as twenty. In addition, all the teachers had for a number of years been responsible for all program decisions relating to their own students' learning, that is, they decided what to teach, and how and when to teach it.

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CJEC, VOL. 16, NO. 3, PAGES 257 – 264, ISSN 0710 4340

As a result of these two factors, most teachers viewed themselves as competent professionals; further, they could see little pedagogical reason for the proposed changes given that students were passing the required tests and that the new program would reduce the teachers' ability to individualize. Thus, the proposed changes were viewed with considerable skepticism, indeed resistance, and this reaction tended to spill over to the proposed training. Our task of developing and providing training was one which my colleague and I would have preferred to avoid; however, this was not possible. The following is a description of what was done in an attempt to deal with the dilemma in which we found ourselves.

THE FIRST STEP: CONCEPTUALIZING THE PROBLEM

We began by assessing what we already knew that would help structure the problem in a useful way. Being familiar with the implementation and change literature, and Charters and Jones' (1973) summary of it as a 'non-event', we recognized the need to view the proposed training package in a somewhat novel way from that traditionally associated with the rational, institutional notion of change implied in the concept of 'implementation'. We chose to view the planned change as a learning process — as an on-going, largely intemalized process — occurring at the level of the individual even when instituted at the level of the organization.

In terms of a change model, this approach could be termed normative — re-educative (Chin & Benne, 1969). The important point is that change or learning is only a possible, not a certain, outcome of being faced with new information. Logic or reason alone will not control the outcome, and coercion will only have a temporary effect. Learners can have access to new information, but their responses to it are dependent on their previous knowledge and experience, and their desire and ability to change. They may ignore the information, or they may choose to use it in their own way.

Given that we had chosen to operate within this learning framework, the next step was to consider what we knew about the adult learning process. Aside from our personal experience with adult learners, our conception was influenced and refined through reference to the andragogy literature (e.g., Tough, 1971; Kidd, 1973; Knowles, 1973).

The adult learner is someone who, *when personally motivated,* is a very good learner, who can act independently and be self-directed. Since personal motivation is a prerequisite, the easiest kind of learning tends to occur when the outcome is highly relevant for immediate application. As personal dilemmas are often the starting point of such learning, the adult learners' experiences are their most important resource; they frequently learn through becoming aware of and evaluating their own experiences.

We also had some knowledge about the teacher as an adult learner. The following points seemed significant. First, reflection on and self-assessment of one's practice are important steps in undertaking change. Second, although change occurs at the level of the individual, collegial support is important in sustaining the attempt (Brundage & Mackeracher, 1980) as teachers view each other as important resources and sources of help (e.g., Fullan, 1981; Holdaway & 1980). Third, long-term institutional support in the form of on-going training and materials is important in sustaining the

change (e.g., Lighthall, 1973). Finally, the notion of 'deskilling' (Elliott & MacDonald, 1975) was helpful in reminding us that in many cases adults need to unlearn something before they can learn something new. Even when a change is desired by an individual, extensive practice may be required to develop the new skill because old habits must first be extinguished.

With this conceptual structure as a guide, we began to prepare the training package. The task was divided into two major components: developing materials and establishing an appropriate procedure and process (both in and out of the workshop) to facilitate the individual teacher's learning.

MATERIALS DEVELOPMENT

The four month developmental process was initiated by holding meetings to which all teachers were invited. The reasons for this are the following. First, we wanted teachers to have a sense of ownership, a stake, in the training process. Second, we needed to respond directly to teacher needs, not our perception of their needs, if teachers were to be interested in and motivated to undertake learning and change.

At these meetings, we described the planned changes which we were to prepare training for and asked teachers to pinpoint potential areas of difficulty. Since the plan had not been implemented, everyone's notion was hypothetical. We promised that within our ability we would use their concerns as the basis of our work and that issues beyond our control would be passed on to management. We audio-recorded these meetings so that it was possible to make transcripts and go over them later in order to list the ideas and suggestions offered. This list in the form of a memo was then sent out to all the teachers and further ideas were solicited. The summary of information gained from these meetings and the later memo provided the base from which all materials development proceeded.

A number of concerns emerged from this process, but there were two major ones relating to the proposed teacher/student interviews. Since these concerns are generalizable to other settings, they will serve as the basis for examples presented in this case study. One concern was a feeling of inadequacy about the teacher's ability to use interviewing skills effectively. A second related concern was the teacher's ability to conduct the interview in French, given that even in a first language some interviewing can be difficult.

With the objectives defined, the next step was to find 'input', information that might usefully be offered to the teachers during the workshop. This input was drawn from a variety of sources. For example, an ERIC search was conducted to uncover articles and research reports that dealt with the teachers' concerns, and film and video catalogues were reviewed to locate potentially useful materials. After collecting as much information as time and personal resources would allow, we began an instructional design process in which materials were developed, reviewed by experts, revised, used in very limited trials ($n = 2$), and revised again. These, then, became provisional versions for the first workshop.

The structure or organization of the developed materials is a response to our

understanding of how an adult, in this case a teacher, learns and undertakes change. At the beginning of each set of materials, there is an objective clearly stated so that users understand the task to be accomplished; there is also a description of the exercises to provide users with an overview of the process being undertaken. As well, it is often suggested that users work with another teacher or at least that they find someone to respond to their ideas or work, that is, to use a colleague as a resource.

At the end of each set of materials, users are asked to create 'something', for example, a video or an essay, in order to apply or try out any new information they have gained and see whether they can and want to consolidate it into their practice. Finally, self-evaluation is a feature as well; users are asked to assess specific aspects of their behaviour in the 'product' they have created. In terms of interviewing skills and the use of French, there are eight 'units', that is, individual packages of exercises and activities.

Each unit follows the same format. First, there is a title page with the major heading "Interviewing" and a unit title describing the aspect of interviewing dealt with in that unit (e.g., *Using Non-Verbal Cues to Facilitate Effective Communication).* Next, there is a performance objective page describing what the user can expect to be able to do at the end of the unit, what the unit consists of in the way of exercises and activities, and what additional resources the user will need in order to complete the unit. After this, there is a table of contents. Then, the actual exercises begin. The exercises are designed to provide input useful for accomplishing the performance objective. Doing an exercise could involve watching a video in order to fill in a grid, reading and summarizing some excerpts on a subject or perusing some student materials with particular criteria in mind.

What comes next is the core activity of each unit: an SDL, or self-directed learning, activity. The SDL activity is the realization of the performance objective. It is the opportunity for the user to accomplish the performance objective using personal knowledge and experience and whatever aspects of the input, the exercises, have proven personally relevant. The SDL activity is most often the creation of a product, for example, the writing of a brief essay or the recording of a role play on video or audio cassette.

After creating a product, the user evaluates it in some way. A self-evaluation checklist is often included (especially when the SDL activity is recorded). Of course, the user is free to modify the checklist to suit personal needs. Frequently, it is suggested that the user seek out a colleague to compare and discuss answers.

The final part of a unit contains any or all of the following resources: answer keys, tapescripts, supplementary exercises (usually these focus on the use of French in an interview).

As a result of the development and subsequent revisions (still not complete) of these materials, some features important in facilitating adult learning were incorporated into the units: a focus on perceived needs, the provision of advance organizers, a reliance on peer support and self-evaluation in the learning process. Our biggest concern then became finding a means of conducting the workshops that would enhance these features of the materials.

A PROCESS TO FACILITATE INDIVIDUAL TEACHER LEARNING

We felt the materials would provide a necessary and important contribution to the learning process. Nevertheless, the procedure and process of the workshop and any follow-up activities would be crucial elements in the learning process we were trying to facilitate.

We needed some conceptual framework to guide us in formulating both how we would conduct the workshop and conduct ourselves. We settled on the classroom meeting model (Joyce & Weil, 1972), as it is suggested for the teacher who wants to emphasize improvement of performance through the learner's self-assessment of behaviour.

The classroom meeting model is an approach in which the teacher presents a problem to the learners, after which the discussion becomes learner-initiated. The teacher attempts to make non-evaluative comments, but at the same time tries to encourage the learners to make personal judgments about their behaviour and to make commitments to alternate courses of action. The teacher's responsibility to support learner commitment to change continues after the class. Thus, this model responded to the teacher's need for collegial support, for reflection and self-evaluation in undertaking change and for long-term support in sustaining change. Our post-meeting follow-up support (being conducted now) is not, unfortunately, as extensive as it might have been because of time and travel constraints; we are dealing with teachers in different cities and we are also giving additional workshops and carrying out materials revision. Our efforts have been limited to: seeing, phoning or writing each teacher at least once every six weeks to discuss problems and concerns, pass on any new information, and to try to provide a sense of psychological support.

As for our application of the classroom meeting model to the actual workshop, this can best be understood by a description of how the workshop is conducted.

The four-day workshop begins with a series of activities (individual, pair and group) which clarify everyone's expectations of what can be accomplished. The intent of these activities is to highlight the potential value of the workshop for each participant's professional development. The workshop is only one small portion of the individual and continuous process of developing professional knowledge and expertise.

In the first activity, we emphasize that participants are responsible for setting their own goals and working at their own pace, alone,.in pairs or in groups. We downplay our role as trainers or leaders, stressing our primary responsibility as facilitating and debriefing. The next activity leads to individual needs assessment and goal setting, goal setting being important for focussing participants' learning. In the final activity, each participant receives an index of the available units cross-indexed to the needs assessment just completed. By referring to this index, the participants can make appropriate choices about which units will best serve their needs. Participants are encouraged to make modifications to the exercises in order for the exercises to better suit their needs and preferences, although it is suggested to participants that any major changes be discussed with us. The responsibility we undertake is that one of us will always be available for debriefing or facilitating.

Each day proceeds in roughly the same manner. First, based on our interpretation of the classroom meeting model, there is usually some group activity in which an issue is presented to the group for discussion. One day begins with an exercise in which participants are required to self-evaluate their success on different tasks done in French. This is followed by a group discussion of what criteria they used in the evaluation process, how their experience relates to student self-evaluation, and so on. After this activity, which provides the focus for the participants' thinking and work for the day, participants separate to work as they wish. Debriefing, another aspect of our application of the classroom meeting model, occurs either in a group later in the day, or we meet with participants individually as they finish various activities. On the last afternoon, there is a final group meeting in which participants can form plans for future learning activities.

The preceding has provided a brief glimpse of both the design of the workshop materials and our application of the classroom meeting model to the process of the workshop. What follows is a preliminary report (based on three workshops) of participants' reactions and our observations, as well as a brief discussion of the implications of the approach.

REACTIONS, OBSERVATIONS, IMPLICATIONS

My understanding of the participants' reactions is based on two sets of documents: the overall feedback on the four-day workshop, feedback which was anonymous and did not focus specifically on the approach and materials used; and the unit feedback forms in which participants rated the exercises and the SDL activity for each unit.

The unit feedback forms contained quite uniform trends. Although the rating of units varies (some being more popular than others), consistently the SDL activity in each unit is rated higher (on a ten-point scale) than the exercises for the same unit, a sign that the SDL activity was, as planned, more personally relevant than the exercises.

Of the eighteen feedback sheets received, six of them included unsolicited favourable comments on the approach and materials, for example, "very self-directed, not boring at all (hardly ever had to yawn)" or "a very good feeling — enjoyed reading excerpts . . . and applying them — that's a good way (for me) to learn things."

Nearly all participants reported that they would have liked the workshop to have been longer as no one was able to finish all the units. In fact, in one case, two teachers came back after a workshop and continued to work together on some units. This desire for a longer workshop highlighted three important aspects of the workshop: goal setting (recognizing areas for improvement and making a commitment to change), evaluation, and using peers as a resource.

Since all the units could not be completed, participants were forced to choose which ones would be most valuable to them. This was an important criterion of our learning model. At the same time, this solved one of our teaching concerns: we had not been sure there were sufficient materials to keep everyone happily occupied given varying needs and goals and varying learning speeds.

We observed that for some participants, even ones who were later enthusiastic, the

approach was initially confusing. Part of this response was, of course, a reaction to the contrast between this approach and the more traditional in-service training they had been receiving. For example, initially we found participants would often check the limitations on their behaviour. They would ask questions such as: Can I do it this way? May I use a dictionary? They did this until it became clear that they were free to modify exercises and SDL activities to better suit their needs. Of greater concern, perhaps, is that although for some the approach seemed ideal, for others there appeared to be too much freedom and self-direction. A few people asked for more structure. This was probably partly a matter of learning style. Our response was to provide more structure by working quite closely with the few who seemed to want it.

All the participants seemed comfortable with the personal and peer evaluation that was a part of the approach; only one pair asked us to watch one of their videotaped role-plays (with no specific request for feedback), and many participants did not seek us out for debriefing. In these cases, we had to seek them out since we saw debriefing as an important way of fulfilling the demands of the classroom meeting model. One individual summed it up well: "You can learn a lot from your peers — don't have to feel you're being evaluated by anyone."

Overall, there was a positive response to the approach. However, questions remain and arise as one considers the wider implications of this design.

How would the structure and organization of the materials need to be modified for other applications? We have just recently been notified that we are responsible for providing training to teachers in isolated settings. Budgetary constraints do not permit us to provide on-site training. However, these materials are designed to be used primarily by individuals and pairs. Are they, therefore, appropriate for self-access or long distance training? If so, what additional written, video or audio instructions would be necessary? Could conference calls play a role? These are questions that we must face shortly.

A longer range and perhaps more important issue is that this approach shifts the leader's role: she or he needs to respond much more on an individual basis. This shift in focus suggests other questions. For instance, what skills of leadership and counselling become important when working individually? What signs does a leader look for to know when a participant wants to or can benefit from intervention?

To conclude, I hope that the initial positive response to this approach will encourage others in different settings to try similar methods; perhaps, in this way, some of the above questions will be answered.

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Microware Review

Len Proctor

Keyboarding Primer and MECC Keyboarding Master

For those computer users who cannot type, the greatest single barrier to the use of the microcomputer is most likely to be their keyboarding skills. Screen menus may help the inept user to make a particular program function more easily, but original data or text entry still has to be done from the keyboard. Anyone who has watched a frustrated user labor intensively over what should be a relatively effortless process will appreciate the magnitude of this barrier in the efficient use of all types of computers.

The traditional approach to solving this problem has been to defer the introduction of students to touch typing until they were in a secondary or tertiary level school setting. However, with the introduction of microcomputers into elementary schools, the timing of the teaching of these skills needs to be reconsidered. Secondly, the proliferation of computers throughout almost every sector of society, suggests that the voluntary aspects of the acquisition of keyboarding skills may be an expensive luxury. Politics aside, answers to these kinds of questions are almost self-evident The opportunity to acquire keyboarding skills should be available to every student and every student should be encouraged to learn proper keyboarding techniques as early as possible in their academic careers.

While questions regarding why and when keyboarding skills should be developed are usually dealt with by external agencies, practical questions of how to implement programs to develop these kinds of skills are usually foremost on the mind of someone charged with the task of delivering instruction. In this case there is help. Two packages, the MECC Keyboard Primer (A-l 30) and MECC Keyboarding Master (A- 13 1) are available to help teachers teach keyboarding. These programs are part of MECC's (Minnesota Educational Computing Corporation) Computing and Information Collection and are available both to institutional MECC members and non-institutional members. The price for each package for non-members is $84.00 Cdn.

The first package, MECC Keyboarding Primer, contains an on-line introduction to the keyboard and eighteen lessons, each of which is designed to teach students the location of the keys and the correct stroking of alphabetic, numeric and special function

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CJEC, VOL. 16, NO. 3, PAGES 265 – 266, ISSN 0710 · 4340

keys. Through the use of a variety of games and drills, the second program, Keyboarding Master, builds on the basic skills developed in the Keyboard Primer and helps students to increase both their typing speed and their keystroke accuracy. If a structured approach to the development of keyboarding skills is desired, a teacher management utility disk is available with each package. It can be used to track the progress of up to three classes of 1 to 48 students. The Keyboarding Primer and Keyboarding Master will also run on a Corvus hard disk system.

In the introductory lesson of the Keyboarding Primer, students are presented with the following topics: pressing the space bar, body position and posture, home row finger placement and the function of the cursor. In an unstructured setting, students are allowed to choose any lesson in any sequence that they wish. In the structured environment, students are expected to either choose the next lesson in the sequence or review a lesson that they have completed earlier in the course.

Several design factors have been taken into account when these packages were developed. For example, when deciding the order in which to present the keyboard, such elements as the ease of making the keystroke, the frequency of key use, the need to present potentially competing responses close together, and the need to present the most commonly used function keys early were considered. Second, each of the lessons follow a consistent pattern of presentation. A preview of the skills to be addressed in the lesson is shown, then a graphic illustration of the proper finger position on the keys is given. Practice exercises are then presented and finally, after the completion of the lesson, a speed check taken.

No mention of errors is made to the student unless three or more errors are made in one content line. It is suggested in the reference section of the documentation that one area in which learning to keyboard is hindered is the premature placement of emphasis on accuracy. While the end goal of keyboarding is certainly accuracy, in the early stages of learning keyboard skills, it is felt that emphasis should be placed on speed rather than accuracy.

The only known way to improve accuracy is by practicing. The Keyboarding Master contains drills and games that encourage the development of accuracy by pacing students at a rate which is slightly below their maximum speed. Students who complete these exercises should be able to build their typing speed up to a minimum of twenty words per minute and reduce their error rate to no more than three uncorrected errors per minute.

In summary, the content of these two packages is appropriate for students in the Grade 4-9 range. With some teacher input into the practice paragraphs, either package could be easily adapted to accommodate the needs of a Grade 10 and above. The sequential development of keyboarding skills is appropriate as they are presented. But, in the event that there are special learner needs present in a group, the program is flexible enough to be easily adapted to serve the needs of special learners. While not designed to be a totally stand alone package, instructions to the student are well explained, and consistent. No programming errors have been detected thus far. Feedback is immediate, positive and relevant to the user. The documentation is available, clearly-written and adequate for the purposes for which it was intended. Reference lists are supplied for those teachers who wish to pursue the topic further.

From the Educational Communication and Technology Periodicals

Richard Ellis, Editor

This column is an edited listing of articles that have appeared recently in the literature of educational communication and technology.

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Halliwell, J. "Is distance education by radio outdated? A consideration of the outcome of an experiment in continuing medical education with rural health care workers in Jamaica"

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Hosie, P. J. "Satellites and education in Australia — Learning from international experience"

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Dyrli, 0. E. "Leaders of the pack: Will they still be contenders next year?"

Harvey, B. "Finding the best LOGO for your students"

Scrogan, L. "What's new in online information services?"

Eiser, L. "No more hunt-and-peck!"

Ary, T. S. "The giant inch and other LOGO programs for math class"

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Journal of Instructional Development, 9 (3), 1986

Krafczek, D. E., & Lefferts, B. "Evaluating personal income from internships"
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Book Reviews

Rose Bene, Editor

Books reviewed in this issue are: *Transmission,* edited by Peter D'Agostino and *Using Computers: Human Factors in Information Systems* by Raymond S. Nickerson.

Transmission, edited by Peter D'Agostino. New York, NY: Tanam Press, 1985,326 pages.

Reviewed by Suzanne Daningburg

This book is about some of the psychological implications of television, with an emphasis on the medium's manifestation of art and politics. Editor Peter D'Agostino has put together thought-provoking papers about modem society as depicted through television. Steering clear of any reference to commercial aspects of the medium, D'Agostino focuses on social issues and their impact as represented by filmmakers. The main thread cropping up throughout the book concerns the issue of message versus medium. Yet while McCluhan's famous doctrine is referred to in at least one paper, the discussion is kept free from cliched arguments and intelligently exemplified through such real concerns as nuclear war and its portrayal on celluloid.

Many of the papers have been previously published in avant-garde film journals; some have been culled from more standard, academic text publications. For one familiar with the material of experimental video magazines, some of the book will be redundant. For the rest of us, it is an interesting glimpse into state of the art filmmaking issues. The fundamental question pursued is whether television, as the most common and accessible of the telecommunication technologies, can be made to benefit society. As D'Agostino writes in the introduction, the essays in the book are meant to contribute to this task in one of two ways: "Either they challenge accepted beliefs about television, or they identify positive models for the future of television" (p. 5).

The book is divided into three parts: theory; practice; and distribution. These are excellent, very good and poor, respectively. Given that the three parts are neither equally informative nor well-researched, they shall be discussed separately.

The first article in Part I begins with a description of the development of public television by the BBC in 1936. Authors Jon Baggaley and Steven Duck go on to explore the psychological implications of television. This first section goes beyond traditional communication theory and looks at content versus presentation, the functions of television, television as popart, the importance of viewers' act of viewing (i.e., audience response), the context of news and the impact of celebrity newscasters. It also delves into the anthropological effects of television and how children fare as television

viewers. Finally, the section provides an example of interactive television and author Vincent Mosco gives an excellent explanation of Videotex. Mosco refers specifically to the international development of current data transmission systems and charts Canadian progress in this area. The issue of Videotex as a global solution to information and communication problems is discussed. It is pointed out that in fact the medium is shaped by market forces. Although it would be misleading to say this section was complete, it does handle factual information and a psychological study of the medium with flare.

Part II, Practice, offers an intriguing, if also blatantly one-sided look at particular examples of poetry and politics on television. It begins by focusing on pioneer television experimentalist Ernie Kovacs and follows this with a look at the major accomplishments of video artist Narn June Paik. Next comes what amounts to thinly disguised praise of Samuel Beckett's made-for-British-TV "Ghost Trio" in a paper that purports to be descriptive.

The most comprehensive coverage of a topic in this book is James Welsh's essay on the portrayal of nuclear wars in "Nuclear Consciousness on Television." A brief overall history of the political and social issues involved in the making and distribution of the major films about nuclear war is provided. Major films discussed include the commercially successful "The Day After" and "The War Game," banned from broadcast television by the BBC. While informative, the essay sometimes reads like a promotional pitch for director Peter Watkins.

Author Ernie Bamouw provides an interesting study of what happened to war-time film footage dealing with effects of the atom bomb dropped on Hiroshima and Nagasaki. While more historical than strictly communications-oriented, this paper does not seem out of place, coming as it does right after the discussion of nuclear war films. Following this, a short essay on guerrilla television defines this term and makes a moderate attempt to compare video artists to video documentarists. This is followed by a feeble comparison of television to print and cable television to its broadcast counterpart. Part of the reason this essay fails is its assumption that most readers are familiar with the one experimental weekly cable series, Paper Tiger TV, described. A printed conversation with poet Robert Bly, wrapping up this section, seems incongruous with the main theme of the book.

The phrase "theory and practice for a new television aesthetics" is printed on the book's front cover. While both theory and practice are discussed well, the third part of the book, on distribution, simply does not measure up to the quality of its preceding parts. It contains a thin selection of articles about specific experimental television channels in Britain, New York, Boston and San Francisco, and concludes with a selected chronology of major video events and shows of the last 20 years.

The book should not be faulted for providing a left-of-centre discussion of television aesthetics, when this is exactly what it was meant to provide. Its concern, to describe a "new television aesthetics," is met with some degree of success. The book would be suitable as supplementary reading for anyone interested in what television can and/or should achieve.

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Using Computers: Human Factors in Information Systems, by Raymond S. Nickerson. Cambridge: MIT Press, 1986,434 pages ($22.50 U.S.).

Reviewed by J. T. Giard

Since *Time* magazine selected the computer as "Man of the Year," reviewers presenting a book relating to this personage often feel the need to prompt potential readers to read on with the opening phrase "This is not just another book about computers. . ." We have no fear of this kind; the book under review here is (mostly) about people.

Computers have been around for some forty years now, and it is commonly acknowledged that the extraordinary usefulness of these machines has made demands for computing magnitude. One of their most remarkable achievements has been to reduce transmission delays to a minimal level. The study of human factors in user-computer interactions does not go back much more than twenty years, but Nickerson makes a strong point in saying that "the challenge for the future is more in the area of psychology than in communication technology. That challenge is to find more effective ways of organizing and presenting information for human comprehension, assimilation and retention."

For the past 20 years, Nickerson has been a prolific and creative researcher in the field of human factors in man-machine communication. His work, as presented in this book, has valuable resources to offer the various categories of people involved in designing and building computer-based systems for individuals who have not been trained in computer technology. It constitutes a compendium of ideas and guidelines that can be applied to the evaluation of existing software and interfaces as well as to the design and implementation of new products. Most of all, because of its extended base of over a thousand references and its questions open for investigation scattered throughout the text or listed at the end, it is a unique source of information concerning past, current and prospective research in the area of human-computer interaction.

The purpose of the volume is therefore threefold: first, to provide an overview of where information technology is at present and where it appears to be heading; second, to review the human factors research conducted on computer-based systems to date; last, to investigate some of the issues and questions that seem to be especially worthy of further research.

The book's first four chapters present an overview of the development of computers from vacuum-tube devices to machines with multiple processors operating in parallel. They also survey areas where computer technology is currently being applied, attempting at the same time to list characteristics of different users, and indicating the great variability in purpose and frequency of use, as well as knowledge and skills within any user group. Chapter 4 elaborates on how computer and communication technologies have merged to a degree where they are rapidly becoming blurred, and points at trends and developments for the foreseeable future.

The following chapters are the piece de in Nickerson's menu; they focus on the study of the person-computer interaction. Licklider's (impossible?) dream of a symbiotic relationship evolving between computer users and their machines is evoked,

the main impediment to its processes, as identified by DeGreene. Approaches including simulation and modelling, observation and controlled experimentation, with this last one appearing to be perhaps the most yielding, are suggested as research methodologies that could induce the development of a true experimental science in the area of human factors in person-computer interaction. Of course, with computer technology evolving at such great speed, experimenters run the risk of seeing the results of their research becoming obsolete even before they are completed. However, Nickerson maintains that this problem can be at least partially avoided if research "is addressed to issues that are system independent and (oriented towards) the discovery of general principles that are applicable across a broad range of equipment."

Chapters 6 and 7 are quite unique in that they explore the many facets of the physical and cognitive interfaces between a computer and a user. Current and prospective manual input devices and visual displays are reviewed: the importance of typing skills is discussed and future developments towards the design of interfaces that would adapt to the idiosyncrasies of the user instead of the opposite are evoked. Features of programming languages and tools are discussed; menus and commands are compared as to their relative advantages and disadvantages; the design of names and abbreviations is explained; current progress towards using natural language and speech as input and output channels is reported. A suggestion is made that the concept of friendliness be replaced by that of usability.

Chapters 8 to 11 review the different types of existing software, such as statistical and data-management packages, authoring and editing tools, as well as available communication and information services, from electronic mail, networking and computer conferencing through to consumer information services and data banks. The impact of this technology on office and other computer-related jobs is discussed briefly. However, these chapters do not seem to offer anything new to the reader who already has a basic familiarity with the field.

More practical issues are tackled in chapters 12 and 13, containing a set of guidelines for designing interactive systems. While agreeing that most suggested guidelines lack empirical validation and are therefore open to challenge, Nickerson underlines the merit of guided evolution as an approach to design. This approach refers to the process of building a system gradually, by repeated interaction between users and designers. The process moves from small configurations containing some of the functions specified by the users, to the larger ones that contain designer-provided improvements. The importance of maintaining flexibility throughout the process is emphasized. Research results concerning user issues related to attitudes and motivation, acceptance, source of errors and different skill levels are presented and discussed.

Chapter 14 presents an original treatment of the topic of computer programming. This activity is viewed as a "new type of intellectual activity . . . that provides a vehicle for representing and cumulating knowledge . . .and a new way of testing the depth and adequacy of our understanding of specific knowledge." Programming is discussed alternatively as a professional activity, a learning activity and a craft. In all cases, it is referred to as a cognitively demanding knowledge-based activity which could benefit from an attempt at determining its cognitive prerequisites and consequences.

Chapter 15 wraps up the second part of the book with a (necessarily brief)

the-art of artificial intelligence. Adopting Kay's (1984) definition ("stuff that is interesting that we do not know how to do yet"), suggests a desire to learn more about human intelligence, to extend the Industrial Revolution to the intellect and to meet an intellectual challenge, as reasons that motivate complexity of commonplace skills and the problems of knowledge representation are evoked in connection with the commercialization of AI through the building of expert systems. In concluding, Nickerson points at the need for "developing a domain-independent theory of human expertise."

The final three chapters list a number of possibly interesting questions related to research on human factors, with a critical one being about where to put limited resources. The book ends with considerations about the potential of information technology for enhancing the quality of life.

No single work can cover everything germane to a given area. This is certainly the case here, although the book is relatively unusual in amassing 'human factors' research from both sides of the Atlantic. Nickerson's book does not provide an in-depth coverage of all these topics, nor does it make a contribution to theory, or pretend to. It is a survey of the practical aspects of human-computer interaction, and as such, it is exhaustive and systematic. Inevitably, the lists of software tools and systems referred to in the book are limited to items existing prior to 1985. But the well-indexed research material will make valuable reading for years to come.

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Information for Authors

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