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INSTRUCTIONAL INNOVATOR, October, 1982

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PROJECT DISCOVERY: A DEMONSTRATION IN EDUCATION Motion Picture, Encyclopedia Britannica (Visual Education Centre), 1965. 29 mins., sd., col.

A report on the results of a classroom experiment, in which media is used as basic materials of instruction; the film includes reactions of students and teachers.

PROJECT THE RIGHT IMAGE Motion Picture, Rank International Telefilm), 1977. 13 mins., sd., col.

How to present a film showing. The focus is on the preparation and planning which achieve the professional result.

TEACHING BASIC SKILLS WITH FILM Videorecording, Marlin Motion Pictures, 1980. 90 mins., sd., col.

This is a workshop session written by two teachers. It gives practical suggestions for effective and creative teaching using film. The program is available for free dubbing.

TO HELP THEM LEARN Motion Picture, Xerox (International Telefilm), 1978, 21 mins., sd., col.

Emphasizing the need of today's student for visual and auditory stimuli, this film demonstrates media being used to both motivate and teach.

THE UNIQUE CONTRIBUTION Motion Picture, Encyclopaedia Britannica (Visual Education Centre), 1959. 29 mins., sd., col.

Focuses on the contribution of motion pictures to education with illustrations. Still a useful teaching tool.

VISUAL AIDS Motion Picture, BNA (International Telefilm), 1975. 27 mins., sd., col.

Although filmed in a business setting, this film is for all instructors. It humorously presents the right and wrong way of utilizing visual aids. □

LETTERS

Congratulations! Vol. 12, No. 1 is exciting and challenging. You've done a fine job. Production, design and cover are all striking. The content makes one aware that the media field is alive and active.

Gerald Brown
Chief librarian
Winnipeg School District No. 1.

. . . I would like to extend my sincerest congratulations to you on your first edition of *CJEC*. The format is slick and the content bodes well for the future relevance and success of the journal.

T.L. Bennett
Resource Teacher
William Beatty School
Parry Sound, Ontario

Both Richard and I were especially pleased with the first issue of CJEC under your editorship. The journal is particularly strong in graphic appeal. The cover is eye catching and clear. I must commend you on the use of color. The content also displays a fresh new approach. The variety of contributors is a sign of your leadership and ability to enthuse others. Good work!

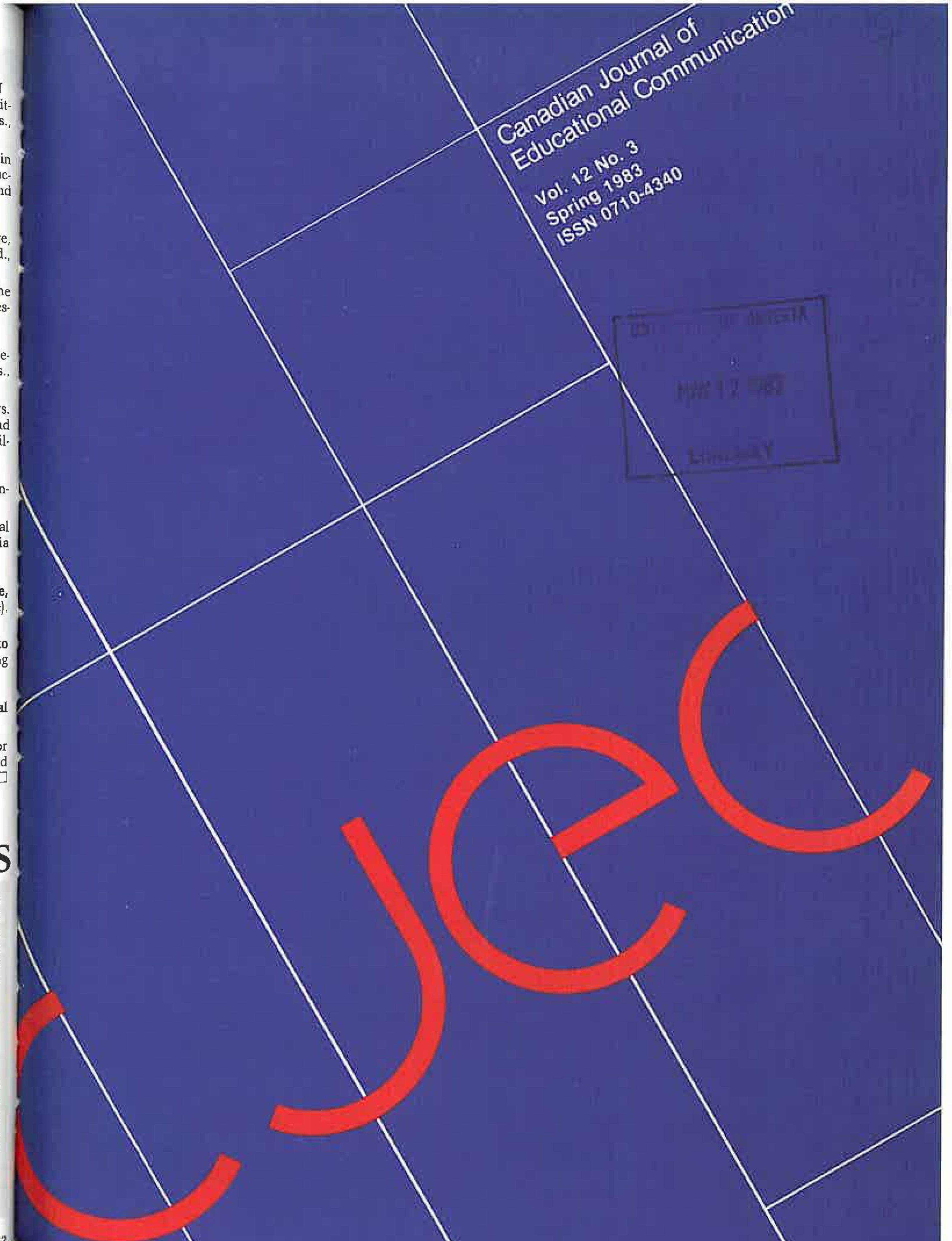
Patricia Lewis
Mount Saint Vincent University
Halifax

A look at your editorial board indicates you are an achiever. I hope that things go well this year with CJEC. With yourself as editor, I will approach it with a positive bias. I also hope that things improve for many of us in the communications profession in the next year.

Jim Burk
Saskatchewan Agriculture
Regina.

I was extremely pleased with the "look" of the most recent CJEC. The tremendous amount of time you must be investing appears to be paying benefits. My heartfelt congratulations on an impressive beginning.

Richard Schwier
University of Saskatchewan



CJEC Vol. 12 No. 3
Spring 1983

Theme: New Communication Technologies
Guest Editor: Paul Hurly, Mt. Royal College, Calgary

CONTENTS

AMTEC

The **Canadian Journal of Educational Communication** is published quarterly by the Association for Media and Technology in Education in Canada, P.O. Box 1021, Station B, Willowdale, Ontario, M2K 2T6. All articles are copyrighted by AMTEC and may be reproduced for nonprofit use without permission provided credit is given to CJEC. CJEC is indexed in the **Canadian Education Index.** All correspondence to the editor should be addressed to
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Faculty of Education
University of Manitoba
Winnipeg, R3T 2N2

EDITORIAL

We are about to be swept away on a journey we can scarcely imagine. Looking back in forty years time we will hardly remember that in 1983 this is the way we were. The changes to our entire social and economic organization promise to be so profound that most predictions about the shape of our future based on the present are almost fanciful. Advances in computer/communications technology and their application in virtually every aspect of life are beginning to transform our society.

Educators have become accustomed to reading about how computers will improve education. Article after article parrots the same phrases. Now is the time for educators to begin to deal with the truly powerful and disconcerting image of an education system transformed by the new communication technologies. It is ironic, I find, that educational technologists have not played a greater role to date in the experimentation with and introduction of the new media in education. Circumstances beyond the classroom will ensure that, unlike television, the role of computers and telecommunications will not be marginalized. The forces of the market place — to improve productivity and quality — will have a profound effect on the delivery, as well as the content, of education.

This special theme issue of **CJEC** is in commemoration of "World Communications Year" (see H.D. Markell, CJEC, Vol. 12, No. 2). The articles assembled for this issue were selected to achieve two objectives. These objectives are:

1) to provide CJEC readers with information identifying and describing the new communication technologies;
2) to explain some of the actual and potential applications and implications of the new communication technologies.

In the first article Pat McMullan demonstrates how the new media could support the new "self-help" and "wellness centre" approaches to health care. In the process, she provides an introduction to the new technologies. Laura Kann's article about Artificial Intelligence is an excellent survey of a dramatic application of computers. Kann provides a range of definitions of AI, cites several application case studies, and summarizes the anticipated benefits and limitations. We are used to hearing about the impact of computerization on blue collar and clerical labour, but the impact of "intelligent software" on white collar positions has hardly been considered. Kann's article will draw readers' attention to this issue. Both the Kann and McMullan articles were orginally submitted as graduate papers for a course on new communication technologies taught by the guest editor.

David Williams has provided an intriguing and challenging critique of human nature and technology in his article "The Computer as Fool". Can computers reform education? In whose interest will computers be implemented in education? Will computers lead to mediocrity in education? Will the introduction of new technologies transform the content and form of current learning in schools, or will it strengthen present practises? Williams explores these and other issues.

Finally, Peter Sindell provides a glimpse of the Information Society and the challenges he envisages for education, particularly continuing education. Sindell's message is clear. Uncontrolled change can enslave as easily as it can liberate. Educators have a tremendous responsibility and opportunity to use computer and communication technologies to steer Canadian society into a bouyant 21st Century. This task can only be achieved, Sindell argues, if educators possess an understanding of the technologies, a vision of our future, and the optimism and will to undertake the immense and rewarding work that lies ahead.

— Paul Hurly

Notes for the Guidance of Authors

The Editor is always pleased to receive for consideration articles on aspects of educational technology, media use and research likely to be of interest to readers. Topics of interest include: computer assisted instruction, learning resources centres, communication, evaluation, instructional design, simulation, gaming, and other aspects of the use of technology in the learning process. Two primary forms of contributions are welcomed: refereed articles, and notes and non-refereed articles. It is important that contributions conform to the notes below.

Notes and Non-Refereed Articles

1. Contributions for this category are welcomed from all members. Writers are encouraged to use a familiar, casual style. Jargon should be avoided.
2. Contributors to this section surrender to the editor the responsibility of final copy edit. Articles will not be returned for author approval prior to publication.
3. Contributions to this section do not require additional notes or references. If these are included they must adhere to the style guidelines for refereed articles.
4. Include your name, position, institution and mailing address.
5. Type contributions on 8 1/2 x 11 paper using a 60 stroke line, and double-spaced. Do not break words at the end of a line.
6. Non-referreed articles should be from one to five pages in length. Notes of upcoming events or other news should be one paragraph in length.

Refereed Papers

1. Manuscripts should be 5-20 double spaced, typed pages.
2. Include an abstract of about 100 to 150 words.
3. The author's name, position, institution, and mailing address should be on a separate page.
4. Authors should send three copies.
5. Contributions are accepted on condition that the material is original and the copyright vests in the Association for Media and Technology in Education in Canada. Contributors must obtain all necessary permissions and pay any fees for the use of materials already subject to copyright.
6. Type contributions on 8 1/2 x 11 paper, using a 60-stroke line. Do not break words at the end of a line.
7. **Main Headings** should be centered and typed in upper case. Secondary headings should be typed at the left-hand margin, using upper and lower case underlined.
8. All tables, diagrams, figures, or photographs should be submitted in camera ready format. Diagrams, tables, and figures should be provided on separate sheets of paper. The position of each item in the text should be indicated as follows:

   Table 1 about here.

9. References in the text should employ the author/date format (eg: Kowal, 1982). All references should be listed at the end of the paper in alphabetical order. The American Psychological Association Style Manual (2nd edition) should be referred to by all authors to ensure consistent reference style.
10. Spelling should conform to the Merriam-Webster **Third New International Dictionary.**

AMTEC Achievement Award: Call For Nominations

A. General

1. The AMTEC Achievement Award is in the form of an engraved plaque or plaques awarded annually by AMTEC.
2. The AMTEC Achievement Award is sponsored by the Educational Media Producers and Distributors Association of Canada (EMPDAC).
3. The Award is made to up to five recipients per year. If the recipient is a group, each member of the group receives a copy of the award. A group receiving an AMTEC Achievement Award is considered one recipient.
4. The Award is presented in recognition of outstanding ability in promoting the use or creative development of audio visual materials in the classroom in the kindergarten, elementary, secondary, post-secondary or training environments. The successful recipient(s) will have made a significant contribution to the learning process employing audio visual materials in the classroom.

B. Implementation

1. The Spring issue of the Journal will carry a request for nominations. The Awards Committee will receive nominations in time for its recommendation to be considered for approval at the February Board meeting of the AMTEC board. It will be the responsibility of the Awards Committee Chairman to submit the notice to the Journal editor. The notice must include an address to which nominations are to be sent.
2. Nominations may be made by any member of AMTEC or EMPDAC.
3. Nominations are made by the nominator submitting a letter to the AMTEC Achievement Award Chairman. The nominating letter and accompanying documents should indicate the following:

   i) the name, address and telephone number of the nominator.
   ii) the name, address and telephone number of the nominee.
   iii) a brief biographical sketch of the nominee.
   iv) a comprehensive project description including:

      a) the purpose of the project
      b) implementation and timeline details
      c) a brief overview of the content of the project
      d) the utilization strategy and/or creative development
      e) evaluation of the success and/or results of the project.

   v. names, addresses and telephone numbers of three individuals who are familiar with the project and are willing to act as references for the nominee.

C. Awards Committee

1. The Awards Committee will be appointed by the AMTEC Board and will consist of at least three persons, one of which will be a present member of AMTEC Board.

D. Presentation

1. Recipients of the AMTEC Achievement Award will be notified in writing following the February Board meeting and prior to the Annual Conference.
2. The presentation will be made at the AMTEC Annual Conference Awards function, by a representative of EMPDAC.
3. The first issue of the Journal following the Conference will carry the names of recipients of that year's AMTEC Achievement Awards.
4. As soon as convenient, AMTEC and/or EMPDAC may publish a paper or summary of a paper on the recipients' outstanding achievements.

If you would like to submit a nomination for an AMTEC Achievement Award, forward documentation detailed in B.3. (noted above) to:

W.R. Hanson
AMTEC Achievement Award Chairman
c/o Media Services Group
Calgary Board of Education
3610-9th Street S.E.
Calgary, Alberta T2G 3C5

Communications Technology & Health Education

By Pat McMullan

What does the future hold for those of us in health education? There certainly are forces at work which point to necessary change in the delivery of health care. There are new technologies which could assist health educators to reach more people in a more consistent and individualized way. The public is generally more knowledgeable, has higher expectations, and there is a growing interest in the self-care movement. How do these seemingly unrelated factors fit together? In this article I will present my scenario for the future in health education. It is, I feel, entirely possible although of course, not the only possible way to go. The intent is to explore what I consider to be the major pressures on the present system, as well as briefly discussing the new communications technologies and how they could be applied in an integrated system for a comprehensive health education program.

Influencing Factors

Costs. Everywhere in the world, increasing costs of medical care pose serious problems. In Canada, we can see cracks in the facade of universal medicare as doctors demand increased fees which governments, caught between these demands and the pressures of the current economic situation, refuse to grant. Increasingly high costs for the acquisition of new diagnostic and treatment technologies which must then be used and maintained, as well as the public's increasing expectations and demands, put additional pressures on the health care budget. The financial issues are becoming so acute that they tend to push all other matters into the background as policy makers search for mechanisms to contain costs. Containing costs is only part of the problem, however. The challenge is to do so while providing reasonable access to medical care that is effective and humane. If it were a simple matter of costs, the solution would be easy — reduce budgets. However, the achievement of limiting costs without also significantly limiting access or high quality care, and doing so in a politically acceptable manner is a real challenge.

Self-Care Movement. Many authors including Illich (1976) and Knowles (1977) are increasingly advocating the importance of individual responsibility for health outcomes. Although medical self-care has always been an unavoidable fact of life, organized self-care education is relatively new. Until thirty or forty years ago, care for minor health problems was taught by mother to daughter. Since then, the phenomenal expansion of the science of medicine has decreased consumer confidence in caring for themselves.

In recent years, the trend has again begun to change. Many guidelines based on sound medical advice have been placed within easy reach of consumers. It has been estimated that how well one develops competence and confidence in using this knowledge will directly determine the quality of care provided for up to 96% of all health problems (1, 18, 22, 24). Particularly in the United States, where the consumer directly bears a large percentage of his/her health care costs, health activation and medical self-care classes, books and films are increasingly being used to develop consumers' knowledge base. Related programs such as wellness and health promotion programs are oriented to positive health objectives, rather than specific health problems.

Scenario for Health Care/Health Education in the Future

Considering the forces at work on the health care system it seems inevitable that changes must occur. Howell (1980) presents a futurist's view of the system:

> "As pointed out by Jonas Salk in **Survival of the Wisest** and Maxmen in **The Post Physician Era**, we should expect major structural and procedural changes in future health care systems. The future system will be less disease-oriented and more conscious of prevention and health promotion. It will be guided by those individuals trained in health rather than diagnosis and treatment of diseases. Medicine will still be a major component but will not be the thrust or controller of future systems." (19:25)

A great deal of planning and work must be done. Our task will be develop effective approaches to have an impact on specific factors related to health behaviours and to utilize advanced communication techniques to provide sophisticated, person-oriented health information.

One possible scenario for the future is the establishment of Wellness Resource Centres. I predict that these would: (a) help to reach more people, allowing all citizens both ill and well to use the health care system they pay for (b) shift the focus of health care to the individual and (c) be cost-effective by helping to increase overall long term health and well being.

The first generation of these centres are already in existence in such places as the University of Southern Illinois. These centres promote holistic health, self-responsibility and self-care through a variety of methods such as "rap sessions," classroom presentations, special programs and individual and group counselling.

It is my opinion that the Canadian departments of health (federal and provincial) could take this idea and enlarge it to provide resource centres in each community or city region, much as libraries are provided today. These centres could be staffed by health educators who could act as facilitators, assisting consumers to find and utilize the appropriate resources to suit their individual needs. A variety of communications technology systems could be integrated to provide access to information not normally within easy reach of consumers through print media. Other services could be provided through interactive programs for individuals or groups. This is not to say that the human element would be missing, but rather that the new technologies could be used as adjuncts to health education, allowing much wider disemmination of information on a more individualized basis.

In this scenario, health education systems will utilize a main frame computer for regional networks with terminals in wellness resource centres. Integrated with the system will be videodisc storage, satellite relays, as well as videotex. Services provided by the system could be accessed at wellness resource centres, or for those who have terminals, in the home.

Using Communications Technology as Adjuncts to Health Education

To date, media used for health education has been mostly confined to radio, videotapes, and television. Several third world countries have used radio programs to reach their populations. The University of South Dakota Medical School has made extensive use of both radio and television for public service announcements (13) and the University of Tennessee has profitably used closed circuit video tape presentations (7). In the future, Wellness Resource Centres, however, will make much more extensive use of increasingly sophisticated communications technologies.

Computers. In a complex integrated system, a regional mainframe computer would be utilized to control and coordinate the communication system. Wylie (1980) describes microprocessors and microcomputers this way:

> "A microprocessor is any device that utilizes digital technology and micro-electronics to 'process' (alter, combine, analyze, store and retrieve, and so forth) information in a specific, basically unalterable way. A microcomputer might be called an 'intelligent' microprocessor. It is capable of processing information in programmable ways." (41:88)

If there is a microprocessor at receiving sites, it becomes possible to provide a media presentation on a main channel and digital information on sub-channels that instruct the microprocessor what to do if a user does one thing or another, thus allowing a variety of programs depending on the interaction. Gold and Duncan (1980) state several advantages of computers that are applicable to health education: First interaction on a one-to-one basis — computers are designed to interact with individuals and respond to the nature of questions or requests, or patterns of responses. Second, accurate, consistent, and unbiased information — an enormous storehouse of information can be provided to individuals that is not subject to variation due to the "moods" or "health" of the computer. Third, apart from the novelty, people generally enjoy interacting with computers because they are responsive.

Fourth, in addition to providing useful information, computers can also gather and store health information. Fifth, home computers can be available when needed — whenever the "teachable moment" arises. Sixth, the branching capabilities of computers allow logical sequences of information to be provided, based on queries of the user or patterns of responses. Seventh, speed and accuracy of recall — many thousands of operations can be handled in seconds, much faster, and probably more accurately than humans can provide information.

Finally, instant indexing and queing capabilities make the home computer faster and more easily usable than reference books.

Videotex. Videotex technology has the potential for significant impact on health education, especially in remote areas, since its interactive function can provide a wide range of services either through a user's ordinary television set or through computer monitors. Hurly et al. (1982) describe videotex this way:

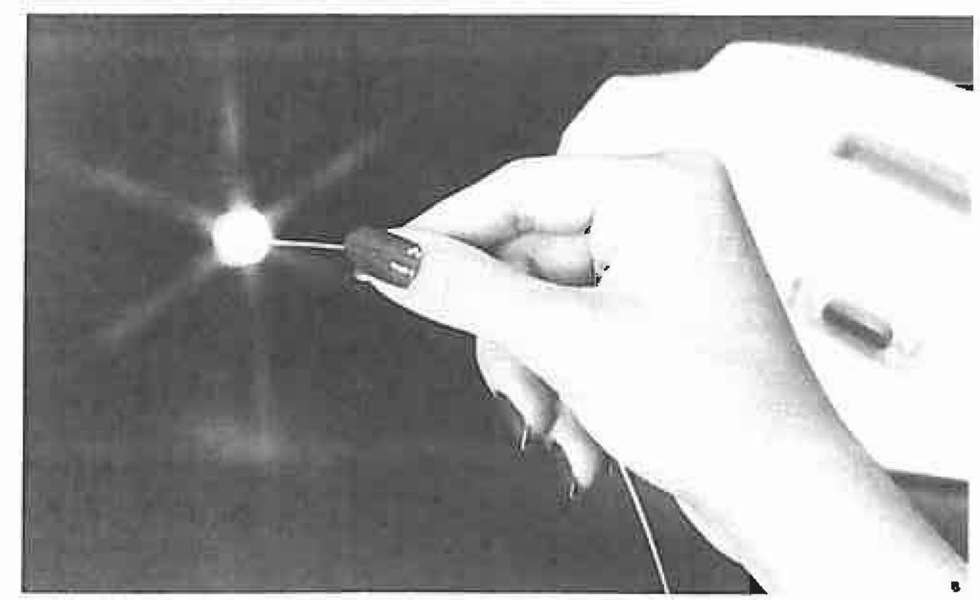
> "Videotex is a medium by which coded information is stored in digital form in a mainframe (host) computer and is transmitted via the vertical blanking interval or full screen video format to a conventional TV cathode ray tube (picture tube) or other monitor by voice grade telephone lines, co-axial cable or fibre optic lines." (20:3)

Cioni (1982) reports a number of future videotex services as seen by the Ontario Educational Communications Authority. First, videotex can act as a complement to educational television broadcast listings, program notes, closed captioning for the hearing impaired, discussion questions and answers, promotion of support services such as seminars, workshops, available materials. This would be very useful in health education as well as in general education. Second, videotex can provide an alternative to conventional print medium especially with rising costs for materials and postage. Users could have access to materials when they need them rather than having to wait and search. This system would provide much more equality of access to health education, especially in remote areas. Third, videotex can be used to distribute educational information. In the health field this could include such things as nutritional information along with simple menus or alerts to parents re: outbreaks of pediculosis amongs school children, together with information re: cure.

Fourth, videotex can provide information retrieval from data banks or reference materials. Fifth, videotex can provide interactive learning programs using TV programs to present the information and computer managed learning to allow users to give individual responses. Sophisticated computer assisted learning algorithms cannot easily be implemented on the present versions of videotex such as Telidon because of host computer limitations since the software was designed primarily for simple information retrieval. In the future, however, it is forseen that software will permit complex interactions among terminals and host computers. Muter (1980) suggests several possibilities for videotex aided learning. Future plans from the Department of Communications, Ottawa, include development of Sound Description Instructions (SDI's) which would permit the storage, transmission, and delivery of auditory messages. He also forsees a facility for talking and teleconferencing over the same lines on which data is transmitted, thus opening up the possibility of a distributed classroom in which educators and learners talk to each other at a distance and simultaneously manipulate images in a common visual space. He sees future terminals as including joysticks, light pens, touch sensitive screens, videodisc players, and tape cassette players. According to Muter, the Telidon terminal contains sufficient intelligence and memory to act as a personal stand-alone computer and to execute programs that have been downline loaded from a remote computer.

At present the use of copper wire telephone lines restricts the rate of information flow and the keypad permits only limited responses, but with full keyboards

MANITOBA TELEPHONE SYSTEM



Fibre optic lines like this will greatly increase the volume and speed of data communications handled at any given time.

Patricia McMullan is Second Year Coordinator of the Diploma Nursing Program in the School of Nursing, St. Boniface Hospital, Winnipeg.

and high-capacity telecommunications channels in place, there is tremendous potential for computer assisted learning on videotex.

Videodisc. This technology provides a method for storing large quantities of information on a metal coated plastic disc in tracks each having an address, with the information being read by a laser or other light source.

With conventional instructional television, a program begins with the first frame and proceeds in order to the last. On videodisc, however, with its capability for random-access any one of roughly 54,000 frames, this need not be so. The author can design interactive strategies that allow the learner to become directly involved with the program. The American Heart Association has utilized a microcomputer/videodisc system in conjunction with the commonly used simulator manikin "Resusci-Annie" to increase the effectiveness and decrease the training time of cardiopulmonary resuscitation (CPR) courses. A similar simulation system could be quite useful in, for example, teaching a new diagnosed diabetic to administer insulin to himself, or an ostomate to care for his stoma.

Computer simulations by themselves enable users to interact with the computer but can only tell them what they are seeing in a hypothetical case. Coupling a videodisc player with the micro-computer presents verbal information and corresponding visual and audio stimuli simultaneously. The technique allows the user to observe, draw conclusions based on those observations, and respond properly. A branching program can more nearly simulate the thought processes of a "real-life" situation. In this method, students are required to instigate each step without prompting. They must tell the computer when they are ready for an observation, analyse verbal data from the computer as well as visual and audio data from the videodisc, draw conclusions and decide on a plan of action.

Backer (1982) describes a process by which the Massachusetts Institute of Technology utilizes the random-access image storage of the videodisc, to be combined over and over in different ways without repeating the same movie twice. The prototype system which is used for interactive tutorials has three components 1) hardware that supplies the imagery and the means for inputs 2) software that generates the graphics for the viewer functions, handles interactions and controls the imagery and 3) the imagery and sound and the database that represents it. The touch sensitive screen allows the viewer to interact. The system is interruptable and is always responsive to the viewer so that changes can occur at any point. The movie then is continuously interactive and is driven by "simultaneous processing" both by the system and by the viewer whose interests and needs may change as he goes along.

Backer cites several enhancements to the system which are in the planning stages: new interactive controls and alternative graphic formats, e.g., a slow forward/slow reverse function so that any motion sequence can be examined in detail in either direction; image processing techniques will divide images into identified regions that can become active buttons to access further information. This will mean that interaction will no longer be restricted to a certain "menu" but instead information will be "behind" areas of the screen with which it is associated. Videodiscs will also provide other avenues of interaction, including recognition of three dimensional gestures (via spatial tracking sensors) for viewer input and control, as well as voice recognition is specific contexts. These will free viewers from the small monitor format as well as allowing natural interaction when the viewers hands are occupied with equipment in a "hands on" situation.

As Butler (1981) points out, however, there are at present a number of limitations to the use of videodiscs. The cost of producing a master copy is very high and so an agency must be sure of high distribution volume to offset high implementation costs. The fixed videodisc is not well suited for trial and error implementation. Any design or production error that is transferred to the discmaster can turn the initial mastering investment into a total loss. Developing effective interactive video software is difficult and people who can design these materials are scarce. Interdisciplinary expertise in new technologies takes time to develop. In order to take advantage of these media we must develop new instructional design models that allow multidimensional and cluster development of materials, planning for heterogeneous audiences and multiple and continuing format selection. Another problem is that of learning to match the technological quality of commercial television which learners are used to watching. There are some hidden operational costs such as design costs and a breakeven point of 2,000 copies in production. Finally there are several other obstacles identified by Butler as follows (although these apply to tape formats as well): the high cost of videodisc players; the high cost of replacing existing equipment; the lack of technical expertise among instructional personnel; the possible incompatibility of playback models or interfaces with other equipment.

MANITOBA TELEPHONE SYSTEM

Telidon videotex images can be received by modified TV sets, like the one above, or on video monitors with decoders.

Satellite Technology. A direct broadcasting satellite system utilizes high powered satellites to transmit television signals which can be received by a low cost "dish" receiver with an antenna one metre or less in diameter. This technology is very important to a system which is to provide equality of access to remote areas, such as is the case in Canada.

India used the ATS6 satellite from 1975 through 1976 on a national scale. Among other programming, health and hygiene discussions as well as family planning were included. Canada has developed a domestic communication satellite network, the Anik series, which could be used to support health education. It is already used, among other things, to provide medical information and services to small communities and remote areas. Most locations using the satellite have a two-way audio voice capability.

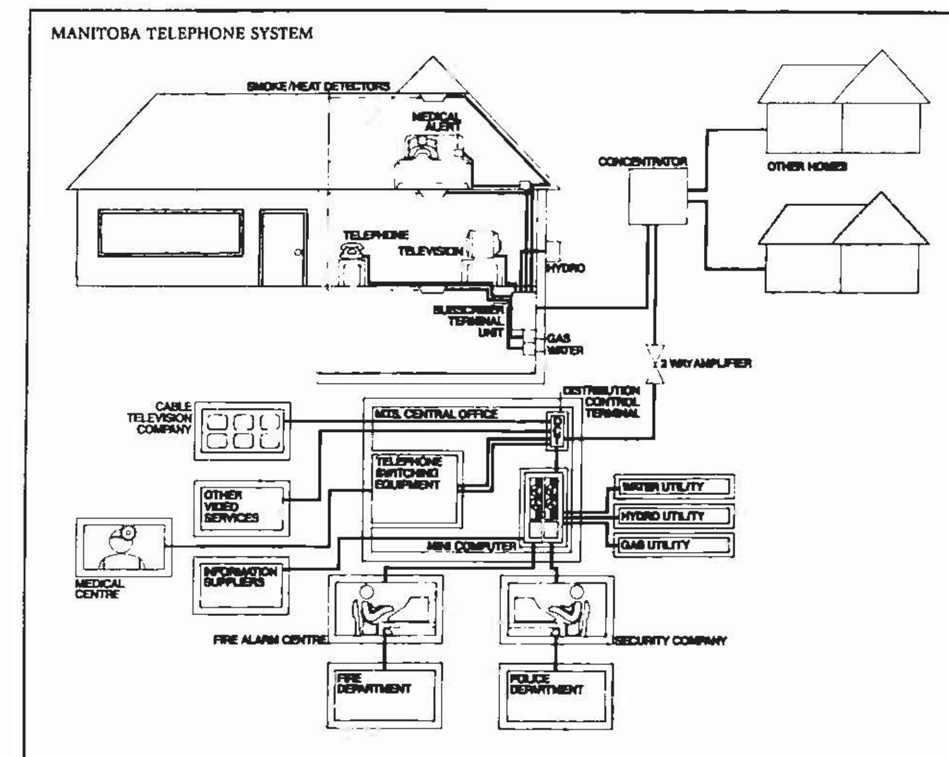
The satellites could have important applications for health education as a relay point for videotex, educational television programs, or telesoftware which could be relayed in offpeak time for storage in local terminals. Some of the constraints in utilizing satellites are the high costs of production and launch (which are decreasing with miniaturization and the space shuttle), as well as crowding of the orbits and broadcast bands. A social constraint is the problem of broadcasting to areas where local individuals and/or governments do not want a signal. Much work has to be done on standards and regulations.

Application to Health Education

What needs to be done in order to make the new technologies a positive extension of health educators? What kinds of programs can be developed that would have an impact on an individual's health? These are not easy questions to answer and several factors must be taken into consideration.

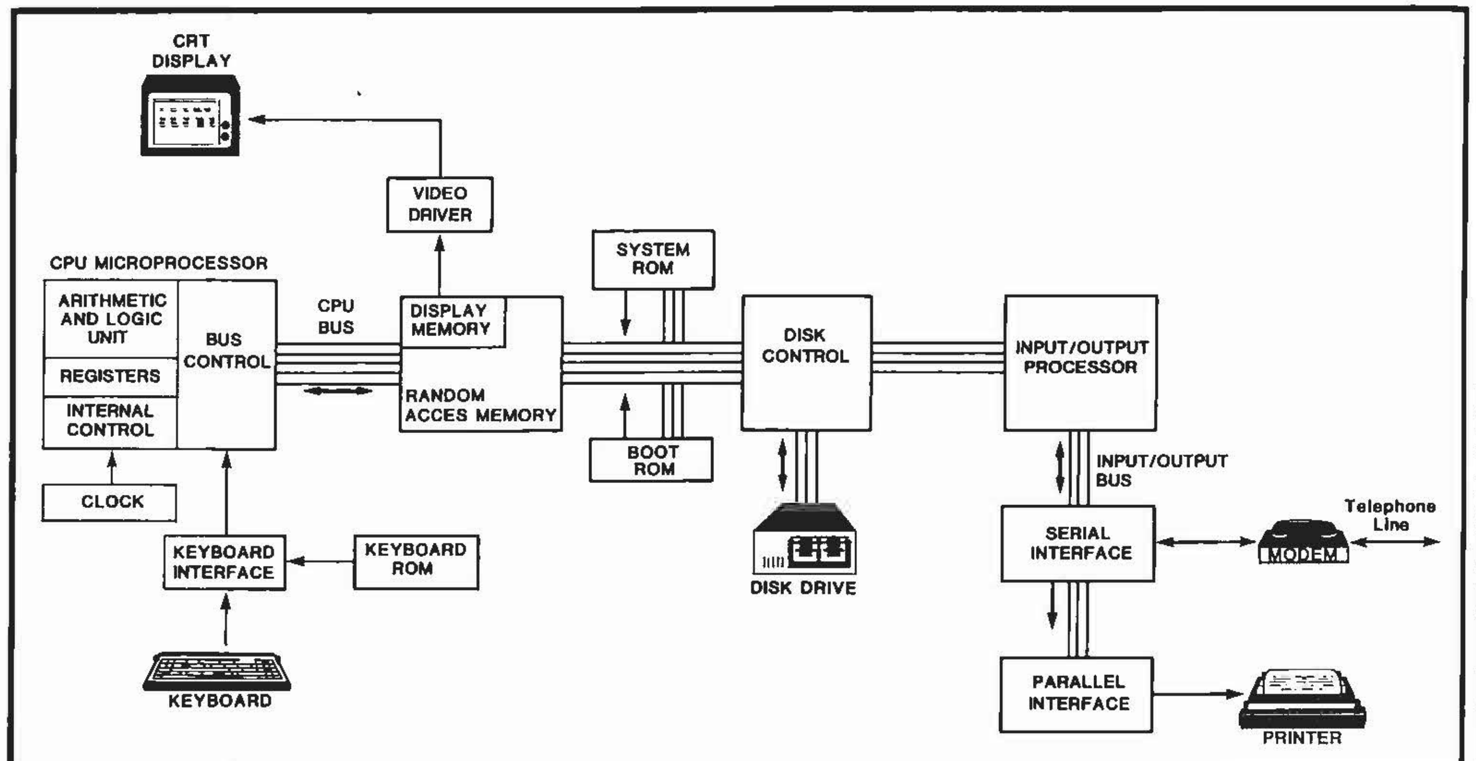
First, health education must be in-

Continued on page 26



This schematic diagram of Manitoba's Project Ida shows a wide range of services can be delivered electronically to the home.

How it Works: The Microcomputer



This discussion refers to a hypothetical microcomputer.

1. The main information link in a microcomputer is the central processing unit bus (**CPU BUS**). This set of wires carries two types of data: address lines specify where data is going; data lines transport the data.
2. When the computer is turned on the **Boot ROM** (read only memory) sends a simple program to the CPU. The Boot program tells the **CPU** to turn on the disk drive that contains the operating system (**OS**).
3. The OS is a program that manages the computer and its peripheral devices like a traffic cop regulates the flow of vehicles. Some microcomputers place the **OS** in the System ROM. An **OS** may also include utility programs for copying or erasing files.
4. Application programs (e.g. word processing, accounting) read in by a disk drive pass into RAM (random access memory) by direction of the **OS**.
5. The CPU processes data in units called "words". The first microcomputers used 8-bit microprocessors. A new 16-bit version hit the market in December 1982, which processes data in units of 2 8-bit bytes. A 32-bit microprocessor is also now in use.
6. When a key is pressed on the keyboard a processor in the **keyboard interface** determines the position and the code for the key stored in the **keyboard ROM.** The code is placed on the data bus and is passed by the **CPU** to the display memory.
7. Bits in the display memory are turned on or off to correspond with positions on the **CRT** display screen. The **video driver** reads these bits in the order they will appear on the screen, translates these into an on/off electronic impulse and sends them to the electron gun at the back of the **CRT display.**
8. The microcomputer communicates with peripheral devices like printers via input/output ports. Serial and parallel interface ports are required for different devices. Serial ports handle data in a single sequential stream; parallel ports can process several data streams simultaneously.

— Paul Hurly

Artificial Intelligence and its Implications for Education

By Laura Kann

Introduction

Twenty-two years ago the study of artificial intelligence (AI) had barely begun to crawl. An area of study fraught with controversy, diversity, and decentralized leadership and coordination, considerable progress has been made. AI is just now reaching the point whereby it can have crucial implications for all aspects of life. The home, industry, business, government, recreation, health care, and education will all be affected. This article will focus on the educational implications of AI, now and in the near future. Specific uses of AI will be illustrated and the issues surrounding these uses evaluated. However, in order to facilitate a more accurate perception of the issues and to provide equal footing from which to base evaluations on, several critical terms and somewhat philosophical issues need to be discussed first.

Essential Definitions

The most obvious place to start is with the term *artificial intelligence.* There are probably as many different definitions of this concept as there are people doing research in it. Nonetheless, there is general agreement that AI is a branch of advanced engineering, though not to be confused with the study of computers, which is computer science. Instead, AI is a study of computer programs (Boden, 1977). AI is also a cognitive science concerned with the nature of learning and language (Papert, 1980). It has also been identified as one of the three leading technological breakthroughs of modern times along with genetic engineering and microelectronics (Bernhard, 1980).

Definitions from leading researchers in the field begin to explain its scope and purposes somewhat more specifically. Margaret Boden, a philosopher from the University of Sussex, defines AI as the study of intelligence as computation or the development of a systematic theory of intellectual processes (Boden, 1977). Similarly, Seymour Papert, a mathematician with an extensive background in educational psychology, describes AI as the use of computational models to gain insight into human psychology and reflect on it as a source of ideas about how to make mechanisms emulate human intelligence (Papert, 1980). Robert Bernhard suggests that AI is the method by which behavorial scientists will develop the first detailed models of human thinking (Bernhard, 1980). Banerji Ranan offers yet another perspective by defining AI as the totality of attempts to make and understand machines that are able to perform tasks that, until recently, only human beings could perform, and to perform them with the effectiveness and speed comparable to a human (Banerji, 1969).

Donald Fink suggests that AI be defined very functionally as a) the ability of machines to organize information into meaningful patterns and to recognize, store, recall, and manipulate such patterns in playing games, solving problems, answering questions and in controlling the actions of other mechanisms; b) the ability of a machine to respond to patterns of stimulation, particularly those not forseen in its design; and c) the observed performance of such machines as measured by comparison with or in competition against human intelligence (Fink, 1966). However, the above definitions not withstanding, the most quoted and concise definition is that of Marvin Minsky of MIT who defines AI as *the science of making machines do things that people need intelligence to do* (The Seeds of Artificial Intelligence, 1980).

Another way to look at AI is to examine each term of the concept. "Artificial" can be easily defined as synthetic, man-made, or unnatural, terms most people apply to computers. But attempts to define "intelligence" simply and satisfactorily are considerably more difficult. Nonetheless, it is necessary to confront this definitional dilemma in order to firmly grasp the implications of AI and the controversies surrounding it.

Christopher Evans in **The Mighty Micro** (1980) defines intelligence as the ability of a system to adjust appropriately to a changing world. The greater its ability to adjust, that is its degree of versatility, the more intelligent that system is. As a general working definition this one is sufficient, but it does not deal with the more subtle facets of intelligence that are necessary for a true understanding of the concept. Therefore, Evans (1980) suggests six key factors that can be used to determine a system's degree of intelligence. While they are described in technological terms, they apply equally to all biological systems as well. The first key factor is data capture ability, which is a system's ability to extract information from the environment. Another important aspect of intelligence is data storage ability, that is, the ability of an entity to store information once it is captured and then refer to it in the future to improve its ability to adjust to the environment. The third critical part of intelligence is processing speed. This refers to the speed at which a system can process information and switch between basic units.

Software flexibility, the fourth factor, is probably the most important factor of intelligence. It can be described as the extent to which a system's software can be rapidly and easily modified. A fifth key factor of intelligence is software efficiency or how an entity adjusts to novel happenings in the environment. Finally, software range concerns the size and range of programs with which a system can be equipped and with which its central processor can cope. For all six key factors mentioned the more advanced they are in a system the more intelligent that system is. They can be used as a framework to judge one system's intelligence in comparison with another's.

Intelligence, Thinking and Learning

Man has evaluated intelligence in various ways for centuries. During the last sixty years the most common method has been the IQ test with scores projected on a scale from one to two hundred. For those not keen on the idea of a computer being intelligent, it should be a comfort to know that modern day computers would not earn more than a mere fraction of a point on a standard IQ test (Evans, 1980). However, it is also important to remember that man has had several hundred million years to develop, while computers have only been around for thirty years, and the field of AI even less. Moreover, at this point AI research is only concerned with making a computer intelligent. The other functions man has, and has had to put equal effort into developing, such as reproduction, defense, mobility, socialization, repair, and maintenance are not of concern to computers. Regardless of this present situation, what should be obvious is that the term "intelligence" is a complex one indeed and not one to be used lightly. Consequently, it will be used in quotations throughout the rest of this article.

Another issue of semantics the AI field deals with concerns the concept of thinking, usually with respect to the perennial question: can computers think? Alan Turing, the British genius and mathematician, while neither defining the term precisely nor answering the question unequivocally, did propose a solution that has generally settled the issue (Evans, 1980). His solution took the form of a test now called the Turing Test for Thinking Machines. The test is based on the idea that humans infer what others are thinking by the kind of conversation they can have with them.

The Turing Test basically involves two humans and one computer. One human serves as the judge or tester and in connected by computer terminals to the other human and to the computer being evaluated. The judge cannot know in the beginning which terminal is connected to which, but by typing messages into either terminal and by receiving messages back is to try to decide. A stupid computer will be easily revealed as such and the human will have no difficulty identifying it. On the other hand, if the judge cannot determine which terminal is connected to the computer then the computer will have passed the test and could be called a thinking machine. To date, though repeated attempts have been made, no computer has passed the Turing Test unconditionally.

This has only served to fuel the fire of the opponents to the concept of a thinking machine. Their arguments were first categorized by Turing and are essentially still the same today. They can be summarized as follows (Evans, 1980).

1) The Technological Objection — Man is a creation of God, and has been given a soul and the power of conscious thought. Machines are not spiritual beings, having no soul and thus must be incapable of thought.
2) The Head in the Sand Objection — This is really not an argument about why it cannot happen, but rather an expression of a wish that it never will, such as 'what a horrible idea!'
3) The Extra Sensory Objection — If there was such a thing as extrasensory perception and if it were is some way a function of human brains, then it can, also, be an important part of human thought. However, in the absence of any evidence proving that computers are telepathic, one must assume that they can never be capable of thinking.
4) The Personal Consciousness Objection — Not until a computer can write a sonnet or compose a concerto because of thoughts and emotions felt, not by the chance fall of symbols, and know that it had written it, can a machine be considered to be thinking.
5) The Unpredictability Objection — While humans behave and think unpredictably, computers are created according to a specific set of rules and operate only according to a specific script, therefore thinking must be an essentially human ability.
6) The 'See How Stupid They Are' Objection — Because of the many limitations computers now have there is no hope that they could ever think.
7) The 'Ah But It Can't Do That' Objection — This is an eternally regressing argument that continually adds a new challenge every time an earlier one is met.
8) The 'It Is Not Biological' Objection — Only living things can have the capacity for thought, so non-biological systems cannot possibly think.
9) The Mathematical Objection — Based on Kurt Gödel's theorem the argument follows that no matter how powerful a computer is it can never tackle every task on its own.
10) Lady Lovelace's Objection — A computer cannot do anything it has not been programmed to do.

Each of these arguments has been refuted by Turing as well as many other proponents of the thinking machine. To this group past failures merely imply that the technology necessary is not yet available, not that it never will be available (Dreyfus, 1980). Moreover, many computer programs with limited thinking abilities have been developed, as will be shown later.

Regardless of which side is right, there are negative implications for both. For example, if computers were proven unable to think then that would imply that a scientific account of thinking is not possible, that thinking is beyond the range of rational thought, and that those who do think must contain a non-mechanical or non-physical mysterious something. On the other hand, if computers were proven able to think, then man would be merely a wonderful rational thinker no better than a machine (Kugel, 1979). Both options pose interesting dilemmas, which is why the controversy is so heated at the present.

A final issue surrounding the field of AI that must be dealt with concerns the concept of learning. Just as the degrees of intelligence and thinking ability are used to evaluate an AI computer program so is its ability to learn. The term learning is typically defined as the capacity of a system to change its behavior as a consequence of experiences (Michie, 1974). However, the controversy does not concern this definition, but rather the theories for how learning, particularly the learning of language, takes place. AI work cuts across the age-old conflict about the relation between linguistic ability and other congnitive functions in the developing child. Questions concerning the domain-specificity of certain abilities, their relationship to particular brain structures, and their extent of innateness, all come into play when an AI researcher attempts to simulate or duplicate human "intelligence."

Typically, either the traditional Chomskian or Piagetian perspectives are used as frameworks for the AI computer programs. According to the Chomskian view each child is born with a definite linguistic competence that is extremely specific to language, has little overlap with other congnitive abilities, and is determined by innate biological structures. In contrast, the Piagetian perspective maintains that linguistic competence shares the major congnitive processes with other intellectual domains and is explicable in terms of the psychodevelopment process based predominately on unstructured experiences (The Seeds of Artificial Intelligence, 1980). Regardless of which point of view ever proves correct, AI has a direct bearing on the issue. For no complete model of human intelligence can ever be devised without a clear theoretical framework upon which to base it. Consequently, only a very few AI programs at this time exhibit any learning abilities.

Obviously the issues surrounding the field of AI are neither simplistic nor easily solved. As a result, their effect on the actual work done is great and will remain so until they are satisfactorily resolved. One of the primary areas toward which AI research is being directed, and one that confronts many of these issues directly, is education. To fully appreciate the impact that AI is having, and will be having, on education this paper will review the present and potential uses of computers in education.

Computers in Education

The use of computers in education has traditionally been in just two domains (Sugarman, 1978). The first of these is the use of computers for class scheduling, registration, payroll matters, and general record keeping. The other use of computers in education is computer aided instruction (CAI) or programmed instruction. CAI was first introduced into education in higher education and industrial training in the late 1950's when computers were still quite large, very slow, and had rather small memories by today's standards. While considered to be revolutionary at the time, CAI never fulfilled its initial promises. Compared to some present day computers those used initially for CAI can be considered stupid. They were typically employed to drill a large number of students in memorization exercises or to present material in small, highly structured pieces, each idea building on the last, and each piece followed by a simple question to facilitate integration. Today in primary and secondary schools, CAI is often integrated into foreign language and social classes studies. At the university level many introductory courses in mathematics or physics utilize the traditional CAI as a supplement to regular lectures.

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Regardless of their specific function most of the early CAI programs have two detrimental characteristics (Raphael, 1976). First, only one-way communication is allowed. Material is presented in a passive manner and the student is not allowed to interact with it in any original way. Secondly, because the computer does not allow significant two-way communication, the student is not encouraged to think. Many people feel that this is very detrimental to a student's natural initiative, originality, and creativity. Moreover, only a few studies show that students gain significantly from the factual information presented by CAI. With these restrictions in mind it is obvious why CAI's popularity suffered so severely in the late Seventies.

Fortunately, work in AI has progressed to such a point that some computer programs, while not yet capable of passing the Turing Test, have definitely become "intelligent" computers. AI has provided the second chance CAI was in desperate need of.

Applying AI to CAI

The new programs produced by AI research are based on the belief that a highly intelligent, empathetic, personal tutor can enhance the intellectual development of children, even if it is not a human but a computer (Raphael, 1976). Furthermore, the AI researchers realize that for learning to take place there is more involved than merely placing information in a student's memory (Norman, 1979). Therefore, the programs developed are highly sophisticated and have attempted to incorporate many of the best characteristics of the best human teachers. Criteria for an effective AI program for "intelligent" CAI include the ability to respond to two-way communication; to decide whether to generate a particular display; to test knowledge of a certain concept that previously posed problems to the student; to terminate an interactive session if the student's interest, motivation, or competency diminishes; to determine a sequence of experiments needed for the student to gather the best information; to select both difficult and easy paths toward a solution; to generate feedback dynamically; to improve performance over time; to possess a wide range of behavorial goals for the learner; and to present a structural description of the subject matter and performance criteria (Offir, 1976). There are basically seven applications of AI programs that have arisen from these criteria for "intelligent" CAI. While none are entirely exclusive of any other, each type does offer a slightly different emphasis or perspective.

The most successful and most widely implemented and evaluated AI programs for educating children are based on the principle that the child should control the computer rather than letting the computer control the child, as it traditionally does. A specific example of this, using a language called LOGO, is Turtle Geometry (Papert, 1980). Developed by Seymour Papert and his colleagues at the Artificial Intelligence Laboratory and Computer Science Laboratory at MIT during the early Seventies, Turtle Geometry is probably the first AI program designed particularly with the needs of children in mind. The language, LOGO, is non-mathematically oriented, simple to learn, based predominantly on symbols, but most importantly, sophisticated enough to be as powerful as many professional computer languages. The Turtle is, as Papert describes it, an "object to think with" (Papert, 1980, p. 11). More concretely, the Turtle is a computer controlled cybernetic animal that exists in the cognitive miniculture of the LOGO environment. It can be triangle on a computer screen or a mechanical object. The Turtle robot can run on the floor with a pencil in its center which can be lowered so that the turtle leaves a trail behind itself. Overtly, children use LOGO to program the Turtle to draw geometric shapes of the teacher's or their own choosing. This activity teaches them many principles and concepts of geometry. Indirectly, and probably most importantly, the children learn to verbalize their ideas in a concise manner, divide a task into manageable chunks, and correct and improve trial solutions progressively. In general, what the children develop as a result of their work with the Turtle is a very sophisticated style of problem solving applicable to any other school subject as well as all additional aspects of their lives. Moreover, they truly enjoy learning this way, which is something that cannot often be said for traditional teaching methods.

A second use of "intelligent" computer programs is called **mixed initiative computerized educational instruction systems** (Raphael, 1976). In this instance the computer acts as an active partner in the student's learning process. It does not merely feed facts to the student like the old CAI programs, nor is it programmed exclusively by the student as with Turtle Geometry. Instead, these programs use a fairly extensive knowledge base to facilitate the student's acquisition of the material. They can ask questions of the student based on past performance as well as answer questions posed by the student. Furthermore, these programs can understand natural language commands to a fairly sophisticated degree, sense student boredom or the need to change the pace of a course, and guide the work to areas the student needs the most help with.

One example of this type of "intelligent" program is called SCHOLAR (Raphael, 1976). SCHOLAR's specific domain is South America geography and meteorology. While it is undoubtably restricted, its knowledge base of the specific topics is extensive and is natural language understanding system is truly remarkable. Like Turtle Geometry it teaches advanced reasoning procedures as well as South American geography and meteorology.

Another example of the mixed initiative computerized educational instruction systems is SOPHIE, which tutors electronic troubleshooting (Bregar, 1980). Like SCHOLAR, though its domain is restricted, SOPHIE's understanding of natural language is very flexible. It can respond to questions students asks about actual or hypothetical situations, and analyzes students' responses by determining the consistency of their arguments. It also helps students to develop sound reasoning skills as well as competency with electronic circuits.

A third application of AI programs in education is called *expert programs* (The Seeds of Artificial Intelligence, 1980). These possess a substantial amount of knowledge about a given problem domain and, most importantly, the procedural skills necessary for solving such problems. They are not merely a computerized library that provides information, for they can manipulate the information in quite a sophisticated manner as well. Typically these AI programs are created in limited specialty areas of mathematics, the sciences, and particularly medicine, by an AI expert in conjunction with one or more human specialists in that field. A few examples include MOLGEN created to plan experiments in DNA manipulation, INTERNIST which is used to diagnose internal medical problems, and HEADMED that serves as a psychopharmacology advisor. Doctors use these programs for advice and confirmation of difficult medical diagnoses. So far, though they are not used widely, their success rate has been quite high. Nonetheless, the use of expert programs in education has been limited to the confirmation of practice diagnoses by students specializing in that particular field of medicine the computer is programmed in. However, with time, their use may be expanded to a wider range of less specific subjects so that they may be applicable to the general classroom as well.

"Intelligent" computer programs also have been developed to tutor experimentally based mathematics and physics courses (Raphael, 1976). This fourth form of AI program utilizes graphics extensively to simulate actual experimental conditions. By trying an experiment out first on the computer a student can save both time and resources. Students are also encouraged to hypothesize difficult or even impossible experiments to do in the laboratory, because the computer can simulate these results as well. For what would take hours to calculate and plot even with a hand held calculator, like the shape of curves as certain variables change or the behavior of balls under different conditions in a kinetics problem, the "intelligent" computer can do instantly. Computer simulations can even suggest further areas of exploration. Similar to the other types of "intelligent" computer programs discussed, these programs encourage student initiative and general problem solving skills.

A fifth way programs developed by AI research are being utilized for education is in teaching foreign languages (Raphael, 1976). In one instance the computer can operate a slide projector and a tape recorder, so that the student can hear the new word pronounced correctly, while at the same time associate it with an appropriate illustration. The number of words or the speed at which they are presented can be altered by either the computer or the student, for both are capable of detecting errors and areas in need of additional work. Once again good study and problem solving skills are emphasized. More technically advanced programs use visual representation of phonetic sound patterns to compare and contrast input by teacher and students or even the computer and students. This is especially helpful to students concerned with getting the proper accent for each word. These programs have also been used quite successfully to help deaf individuals to learn to speak. Traditional methods of depicting the appropriate sounds have often been widely misinterpreted by the deaf person and have thus resulted in very poor speech patterns.

The sixth use for the new "intelligent" computers in education is computerized homework (Raphael, 1976). These programs, often used in conjunction with math classes, present problems for students to work out. As students improve the difficulty of the problem increases. Each problem is composed of randomly selected numbers so that lessons can be repeated without the exact same problems being presented. Should the students find a certain problem particularly difficult they can ask for clues from the computer, or the computer will revert to an easier but similar problem and will slowly guide the student to the correct answer of the more difficult problem. Studies of this type of AI program show that more homework is completed in a much more enjoyable way, which probably leads to better course marks.

A final use for the "intelligent" computers developed by AI is the one most enjoyed by the students. Authoring programs allow students to create their own computerized lessons for other class members to use (Raphael, 1976). This activity requires students possess a thorough understanding of a topic regardless of its breadth, a competency with a computer language or at least an understanding of how a computer utilizes natural language, and most importantly, highly developed problem solving skills to debug the programs so that others can benefit from them. As with all the other uses for "intelligent" computers the problem solving skills are emphasized because of their applicability to all facets of life regardless of the specific problem at hand.

The Benefits

These seven examples of the use of AI for CAI demonstrate the many benefits that students could receive if these programs were to be implemented widely instead of in just the few laboratories and experimental settings now available. Specifically, the benefits of these programs in education can be summarized as follows.

First, they can reduce the number of computer elite (Boden, 1977). As our society becomes more reliant on computers those who can interact competently and comfortably with them will be at a definite advantage over those who cannot. It is important that children be introduced to computers at an early age and the school is the perfect setting for this to occur. Second, they can create an opportunity for students to think about their own thinking in a very helpful way (Boden, 1977). In order to program a computer and then debug the program students must take a positive attitude rather than a self defeating, negative one (Bregar, 1980). Furthermore, they must be able to describe verbally and concisely their reasoning, future plans, and the mistakes they have made. Few other school exercises require such precise and in depth analysis of the thought process (Raphael, 1976). Consequently, the student deliberately learns to imitate mechanical thinking and is able to articulate what mechanical thinking is and what it is not. This can lead to a greater confidence about the ability to choose a cognitive style that suits the problem, not to mention the realization that there is such a thing as a cognitive style in the first place. This is not to say that mechanical thinking is necessarily the best approach, though it may be in a mathematics class, but merely that through work with "intelligent" computers students will have the opportunity to learn to think articulately about their thinking with respect to the particular problem at hand.

Third, AI programs can produce an improvement in the understanding of the sciences and mathematics (Boden, 1977). A great number of students, particularly females, grow up with a serious fear and general apprehension to anything mathematically oriented. Commonly called mathophobia, this phenomenon tends to irreparably separate the humanities from the sciences within society. Two cultures arise from this situation, each set on strengthening the differences between the two. An early introduction and competency with computers allows mathematics to become a natural vocabulary, not in opposition to but complementary to the traditional linguistic language. As a result the gulf between the humanities and sciences could be lessened and ultimately society could retire the compartmentalized view of knowledge and learning and instead see how well each "side" could benefit the other. Less abstractly, students can realize how well each subject in school compliments the others and how much each has in common, for there are very few subjects that could not be taught to at least a minimal degree with an "intelligent" computer program (Papert, 1980). Fourth, these programs should produce an increase in the degree of student participation (Raphael, 1976). "Intelligent" computer programs by their very nature require a great deal of active student involvement. No longer can a student merely daydream through a teacher's lecture. Each idea presented by a computer must be acted upon by the student. When a student has complete charge of the programming even more involvement is required. A mere nod of the head in acquiescence will not encourage a computer to continue. Undoubtably, this makes a student a better learner by sharpening the concentration and attention spans and by reinforcing the idea that learning is most productive when it is an active process.

Whether or not AI's potential to positively effect education will be realized can only be speculated. Though the issues involved are many it is clear that any talk of the future must be based on the assumption that computer technology has not reached its peak that growth will continue (Evans, 1980). Improvements are needed in the programs' abilities to respond to natural language and in understanding of the human thought and reasoning processes in order for the programs to be truly interactive and "intelligent."

Some Objections and Concerns

Opponents to widespread "intelligent" computer use in the classroom fear that computers will take over the teacher's job. This is highly unlikely for computers are a long way from possessing all the necessary traits required to abolish the teaching profession as it is today. Nonetheless, computers will be used increasingly to supplement human lectures, provide unlimited individual attention and infinite patience, and to keep lessons moving at a pace beneficial to all (Raphael, 1976). Even if computers were to gain the technological sophistication necessary to take the teacher's place such a drastic change would likely occur very slowly to many impending factors in educational institutions (Sugarman, 1978). Undoubtably, the classroom is an artificial and inefficient learning environment, but one that was forced out of necessity to develop because certain essential subjects such as mathematics and writing could not be assimilated in informal environments. Clearly, only truly "intelligent" computers capable of passing Turing's rigorous test would ever allow modification of the learning environment so that the knowledge schools now try to teach could be learned without human mediated instruction (Papert, 1980).

Another concern of the critics of AI's applications to education is the present lack of standards by which computers operate in the classroom. They feel that any teaching tool professing to be as powerful as computers are should not be implemented widely without some kind of protective restrictions. While Orwellian images of children 'running wild,' 'drugging themselves,' or 'making life impossible for their parents' are probably exaggerated, they do exemplify an area in great need of attention (Papert, 1980). A lasting solution can be possible only when education becomes a true science and the real nature of learning is understood (Evans, 1980). Simple solutions in the past, such as Skinner's teaching machine, have been insufficient and have probably done more to confuse than to resolve the problem. At present teachers, AI researchers, and administrators subscribe to their own personal theories of learning regardless of their actual appropriateness to the specific teaching situation. Only time can tell whether or not those with the power will have enough foresight and insight to address the confusion before it is too late.

One other major issue raised by AI's opponents is whether or not the ability of people to do simple calculations will be lost due to the computer's greater efficiency and accuracy with computational skills (Evans, 1980). This may not be actually detrimental because, though at this point it is impossible to tell, many people feel that truly natural and interactive mathematical powers are already inhibited by the formal discipline of learning trivial computational rules. "Intelligent" computers, they argue, will free students from the need to learn these unnecessary skills in mathematics and other subjects, so that they can tackle higher levels of learning and understanding. Consequently, it is possible that as computers become more "intelligent" student intelligence will also increase. These more "intelligent" students will then develop even better computers in a never ending upward spiral (Raphael, 1976). While this totally limitless growth in computing is neither predicted nor desired by many at present, it is surely possible.

Conclusion

Even though AI's opponents present some very real problems demanding attention, it appears they will do little to stop or even slow AI research into educational applications. Consequently "intelligent" computer use in the classroom will probably have an even greater effect on the intellectual development of children than any other teaching tool or technology, including the television, previously devised (Papert, 1980). Obviously, the issues discussed earlier concerning intelligence, thinking, and learning will need to be settled and many technological and social obstacles must be overcome. However, with the present disillusionment with the current school system and the promises that AI's application to education have offered, little appears to be stopping the eventual widespread use of artificial intelligence in education.

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BOOK REVIEWS

The Computer in the School: Tutor, Tool, Tutee. Robert P. Taylor (ed.) Teachers College Press, 1980

Information Technology: Innovations and Applications. Bernard S. Sheehan (ed.) Jossey-Bass Inc., 1982

Meeting Learners' Needs Through Telecommunications: A Directory and Guide to Programs. Raymond J. Lewis American Association for Higher Education, 1983

The Coming Information Age. Wilson P. Dizard, Jr., Longman, 1982.

By Paul Hurly

The bountiful harvest of recent books concerned with the role of new media in education and society leaves educators and educational administrators with few excuses for being ill-informed. The following is a sample of some of the best of the new crop.

Robert P. Taylor gathered five of the most innovative educators using computers in the United States — Alfred Bork, Thomas Dwyer, Arthur Luehrmann, Seymour Papert and Patrick Suppes — to discuss their philosophies and approaches in **The Computer in the School: Tutor, Tool, Tutee.** Taylor conceived a tri-modal framework for analyzing the educational role of computers which these five pioneers describe.

As a **tutor** the computer tests student knowledge, provides remedial material, and manages the learning process. As a **tool** the computer is programmed to perform such functions as simulations or word processing. The **tutee** mode, which receives the greatest focus in the book, is when the student tutors the computer via a computer language. Beautifully conceived, Taylor's text provides an uplifting glimpse of the potential future direction of schooling and formal learning in North America.

A much broader range of educational technologies are scrutinized by the authors gathered by Sheehan in **Information Technology: Innovations and Applications.** By itself this book does not provide sufficiently detailed descriptions of the new technologies to assist those readers who are less well informed about computers and new media terminology. The strength of this book is its attention to the broader context in which decisions are made regarding the use of educational media and information technology.

Manfred Kochen and Carl Adams discuss the challenge of planning for the implementation of information technologies and responding educational to their impact on society. They also identify some benefits of information technologies for planners. Richard Evans provides an update of his 1968 study on resistances to innovation in higher education and suggests several pragmatic steps for overcoming the blockages. Despite the learned opinions of Sheehan and his colleagues, however, educational technologists may sense that information technologies will have a far greater impact on the typing pool than in the classroom domain of the professor.

In **Meeting Learners' Needs** Through **Telecommunications,** Raymond Lewis has provided impressive evidence that innovative media-based educational programs are alive, well and thriving. Using mail and telephone surveys Lewis compiled summaries of 70 educational programs at the college and university level which use CATV, interactive CATV, teleconferencing, videoconferencing, computers and computerconferencing, television and videotape media to serve the needs of a wide range of learners. Prose and point form summaries for each project cover a range of standard topics such as educational mission, problems encountered, delivery system, finances, administrative structure and observations about distance learning. This is an excellent directory for planners and administrators seeking models for implementing innovative telecommunication-based learning strategies for their institutions.

Planning for the successful implementation of information technologies, argues Wilson Dizard, Jr., requires strong central leadership and the participation of all, or as many as possible of the sub-groups in society. Otherwise, he states, we risk making decisions which will benefit elites and will ultimately undermine democratic freedoms.

In **The Coming Information Age** Dizard provides a summary of the development of computer, satellite and telephone communications in the United States, and the facts to demonstrate the economic preeminence of the telecommunications sector in the 1980's. His discussion of the follies of Washington bureaucratic communication planning and corporate gamesmanship underscores similar points made by John Wicklein in his largely ignored but insightful, **Electronic Nightmare.** Dizard's observations on the dangers awaiting society if corporate machinations, and government disarray, regarding telecommunications policies persists, will give Canadians considerable cause for anxiety. The recent track record of Francis Fox's DOC mandarins, and the CRTC, typify the frenetic approach to planning Dizard advises we must foresake. In this advice there is also a strong message for educational planners.

AMTEC Board of Directors

AMTEC ADATE

CONFLUENCE '83
JUNE 20-22 JUIN
MONTRÉAL

TENTATIVE PROGRAM

Sunday, June 19	13:00 - 19:00 Evening	Conference Registration Buffet — Bell & Howell
Monday, June 20	Morning	Keynote Speaker — Dr. G.L. Gardiner: **On Turtles, and Turning Teaching Inside-out** GAMMA Future Studies Group University of Montreal/McGill Exibitors visiting time
	Afternoon	Special Interest Groups — Copyright — Computers — Media Management
	Evening	Bus Tour of Montreal Dinner: — Festin du Gouverneur (Ile Ste-Hélène)
Tuesday, June 21	Morning	Keynote Speaker — Mr. Fred Elie: **Cost-effective Video and Computer Based Training** Training Director Informatique, Hydro-Québec Special Interest Groups: — Instructional Designer — Utilisation Consultant
	Noon	AMTEC Business Meeting
	Afternoon	ADATE Media Showcase Panasonic — reception
	Evening	Media Festival Awards
Wednesday, June 22	Morning	Award Winner's Screening Keynote Speaker: AECT President: **International Co-operation in Educational Media**
	Midday	Tour to National Film Board Luncheon and Screenings

The program will include presentations in the following areas:

- Applications of small computers: — in classrooms
  — in management systems
- Videotext (TELIDON) in Education
- Designing the educational message: — theoretical persepctives
  — practical perspectives
- ACCESS Alberta today
- Update on the copyright law
- Audiovisual Standards
- Evaluation is the production process
- Using media to promote the schools

In conjunction with the annual AMTEC Conference, awards will be presented for excellence in the production of instructional media materials. A panel of judges may grant Certificates of Merit for productions meeting pre-established criteria. At the discretion of the judges, one Award of Excellence may be given in each category and class. All entries will receive written critique from the panel of judges.

AMTEC MEDIA FESTIVAL ENTRY FORM

1. Submit one entry form (or photocopy) for each project.
2. Ensure that all materials and components are clearly labelled.
3. In the case of sound/slide or sound/filmstrip programs you must indicate clearly which cueing system was used for production.
4. Entries must have been completed after January 1 of the year before the conference.
5. Entry fee — For each submission there is a $10.00 fee. Please make cheque or money order payable to: CONFLUENCE '83.
6. Classification is subject to approval of the Festival Committee.

Category (circle one)

1. 16mm or super 8mm (open reel) Does not include kineoscopes of videotape or other films made using electronic process
2. Videotape (1/2" or 3/4" cassette)
3. Sound/filmstrip (audio cassette)
4. Sound/slide (audio cassette)
5. Microcomputer software
   a) PET/CBM, Commodore 4.0 BASIC
   b) Apple II Plus, Dos 3.3
   c) Radio Shack TRS-80, Model 3
   d) IBM Microcomputer

Class (circle one)

1. Individual School
2. School System
3. Post-Secondary
4. Government Media Agency
5. Student (as part of a course)
6. Commercial Producer
7. Business/Industry
8. Other ______

A SEPARATE FORM MUST ACCOMPANY EACH ENTRY

TITLE ______

LIST COMPONENTS ______

LIST NECESSARY (Manfacturer & Model) ______

RUNNING TIME ______ DATE OF PRODUCTION ______

NAME OF PRODUCING INSTITUTION(S) ______

PRODUCERS ______

PERSON(S) SUBMITTING ENTRY — NAME(S) ______ TITLE ______

ADDRESS ______ TELEPHONE NO. ______

NAME TO APPEAR ON AWARD (if different from above) ______

TARGET AUDIENCE & OBJECTIVE OF PROGRAM: (Attach additional material) ______

All entries must be received by: 12 May 1983

Entries must be shipped to: Cynthia Weston
Media Festival Chairperson
Confluence '83
McGill University,
Faculty of Education
3700 McTavish
Montreal, Quebec, H3A 1Y2

Return address (if different from above) ______

Will pick up material at Conference — By whom ______

Return by Mail ______

Excerpts of winning entries will be transferred to videotape for the awards presentation and for the AMTEC Archives.

I accept the terms as stated in the Media Festival Rules of Entry ______

Signature & title of entrant

The Computer as Fool:
A Reconnaissance of Post-technology and Its Participants

By David C. Williams

No! I am not Prince Hamlet, nor was meant to be;
An an attendant lord, one that will do
To swell a progress, start a scene or two,
Advise the prince; no doubt, an easy tool,
Deferential, glad to be of use,
Politic, cautious, and meticulous;
Full of high sentence, but a bit obtuse;
At times, indeed, almost ridiculous —
Almost, at times, the Fool.
The Love Song of J. Alfred Prufrock
— T.S. Eliot

Introduction

This essay explores three commonplaces and offers a tentative critique concerning educational use of computers. Commonplaces are platitudes or truisms which range from profound to banal. The critique is tentative because it is hesitant. It is prepared as the author's first prolonged and voluntary interaction with computers reaches denouement. Its hesitance is induced more by conflict than confusion. And there its sharing with Jeremy Bernstein's **The Analytical Engine** (1964) stops, in part because such urbanity is difficult to match.

These are the commonplaces:

1. Computers do only what people program them to do (they are neither good nor evil).
2. There are and should be no limits to possible applications of computer technology (progress, like information, is a product).
3. Everyone is going to get a computer (and everyone is going to need one).

The critique has almost nothing to do with technicial aspects of the computer revolution. Indeed, it is a source of marvel that computer technicians are reducing and expanding relatively non-vicious things in a time when the precious shrinks and horrible prospects grow with ominous rapidity. And yet, one might worry, there is a nagging relationship between the machine in computer chess and the machine prepared to program the holocaust. In each, the human is the dependent variable. That is the source of any "critique" by an organic compound confronted with inorganic invincibility.

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Remarks on the inevitable must heap themselves with disclaimers and caveats, and this look shares that burden. Microcomputers in education, computer crime, computer war, computer money, computer recreation — all share a vision of progress. And so the first and most important exception for or from critique is that one cannot reasonably plead for abandonment of all progress, dreaming of return to some golden age blend of **Excalibur, Star Wars,** and **Clash of the Titans.** Whenever it was, things really were not better "back then" anyway.

A second and related limit to critique is that almost any advance in any aspect of computer use does some good for some people of the time. Democracy revels in that process which transform the arcane to the communal. A spurious focus of computer critique is the "nefarious machine versus the noble people" argument. Attention more appropriately directs itself at unfair advantage gained by individuals and groups over others via computer mastery or control, or at iatrogenic impact of computer applications. Such occurrences are represented, for example, in implanting microcomputer contact with learners where honest effort at human interaction has not been encouraged, refined and expanded. The author is aware of the belabored objection to such a claim: computers are intended to supplement rather than supplant human interaction. To the businessmen who controlled education long before Thorstein Veblen objected to them, such a statement is only one among many appeasing Munich Agreements.

Concern for iatrogenesis — the cure that kills — invites this essay's final disclaimer: people with computer savvy must be accountable for the social consequences of applying their skill, but they cannot be held accountable for being people. It may rightly be a matter of human nature that, among the species, humankind sedulously rediscovers fascination in invention and control of instruments in its service. This is on the "plus" side of critique. Less deserving of affirmation is implementation of devices in such a manner as to obscure the process of progress and the array of human glories and fallibilities. It is one matter to intervene via machine when humans err. It is another to selectively perceive mechanical mastery as deliverance from assumedly perpetual human folly.

The First Commonplace

The mass of data and ideas with which the individual is bombarded by the modern communications media augments the scale of his biographical designing board. Once more this has both positive and negative implications for the individual. It may give him a sense of expansiveness and freedom. It may also mediate experiences of rootlessness and anomie.
Peter Berger, Brigitte Berger, and Hansfried Kellner, The **Homeless Mind** (1973, p. 76)

GIGO — garbage in, garbage out — holds an honored spot among the oldest known principles of computer programming. The axiom belies power of late-model machines which program other machines. Further, it underestimates computers' impact as inchaote, subtle, and subservient influence-wielders, partially reflecting the role of the Shakespearean fool. Reliance on the cliche that computers do only what they are programmed to do deters one from pondering effects of sustained interface with computers on learners and technologists alike. The question of what computers "do" to people is different from questions concerning socio-psychological outcomes of their programs. For learners, what does one say of encounters with computers that become either invitation to or sanctuary from and ragogical drudgery? What does it mean to become caught up in the idea that, as a vanguard breed of technological wizards, instructional developers with computers "become agents in the evolution of man" (Mitchell, 1975, p. 127)?

Tiedeman (1981) notes that computers are not essential to liberating learning and environments. Rather, a commitment to holistic education, as opposed to the training of parts, is called for. The new technology, however, is as firmly entrenched in practice as it is complementary to prevailing educational philosophy. The latter emphasizes immediacy of feedback ("reinforcement"), tangibility of objectives, and replicability of outcomes. Its hallmark is overpowering fixation on "accountability" through performance standards and, less often, performance measures. It disdains what Polanyi (1966) enunciated as the "tacit dimension" and the subtlety of interactions described by Goffman (1959, p. 2): "Many crudical facts lie beyond the time and place of interaction, or lie concealed within it."

Again, however, the matter is one of imposition by humans, not machines, which abide as silently as Kubrick's monolith, as patiently as Yeats' sphinx. "The danger," warns Ellis (1974, p. 49), "is that we will use computers to *compensate* for educational problems, thereby never coming to correct these problems." Compounding the error entails "automating a procedure that is not worth doing at all, even by hand" (Ellis, 1974, p. 47). The trap is that of the Type Three Error (Mitroff, 1980, p. 189): using computers as tools to solve the wrong problems with the greatest precision.

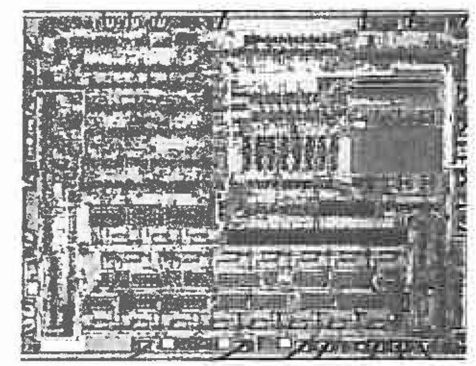
Educational machinery, like behavioral objectives, can manage the overt aspects of intended learning. But, as Dunlop (1977, p. 244) observes, much of what educators wish to be conveyed is "strictly unformulable and elusive." Beyond personal qualities, these range from "the application of moral principles to situations of real life" and "plausible historical argument" to "the ability to find the right word to describe things." The point is not that machines can assist in some of these endeavors. It is that as machines take on greater roles, humans lapse more rapidly into Skinnerian slots as occasional arrangers of contingencies of reinforcement. The UNESCO report, Learning to Be (Faure et al., 1972, p. 140), puts it this way: "One of the great merits inherent in mass media is that they relieve the teacher of exclusive concern with the transmission of knowledge and thereby enable him to pay greater attention to his mission as educator." While pondering such mechanistic dichotomization of roles, consider Jacques Soutelle's famous comment (Ellul, 1964, p. 99) on the atomic bomb: "Since it was possible, it was necessary."

Mastery of computer paraphernalia — either software or hardware — proffers an unusual invitation to the future. For the learner, recent events in the unwinding chain of computerization, especially the advent of microcomputers, could offer unparalleled modes of experience. But the transformation is even more dramatic for the programmer, designer, technician, and engineer. The mandarins of the past — industrialists and practitioners in the traditional professions — now find increasingly popular language, procedure, and environment commanded by a new class essentially beyond their comprehension. Since Comte, none of the sciences has so captured public imagination and perception of need, and all in a time of rising distrust for scientific rationality.

It is no small irony that such events unfold during eclipse of ethics of the scientific revolution. "Big science," invokes Karl Popper (1975, p. 84), "may destroy great science." As Popper decries the blurring of "scientific revolution" with "ideological revolution", Nisbet (1980, p. 340) isolates the "degradation of knowledge" as the contemporary nemesis. He borrows from William James to warn against *knowledge of* (that which is in "the common possession of all living beings" and which "describes simply the habits, adjustments, and techniques we employ in the business of living") supplanting *knowledge about* ("the province of the scholar, scientist, historian, philosopher, technologist, and others whose primary function is that of advancing our knowledge about the cosmos, society, and man").

Two issues must confront the new mandarins. The first asks, "In whose service are these new methods?" "Power in our time," observes Conor Cruise O'Brien (1967, p. 60), "has more intelligence in its service, and allows that intelligence more discretion as to its methods, than ever before in history." He warns that this event increasingly promotes "a society maimed through the systematic corruption of intelligence." The computer

NORTHERN TELECOM LIMITED



Northern Telecom filter-code chip used in advanced telecommunications systems.

revolution already provides new plateaus in criminality (Bequai, 1978). A more circumfluent problem is the overall role of data banks in a free society (National Academy of Sciences, 1972). While a power elite may not understand computers or computer people, they may well succeed as highest bidders for (and, therefore, manipulators of) their services.

However equitable the distribution of microcomputers, for example, the crucible must be control of input decisions. Aldous Huxley (1958, p. 5) foretold that "government through terror works on the whole less well than government through the non-violent manipulation of the environment and of the thoughts and feelings of individual men, women, and children." The demise of a critical intelligentsia (Lipset and Dobson, 1972, p. 138), its replacement with "managerial technicism" (Feuer, 1963), or the failure to enliven a new critical intelligensia with computerists in its midst, paves the way to new dimensions in both terror and manipulation. The Polish philosopher, Leszek Kolakowski, reminds (1968, p. 179) that "the less one is capable of ruling by intellectual means, the more one must resort to the instruments of force."

The second issue rests perhaps somewhere between force and manipulation. It is mediocrity, or, in education, the mediocratization of what is to be learned (Williams, 1974). Knowles (1970, p. 136) proposes that "the notion of some programmer predetermining what is desirable behavior for an individual and then controlling the stimuli and responses so as to produce that behavior conflicts with the concept of an adult as a self-directing organism." Is lifelong learning, abetted by microcomputers, to unfold as lifelong boredom? Even considering the hideous possibilities wrought of advancing research in isotope fractionation, aging, and extraterrestrial intelligence, more awesome is the failure of progress to come to grips with the Age of Leisure (Gabor, 1964). Perhaps microcomputers in education will save time principally for those who already have too much.

The Second Commonplace

The single factor that most distinguishes the coming civilization, whatever one chooses to call it, is the subsitution of "communication" processes for traditional "work" as man's primary activity.
Victor C. Ferkiss, Technological Man (1969, p. 108)

Economic and social systems in this century transformed with alarming rapidity, although the processes have been neither as alarming nor as rapid as some would like. In more developed parts of the world, organization of human effort billowed into the 1900s from an auspicious industrial base. Then came the technological society, followed by the service society, which has now metamorphosed as the information, or communication society. Economically advanced nations entered the century spurred by unchallenged faith in limitless growth. Today's information society spreads the doctrine of declining abundance and the limits to growth, except in computers.

Microcomputers represent the fastest growing area in educational technology. IBM estimates that up to "70% of its future worldwide growth potential" lies in microcomputer sales (Myers, 1980, p. 192). In business, the popularity of distributed data processing increasingly liberated from mainframe systems accounts for much of this growth. But education systems likewise revel at the prospects of such freedom. Fifteen years ago, Bowen (1966, p. 78) asserted that "computer usage will be decentralized to the point where terminals will be available to individuals in offices, laboratories, classrooms, and homes where such usage can be economically justified." The arrival of microcomputers introduces a plateau of usage far beyond terminals, and, for some, holds the key to wholesale economic justification.

The educational technology community grasps an undaunted faith that microcomputers will not traverse the path of obsolescence so well carved by 8-track audiotapes, quadraphonic stereo, reel-to-reel video tape systems, and, probably, videodiscs. In fairness, such items probably were necessary building blocks in development. However, their diffusion throughout less-developed and middle-developed countries (LDCs and MDCs) represents as tragically pervasive incidence of inappropriate technology.

In highly developed nations, such matters as cost efficiency in educational technology might assume almost banal appearances. For example, Hershfield (1980) isolates cost as a major "systemic barrier" to technology-based (e.g. computer-assisted) courses in post-secondary institutions. Comparing such courses to human labor-intensive modes, his study detected five-year capital costs for technology-based courses to be five times greater.

The privilege of making such comparisons, without catastrophic consequences, evades most of the world. The "increasing entropy" (Weiner, 1956, p. 304) of the scientific ethic noted earlier has escorted a sense that cure for the problems of technology is more technology (McDermott, 1969). Technology, whether in education, commerce, government, or industry, is envisaged commonly as a self-correcting system. This is the altruistic, ameliorative image of a gifted "intellectual technology" (Bell, 1973, p. 26) rising to any challenge, except, perhaps, its own. That even the richest states can any longer finance such a vision attracts increasing evidence for doubt (Meadow et al., 1972).

For poorer nations — industrially and agriculturally deficient, energy dependent, and skill drained — more than doubt is in evidence. The denizens of technology and progress have dumped on this ill-fated group an array of obsolete machines and outdated gimmicks almost comic in dimensions and, unfortunately, pathetic in effect. Millions of fatal infant diarrhea cases attributed to unscrupulous "marketing" of formula in the Third World by Western manufacturers present one stark example. The substitution of television and computers for traditional forms of "mediating intelligentsia" (Gouldner, 1976, p. 168) in ideological, political, and cultural development offers another, perhaps more global case.

Some irony touches discussion of appropriateness. Reflection on the topic abounds among and within LDCs, whereas developed nations plunged into such areas as educational use of microcomputers without much attention to the parameters of appropriateness. Perhaps this is attributable to technological innovation not arising "out of thin air," as Schiller (1976, pp. 74-75) comments, but rather being "encouraged (or discouraged) by the prevailing social system . . . to achieve the objectives of the dominant elements already commanding the social scene." Allegiance to a crassly simplistic theory of market economy (promote whatever markets will bear and bear whatever markets will promote) exacerbates the scope of such conditions.

Microcomputers could be included among appropriate technologies in much of the world. Reddy (1979, p. 173) describes "appropriate" development as that which satisfies basic human needs in order to reduce inequalities, which promotes "endogenous self-reliance through social participation and control," and which increases harmony with environment. In the past, attention to technique and technology fixed on industrial and economic dimensions. Resources were so ordered as to achieve ends in those dimensions only and, as Ellul (1964) laments, were organized to their fullest capacity without regard for good or evil. Resources can be ordered in less mechanistic, more humane ways, especially when the human dimension assumes the prominence typically reserved for the magic of machines. Among other educators, Hall (1980) confronts this need in arguing for horizontal communication: that which facilitates discourse, participatory research, and action *among* rather than transmission of sterile bits of information *to*. Properly allinged, microcomputers in education might invigorate such communication. And so, while there might be limits to growth, there may be "no limits to learning" (Botkin et al., 1979). The trick, so to speak, is in willfully reversing patterns of misuse and neglect.

The Third Commonplace

> The effectiveness of a doctrine does not come from its meaning but from its certitude.
>
> Eric Hoffer, **The True Believer** (1951, p. 76)

The final commonplace concerns the inevitability of "everyone" getting a computer, either before or after "everyone" needs one. Of course, if "everyone" has or will have such a need, economy in finance and space would make powerful argument for microcomputers. But economy is not the issue here. The present concern is the ascription of need and the dimension of need.

If optimistic testimonials and fair-like hoopla are indications of need, microcomputers are about to assume their rightful place between automatic garage door openers and digital watches. At least one American company now markets a course complete with attache case-size kit for building a microprocessor/communication system. The National University in San Diego boasts programs based around an IBM 371/3031 and several microcomputers. These connect students with annotated bibliographies, research updates, key concept definitions in several disciplines, diagnosis and prescription of learning disabilities, inventories, statistical packages, curriculum ideas, and graduate student portfolios.

Bucknell University's Departmemt of Management offers an "Affordable Small Computer" course to assist in determining needs, rating different systems, selecting vendors, negotiating costs, and operationalizing a computer system. In May, 1981, the National Computer Conference sponsored in Chicago a one-day Personal Computer Fair. Planning abounds for computer-driven holograms to provide three-dimensional images for storage and display (House, 1978). Tiedeman (1981, p. 6) promotes use of guidance computers "prosthetically with the minds of learners." And from Bodington's, **Computers and Socialism** (1973), one learns that it has become necessary for Marxists to simultaneously embrace and deplore computerization.

Like wholesale educational use of pocket calculators, the urge to massively microcompute rides a wave of myopic inevitability (perhaps inevitable myopia). For some reason, it has become an automatic assumption that computer-based human communication systems (CBHCSs) are prerequisites for "flextime" (Best, 1980), "cyclic life plans," and consummate "non-linearization" of life sytles (Scher, 1980). Is it possible that people might want more "supportive interface" with each other rather than with machines?

Gelpi (1979) asserts that lifelong learning in its fullest implications will transform society. It seems that microcomputers, in turn, will transform lifelong learning. But will they transform the all-too-common political domination of what is to be learned and how one is to learn? Are microcomputers linked to lifelong adult education to offer only another form of dependence and guaranteed inadequacy (Ohliger, 1974)? For example, automated information retrieval, rather than expanding access in an egalitarian fashion, progressively limits access to those who can pay. More and more, librarians urge that information be priced according to laws of supply and demand. In the future, those who cannot pay may hope for, at best, some form of government-supported "information welfare" (Freedman, 1978).

Typical is the view (King et al., 1974, p. 35) that the ultimate "technological phase" in lifelong learning is "dependent on a much greater sharing of knowledge and experience, . . .with interchange and feedback as characteristics of widely diffused responsibility." But manipulated by it. Through simulation or whatever mode, a paramount reinfication results from promoting images of computers as "rethinking" their positions. In reality, the learner with the computer differs insignificantly from Bowers' student in traditional settings (1974, pp. 27-28): he unconsciously learns "appropriate question-asking behaviors . . . in such a way that they become part of his own perceptions." This student "is not likely to see that he has the right and the ability to make his own interpretation of appropriate question-asking behavior, and to engage in the political process of getting others to rethink their positions." Using computers "prosthetically" with the minds of learners presumes missing pieces in those minds, rather than in socio-political contingencies impacting on those possessing minds.

Conclusion

> The fear of machines is almost as old as industrial civilization. Oswald Spengler's prophecy that "Faustian Man will be dragged to death by his own machines" has never been quite forgotten.
>
> Dennis Gabor, **The Mature Society** (1972, p. 40)

Obviously, the three commonplaces discussed herein are related. Each points to the inevitability of computers and, specifically, microcomputer usage in education. These seem destined by market economy and human curiosity to permeate all aspects of educational endeavor as thoroughly as perfection and fallibility, wisdom and folly. In fact, the approaching universality of computerization may make such distinctions moot.

But saying that it has to happen may be simply crass, as crass as the blind optimism accompanying most statements on inevitability. It is crass because it detracts from impetus to resist, to criticize, to carve out a niche of viable rebelliousness. Churchman (1971) warns that, in information technology, designers design to please those who control the rewards. The very tangible rewards to which he alludes are beyond the ability of the renegade critic to dangle even momentarily as bait.

Again, one cannot invoke the computer as scapegoat. And, again, as Tricker (1980, p. 154) reveals, "the important questions, though brought into focus by the potential of computer and telecommunication-based systems, are not about computers at all." Computers are not really impartial observers; they are patient, sometimes cryptic Shakespearean fools. But the fool is not the question. The important question evolves from need for appropriate human authority patterns to link with the rising power of computer awareness. It is no good to fear, respect, smash, or adore the machine. It is one's own species that must assume a new aura.

As the inevitable marches to new heights and depths, it may borrow a not-too-distant lesson from the advent of sound films. Charles Chaplin and other producers disdained them for a time, fearing denigration of the expressiveness of acting, a demise of gesticular language (Martinez, 1979). Acting did not lose its value but adapted to a new medium. In the present case, the challenge of computers in education is who controls the modifications, producer or user.

Even if users can become producers, computers are not yet ranked among popularly endorsed mass communication forms. While this may be a disguised blessing, given the "electronic colonialism" (McPhail, 1980) so abundant in other media, the microcomputer movement may greatly benefit from considering its potential relationships with other knowledge areas. While not limited to these, proxemics (investigating the role of space in communication), mathetics (observing humans as they learn), and semiotics (studying signs and symbols and their inter-relationships) may further inform and sophisticate the drive to computerize.

The computer is a fool. The fool, Dahrendorf (1970, p. 54) suggests, "is defined by the very fact that he always acts out of character."

> The power of the fool lies in his freedom with respect to the hierarchy of the social order, that is, he speaks from outside as well as from inside it. The fool belongs to the social order and yet does not commit himself to it; he can without fear even speak uncomfortable truths about it.

As court jester of modern society, the computer makes relative all authority. It may entertain. One may ridicule it mercilessly; it will not budge. It may offer games, diversion, shortcuts, and tricks. One may come to assume its presence or availability, to be succored by its presence. The computer is a fool, and it may have, somewhere, the last laugh.

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Learning and Technology: Dangers and Opportunities*

By Peter S. Sindell

** This paper was originally presented at "IMPACT, Learning and Technology Conference," The Joint Annual Conference of the Canadian Association for Adult Education and the Ontario Association for Continuing Education. October 28, 1981, Toronto.*

Introduction

Speaking to educators these days I get a strong sense of doom and gloom. Budget cuts, falling enrollments, and federal-provincial altercations about transfer payments are some of the causes of this negative tone. Educational institutions and the educators in them seem to be depressed, adrift, at a loss. They seem to be gearing down, or perhaps, winding down would be a better image. Winding down without much conscious analysis of the alternative — which is to consciously gear up for a new role in society, look ahead with excitement and energy to a new and different vocation.

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Looking ahead even to 5 to 10 years — the near to medium term horizon — I assert that educators should be gearing up, not down. Why? The short answer is microelectronics. No one could accuse a humanistic anthropologist such as I am of being a blind idolator of the Goddess of technology, seductive as she may be. Yet I am optimistic because I see the ways in which the new microprocessor base technologies — microcomputers at home and at school, videodiscs, computer aided learning, satellite based learning systems and networks — all these and more can impact our schools and our citizens in a positive liberating way. Microelectronics is not a panacea but it can and will offer much to the world of education. Your fields stands to benefit the most from these new technologies if you can seize the challenge and make it yours.

You have heard a great deal, I dare say far too much for some, about the miracles of microelectronics and the ubiquitous chips on which these miracles are based. 1k, 16k, 32k, 64k bits per chip, LSI, VLSI, RAMS, ROMS — these and other technical terms are becoming common parlance. The technology is easy to get a hold of, to understand in a general way. Its implications are not.

Microelectronics is a transformative technology which is diffusing in Canada at a staggering rate. Most scientific or technological discoveries take 50-100 years before they are developed to the point of commercial viability. In contrast the microprocessor (the computer on a chip) was invented in 1971 and yet is already a multi-billion dollar industry which is affecting dramatically almost all other industries. Products using microprocessors are making possible the automation of our offices and our factories. How fast this process is going even in education is illustrated nicely by a comment Ontario Minister of Education, The Honorable Betty Stephenson, made on October 6th, 1981. She reported that an OISE Study in June of 1980 showed 649 microcomputers in Ontario schools (presumably primary and secondary only) while her ministry found 3239 microcomputers in September, 1981 an increase in a little over a year of more than 500%.

The changes coming in the wake of this technology will have so much impact on learning and on almost every other aspect of our daily lives that we can say, without exaggeration, that we are in the beginning stages of a profound revolution, an "information revolution". Controversy abounds about the effects on employment, about the potential invasion of privacy the revolution could bring, about the psychological and physical effects of living more and more with and through machines. What *is* clear at this point is that we will be searching for understanding, for the human meanings of this revolution for many years. Like chasing *butterflies* the search will take a great deal of energy, lead us into unexpected byways but, when we succeed, be most satisfying.

What I would like to explore in this paper are the two faces of this revolution — the dangers, on the one hand, and the opportunities, on the other. Because the changes which we shall see will be so pervasive they offer great risk or great promise. What we do in our daily work and life, as educators and as citizens, can and will influence the future shape and character of this revolution in Canada and in your home provinces.

Emotional and Intellectual Coping

Each of us has a role to play and we must, therefore, begin with our own feelings. Based on your feelings right now would you perceive yourself as a *technophobe,* someone who is afraid of microelectronic technology? Or are you a *technophile,* someone who feels comfortable with this technology? How you and I react to the new information machines, whether technophilically or technophobically, or some mixture of the two, will very much influence whether we accept the revolution, resist it, or reject it. In our work at GAMMA we have developed three key scenarios for an information society — the telematique, the privatique, and the rejection.

The Telematique Scenario (from the French *Tele-informatique* which refers to telecommunications-computer linkage) is characterized by a central electronic highway linking offices, homes, factories, schools, etc., the ubiquitous presence of terminals and computers in production and consumption activities, and international interconnection via satellite. In the educational context examples of the telematic approach would be networks built around databases about such subjects a continuing education courses available — where — when — cost, or jobs available for graduates (the federal employment database called CHOICE) or dial up networks offering access to specialized educational software and courseware which could be down loaded into your local microcomputer or "smart" terminal.

The Privatique Scenario is characterized again by the omnipresence of computers but interconnection via satellite and the central electronic highway is minimal. The Privatique Scenario in educational terms would imply stand alone word processors, computers — micro and maxi, and the individual purchase of, for example, VTR tapes, videodiscs. In contrast these could be ordered up telematically on line and sent to a cable compatible computer or another kind of terminal, even an ordinary television set.

The Rejection Scenario is characterized by the rejection of high-technology machines and a return to direct non-technologically mediated communication. GAMMA believes that the latter scenario ranks with the others in importance. Thus GAMMA has an ongoing programme of research which specifically concerns the person-machine interface and how this interface can be made harmonious and productive instead of threatening and destructive. This research relates to our research focus on the social impacts of the Information Society — privacy — education — employment — health — politics, etc. The other focus of the GAMMA Research Programme on the Information Society is industrial — balance of payments, industrial strategy, productivity, energy, etc.

Promoting Lifelong Learning

As I asserted before one of the most fruitful opportunities which is emerging for us all is the use of these new technologies to enrich and expand learning opportunities. With satellite transmission we are no longer bound by the constraints of geographical location. OECA and U.B.C., among others, have shown us how we may link willing learners and excellent teachers though they be separated by hundreds of miles by using this new tool, with a microprocessor managing the transponder in the satellite, time barriers too can be erased when a learner can access a computer at his or her convenience and enjoy access to data banks or CAL — Computer Assisted Learning — at any point in the 24 hour cycle of our day. Ontario and Alberta educators are leading the way in research on the potential uses of videodiscs in education and industrial traning as many other provinces explore the educational potential of Telidon. Preconceptions about the proper time in our life cycle for learning — 6 - 16, 18, 20 or 22 — must and will change.

Lifelong learning can change from being a tired cliche to a meaningful reality. The need for lifelong learning will become more and more acute as CAD/CAM, robotics and office automation are introduced by government and industry to reap the bountiful gains in productivity which they promise. The dilemma then becomes how we distribute the fruits of these productivity gains. Do we let hundreds of thousands of jobs go by the wayside with all the human tragedy this implies? Or do we seek other answers? Answers such as educational leave for everyone, regular sabbaticals for everyone, reduced working hours for the same pay, job sharing and so on. If we focus on people's needs for income — which can come from the productivity generated by the productivity by the new technology and not on saving jobs per se then, I believe, we shall be on the right track. Naturally this will require extensive cooperation between government, industry, and labor — what we have called "concertation" at GAMMA in our work on *Industrial Strategy and the Information Economy: Towards a Game Plan for Canada.*

In such a transition to a new kind of economic base educators and education will be central to a successful transition in human terms. In such a scenario we shall need both vastly improved opportunities for retraining and much greater activity in the leisure area in which adult and continuing education is a key stone.

Although Telidon cannot be used without a keyboard for truly interactive CAL, Telidon, personal computers, and microcomputers especially designed for educational uses will indubitably add up a new kind of *University of the Air.* Some have said that the epitome of the information revolution would be reached when we each can access all information in existence from anywhere at any time. Daily this rather extraordinary image is becoming closer to actualization. Already on the market there is an electronic briefcase with a built in screen, memory storage, communications capabilities, and features such as word processing. One California company even claims to have a briefcase sized satellite receiver station in the works. Many thinkers in this field have delineated the possibilities of a small plastic card which could hold and protect all of our personal medical, financial, business, educational, and other records. For those who are more Sartorial in their approach but still want the convenience of carrying their personal electronic filing cabinet, there would be neck ties like mine which hold a silicon memory chip.

Thus if I want to check a reference or see if I have paid a bill I just plug into my tie. Of course that's the opportunity side — no bulging filing cabinets taking up space, ready and immediate access via key word so you don't have to remember in which file you put any particular document, and so on. The danger is of course that others who you don't want to have

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access to your history, your records, your ideas may also be able to plug in.

Divergence and Convergence

Two other difficulties which accompany the emergence of an information society are (1) *technological overload* and (2) *information overload*. A technological tower of Babel is emerging which bodes badly for facilitating communications between people and organizations. This is occurring because, like the 19th Century florescence of railways, we are putting machines in place which cannot easily communicate with each other because their programs are written in several different languages. There is a pressing need for agreed-upon standards or at least interfacing mechanisms. Some progress is being made such as Xerox's Ethernet concept and Bell Canada's Envoi 100 system, but we need much more progress in this area. In this context I would like to congratulate the Ontario Ministries of Education and Industry and Tourism for their bold initiative in establishing the functional specifications for a microcomputer for use in education.

Naturally we must also work toward a common use in education. We must also work toward a common programming language, perhaps NATAL, perhaps another, so the courseware we create can be used by all Canadians and, hopefully, even exported. Canada has a tremendous opportunity here both in educational and industrial terms but to grasp it we must work together on a cooperative, concerted national basis. One exciting Canadian hardware development is NABU, the cable compatible personal computer.

Perhaps a national user oriented body of educators is needed to sort through hardware and courseware, provide advice to users, and encourage communication between the educational and commercial worlds both vis-a-vis hardware and courseware. This would avoid the waste inherent in false starts and duplication. As Canadians we have a strong tradition of cooperative effort and in these days of scarce resources such as course is even more desirable than in the past.

Developing our analytic and perceptive capacities to deal with the hardware and software is difficult but even harder is coping with the flood of data, information, knowledge, and ideas which will be increasingly and productively in our daily activities. Managing it effectively will be even harder than in the past so we need much creativity in this domain too.

The new role of education here too is absolutely central to the successful use of the new information technologies in Canada. Central because education as an industry can generate effects — multiply productivity — increase efficiency — in almost all other industries. How? By disseminating the new knowledge about the potential value of these technologies and teaching people and organizations how to use them. In Great Britain the government has spent millions of pounds giving firms money to hire consultants to do this. In Canada — with a new vision of our role as educators we can use our existing institutions to fill much of this need. Redirecting some of our resources in this direction and learning more ourselves so we can teach others are required but we have a solid base on which to build. This is the economic concept of "forward linkages".

Turning from the individual level of analysis we must be conscious of our increasing dependance upon machines and the vulnerability this creates. We are becoming more and more wired but what happens if our *electronic highways* break down or deteriorate. Our banking system is already highly vulnerable to disruption by union action, sabotage, or natural disaster. Can you imagine the equivalent of our postal strikes in the banking system?

Speaking of banking I should tell you that even criminals are having trouble adjusting to the impact of computerization. Bank robbers are having a particularly bad time and may be faced with severe technological unemployment in the very near future. Fortunately Canadian criminals are a visionary lot — there is a dramatic increase in requests to colleges and universities, continuing education departments for computer science and programming courses. This phenomenon clearly implies a danger in the white collar crime area but a vivid market opportunity for adult educators.

New Learning Opportunities

Thinking about opportunities more broadly, if robots and computer based office equipment take over most of the boring and/or dangerous tasks then the possibilities for personal development of all kinds including *self development through learning* become prodigious. I have argued elsewhere in a paper on public policy that with our extraordinary high quality cable, satellite, data, broadcasting and telephone networks in Canada we have fantastic opportunities to innovate in the cultural industries. We can distribute plays, films, dance, music and all other kinds of creative productions so widely to so many more people on a pay per channel or per program basis that the arts can rise from their present impoverished state and all our creative artists can begin to reap the rewards they so richly deserve.

With more leisure, assuming that this leisure is not accompanied by the loss of income, so much is possible. Gordon Thompson has developed the technological model for Ivan Illich's learning exchange concept, the computer based "serendipity machine". Every person becoming his own publisher is moving closer to realization.

Again here our educational system has marvelous opportunity which at once is liberating and delight giving and will, in my opinion, be extremely important to Canada's economic future. Helping people realize their creative and artistic potential, while building a Canadian base in the cultural industries, is one of the key industries of the future. My opinion, that these industries will be central to the economic development of the western countries, is bolstered by Japanese initiatives in videodiscs and other cultural products.

Conclusion

We have seen in this brief conspectus some of the dangers and some of the opportunities which are emerging from the technologically driven information revolution. If this revolution is to liberate and serve the human spirit then we must forsee and forestall the dangers and seize the opportunities. The alternative is repression and enslavement.

In seeking a harmonious relationship with the machines and the changes they will bring with them, we have a particular responsibility as educators. Your active participation and engagement in the learning experience facilitated by conferences, workshops and special journal issues like this, will be an important step in this process. Concretely, I hope your learning about the technology and its potential impact will lead not only to new understanding and insights but some clear recommendations for action which you personally, and your organization, can implement.

AV Standards Report

By Alan J. Powell and Tom Rich

After the Ottawa Conference of AMTEC '79 at Carleton University, an article was published in **Media Message**[1] (the forerunner of the CJEC), which described Canada's involvement in international standards for education and training.

An AMTEC advisory committee was established to permit Canadian participation in the international committee[2] representative of media professionals from coast to coast. A formal proposal was made during the following year (1980) to the AMTEC Board of Directors for AMTEC support in the formation of such an advisory committee.

At the AMTEC '80 conference in Edmonton, a document was circulated to the membership asking for volunteers to give their time as a long term commitment in the development of international standards.

The circulation of this document produced the names of 16 media professionals willing to commit their time and expertise to this work and to present a specifically Canadian viewpoint to the International Committee.

In the fall of 1980, formal approval by the AMTEC Board of Directors was given to this activity under the proviso that **no AMTEC** funding would be committed to the activity.

Over two years have now elapsed since the involvement of the AMTEC advisory committee in the circulation and development of international standards documents in audio visual. At present 19 AMTEC members are on the committee mailing list.

The principle areas of work covered in the standards documents are:

1. Equipment
2. Operating practices
3. Safety standards
4. Interconnections
5. Methods of measurement

Table I shows typical titles which were circulated for comments and then forwarded to the Canadian sub-committee chairman for coordination. They were then returned to the Canadian Council of Canada, International Standardization Branch, for transmission to the IEC in Geneva, where they were recorded as a national Canadian viewpoint, in the long process of adoption as an international standard.

TABLE I

1. "Electrical Requirements for Interconnection Between a Video Tape Recorder and a Television Receiver by Means of an 8 Pin Connector." IEC Document No.60C (Secretariat) 49, July 1980.
2. "Mechanical Requirements for Interconnection Between a Video Tape Recorder and a Television Receiver by Means of an 8 Pin Connector." IEC Document No.60C (Secretariat) 50, July 1980.
3. "Proposed Standard for Audio Pages." IEC Document NO.60C (Secretariat) 52, July 1980.
4. "Labelling for Audio Cassettes." IEC Document No.60C (Secretariat) 52, July 1980.
5. "Control Systems for Two Still Projectors — Operating Practices." IEC Document NO.60C (Secretariat) 53, July 1980
6. "A Guide to the Safe Handling and Operation of Audio Visual Document." Working Group Document — Circulation. IEC Document No.60C WG4, December 1981.
7. "Questionnaire on the Application of Connectors for Remote Control of All Functions on 50x50mm Automatic Slide Projectors." IEC Document No.60C (Secretariat) 58, June 1981.
8. "Video Recording Systems — Operating Practices to Facilitate Video Browsing." IEC Document No.60C (Secretariat) 59, July 1981.
10. Working Group Document on Learning Laboratories. IEC Document No.60C WG5, March 1982.
11. Draft Proposal on Labelling of Audio Cassettes. IEC Document No.60C (Secretariat) 63, June 1982.

Table II gives a listing of standards documents which originated in Canada, as a result of specifically Canadian applied research and development work, carried out in an audio visual centre.

Both items of work were reported on at AMTEC conference in Truro 1981[3] and Winnipeg 1982[4].

TABLE II

1. Report to Working Group 6 on "Projection Television." IEC Document No.60C (Canada), No.1, 1981.
2. Report to Working Group 7 "Audio Visual Environments and Equipment Standards." IEC Document No.60C (Canada) No.2, 1981.

The AMTEC advisory committee has provided the Canadian Committee, IEC CSC 60C with consistent and solid support over the past two years. The result has been the presentation of a specifically Canadian viewpoint on a wide range of areas in audio visual standards for education.

At AMTEC '83, which will take place in Montreal in June, a concurrent session on Audio Visual Standards is in the planning stages. It is anticipated that the session will cover the work of the Standards Council of Canada, and the background and future directions of audio visual standards work.

The article provides an opportunity to thank the members of the AMTEC advisory committee for their hard work and support on a long term commitment to a vital area of work in the future of audio visual operations, planning and development. Any others who would be interested in contributing to the work of the committee are invited to submit their names to either of the authors.

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MEDIA NEWS

By Joe Connor

The Shastri Indo-Canadian Institute has announced details of an exchange program whereby Canadian specialists in various aspects of educational technology will visit New Delhi India in May of this year. The program is designed to encourage exchanges in educational technology between the two countries, and is sponsored by the Shastri Indo-Canadian Institute and the University Grants Commission of India.

The objectives of the visitation are four:

1. To disseminate information on educational technologies and innovative programs.
2. To promote discussion on the possible uses of educational technology in search of the most efficient ways of delivering educational programs to meet India's need for education and training.
3. To discuss the role of institutions of higher education in the field of distance education and training through modern technologies.
4. To consider the possibilities of collaboration between Canadian and Indian institutions in the development of software.

The tentative program has the Canadians involved in two weeks of workshops, first in New Delhi, then at other locations such as Bombay, Osmania University, and Poona University.

The Canadians participating in the program are

Dr. Bill Winn (Co-ordinator)
University of Calgary

Professor Michel Cartier
University of Quebec

Dr. Glen Cartwright
University of McGill

Dr. Gary Coldevin
Concordia University

Dr. Barry Ellis
University of Calgary

Dr. Denis Hlynka
University of Manitoba

Dr. Jeff Potter
University of Victoria

Dr. Ian Taylor
Athabasca University.

Computer Technologies for Productive Learning, the **Fourth Canadian Symposium on Instructional Technology,** sponsored by the Associate Committee on Instructional Technology of the National Research Council of Canada will be held in Winnipeg on October 19th through the 21st, 1983. This national symposium was called to inform the educational and business communities of recent advances in computer-aided learning technology and its applications. Particular attention will be paid to microcomputers, advanced telecommunication techniques, videodiscs, videotex, and speech generation.

For further information contact:
Ken Charbonneau,
Conference Services Office
National Research Council of Canada
Ottawa, Ont. K1A 0R6 (613) 933-9009
Telex: 053-3145

Educators from Austria, Belgium, Canada, Denmark, Finland, France, Hungary, Israel, Italy, Spain, Sweden, Ukrainian S.S.R., U.S.S.R., United

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COMPUTER NEWS

By Rick Kenny

This column is intended to be mainly a vehicle for informing members of current happenings on the Canadian and international educational computing scene. If you have news items which you would like to submit, please forward them to:

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3610 - 9th Street S.E.
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T2G 3C5

TV Ontario Academy On Computers In Education

Beginning February 16, TV Ontario has been offering a twelve week academy on computers in education. The academy is on television-based do-it-yourself learning system designed to help the viewer to become familiar with the workings of a microcomputer and the related terminology, to operate one of three micros (The PET, The Apple II Plus, and TRS-80), to develop simple computer programs, to evaluate and select software for classroom use and to discover available resources. It includes a series of twelve half-hour television programs, four texts, and continual direction from course developers through correspondence and newsletters.

The programs are being broadcast over the TV Ontario network Wednesdays at 9:00 p.m. E.S.T. and are repeated the following Saturday at 12:30 p.m. The series is entitled **BITS** and **BYTES** and features Billy Van and Luba Goy. The supporting tests include a TVO Academy Participant's Guide, an Educational-Applications Handbook, the Bits and Bytes Resource Book (for the television series) and a Hands-on-Beginner's Manual (for one of the afore-mentioned microcomputers).

For further information, contact the TVO Academy on Computers in Education, Part-Time Learning, TV Ontario, Box 200, Station Q, Toronto, Ontario, M4T 2T1.

Consumers Union and EPIE Launch Evaluation Service

Consumers Union, publisher of **Consumer Reports** and **Penny Power** magazines and the EPIE Institute have joined together to develop a new evaluation service designed to provide schools and parent groups with in-depth, unbiased evaluations of educational computer products. They will provide subscribers with detailed reports on computers, monitors, printers and software, as well as with a monthly school consumer newsletter.

The reports will be in the form of regularly updatable and expandable files — to be known as PRO/FILES — and will offer detailed reviews of tested products. The newsletter, MICROGRAM, is intended to be a vehicle for collecting and acting on consumer concerns, complaints, and, hopefully, commendations for good products and services. It will also keep its readers informed of the largest hardware purchased for testing by Consumers Union and EPIE. Microgram will also be published regularly in the **Computing Teacher.**

The regular annual subscription to the service will cost $298 U.S. but a special charter subscription is available for $195 U.S. For more information, contact EPIE — Consumers Union, P.O. Box 620, Stony Brook, New York, U.S.A., 11790.

The U.S. National Diffusion Network

The National Diffusion Network (NDN) is an American, federally-funded system designed to make exemplary educational programs available for adoption by schools, colleges, and other institutions. It does so by providing funds to these programs to allow them to advertise their services to these institutions and to provide inservice training, follow-up assistance, and, in some cases, curriculum materials. All programs are reviewed by a panel composed of education and evaluation experts from the U.S. Department of Education.

Of interest to Canadians from this service may be NDN's catalogue entitled **Educational Programs That Work.** It contains a description of each program, evaluation data, costs (U.S.) adoption requirements, the director of the particular program, and costs $5.50 U.S. per copy (prepaid). Write to:

Far-West Laboratory for Educational Research and Development, 1855 Folsom Street, San Francisco, California, U.S.A., 94103.

Erasable Video Disk Developed

An erasable, re-recordable video disk has been developed by the Japan Broadcasting Corporation. The Japanese prototype uses a helium neon laser to write data on a disk coated with a magnetic film. The laser beam's heat causes local reversals of the film's magnetic field, thus enabling data to be recorded. The entire disk can be erased by placing it in a strong magnetic field. New data can also be written over top of old. Conventional laser disc systems use a destructive form of recording by punching holes in the coating of the disk.

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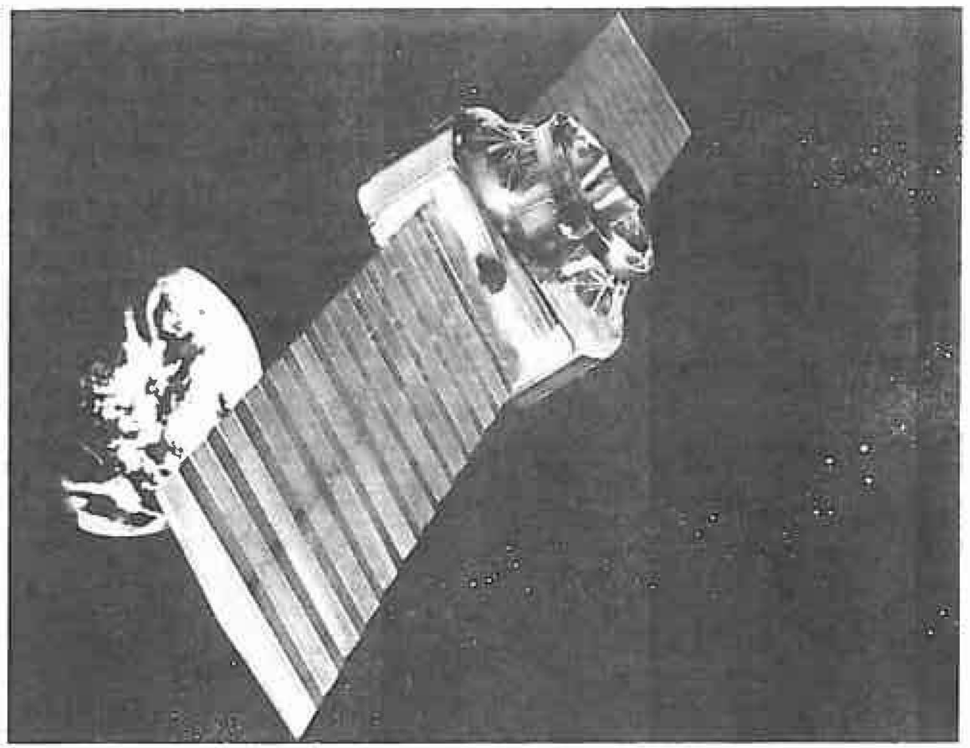
dividualized with respect to the health education needs of the users. We must consider what kinds of things people would want or need on programs. Second, health education applications should be useful to large numbers of people. This being the case, applications would need to be developed that are based on "generic" needs, not so specialized that only a few individuals would benefit from them. Third, health education programs must be developed keeping in mind the variability of health background and experiences of the users. We must recognize that users will be of different ages, educational backgrounds, ethnic identity and health status. Fourth, health education programs should provide more than information needs, they should also be designed to include educational components that could have an impact on attitudes and behaviours.

What kinds of programs could we provide for health education? I think the possibilities are endless and there are many creative minds out there that could provide quality applications. To begin with, however, we could have numerous self-evaluation applications; e.g., computerized dietary analysis with immediate feedback to the user; life-style evaluation, with assessment of health risk factors and feedback re: impact on life expectancy; or mental health application such as life stress analysis. Other possibilities might include a first aid program which could utilize the branching capabilities of the computer to lead the user quickly through decision making to determine rationally what first aid was indicated in, for example, a case of poisoning. Similarly, there could be an important role for programs which could help the user to determine when a physician could be called for a stomach ache, fever, etc. These last two would be especially useful with home terminals. Another useful program might identify potentially hazardous or undesirable interactions of various prescribed and over-the-counter drugs and other substances.

DEPARTMENT OF COMMUNICATIONS



Canada's ANIK B satellite

Implications of Technological Innovation

The issues surrounding the extension of the new technologies into the educational field have been addressed by, among others, Bulger (1982), Butler (1981), Dede (1981), Forsythe (1980), and Hurly and Hlynka (1981).

Christopher Dede (1981) has postulated several effects of technological innovation on education which can be adapted to the health education field as well. A larger proportion of the society will have access to instruction. This means that the potential for impact on the health practices of our society will be tremendously improved.

There will be a high initial capital investment in development and delivery systems followed by an overall reduction in costs in the long term. These savings will be due in part from the substitution of machines for human effort. More people can be reached with a more consistent message using the new technologies — hundreds or thousands at one time as contrasted with the ten to twelve per day who can be reached by public health nurses or health educators at present. Considering the present economic recession and high interest rates, the high start-up costs may delay the utilization of the new technologies, however. The use of such media for health education would require strong political support and it would be quite difficult for politicians to justify the massive costs at a time when there are many other pressing demands.

Finally, to realize potential cost reductions, large numbers of instructional devices must be utilized and curricula will have to be centrally produced. Due to the economics of sale, specialized programs are very expensive while those which have a broad application are much cheaper. This, unfortunately would decrease local control over content.

Erkel (1979) found that unless health care plans are congruent with consumers lifestyles and needs, they will not be implemented. Taking this into consideration then, the centralization of production, while it would decrease costs, could lead to totally ineffective programs. Something produced for the Maritimes or a Toronto audience might be culturally and ethnically inappropriate for a target audience in northern Manitoba since it would depict an environment greatly divergent from that of the target audience. We must also be concerned about the appropriateness of educational level.

Considering the diversity of needs in Canada, it would seem better to have at least regional needs considered. Debbie Bulger (1982) and her colleagues in making a videotape for families of their patient population at the University of Tennessee carefully tailored the videotape to the patient population. Skin tones in the graphics were ambiguous so that white families would see a white mother and baby and black families would see a black mother and baby. Professionals and patients were of both races and all had southern accents. They found that these details made the viewers more comfortable with the information they received.

This experience illustrates the point made by Zimbardo (1977) — that the likelihood that a receiver will accept the conclusions advocated in a given message is in part a function of the receiver's perception of the source's credibility which, in turn, is in part dependent on source-receiver dependability. Similar conclusions have been made from work done by communications theorists at Yale University. Psychological factors are important in any communication but especially so when technology is used. It is most important to pay attention to the local context and provide human support systems especially in remote areas. It is essential that we balance the need for economy of scale with the needs of various cultural or regional groups.

A further consequence of the new instructional technologies will be the necessity for massive changes in both preservice and inservice training for health educators. They must be prepared to do both low-level maintenance and programming of these systems. This will mean an extensive infra-structure and educational support system. A related issue is the technological literacy of the users. More and more children will be learning about the technologies in school but what about their parents or even older siblings? It will be necessary to provide courses for them perhaps through community evening programs or some other form of continuing education.

An issue not addressed by Dede but certainly of concern is the role of the educator. One argument is that the amplication of human effort through the use of technology enables more people to be served in more places at less cost. On the other hand, there is a great concern that there is a unique quality to a human intensive activity, such as education that cannot and should not be replaced by technique or machines.

Forsythe and Hart (1980) feel that what seems to be overlooked in the argument against technological approaches is that standard classroom teaching practices probably do far more to curb individual uniqueness and learning. Their point is that resources can be used to individualize while human beings can be employed to personalize the learning experience and learning environment.

> "The role of the human interface is as a guide, catalyst, learning helper and motivator as well as expert learner. The content of knowledge will be contained in resources such as books, cmputers, videotapes, audiotapes, television and other people. Knowledge itself is as much the process or skill of acquiring it as it is the content and so any human assistance must be well versed in process as well." (15:369)

As mentioned throughout this paper, there must be skilled people, facilities for production and sufficient money available for the production of high quality software in order to make an education program successful. When introducing any innovation, it is also important to consider the attitudes and values of the target population in reference to the change. Individuals need time and assistance to adjust. In the case of this health education scenario, the problem will be to change the focus from illness to wellness, and the responsibility for wellness from the government or the medical profession to the individual or family.

Conclusions

The current economic situation together with swiftly rising health care costs are putting great pressure on the system. How do we provide for optimum health within our resource base? Another pressure is public expectations. There has been a continuing growth in public awareness in the health care fields, coming in part from the generally increasing levels of education. A public which is knowledgeable both demands and expects more. The existence of a universal medicare system contributes to these expectations in that it is assured that if one requires health care, not only is it available to all but also accessible to all. It is evident that it is more usual for the articulate middle class to take maximum advantage. A caring society may have as its goal educating less vocal groups to a better understanding and use of community

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How it Works: Guided Wave Optics

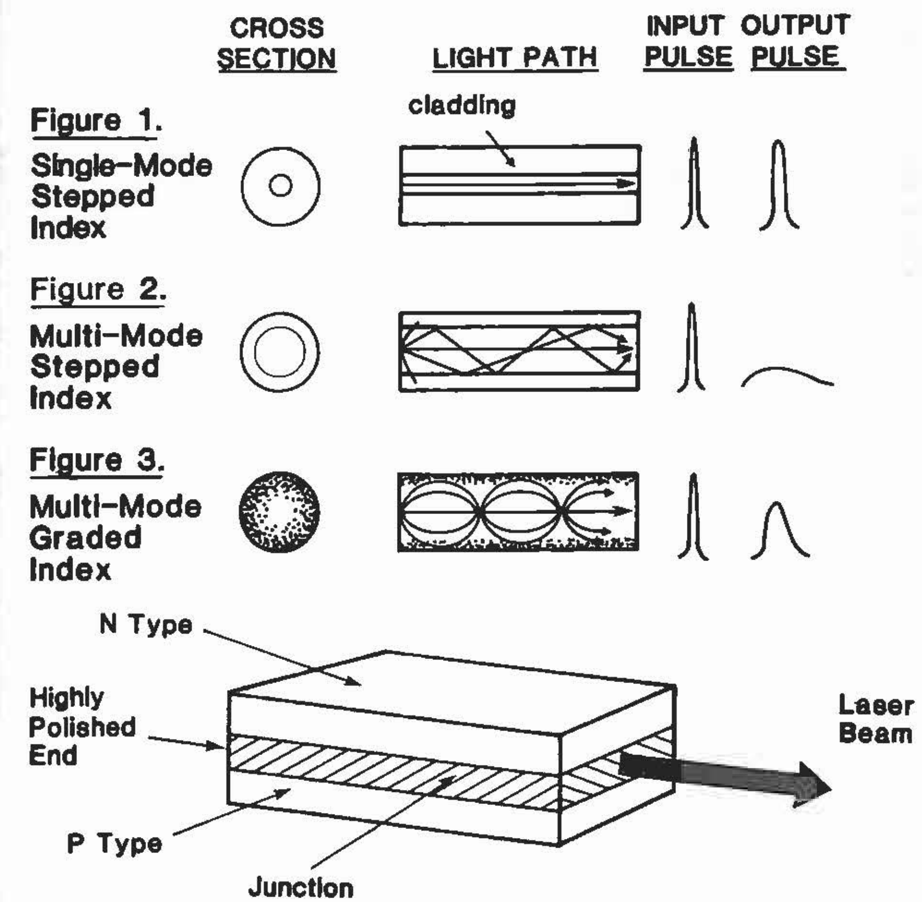

Figure 4. Semiconductor Injection Laser

DEMODULATOR

An optical fibre is a cylindrical glass core of uniform refraction surrounded by a concentric layer (the cladding) which has a lower index of refraction. Light enters one end and as it disperses along the length of the fibre it is reflected back by the cladding. The core diameter of single-(mono) mode fibres (figure 1) is 7-10 millionths of a meter (micrometers). Multi-mode graded index fibres (figure 3) are currently in use as communication lines because they are easier to join (the cores are larger than single-mode fibres) and light dispersion is not as bad as with stepped-index fibres (figure 2).

Light signals are generated in digital code by semiconductor injection lasers (figure 4). An electron moves from the negative (N-type) semiconductor material to the positive (P-type) material as an electrical current is applied. As the electron crosses the junction energy is lost which is emitted as light.

Technological advances soon will make it possible to use single-mode fibres. New installation equipment will allow technicians to align the smaller cores in the field. Newer lasers capable of generating light pulses in picoseconds (trillionths of a second) will use the greater capacity of single-mode fibres. These fibres can carry over 100,000 telephone conversations simultaneously, and television, videotex or other broadband data transmissions at 9600 bits per second.

— Paul Hurly

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resources as well as continuing to provide for the others. How can this be accomplished? One possible scenario, which has been explored in this paper, is a broader application of health education, utilizing the new communication technologies to provide equality of access to resources.

If we accept this scenario as a possibility for the future, as health educators we have an important responsibility in the present. We must learn all we can about the new technologies, what they can and cannot do, and their possible impact upon our clients. We must lobby, become committee members and generally make our presence felt so that when decisions are being made, regulations and standings being set, we can influence the decision makers in ways that will allow the new technologies to be used to best advantage.

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By Patrick Wright

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Mediography

Media on Technology

by Nancy Lane

A few months ago I wrote a column on "Media On Computers": The listing below describes some new programs which deal with the same subject, but focus primarily on the nature of technology and its social impact.

BITS AND BYTES videorecording, TV Ontario, 1983 A series of 10 programs, 30 min. ea., sd., col.

This is a new series, currently seen on television in Ontario. It is a home-computer-instruction course geared to the entire family.

THE COLOR COMPUTER motion picture, McGraw Hill, 7 min., sd., col., 1982.

An introduction the the computer. This film describes the functional aspects. It is geared to beginning programmers and operators.

CONNECTIONS motion picture, BBC, 1979 A series of 10 programs, 40 min. ea., sd., col.

A history of the social and technological changes occuring over thousands of yers which resulted in the technological age in which we live today. Program titles include THE LONG CHANGES, YESTERDAY TOMORROW AND YOU. The writer and presenter is James Burke.

DON'T BOTHER ME, I'M LEARNING: COMPUTERS IN THE COMMUNITY motion picture, McGraw Hill, 22 min., sd., col., 1983

An examination of the use of the computer in the community — schools, organizations, clubs, libraries, etc.

AN INTRODUCTION TO MICROCOMPUTERS motion picture, McGraw Hill, 25 min., sd., col., 1983

Here the uses and potential of the microcomputer are examined.

MANAGING THE MICRO videorecording, BBC, 1981. A series of 5 programs, 25 min. ea., sd., col.

A study of the benefits of the micro to small companies as well as large ones; of the effects of microtechnology on jobs; of the changes which are occuring in working practices and training. Titles are: THINKING SMALL, GETTING IN ON THE ACT, TOWARDS THE LAST FRONTIER, ON LINE, AND THE HUMAN FACTOR.

MEDIA PROBES motion picture, Time Life (Marlin), 1982 A series of programs, 30 min. ea., sd., col.

An exploration of the role of mass communications on daily life. Titles include COMPUTERS AND THE FUTURE, DESIGN, SOUNDAROUND, TV NEWS.

THE TELEVISION EXPLOSION videorecording, Time Life (Marlin), 58 min., sd., col., 1982

The past, present and future of American television is explored. The focus is on new technology and the potential social impact.

FAST FORWARD I Videorecording, TV Ontario, 1979. 30 mins. ea., sd., col.

This series of 13 programs explores the technological revolution and its influence on a number of aspects of daily life. The titles in the first series are: "The Microelectronic Revolution", "The Information Marketplace", "Personal Computing", "Global Television", "Humanized Technology", "Biomedical Engineering", "Communications", "New Perspectives", "Simulations", "Electronic Medicine", "Memory and Storage", "Music", "Television".

FAST FORWARD II Videorecording, TV Ontario, 1981. 30 mins. ea., sd., col.

This second set of 13 programs continues the exploration of technology and its influence on and penetration into everyday living. The titles in the second series are: "Games", "Lasers", "Education", "Electricity/Energy", "Transportation", "Space", "The Business of Information", "Security", "Medicine", "Military Communications", "About Computers", "State of the Arts", "Implications".

GOODBYE GUTTENBERG Videorecording, BBC, 1980. 80 mins., sd., col.

A fascinating account of the effect of the information revolution on everyday life. The program suggests that the electronic text will have the same impact on our society as did the invention of the printing press 500 years ago.

SORTING OUT SORTING Motion Picture, University of Toronto, 1981. 30 mins., sd., col.

This is a film for all levels of computer science instruction. It presents nine sorting techniques, groupd into three classes: insertion sorts, exchange sorts, and selection sorts. The program is computer generated in its entirety.

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Kingdom, U.S.A., will have the opportunity to compare the educational use of new communication and information technologies through a study being undertaken by the national commissions for Unesco in the countries of the European region. The first meeting of the three-year joint study was convened by the Canadian and American commissions in collaboration with the Canadian lead agency — TV Ontario (TVO). On behalf of the Canadian commission, TVO is coordinating the first year of the study aimed at surveying the educational use of the new technologies, studying their impact and identifying areas in which further development, research and evaluation are indicated for pursuit at the national, regional and international levels. For further information contact: Mariette Hogue, Programme Officer, Education, Canadian Commission for Unesco, 255 Albert St., P.O. Box 1047, Ottawa, Ontario K1P 5V8 (613) 237-3408.

The International Council for Educational Media (ICEM) has announced the theme of its 1982/83 visual literacy series competition for students. The theme is "Monster". Entrants in the competition must create a 4-7 minute film, videotape, or slide programme that will tell a story without words. Speech may be used but the plot must not depend on words. Further information is availabe from:
International Council for Educational Media,
c/o Hans G. Kratz,
145 Voyageur Estates
52152 Range Road 210
Sherwood Park, Alberta T5G 1AS

"Database publishing", the field which supplies archive information to professional customers — pharmacists, patent attorneys, stock analysts — has a new storage medium. Microfiche discus can contain 6000 documents or 4-megabytes of data. Laser and electron beam lithography is used to reduce the images, which are stamped onto a clear plastic disc. A workstation, with Apple II computing power, is used to locate the indexed information and to display it on a high resolution video screen.

The Toronto International Centre is the site for Computer Fair 1983 on June 23rd through the 26th. Computer Fair will stress microcomputer applications in telecommunications, education, word processing, graphics, music, games, languages, database management. Lectures, seminars, and a large exhibit display will highlight the fair.

For further information contact:
Debbie Bannon
Cam MacDonald
Computer Fair 2283 Queen St. E.,
Toronto, Ont. M4E 1G6 (416) 690-9666

SaskMedia, a Crown corporation established in 1974 to produce and distribute educational materials, will be dissolved March 31, Gary Lane, the minister responsible, announced Jan. 19.

The government will continue to distribute educational materials, such as films, slides, tapes, video-tapes and transparencies, but the private sector will be invited to take over production, Lane said.

Cabinet decided to get rid of the Saskatchewan Educational Communications Corporation after receiving recommendations from an internal advisory committee established in September to assess the corporation's performance.

Elimination of SaskMedia will save the government about $1 million a year, Lane said. The corporation's assets, including the film and tape library, and 40 of the 64 employees will be transferred to the education department.

The distribution services will be maintained as a separate unit within the department until more permanent accommodations can be made, and attempts will be made to accommodate the remaining 24 employees elsewhere in the government, Lane said in a release.

The government will try to encourage private production of educational programs by allowing Saskatchewan film producers to use SaskMedia's production facilities at a favorable cost, the minister said.

"The private sector can effectively fulfill many of the government requirements for the production of educational programs, whereas the production services of SaskMedia have for some time been the object of severe criticism on the part of dissatisfied customers and private sector competitors alike."

—Reprinted from the Saskatoon Star-Phoenix, Jan. 19, 1983.