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ABSTRACT

Videotex is a generic term used to describe computerized two-way information delivery systems designed for simple, mass-market use which provide access to computer-based information via a telecommunications link and an information display, usually a modified home television set. In Canada videotex has become almost synonymous with the name Telidon, which has been described as a high level, efficient communication code for the creation, storage, and transmission of graphics and text. Telidon has been used by both academics and corporations in experiments, field trials, and applications for formal and nonformal education purposes. Flexible enough for use by people of all ages, Telidon has been applied in computer assisted instruction courses, business and information libraries, information databases, supplements to science and museum educational exhibits, distance education and teleconferencing programs, special education programs, TVOntario educational sequences, and many others. Some of the issues surrounding the use of Telidon/videotex are: (1) the need for more research, development, and evaluation in distance education, special education, and in the broader field of computers in education; (2) the need for support materials and resources; (3) the need for local access to page creation facilities (and inexpensive equipment) and the potentially prohibitive cost of the Telidon/videotex system; and (4) the effects of Telidon/videotex on privacy, employment, industrial development, technological change, and other 'social impact' questions. (30 references) (DB)

TVOntario

Office of Development Research
Bureau de recherche pour le développement

NEW TECHNOLOGIES IN CANADIAN EDUCATION

PAPER 11

EDUCATIONAL APPLICATIONS OF VIDEOTEX/TELIDON IN CANADA

By Joy Wilson

Study Coordinator
Ignacy Waniewicz

January 1984

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NEW TECHNOLOGIES IN CANADIAN EDUCATION

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Paper 17 New technologies in education in Canada: Issues and concerns

Copies of these papers can be purchased from TVOntario, Box 200, Station Q, Toronto, Ontario, Canada M4T 2T1.

FOREWORD

We dedicate this series to its designer and director, Ignacy Waniewicz. His death on February 21, 1984, has left us with a feeling of immeasurable loss.

With uncanny intelligence, instinct, and energy, Ignacy introduced the first educational television programs in his native Poland in 1957 and rose to the position of Director of Educational Broadcasting. During the mid-1960s, he served as a Paris-based program specialist in the educational use of radio and television, working for UNESCO in Chile, Cuba, Ivory Coast, Upper Volta, Mexico, Egypt, Nigeria, Senegal, Ghana, Great Britain, United States, Switzerland, and Israel. Ignacy shared the experience and insight he gained from this work by teaching and writing in Polish, German, Russian, Hebrew, Spanish, French, and English. His achievements are widely recognized in the broadcasting and academic communities on four continents.

As Director of the Office of Development Research at TVOntario, Ignacy explored his farsighted and consuming interests in adult education, media literacy, television as a primary tool for lifelong learning, and most recently, the educational uses of new technologies. His work did much to shape and guide TVOntario's progress over the last 15 years.

It is with love and respect that we dedicate this series to Ignacy Waniewicz. In its enormous scope, its thorough documentation, its emphasis on concrete results, and its concern with educational issues, this series reflects both Ignacy's vision and his intellectual legacy.

Donna Sharon
for the Office of Development Research

Preface to the Series

NEW TECHNOLOGIES IN CANADIAN EDUCATION

These papers in the series "New Technologies in Canadian Education" are the result of an international commitment. In June 1980, the Third Conference of Ministers of Education of Member States of the European Region of UNESCO adopted a recommendation requesting the member states to carry out joint comparative studies on well-defined problems of common interest in education. At a subsequent meeting of the European Region National Commissions for UNESCO, 14 subjects were agreed on for joint studies.

The theme "New Technologies in Education" was selected as study #11. The 17 countries participating in the study are Austria, Belgium, Denmark, Finland, France, Hungary, Italy, the Netherlands, Poland, Spain, Sweden, Ukrainian SSR, USSR, United Kingdom, as well as Canada, Israel, and the U.S.A. who are also members of the UNESCO European Region. At the first meeting of the national coordinators from these countries, held in October, 1982, at the University of South Carolina in Columbia, South Carolina, U.S.A., a plan was adopted for the study. In the first phase of this plan, the individual countries are to report on the ways in which the new technologies are being used in education. (A brief outline of the international design is available on request.)

The Canadian Commission for UNESCO was requested to coordinate, on an international level, the first year of the study. We are grateful to the Canadian Commission for selecting TVOntario, and the Office of Development Research (ODR) to be in charge of this task. The ODR was also asked to coordinate the Canadian contribution to the study, with financial support from the Department of the Secretary of State. We gratefully acknowledge their assistance.

In preparing the Canadian review of the use of technology in education, the ODR contacted a number of educators, academics, government officials, administrators in educational communications organizations, and others, across the country. It became apparent that there was a strong need for a well-documented account of the uses of both the "older" technologies (e.g., film, audio, television) and the newer technologies (e.g., computers, videodiscs, videotex) in the complex Canadian educational system.

Early in 1983, several types of research activities began simultaneously: designing instruments to gather information from each type of institution or interest group, identifying uses and users of each type of technology, and exploring the areas where Canada's distinctive features predispose toward technological developments. The 17 papers listed on the back of the title page emerged as a result.

Information for these papers was provided by hundreds of individuals expressing their own views or reporting on behalf of educational institutions and organizations, government departments, public and private corporations. We extend to them our sincere thanks.

I would like to acknowledge the contribution made by Thelma Rosen who assisted in the development of the inquiry instruments and played a major role in the gathering of this information. The task of supervising the final editing, production, and distribution of the papers was assigned to Donna Sharon. Her resourcefulness and persistence have contributed greatly to the completion of this series. Sharon Parker typed most of the papers from the initial drafts to their final versions. Her dedication made it possible to complete the study in such a relatively short period.

While the preparation of these papers has been supported by the Canadian Commission for UNESCO and the Department of the Secretary of State, the papers' contents do not necessarily reflect the official views of either party on issues related to technology in education.

Ignacy Waniewicz
Study Coordinator
Director
Office of Development Research
TVOntario

January 1984

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INTRODUCTION

Videotex is a generic term used to describe computerized two-way information delivery systems designed for simple, mass-market use. Its world-wide technological development is an important part of the "information revolution" that many industrialized countries are now undergoing. "The technologies which underlie the 'information revolution' at once reflect our culture and reshape it.... They do not evolve simply from their own internal logic but are heavily shaped by dominant economic and political forces ... and so it will be with ... videotex."[1] In Canada, videotex has become almost synonymous with the name Telidon, which is used variously to describe the technology, the videotex system, and the graphics presentation protocol.

Developed in Canada by the Communications Research Centre of the federal Department of Communication, Telidon has attracted the attention and participation of many innovative individuals and institutions because of its potential applications to, and impact on, education. These applications reflect the development of the technology and its place in a Canadian industrial and educational strategy.

The main purpose of this paper is to give an overview of the educational applications of Telidon, and the issues connected with them.

TELIDON: AN INTRODUCTION TO THE TECHNOLOGY

Telidon: A definition

Telidon has been described as a high level, efficient communication code for the creation, storage, and transmission of graphics and text, independent from display hardware limitations.[2]

A code is a set of symbols designating a set of characters or a particular geometric shape (e.g., a circle). For example, the American Standard Code for Information Interchange (ASCII) has almost universally been adopted by the computer communications industry for the assignment of character codes (symbols) for text. The Telidon Presentation Level Protocol builds upon the existing ASCII standard by including a supplementary set of characters and a series of commands known as Picture Description Instructions (PDIs). It is this enhancement and extension of the ASCII code to include PDIs that form the essence of Telidon.

Picture Description Instructions (PDIs)

PDIs describe any picture or graphic image in terms of its basic geometric elements - point, line, arc, polygon, and rectangle - with a separate command to shift from a graphic image to alphanumerics (letters and numbers) for text messages. It is, therefore, known as an alpha-geometric code. Owing to this capability, it can describe smooth lines and curves that the earlier alphamosaic systems had difficulty creating. (In an alphamosaic approach, images are composed by building up a series of colored blocks, or squares; for example, a curve drawn by that method will look like a staircase rather than a smooth line.) Moreover, an alphamosaic image fills in sequentially, line by line, across the television screen until the entire picture (text and graphics) is displayed. With Telidon, the order in which text and graphics are displayed is up to the page designer or creator. In fact, this order of display can be changed after the page is created, if the page creator wishes. For example, a designer may review the appearance of a page, and decide that a particular graphic image should have a caption. The caption can be added to the page, and the designer can then order the system to display the caption before

displaying the graphic image. Additionally, this function can be used in conjunction with a time-coded instruction embedded in the page display commands to give the designer some flexibility in creating limited animation of images. Telidon can also describe images as a series of scanned points in color or in black and white; as a result, photographs can be copied and reproduced to form a facsimile.

This alpha-geometric code is the heart of Telidon. It was devised as a simple code that would not depend upon any one display technology: it can be displayed on a home television set, either at the North American standard of 525 lines per screen or at the European standard of 625 lines, or on any other kind of display (a high-resolution computer terminal screen or a non-TV technology such as a liquid crystal display). For that reason, it is known as a hardware-independent graphics code, and it should not become outdated as communications technology develops.

As a result of its initial capabilities, Telidon's alpha-geometric code became, in 1980, one of three international standards recognized by the International Telegraph and Telephone Consultative Committee (CCITT), which is the United Nations agency responsible for setting international telecommunications standards.

The graphics code itself should not become obsolete because it permits the addition of new features. For example, the original code could display only eight colors but is now capable of displaying any color imaginable. (Note: the code produces this color range by manipulating the brightness or dominance of the three electronic color "guns" - red, green, and blue - used in video display technology.) Recently, increased capabilities in the animation and manipulation of images have been achieved; for example, a circle can be instructed to turn into a different shape altogether (such as a rectangle) after a specified period of time. The Telidon code, with its new expanded capabilities, was accepted as a North American standard in 1981, and has been formally adopted as a North American Presentation Level Protocol Syntax (NAPLPS).

The formal acceptance of the NAPLPS standard is significant because the adoption of standards gives assurance to equipment manufacturers and users that products are less sensitive to obsolescence. There are now three standards for

videotex systems throughout the world that have CCITT approval and they are: the Alpha-geometric (NAPLPS), the Alphamosaic CEPT Format endorsed by the Conference of European Post and Telecommunications Administration, and Japan's Alphaphotographic Captain System. The task now facing governments and industries is not which of these standards will become the world standard, but rather to develop common functions within these three standards to facilitate their interconnection. This is of particular concern to those who wish to market or exchange content applications (including those in education) at an international level.

Telidon as a graphics code can be incorporated into any database management system, or it can be used to enhance a software program by, for example, adding graphics to a computer assisted learning program written in many languages, including BASIC, PASCAL, or FORTRAN.

Obviously, electronic graphics can be used to enhance computer-assisted learning in the same way that graphics enhance the text of a book. Electronic graphics can be used also to supply the graphics for an audiovisual presentation, such as a slide show or a television program. The interest in Telidon as a graphics code for use in education is, therefore, not surprising. When, in 1978, TVOntario was exploring the feasibility of offering a broadcast videotex service to supplement its television programs, the superiority of Telidon's graphics was a key factor in the choice of Telidon over the European alphamosaic systems.

That choice also reflects the fact that Telidon has quickly been recognized as much more than just a graphics code: it has become associated with a particular type of information retrieval system known as videotex.

Videotex systems

Videotex is the name used for a whole class of electronic systems, of which Telidon is only one implementation. A videotex system has three essential elements:

- A source of computer-based information, remote from the user.

- A connection to the source by a telecommunications link, such as a telephone line, coaxial cable, optical fibre, or broadcast signal.

- An informaton display, usually a modified home television set.

The information usually appears in response to the command of the user, who selects the desired information from a wide choice of material made available by diverse groups of information providers (i.e., the publishers or producers - the people who create the content to be viewed).

To enable this information to be obtained easily by the general public, a system of organizing the information had to be devised that would not require the user to have specialized training.[3]

The structure of videotex/Telidon information

In designing a service for the general public, a simple approach to obtaining information was developed. Information is stored at the source computer in a numerically based "tree structure" composed of a main index page consisting of nine topics from which to choose. A page is a "screenful" of information. The main page acts as the "trunk" of the tree. Each of the topics from this page may lead to other pages offering other sets of nine topics each. These subindexes descend and branch out from the main index. Once a user selects a topic from an index page, the topic is presented as a series of continuous pages, in much the same way that a reader turns to a particular page in a book after looking it up in the table of contents. (See Figure 1.)

There are two ways to get to each page in the tree: it can be found by following the branches of the tree, or it can be retrieved directly by pressing its page number on the numeric keypad attached to the videotex set - assuming the user knows the right page number. While this structure lends itself to simple information retrieval (locating a topic by "menu" searches, then reading a series of "pages"), creative educators can mix menu or "multiple-choice" pages with information pages to create lessons that involve the student in an active decision-making process in which the Telidon

Figure 1

SAMPLE TELIDON TREE-STRUCTURED DATABASE

OPENING PAGE:
MAIN INDEX/MENU

Business/Finance	1
Education	2
Entertainment Listings	3
Games & Quizzes	4
Government Services	5
News, Weather, Sports	6
Retail Information	7
Statistics	8
Travel & Tourism	9

Choose selection by pressing #

(Return to this page by pressing 2 up arrows ^ ^)

Education Main Menu

(submenu)

Art & Science Courses	1
Business and Commerce Courses	2
Vocational/Trade Courses	3
Correspondence Courses	4
Distance Education	5
Educational Event	6
Educational Games	7
Educational Reports	8
Subject Index	9

Business and Commerce Course Menu

(submenu)

Accounting	1
Bookkeeping	2
Data Processing	3

(To return to education menu press up arrow ^)

(Actual content pages; to go to next page use forward arrow)

ACCOUNTING COURSE Level One In this course you will be expected to learn... ..... To continue press >

ACCOUNTING COURSE Level One Also, you will be tested weekly..... ..... >

lesson is characterized by an interactive "dialogue" between the student and the videotex system. Since 1982, it has been possible to offer users up to 25 choices per page, and to assign names to the pages to facilitate the use of a keyword, or alphabetic approach, to accessing information (by means of a keyboard). At the same time, advances have been made in the linking of interactive computer programs to a videotex structure. In this way, "transactional" software has been made accessible for use by the general public, giving them the opportunity to make (or "transact") bank deposits or withdrawals, order shopping items from an online catalogue, express their opinions in an electronic poll, calculate mortgage rates and engage in other such types of activities. Of more interest to educators is the fact that this linking capability can be used to incorporate computer assisted (or managed) programming within the context of a videotex learning system. However, these advances are relatively new additions to videotex, and almost all the educational applications developed between 1979 and the Spring of 1983 were designed in the context of the original tree structure.

Page creation

For almost all the applications undertaken and subsequently described in this paper, pages were created manually, using a device known as an Information Provider System (IPS). These are specialized desk-size minicomputers equipped with a display monitor, keyboard, and graphics tablet. Using the keyboard and tablet, a page creator uses a set of simple commands to enter text or to draw graphics according to Telidon's simple geometric principles. The cost of these minicomputers averages $20,000 (Canadian). The cost and size of these units limit both their availability and their portability.

In most Telidon field trials, the system operators use these units (acquired mostly from the manufacturing firm, Norpak) on their premises. The information providers are able to share the use of the units at a central site. In creating their content, information providers would either use the shared facilities and create their own material, or pay a page-creation fee to a private company or individual. The price depends on the ratio of text to graphics and the complexity of the graphics; fees vary from $10 for a simple

text and graphic page to over $100 for a complex graphic page.

Initially, the graphic functions of the IPS unit were restricted to the use of eight colors and the creation of images through the basic geometric functions (arc, circle, dot, line, rectangle, polygon) combined with a simple text entry command. Elements (or objects) drawn on the screen could be erased, moved, copied or re-ordered to display before or after another element. The mechanics of the system were such that someone could learn to create pages within one to two hours of instruction and practice. By 1982, more sophisticated functions were available for use. For example, the addition of six shades of grey increased dramatically the sophistication of graphics possible; the elements or objects on the screen could be manipulated to change in size (using a scale function) or to change direction (through rotation or reflection); and some text editing functions were introduced. An ability to overlay images from one page (screenful) to another allowed creators more flexibility in their instructional design. However, with every new refinement in the technology, there was a proportionate rise in the amount of time required to master the new techniques available. Thus the average training period in which to acquire proficiency in page creation extended upwards of a week or two. With implementation of the most sophisticated level of Telidon refinements - the NAPLPS standard - considerably more time and training are required. The impact of these technological developments on skills acquisition and the resulting development of a new field of study are discussed later in this paper.

As the capabilities of the Telidon code increased, the IPS units were continually upgraded. At the same time, alternative microcomputer-based page creation systems (less expensive, with the same capabilities) were being developed. Unfortunately, their development and implementation came too late for incorporation into general use in the field trials and applications reviewed in this paper.

Even as the technology has grown rapidly in sophistication, Telidon's fundamental appeal remains that of a tool which is designed to allow individuals, such as teachers, to create, control, and command their own content applications. The time needed for creating can vary from 10 minutes a page for text with a colored border, to several

hours for graphic elements. It is a process which can be expensive or time-consuming or both. Initially, there was no formal training for page creators who had to learn informally from others and from the manufacturers' manuals. Thus, time had to be allotted within the development of content applications to allow for learning the actual mechanics of page creation. These factors of access to resources and time for the acquisition of skills are important variables, particularly for educators. For, in general, educators have to balance these factors within an overall time-frame that includes their regular teaching/administrative workloads. Once the pages are created, they are put into a large host computer and made available for distribution to the user's videotex terminal.

It should be pointed out that the quality of any content developed depends upon not only the accessibility of resources and time, but also on the skills each content designer/page creator has to bring to the task of production (or each team, as some schools and institutions divide the production process amongst a number of people - a subject specialist, writer, graphic artist, database analyst). While educators who are involved in content development have the necessary subject background and pedagogical skills for creating learning units, all are faced with the challenge of acquiring the mechanical, conceptual, and creative skills required for working in an essentially new medium - videotex. By its nature, videotex demands conciseness, coherence and continuity of text and graphics if it is to be used as an effective communications device. Furthermore, motivational and presentational factors have to be assessed and incorporated into the content design to achieve a specific educational objective matched to a specific target audience. For example, this process needs to address a number of questions, such as: Should a lesson be linear in presentation or highly interactive? What vocabulary level should be used? What colours and size(s) of text are needed for legibility? What graphics will enhance or detract from the central message? What mix and order of display of text and/or graphics are required to sustain interest and to communicate effectively?[4] While many content designers/page creators with little training have learned to use the technology productively, many others have felt that specialized training in writing, graphics design, and database structuring is needed for content development. As Telidon develops in

sophistication (in programming and presentation), so also will the skills needed for content design.

Videotex and teletext

There are two forms of videotex: two-way, or interactive, videotex and one-way broadcast videotex. The latter is often referred to as teletext, the term that will be used in this paper. Both forms can deliver and display text and graphics; in both cases the user selects the page (or screenful) to be viewed by means of a keypad or keyboard attached to the display terminal or television set (adapted with a videotex decoder). The essential differences between the two forms lie in the quantity of information they make available and the level of interaction they offer to the user.

Teletext transmits pages from a source, or "host" computer, to a modified television set, i.e., one equipped with a videotex decoder to display the electronic information in video form, in the same way that a television program is transmitted. Broadcasters can take advantage of the unused lines in the broadcast television signal, known as the vertical blanking interval (visible as a black bar if the picture screen rolls), and can encode, or place, the videotex pages on those lines. In a sense, they are "piggybacking" the digital information onto the broadcast signal. About 300 screenfuls or pages of material can be accommodated in the vertical blanking interval. However, should a broadcaster be able to devote an entire channel, i.e., all the 525 lines available, then several thousand pages of material could be distributed simultaneously. In either case, the entire database, or collection of pages, is accessible to the viewer since it is repeatedly transmitted page by page in a cyclical manner. When a user requests a page, the decoder "grabs" the page as it goes by in the broadcast signal and displays it on the screen. If the broadcaster chooses, the content of the pages can be changed quickly and efficiently at the source computer. Since the user cannot send a message back to the computer or use the service to communicate to another user, the teletext form of videotex is called "one-way."

One-way videotex has the advantage that there is no limit to the number of simultaneous users of the service, as long as they have a videotex terminal or television set and are within the reach of the television transmitter. Another

advantage is the cost-effectiveness of a system that can use the existing television network facilities for distribution. The signal may be provided as an additional "free" service to the end user, whose only expense may be the videotex decoder or terminal, with no additional "carriage fee" for receiving the information over the airwaves.

Nonbroadcast videotex is called two-way because the user is connected directly with the originating host computer by means of a wired connection (cable, telephone, fibre optics). He or she may communicate with another user of the service through an "electronic mail" function, or in a more direct dialogue in which they "share visual space" in an electronic version of a telephone conversation. The interactive capacity of videotex enables it to accommodate individualized responses and record keeping, since it can be programmed to handle complex databases. This increased complexity of response is essential if the system is to be useful at all to educators as a form of computer-assisted, or computer-managed, learning. Unfortunately, during the Telidon/videotex trials, few of these advanced, interactive capabilities were available. The other advantage of videotex is its ability to store hundreds of thousands of pages and make them accessible to a user.

However, the number of users that can access the service at any one time depends on how large or powerful the source computer is, i.e., how many requests it can process at one time, and how many telephone "ports," or lines, there are in the computer. If too many people dial in, they may get a busy signal.

The linkage of host computers (in a central location, or through a regional network of hosts) should ensure equitable access on a technical level, but the issue of retrieval costs remains.

During the Telidon field trials, the end user has been given the use of the technology and its information services free of charge or at a low cost which has been heavily subsidized. In future, however, the cost of telecommunications facilities (rental of telephone lines and data carriage costs) and even the information, which is a commodity, will have to be paid for by some means if a videotex marketplace is to evolve. The educational system constitutes a major part of the potential market, both as a

buyer and a seller. The cost of operating and accessing an educational videotex service will have a significant influence on its feasibility and acceptability as an educational tool.

To a large degree, the acceptance by business and home consumers of a broad range of videotex services will be crucial for the financial feasibility of an educational market. As one educator, Robert Abell, has pointed out, "the educational world and particularly the distance education/continuing education segment, has a large stake in the industry/business related trials because only a substantial success here will lead quickly to a widespread terminal availability and reduced price."[5]

TELIDON IN EDUCATION

Compared to the development of microcomputers, which could be considered as evolving from a grassroots market demand, the development of Telidon is notable as a "top-down," technology-driven approach to creating a market for a new technology. It has been called a "technology in search of an application, i.e., a solution looking for a problem,"[6] and this has been especially so in education.

In the search for Telidon applications, the federal government created a four-year Telidon program to "effect the transfer of the technology from the research laboratory."[7] Funds were allocated for support of research and development, public trials, standards, advertising,[8] and industrial, commercial, and public-sector exploitation.

The program stimulated the participation of industry through subsidies for various activities, companies, and agencies in the public and private sectors (for example, manufacturers, systems operators, electronic publishers, information providers, and telecommunications carriers), all of whom were expected to spend much more money on development than they would receive from government funding.[9] "Since education is a provincial matter, it [was] not included in the national objective of the program."[10]

Nevertheless, educational representatives were included in a senior advisory committee which the Department of Communications set up early in the program. The committee, known as the Canadian Videotex Consultative Committee (CVCC), was planned as a forum in which various sectors - broadcasting, publishing, manufacturing, consumers, and so on - could come together to exchange advice and information and to act as a lobby group to government and industry. The committee, in turn, created subcommittees to deal with such things as standards, legal matters, education, marketing and industrial matters, and social implications. The existence of an education committee at the national level was a recognition on the part of government and industry of the potential role that this sector could play in the development of videotex systems. This recognition evolved from a number of events that had occurred in the initial videotex trials in the country.

Educational interest and involvement: Background

In 1979, Bell Canada, the telecommunications carrier in Ontario and Quebec, conducted a pilot videotex trial, using an alphamosaic system, to "assist in technical and business evaluations of the service. Twenty-five user terminals were employed with access to some 2,000 pages of content, ranging from informational content to interactive games and calculations; the user terminals were loaned to interested participants in government, education and information-provider organizations...as well, terminals were demonstrated in company offices and at public trade exhibitions. Public reaction was very favorable. From a marketing point of view, residential customers showed high interest in educational and consumer-oriented services."[11]

As a result of the pilot trial, Bell Canada held a major field trial of videotex using Telidon. This was the VISTA trial, which lasted from 1980-83. Although Bell's primary purpose was to conduct a commercial and consumer trial, it kept the initial evaluation of services in mind and encouraged educational information providers to participate. That participation was facilitated by Bell's agreement with the Department of Communications and TVOntario with regard to sharing Bell's VISTA host computer for storing and distributing TVOntario's educational videotex material. (As in all the telecommunication carrier trials in the country, Bell functioned primarily as the carrier of signals provided by outside information providers, as required by federal regulations.)[12] The popularity of educational material in the home market lent emphasis to the need for a separate subcommittee of the CVCC to address the needs of education.

At the same time, the emergence, in 1979, of a large-scale educational field trial of Telidon, i.e., the TVOntario trial, helped to further the development of the education subcommittee. Initially, TVOntario was interested only in testing and developing Telidon as a broadcast videotex (teletext) service, but it quickly changed its view of Telidon as a supplement to television and came to recognize "videotex systems with Telidon graphics as an educational medium in their own right. So ... TVOntario moved ... to an integrated approach using both the teletext and the videotex approach"[13] in order to explore the widest range of educational applications possible within the limits of the resources available. It was assumed that there would be a

complementary, not competitive, relationship between the two services. Teletext would present educational news, supplementary information to the educational television broadcasts, short learning units, and other topical items. The videotex service would provide longer, less time-sensitive information such as basic reference material, lessons that could use a computer-assisted instruction approach to learning, course descriptions and information from college calendars, educational reports, catalogues of videotapes, and so on. It is from that broader perspective that TVOntario has participated in the education subcommittee.

The subcommittee "advises the CVCC on educational applications of videotex systems and liaises with educational authorities to stimulate interest in the field."[14] As a Department of Communications (DOC) representative stated, "The Education Sub-Committee may well serve as a model of national involvement. For the purpose of its work, it has divided Canada into six regions. Regional chairmen bring the inputs and concerns of their regions to the national committee. Recommendations for government action have been produced and circulated. Active work is going on to articulate educational orientation and priorities, as well as facilitating mechanisms."[15]

Those early developments show that, while education per se was not part of the federal objective for Telidon, there was nevertheless a strong educational presence in all aspects of Telidon's development - as a matter of CVCC policy, as a field trial operator (TVOntario), and as information providers to many of the Telidon field trials.

Moreover, numerous educators and educational institutions (particularly universities) became involved in the research and development of the technology: a professor of library science from the University of Toronto contracted with Bell Canada to evaluate the tree-structured databases; a professor at the Université du Montréal wrote "A Study of the Human Response to Pictorial Representation on Telidon" for the DOC Behavioural Research and Evaluation Group. The First Montreal Workshop on Videotex Technology in 1980 received many presentations from professors of information or computer sciences, as well as from the industry. Continued research and development into all aspects of Telidon and videotex systems have been maintained since at the Université du

Québec à Montréal, with its "laboratoire de télématique." Notable amongst its publications is a treatise on the nature of "la télématique" (the covergence of information and telecommunications technologies) and "la médiatique" (the art and science of creating and organizing the information carried by the new information technologies - la télématique). This work at the university has played a leading role in the recognition that videotex must be treated as a new communications media, requiring its own research and study as an emergent academic discipline or field.

At the same time, faculty and students at the University of Victoria, in British Columbia, have been instrumental in the developing convergence of Telidon and microcomputer technologies. The development of a microcomputer-based page creation program (for Telidon graphics), and the use of Telidon graphics to enhance computer-assisted instruction programs for microcomputer use, are two examples of the work undertaken. As well, in 1981, two of the professors wrote, compiled, and edited a book examining the marketplace aspects of Telidon and its potential - an event that has helped raise public awareness of the technology and its socio-economic implications.

These are only a few examples of the part played by academics in the development of Telidon, but it is a role that should not be overlooked because those studies and workshops have parallelled and influenced developments in the design and implementation of Telidon's educational applications.

Before discussing the applications undertaken, it should be noted that in the transfer of the Telidon technology from the federal government's laboratories to the operational field trials, the emphasis in government funding has been focussed on the development and deployment of hardware and operating systems support (i.e., terminals, communications networks, the computer programs to create, store, and display content created by information providers). The actual design and creation of content to display on the hardware/network configuration have received the lowest funding priority - whether the content application planned was for commercial or educational purposes. The costs of creating pages/applications were primarily borne by the information provider. While access to page creation equipment was, in general, provided free of charge to information providers,

the staff time required for travel, training and production often represented a high overhead cost for these information providers - with no cost recovery mechanism available (the end user may or may not have had to pay for the transmission charges for receiving information, but did not pay an additional charge for the information as a commodity in itself). For educational institutions, in particular, the costs of participating in content production were often an inhibiting factor in terms of their level of involvement in the different field trials. It was not until 1984 that the federal government released funds specifically set aside for the development of content applications - with priority given to content with commercial viability. Given that education is a provincial jurisdiction in Canada, public funding of educational content has been, and likely will remain, the responsibility of each provincial government.

This political and economic reality forms the context in which the educational applications discussed in this paper were developed, and will no doubt continue to be the reality in years to come. It is a key factor that underlies the apparent "patchwork quilt" pattern that occurs in the development of educational applications across the country (i.e., the differing levels of activities in some - but not all - provinces, and the lack of a cohesive "national" approach in content development). Given the discrepancy in funding priorities and commitments between the two levels of government (federal and provincial), it is not surprising that a recurring theme amongst educators involved with Telidon was and still is the need for a more public fiscal support for content development and a parallel need to share resources and strategies for development - at both provincial and national levels.

Educational applications

Experimental uses of Telidon have been developed or planned for all levels of education, formal and nonformal, from elementary school to university, as well as for special and continuing education. This paper will give particular attention to the applications that were developed with a specific educational purpose in mind, and whose implementation has yielded some preliminary findings regarding the utility of Telidon in education.

Nonformal education, home market. The Manitoba Telephone System has been involved in two trial projects (Ida and Elie) that incorporated Telidon videotex services within an overall communications service to the home and farm environments. Project Ida was a short-term trial that involved 100 homes in an urban suburb of Winnipeg, with a wide range of services offered (additional television services, automatic fire alarm reporting, automatic utility metre reading, digital telephone service, and a videotex service) using coaxial cable as the delivery system. Project Ida and the longer-term rural trial, Elie, acted as catalysts for stimulating the interest of educators in videotex. Elie was primarily a fibre-optics trial in the rural communities of Elie and St. Eustache, but it served as a vehicle for the delivery of a major videotex service known as "Grassroots." The trial began in 1979, with 150 subscribers.

Satisfaction with the field trial resulted in the decision to continue its operation as a national test-bed for future technology and service trials. For the trial, two information providers offered videotex services. Infomart, a major Telidon system operator and service provider, has offered a commercial service for farmers (under the name 'Grassroots') with a focus on agriculture, business, and government information (news, weather, stock prices, grain prices, etc.). A secondary provider, Cybershare, has offered a smaller experimental database of educational materials. This material provides three categories of services, with the first two having a highly interactive nature, with some utilizing sophisticated programming techniques to manipulate information, rather than the traditional tree-structured approach used in other trials. The categories are: computer-aided instruction courses, a business library, and an information library.

"The computer-aided instruction courses are at a high school and community college level and are adaptable to the speed and capability of the student."[16] Some of the courses are: mathematics of finance, technology mathematics, 'BASIC' programming, and electricity. The business library has calculation programs (to calculate interest on loans, savings, annuities) as well as simulation programs (feed lot operations, hog operations). The Information Library carries facts on plants and nutrition.

While Infomart concentrates primarily on the provision of commercial services, it did encourage the development of educational content applications through joint cooperation with the Manitoba Department of Education. As a result, a small number of educational applications were developed (such as a graphic lesson based on Manitoba history) and an association was established for those individuals involved in educational videotex. The Manitoba Educational Telidon Association (META) represents an example of the "team" approach to content development. META realizes that teachers seldom have the skills to create pages but are able to write lesson plans. Therefore, META asks teachers to use lesson-plan forms on which to draw, print or define the pages' contents. Skilled personnel at Infomart, in consultation with the teachers, then create the final pages.

Unfortunately, no evaluation of these home-education applications is available. However, some opinion surveys have been done. They reveal that children are the most frequent users, followed by men and then women. Their use of the services available ranked education courses last, but 26 per cent of the user population were listed as users of the courses. In general, users found the system "informative," "useful," and "entertaining," with improvement needed in speed of access and speed of page display. Without giving educators much guidance, the project does indicate what type of educational applications have been developed for a rural home market.

On an up-to-date note, the success of Elie and the Grassroots service has encouraged educators to test Telidon in the classroom environment. Project MicroCOMM is a joint venture between the Manitoba Telephone System, the Department of Education, the St. James-Assiniboia School Division, and at least one rural school division. MicroCOMM is planned to explore all the feasible ways in which telecommunications can serve the informatics needs of computer education. As part of the project, Telidon terminals have been placed in nine school sites, with access supplied to the Grassroots database. While there are no evaluations of this recent development in Manitoba schools, the project represents an example of the spread of the technology from a home-based trial into the more formal education arena.

Following upon its original alphamosaic videotex trial (referred to earlier in this paper), Bell Canada has carried

out a Telidon videotex field trial in Toronto and Montreal with English- and French-language services. The project, called VISTA, started in January, 1981, and ended in September, 1983. It had 435 home users. As previously mentioned, educational material was one part of the database. This material was unlike that of the Elie trial, which was created by only two informaton providers, with defined categories of information. Rather, VISTA was a demonstration database comprising a mix of topics and approaches (information, games, and quizzes) created by a wide variety of information providers from government, business, and the educational system. For example, World Book Encyclopedia, an educational publisher, experimented with brief history quizzes; Agriculture Canada presented material on common pests and pesticides, and Atomic Energy of Canada gave an explanation of nuclear fission and nuclear reactors; and Infomart experimented with interactive computer games, enhanced with Telidon graphics. In one of Infomart's games, the viewer must travel across a map of Canada, winning and losing points by replying in English to multiple-choice questions asked in French, or vice versa, the objective being to test the user's bilingualism. The Ontario Association for Continuing Education tested a prototype directory of continuing education courses.

In Montreal, the Vista trial was coordinated by a private company, Edemedia. Edemedia's database included 6,000 pages of educational material at the university level, primarily in two areas: information about university programs and courses, and computer-assisted learning sequences in biology.

The bulk of the educational materials was supplied by TVOntario and its information providers. These materials were stored for distribution in the Bell Canada host computer. The applications sponsored by TVOntario will be covered later in this paper. As in the Elie-Grassroots trial, little evaluation is so far available for the applications carried in the Bell trial. However, the popularity of educational material can be seen in the statistics on use - TVOntario's material rarely ranked lower than fifth and was often in first or second place in terms of the number of pages chosen by users from a selection of over 100 information providers.[17] That may of course be due to the high use of the system by young people in the families attracted to the quizzes and games, as well as the fact that many of the schools in the TVOntario trial used this

database, thus making it difficult to determine how many homes accounted for the popularity of the material. However, there is corroborative evidence from the Times Mirror Telidon trial in California (with a home population) to suggest that the public does consider education to be an important videotex service (57 per cent rated education for children as an essential service).[18]

Nonformal education, public institutions. Two interesting uses of Telidon as accompaniments to educational exhibits have been created - one by the National Museum of Man in Ottawa, Ontario, and the other at the Ontario Science Centre in Toronto.

As part of the TVOntario field trial, the National Museum of Man created two educational packages. One gave background information about the museum, and the other explained the technology of early native Canadians. In the TVOntario evaluation process, "many teachers found that this sequence provided information rather than instructional material or a game. The teachers felt the graphics were the sequence's major strength...and felt the sequence was well organized." The complaints were that "there was too much text for easy reading and that the actual amount of information to be gained was not that great."[19] As a result of the experience in creating content, the museum has plans to use Telidon to create pages on terminals in the museum about the museum's artifacts and programs. The pages could possibly be made available to outside educational databases.

In a different approach, the Ontario Science Centre worked with the education division of St. John's Ambulance (a voluntary public health and first-aid organization) to create a quiz game on first-aid tips. Rather than access this unit from a central host, using the standard calculator-size keypad, the Centre incorporated a modified Telidon decoder (with its own mini-database stored inside) which was housed in a specially built stand that featured a flat panel of large buttons to be used for choosing the answers. The questions were given in multiple- choice form and displayed on the normal television screen. Although there is no qualitative evaluation of the unit or its display mechanism, it did attract attention and represents a different educational application of the technology.

Formal education. Three main studies are representative of the uses and assessment of Telidon in formal education. Two are ventures in distance education in Alberta, and one involves all levels of education in Ontario (the multifaceted TVOntario field trial).

Distance education: Telidon and teleconferencing. In 1982, the University of Calgary, with the cooperation of Alberta Government Telephone and Athabasca University (supplier of Telidon software for storing information on a host computer), established a pilot project to combine Telidon with audio-teleconferencing. "The major purposes of this feasibility trial were to evaluate the technical aspects of the delivery system, the effectiveness of Telidon as an enhancement of audio-teleconferencing, and the effectiveness of the course itself."[20] (See Paper 5 on distance education, and Paper 14 on educational teleconferencing.)

On the technical side, a prototype switch had to be developed to allow a voice and Telidon data to be transmitted on the same telephone line. The English grammar course had to be completely replanned and redesigned to take advantage of the graphics capabilities. To keep the project manageable, enrollment was limited to 52 students and six teleconference centres were set up to receive the enhanced service (with cooperation from other educational agencies and institutions).

The course was divided into seven sessions, with the students meeting as a class for the first and last sessions for orientation and review.

> "The spoken parts of the course were delivered in the normal way for teleconferencing with the two instructors talking to the centres, asking questions, conducting discussions, and so on. When it came time to send a graphic, one of the instructors would indicate that a graphic was about to be sent. The technician in the Teleconference Centre control room would then switch the system from voice to graphic mode, while someone in the centres would likewise switch their systems from voice to graphics, and the instructor would key in a page number to the computer, which would then transmit the data. Once the graphic had arrived, the system would be

switched back to voice transmission. Though cumbersome, this system was at least functional."[21]

In evaluating the project, information was collected from evaluation sheets at the end of each session, and a questionnaire was completed during the last session. As well, a report was submitted by two persons who had entered data into the Telidon system. When the findings were assessed, a number of conclusions, as well as questions, emerged. The project proved that Telidon could be used together with audio-teleconferencing and that the addition of graphics was worthwhile. "The project provided evidence that the system works, and that Telidon adds considerably to teleconferencing in its traditional mode without visuals."[22]

However, there was also some criticism. "More technical development is required to make voice/data transmission easier to handle, and more thought needs to be done with regard to the use of Telidon versus the use of print handouts (which students can carry with them: Telidon images are more ephemeral, and not necessarily an improvement over other media). The use of Telidon did appeal to one student who was visually oriented, and this suggests that there may be individual differences among learners that predict the degree to which they learn successfully from Telidon. This is something that needs to be studied in a future project."[23]

Distance education: Telidon and correspondence education. In 1981, the Alberta Correspondence School, Alberta Education, and Alberta Government Telephone cooperated in a project to determine the place that Telidon might have in delivering secondary school courses. Because of the need for vocational training in rural areas, a grade-10 mechanics course was chosen as the application to test.

Telidon was used for delivering and correcting students' exercises in three of the four-lesson modules. The Telidon exercises used multiple-choice questions, and the students entered a number on a keypad. After entering an answer, the student received a message on the screen saying whether the answer was right or wrong. Further explanations might also appear.

More than 60 secondary school students in six rural schools took the course, from September, 1981, to June, 1982.

The Department of Educational Administration of the University of Alberta conducted both a summative evaluation of the course, and a formative study of the use of Telidon in the delivery of computer-based distance education.

Regarding the course, the study found that:

- The Telidon group achieved scores on the post-test which were equivalent to those of the traditional correspondence groups; accordingly, it was concluded that Telidon is as effective as traditional instruction.

- There was a significantly higher completion rate for the Telidon group than for the other correspondence groups combined.

- The Telidon group rated the course higher on the evaluation scale, but there was no difference on ratings of difficulty or usefulness.

- The course was a very primitive form of computer-based learning.

- Students and staff were very supportive of the use of Telidon and of computer-based distance education.

- The Telidon graphics protocol could be an effective communications standard for the delivery of materials, but the videotex database structure (system) was inappropriate for computer-based learning.[24]

As a result of the favorable review, the mechanics course will continue to be offered with a Telidon component, and another course (on building construction) was planned for the Fall of 1983.

Of interest, however, were the comments on the problems of using the videotex structure for computer-based learning. Since the traditional videotex structure can present information only in a linear or a restricted multiple-question format and cannot give personal directions to the student, and there is no program for administrative record keeping, it was recommended that a performance-recording analysis system be provided. While the traditional videotex system maintains records of all interactions, there is no adequate program for tracking and assessing a student's

performance - a lack that many of the participants in the TVOntario trial also considered a hindrance to the use of the Telidon videotex system for computer-managed learning. Hence the recommendation was to incorporate the Telidon graphics code in a more effective computer-assisted or -managed, learning program in future trials.

Among other recommendations regarding the development of computer-based learning materials (other than that they be pursued), were several recommendations regarding Telidon.

One recommendation was that Alberta Education should make Telidon decoders available to schools and that the Telidon interface (a newly developed computer circuit board) for the Apple microcomputer should also be made available for schools so that the microcomputer could be used both as a "stand-alone" unit and as a Telidon terminal. The interest in this convergence of two technologies is one that has been expressed by other educators, and is part of a growing trend in integrating Telidon as a part of computers in education.

In the creation of course material, a recommendation was made that "materials should be able to be developed on the same system on which they will be delivered."[25] This recommendation followed the finding that it was frustrating to create a lesson on the Telidon Information Provider System (the page creation computer) because it did not allow the author to test the delivery system immediately to see how the course would work.

It was also suggested that it would be beneficial to have an audio capability along with the Telidon picture display. Again, this recommendation is one that was made throughout the TVOntario trial.

These two studies pertain only to two applications in distance education, but the issues they deal with are representative of those in the broader field of distance education.

In reviewing applications for other aspects of education, it is necessary to examine the findings of the TVOntario field trial. The trial and its evaluation reports were so extensive that this paper can only highlight the principal findings.

The TVOntario field trial. As mentioned previously, TVOntario conducted a major field trial of the Telidon technology - in both its teletext and videotex modes - to test its technology and its applicability to education. The trial, held from 1979 to 1982, was supported largely by the federal Department of Communications and was operated wholly by TVOntario. The broadcast host computer was at TVOntario. The Department of Communications demonstration host computer in Ottawa and the Bell Canada VISTA host computer in Toronto were the distribution points for the interactive videotex material. There were 50 user terminals which had dual modes so as to be able to receive both services (teletext and videotex) unlike the single-mode terminals used in other trials.

The terminals were distributed throughout the Province of Ontario. The participating institutions fell into four categories: elementary and secondary schools; colleges of applied arts and technology (CAATs) and universities; public libraries; and special institutions such as schools for the deaf and the disabled.

TVOntario took a consortium approach in the development of content applications. It encouraged representatives from educational institutions to use the page creation facilities at TVOntario (five information provider systems) and requested that institutions which received terminals reciprocate by creating at least one learning unit (generally called a "sequence") that would meet an educational need established by the institution. The communication costs for accessing content from the two host computers were paid by TVOntario. Besides encouraging the participants to develop applications, the TVOntario Telidon team also created and produced sequences for experimental use in classrooms (otherwise known as "in-field" use). By the end of the trial the participants had access to approximately 60 sequences that reflected a broad range of educational material. As well, they had access to the variety of other content that was included on the Bell VISTA host, and which had been supplied by information providers in business and government.

• Teletext applications. Many of the participating sites, such as schools and libraries, were within the TVOntario broadcast signal area and therefore could receive the teletext service. Originally it comprised only 30 pages of content, but the number increased to over 100 pages by the

Fall of 1981. The content was updated daily or weekly, depending on the nature of the information, and thus reflected an attempt to offer constantly changing, timely, and topical information. It included short learning sequences, educational quizzes, notices of educational conferences or activities, TVOntario broadcast listings and supplemental information to the television service, film and book reviews, news items, and weather information, including a map. Unfortunately, a lack of time prevented the teletext service from being formally evaluated. Consequently, the findings discussed below refer only to the videotex service. However, there are results available from a similar in-school trial of Telidon teletext held in Los Angeles, California (the KCET trial). The findings are reviewed below, since they may also pertain to a Canadian situation.

In general, the use of teletext in the KCET trial was received favorably. The service had two parts: a ten-page "magazine" of exercises and activities to inform and entertain (word problems, puzzles, quizzes, and riddles, with answers available on command); and 60 pages of information (with timely news, sports, weather, and supplementary materials for educational television series). "Teachers cited, most often, motivation and enhancement as being the major advantages of the service...The availability of the teletext supplementary materials increased utilization of the television series, and teachers stated that these materials provided their students with greater understanding of the concepts presented." In general, teachers valued the system "for providing enrichment, news awareness, critical thinking skills, motivation and reward."[26]

• Videotex applications. In this review of the educational applications of videotex, representative sample applications at different educational levels and specialties are described briefly in order to give the range and nature of the content produced. In-depth evaluations of 17 sequences are given in a TVOntario report.[27] The main points in these individual assessments are incorporated below in the section entitled "Educational content concerns."

• Sequences for elementary schools. Two educational games prepared by TVOntario entailed the identification of a country. "Tag the Flag" starts with the flag of a country,

followed by clue pages and a final answer and information page. In "Globetour," which is more interactive and which uses multiple-choice questions, the student travels around the world by answering questions about places along the way. The student accumulates points by identifying countries correctly; a student who gives a wrong answer loses points but the wrong answer provides further information. Both games use graphics extensively to illustrate the textual clues or present information. "Bear Takes," which was devised by the staff of an elementary school, was a drill sequence in which a series of addition problems is displayed on the screen. The students write their answers on paper, and then the answer page is retrieved and displayed (pictures of teddy bears were used to appeal to the students). Another school entry, "Canadian Capitals," followed a question-answer format. A map of Canada was shown on the screen, and the students were asked to name the capital of each province. As each province appeared, the students were asked to write their answers on paper. Then the next page displayed would give the right answer and ask the capital of the next province. Students were encouraged to use atlases at their desks. This sequence was designed to make the students more familiar with maps and atlases and is representative of a supplemental use of the technology (rather than an independent exercise or means of review).

• Sequences for secondary schools. A biology lesson on the human circulatory system provided students with diagrams and textual information. The lesson was presented in short units. The opening page allowed the student to start at different "chapters." A more interactive "game" approach was used in "Geologic Mapping." After "sampling" several parts of the terrain for different types of rock, students were required to recreate a geological map on paper based on information gathered from the Telidon screen. Yet another format was used to present some literary aspects of the novel To Kill a Mockingbird. It used graphics, definitions, open-ended questions, and quotations from the novel in discussing ideas, themes, and style. The sequence was organized in a way that allowed it to be used by students in class or in individual study and for all grades that use the novel (9 to 13).[28]

Two mathematics courses were based on the Ontario Ministry of Education's curriculum guidelines for grade 9.

One dealt with transformations and the other with dilatations. They incorporated text and graphics and included multiple-choice review questions. A correct answer allowed the student to proceed; an incorrect answer provided the student with further information and directed the student to try the question again.[29]

As part of a distance education project, a hundred-and-twenty page sequence was created, covering a section of the grade-13 physics course on light. As in the biology lesson, this sequence was divided into chapters which the students could access separately. And like the biology lesson, it used a linear textbook approach in presenting text and graphic information. This physics course was part of a multimedia project combining an existing ministry correspondence course with microcomputer software, and TVOntario videotapes, for use in a northern Ontario school in 1981-82.[30]

• Sequences for postsecondary schools. "Video Flow" was created as an introduction to the basic elements of broadcast television. Based on a curriculum outline and the lecture notes of the instructor who supervised the production of the sequence, the unit combined text and graphics in linear format. In another experiment, a unit was developed to teach students how to write a resumé when applying for a job. It was an effort to assess Telidon's use in supplying remedial help or resources for students.

• Sequences for special institutions. The Toronto Institute for Medical Technology created a unit entitled "Areas of the Abdomen and Body Types" to see if material in this medium could be integrated effectively into classroom presentations as well as used for individual study by medical technology students.

Two sequences were produced for use by hearing-impaired students: "Words" and "The Rescue." In "Words," the user is provided with a choice of words (e.g., dragon), and on choosing one, the hand-sign for the word is displayed, followed by a simple sentence with the verb missing. Three verbs are presented in a multiple-choice format. The user selects a verb: if the choice is correct, the answer is signed; if incorrect, the user is returned to the page with

the three verbs to choose again. "The Rescue" has a similar format, but a short story is used to teach vocabulary. The story is presented on one page with one word missing from each sentence. As the user advances, each sentence is presented individually with several choices for the missing word. Each sentence is illustrated by a graphic image of the action described in the sentence. Choosing the missing word takes the user back to the multiple choice. Choosing the correct answer brings the hand signs for the word, and then the next sentence to be completed. Teachers from a school for the hearing-impaired, and from a school for the deaf, evaluated the sequence. The main objection raised was the difficulty of portraying sign language on the screen since the direction or orientation of the hand signs was unclear in some cases. Also, signs rely on movement that is difficult to convey through the technology.[31]

The Ontario Federation for the Cerebral Palsied (OFCP) cooperated with TVOntario in a special project that had two purposes: (a) the creation of a special database of community resources for the disabled and, (b) the training of some disabled individuals to test the feasibility of skills training in this new computer technology as a potential employment base for the disabled. Several people, in wheelchairs and with cerebral palsy, were trained; a sample database was created; and a user terminal was placed in a home for disabled people. Residents were enthusiastic with regard to the user terminal's ability to bring informative and entertaining content into their home for viewing.

However, problems were experienced with regard to the "user friendliness" of the terminal due to the size of the keypad. It is usable for people with fine motor control (of hands and fingers) but awkward or impossible to use for individuals lacking the full use of their hands. A larger keypad, or preferably a keyboard (for stability and with bigger buttons to push), is needed if this aspect of the technology is to be made accessible for people with fine motor control disabilities.

Those individuals working with the Information Provider System (IPS) page creation terminal also found them awkward to use. For example, the "knee-hole" space provided by the desk/terminal is designed for a standard chair to fit under; a wheelchair is too broad and too high to fit. As a result,

someone in a wheelchair must either lean far forward or have the keyboard on their lap.

The keyboard and command structure of the software have also been designed for people with the use of two hands (a number of commands for editing tasks require that two buttons be pushed simultaneously - with the buttons laid out on the keyboard being more than one hand's width apart). A simple modification to the keyboard (via redefining function keys) by TVOntario staff allowed those with single hand use (or use of a mouth stick) to use the technology for page creation. Thus, with some modification to keypad and keyboard design, the technology does represent one that can offer new opportunities for the disabled both to acquire information, and to engage in new job opportunities as page creators within a "traditional" workplace, or at home as a new "cottage" industry.

• Overall comments and findings. A great deal of information was acquired during the course of the trial, especially during the last year, when formal evaluative research was undertaken by the TVOntario Office of Project Research. In summing up their findings, the research team pointed out that since "the field trial was changing and improving up to and including its final days, these findings are not intended to be conclusive, but rather indicative of Telidon applications to education."[32] Excerpts from the summary evaluation report form the basis of the findings given below.

• Patterns of use. At all sites, the Telidon terminal was used mostly for learning about the technology, rather than to learn with it. Demonstrations of the system accounted for the most frequent use followed by casual exploration of the system. Terminals were often used for demonstrations of the software created or available at the site; actual classroom use of sequences was not as frequent. There was some curriculum-based use, generally by teachers or instructors using a sequence they had created, or which had been created by a teacher at their school or college. In elementary schools, there was little independent use by students: teachers usually mediated between Telidon and the students by operating the keypad and reading to the students from the screen. In secondary schools, however, there was extensive casual use of the system by interested students. Libraries,

both public and university, used the terminal for demonstrations of information retrieval, or to experiment with the sequences devoted to publicizing or explaining library services. Use at universities tended to be for research and development concerned with the technology rather than specific content applications.

• Factors affecting use. The enthusiasm of, and activity by, the persons responsible for introducing or supervising the terminal in an institution had a major effect upon the extent to which the staff and students used Telidon. Although TVOntario personnel conducted initial demonstrations of the technology at the site, the ongoing pattern of use depended upon the initiative of a small core of people (or in some cases, a lone individual) who acted as catalysts or motivators in introducing a new technology within a traditional learning environment.

• Limits on time and access. Lack of time and difficulty of access were serious hindrances in introducing the technology to the sites. Telidon activities had to be added to the normal workloads of teachers, instructors, and librarians with the result that the lack of time devoted to Telidon adversely affected its use. Many teachers believed that if sufficient print documentation had been made available (instructions for operating the terminal and description of the content), then the planning and scheduling of Telidon activities would have been easier and more productive.

However, problems were also caused by the difficulty in obtaining access to databases. While participants were very pleased by their ability to access databases on distant computers, many reported difficulty in getting or staying on the system. Usually the problem was caused by the limited number of ports, or access points, into the host computer. The next most common problem was poor transmission over the lines. Those difficulties, combined with the occasional breakdown of the terminal, particularly in the early prototype days, made reliable and planned use difficult.

• Placement of the terminal. The placement of the terminal could critically affect its use. Terminals located in one classroom were often not used by students in other classes.

The ideal location was in an institution's library or resource centre.

• Educational content concerns. Because of the developmental nature of the field trial and its wide range of user groups, the database touched on a wide variety of topics but without any great depth or volume of materials in specific subjects. As a result, the participants, although enthusiastic in general about the technology, expressed a need for a more comprehensive range of subject matter.

Telidon's graphics were considered highly attractive, but a great deal was learned about how they should not be used. It was found that complex graphics that took half a minute or more to complete tended to frustrate the viewer, and allow their attention to wander. Also, the importance of graphics that are relevant to the topic (rather than used as embellishments) was identified.

It was recommended that the materials should use the right language level for the intended users. Some sequences had varying levels of vocabulary. It was recommended that each sequence be of uniform linguistic difficulty.

There was a need for good editing by subject specialists before the sequences are used publicly. Some factual errors in the content were discovered.

Teachers familiar with other computer-assisted instruction (CAI) software found Telidon limited compared with CAI courses on other computer systems. They found the interaction between student and content restricted by the multiple-choice question format, which is not suitable for all applications; a capacity for the student to generate individual responses was considered a more flexible approach, but it was not available on the system. Also, the lack of programming for tracking a student's progress was considered a drawback. Those shortcomings of Telidon are the same ones found in the Alberta Correspondence School trial.

• Participation in page creation. The majority of sequences in the trial were created by individuals from the user sites, who travelled to Toronto to use the page creation terminals at TVOntario. The individual educators or their schools or

libraries paid the travel and staff time involved. Those costs affected the amount of time that could be spent working on an application and the ability of sites to participate in the page-creation process.

Page creation was considered time-consuming, and there was competition amongst page producers for time on the limited number of terminals. It was partly because of the difficulty in getting access to page-creation facilities that the participants from Carleton University in Ottawa decided to look for other ways of creating pages. Carleton could not afford to buy a page-creation terminal, yet found access to those available to the public to be too awkward and time-consuming. As well, the University's cartography department had a store of graphics already in digital computerized form that could not be transferred directly into Telidon form. Consequently, work was begun on a software program for creating Telidon pages on a microcomputer, and another program was developed to transfer existing computer graphics to Telidon.[33]

While many participants expressed the desire to create pages using the microcomputers in their schools, there were no established software packages to allow it at that time.

Although individuals were given orientation and brief training in page creation, the staff was too busy with the project to give comprehensive training. Page producers did express the need for more formal training.

• The future of Telidon in education. There was a diversity of opinions regarding the future of Telidon, but generally, the system used in the trial was considered suitable for access to large amounts of worthwhile information and materials.

Two basic tendencies in use were indicated that might suggest directions for Telidon development. Elementary and secondary schools and some community colleges tend to use Telidon for teacher support and computer-assisted instruction, while universities and libraries use it for information searches and research and development.

DEVELOPMENTS IN APPLICATIONS, TRENDS, AND ISSUES

Because technological change has been so rapid within the videotex and microcomputer industries, and in telecommunications in general, a number of solutions have already been found to some of the problems identified in using Telidon in education. At the same time, new issues have come to light.

Videotex/Telidon courses

In response to a growing need for ongoing research and instruction in all aspects of videotex, a number of colleges and universities have started to incorporate videotex-oriented or -related studies into their curriculum. For example, Loyalist College of Applied Arts and Technology (CAAT) in Ontario has developed a page-creation course, as well as a course for technologists in the service and repair of the technology, and a course in marketing skills for the new technology. Several other CAATs, including Algonquin and Sheridan, (both in Ontario) offer instruction in Telidon page creation as part of their course offerings available to students.

At the university level, efforts to deal with the implications of videotex to research and curriculum needs have also been undertaken. For example, at the University of Western Ontario, journalism students have the opportunity to write content for a commercial videotex service (known as Videopress); library and information science students (and professors) are encouraged to research videotex as a new information technology. At the University of Calgary, the Department of Electrical Engineering has used the Telidon system for teaching and research, while the Faculty of Environmental Design has used Telidon's graphic capabilities as a component in architecture and environmental studies. The library has used the system as a student information retrieval system. In Manitoba, the University of Brandon has an ambitious instructional program underway as part of a major university development plan to establish an on-line Telidon videotex service. In Quebec, the "laboratoire de télématique à l'Université du Québec à Montréal" offers courses in Télématique and Médiatique, and undertakes research in all aspects of videotex production and

distribution. This research effort has helped to define the nature of study into the new electronic information world of videotex systems.

Telidon and microcomputers: Converging technologies

While Telidon terminal manufacturers are slowly moving toward the development of multimode, multifunctional terminals (to integrate videotex with microcomputer/office automation services), microcomputer manufacturers and/or software producers are responding to a consumer demand for inexpensive telecommunications capabilities on their home/school/business microcomputer systems. This demand reflects an increasing interest in expanding the power of microcomputers through the ability to access a variety of computer networks for the services that they offer, including new ones such as videotex. At the same time, the need for inexpensive videotex page-creation terminals has created a demand for microcomputer-based videotex applications. In addition, there has been increased demand for Telidon-compatible microcomputers to facilitate the development of micro-based, computer-assisted instruction programs enhanced with Telidon graphics.

As a result, a number of hardware and software products for certain types of microcomputers (e.g., Apple, IBM, Commodore Pet) have been developed which allow these computers to create, send, receive, and display Telidon pages. The use of microcomputers, with Telidon capabilities, may be the critical mechanism needed to establish a broad enough market base to support educational videotex applications economically, given the microcomputer penetration of the home and school markets. Provincial initiatives in support of this trend have already begun: Alberta Education has shown serious interest in the need for a Telidon component for the Apple microcomputer (the prevalent computer in its schools); the Ontario Ministry of Education has stipulated that schools buy microcomputers with Telidon presentation compatibility; in Quebec, there is a series of experiments underway to develop courses at the "Commission scolaires de Mille-Isles" in Montreal, using an Apple microcomputer equipped with a hardware/programming package prepared by Formic, a private Quebec company that develops Telidon software.

Videotex software improvements

Several computer software companies and university computer science departments have developed alternative operating systems for storing and structuring Telidon pages or have refined the systems originally in use.

Infomart, for example, has enhanced the basic videotex system by incorporating more two-way interaction, (e.g., offering viewers the capability of teleshopping, electronic messaging). It has also improved the flexibility of accessing information: i.e., pages may be accessed by an alphabetic name as well as number, and the index pages offer up to 25 choices instead of just nine choices. The opportunity for movement between pages is considerably more flexible than it was.

The University of Waterloo has developed a system software based on the UNIX Operating system, to allow greater flexibility in the access to pages (it includes a keyword approach, as well as electronic messaging capabilities).

L'Université du Québec à Montréal developed an "add-on" keyword indexing software to run with videotex system software.

Telidon and computer-assisted instruction

The early recognition of the limitations of a videotex system to facilitate computer-assisted instruction or computer-managed learning stimulated interest in adapting Telidon (as a graphics code) to various authoring and management systems used to develop educational software.

The Telidon graphics code has been successfully incorporated in selective learning modules using the Canadian National Authoring Language (NATAL), based on developmental work sponsored by the National Research Council involving representatives from several universities including the University of Waterloo and the University of Victoria. NATAL has been developed as a sophisticated authoring (writing) language designed for educators to create lessons; the use of Telidon graphics to enhance these lessons has the potential to make the system a very effective tool for computer-assisted instruction.

Similarly, the Télé-université de l'Université du Québec à Québec has incorporated the use of Telidon graphics as an enhancement to Programmed Learning At a Terminal On-Line (PLATO), an authoring system created by Control Data, a private corporation. The integration of Telidon and PLATO to existing and planned courseware is a major component of a new distance education service planned to cover the province of Quebec.

Newer developments will incorporate Telidon graphics within educational software developed for "stand-alone" microcomputers. This use may answer the question that has been raised by TVOntario (following the field trial) regarding the use of a full videotex system for computer-assisted learning (CAL):

> "...the question is whether a technology designed to transmit graphics economically over great distances should be used for CAL processes and by their very nature tie up equipment, including data lines, for long periods of time. We surmised that the answer to that question is that it should not be so used. We were led to favor, therefore, downloading materials for the creation of local networks for distributed databases in order to relieve the central Telidon system of costly overload."[34]

In the specifications that TVOntario gave to a manufacturer of the latest dual-mode videotex terminals (Norpak), the capacity to store a large number of pages (at least 60) in the terminal was considered very important. With this additional memory capacity, the user can retrieve a long instructional sequence over the telephone lines, or "capture" a computer-assisted program (with or without Telidon graphics) from the teletext signal, and store this information in its own local memory. This information can then be transferred to a microcomputer's storage device, such as a floppy disc or audiocassette. If the information "capture" is a computer program in a language compatible with the microcomputer, then it can be loaded into the microcomputer's memory and run, when required. If the information is a Telidon sequence, the microcomputer is used to transfer the sequence back into the Telidon terminal's memory, for use on its local system. This way of delivering computer programs has resulted in the term "telesoftware." In an ideal situation, the videotex terminal in future will also be a functioning microcomputer, capable of creating,

receiving, storing, and displaying Telidon sequences, as well as computer-assisted instruction programs with the option of including Telidon graphics as part of the program.

Telidon and special education needs

At the University of Western Ontario, work is underway on a device which, attached to a Telidon decoder, will send the contents of pages retrieved from a host computer to a braille printer to enable the blind or visually impaired to access videotex services.

Some developmental work has been done by the National Research Centre and Norpak (a manufacturer of Telidon equipment) on a terminal to generate Blissymbols as an aid for the speech-impaired. However, further work will depend upon government funding.[35] Of course, not all individuals with speech impairments need Blissymbols to communicate. For many, a keyboard attached to a videotex terminal could offer access to the world of computer networks, bringing users not only a variety of databases to choose from, but also the capability of communicating with each other through the electronic messaging capabilities now available on most networks (Telidon or otherwise).

Of interest to the hearing-impaired is the fact that Telidon's teletext mode can also handle services related to television programs such as closed captioning. Its capability to overwrite stored graphics or text over a TV picture can be used by broadcasters. The Canadian Videotex Consultative Committee's (CVCC) Subcommittee on Captioning, which was established in 1980, has been very active in its encouragement of captioned services for the hearing-impaired. The subcommittee, composed of broadcasters, government representatives, and individuals or groups involved with the hearing-impaired, has served as a forum for the discussion of technical matters and social issues. The subcommittee has not only documented the interests and needs of the hearing-impaired, but also examined the use of multilingual captioning (for cultural cross-fertilization) and its potential for pedagogical activities.[36]

Those with multiple and/or mobility impairments may have special needs requiring the design and development of hardware attachments to conventional Telidon system

components (for example, modified keyboards, larger display capabilities for enhanced readability/visibility). Some experimental work has been done in this area, but there is a growing recognition that more efforts are required if the rights of the disabled to education, vocational training, and employment are to be served.

Telidon and closed user groups/local area networks

The use of Telidon in a "closed" network is a growing occurrence. The concept of "closed user groups" is one generally applied to a business or industry setting (e.g., Faxtel's "Marketfax" service for stockbrokers) but may apply also to special interest groups and educational institutions.

In Ontario, for example, Algonquin and Sheridan Colleges of Applied Arts and Technology have plans to implement a local area network of user terminals on-campus and/or in their communities, serviced by their own page creation terminals/host-computer facilities. These networks will carry course information as well as general information about the colleges and/or their communities. They may be used to provide some learning aspects of courses or for course registration. The Universities of Guelph and Waterloo have similar plans to set up on-campus information networks, also with a variety of educational/information applications in mind. The Ontario Federation for the Cerebral Palsied has continued to create information on resources for the disabled, through the acquisition of their own page-creation terminals. The terminals are located at their headquarters and in a number of their residential sites, with plans to establish a network link to create and exchange this information to serve the disabled population in Ontario.

A community-based videotex service (known as AGORA) is being developed by the Université du Québec à Montréal. The service is essentially an electronic information journal, which addresses itself to the disabled, and also to the informatics specialists who will be participating in the journal's development. The service is planned to be available to 188 homes, 20 community centres as well as university research settings and a videotex training centre. Distribution is via a cable system linking the terminals to a central host at the University. The service is planned to allow its users to "gateway" (i.e., link) into other

electronic database services, thus enlarging the scope of information accessible.

In the area of health care information/education, there are several videotex projects currently underway:

- In Montreal, Quebec, a project called Télé-Santé has begun, sponsored by the Clinical Research Institute of Montreal, the Montreal General Hospital and the Rivière des Prairies Hospital. Targeted at the general public, health care institutions and professionals, the service offers information on specific illnesses and information developed to educate people on the broader view of what constitutes good health and health management. The content is bilingual (English and French), and available to users via terminals placed in health clinics throughout Montreal, linked by telephone to one central host computer. There are 10 terminals in current use, with two more planned for placement by the end of 1984.

- Also in Montreal, a medical training and continuing education project is underway as the result of a collaborative effort amongst the College of Physicians, the Faculty of Medicine at the University of Montreal, and the University's 14 affiliated teaching hospitals. The Faculty of Medicine has set up a Bureau of Coordination to facilitate the development of an information service, for administrative and teaching purposes (examples of teaching modules include emergency room procedures, the nature and use of anaesthetics). Two terminals at each of the hospitals, and a number at the Faculty, are linked via telephone lines to a central host computer at the University. Content is produced by Faculty members and by medical staff at each hospital. While distinct from the Télé-Santé project, it is possible to link these two videotex services, and plans for doing so are under review.

- In Ottawa, the Canadian Hospital Association (CHA) is developing a videotex database service to respond to the information needs of its member associations (there are 11 provincial hospital and health associations), and to the needs of the broader health care industry (for example, the Bureau of Medical Devices, and Health and Welfare Canada officials). The information provided falls into three categories: administrative,

critical/emergency medicine, and instructional training. While all of the information is stored in a videotex structure (the information is in tree-based hierarchial relationships, supplemented with a keyword approach), the information will be offered in two formats - one with Telidon graphics, the other without graphics. In this way, CHA can do comparative research on the effectiveness of each format while allowing all of their members to access the information. Since CHA has only 12 Telidon terminals to deploy at the moment, this allows their members who have other types of computer terminals to also use their system. The 12 Telidon terminals are deployed across the country, in the following places: St. John's, Newfoundland; Montreal, Quebec; Ottawa and Toronto, Ontario; Winnipeg, Manitoba; and Vancouver, British Columbia. The terminals are linked via dedicated datapac (telephone) lines to the central host in Ottawa. In the future, CHA would like to develop a linked network of regionally distributed databases, with the Ottawa node as the main database and network control centre. For the moment, their user groups have access to the central host and may also access the University of Montreal's medical information service.

The emergence of special-interest groups and community-based information systems, combined with the high cost of data retrieval over long distances from a remote host, may indicate a trend away from large, centralized host computers toward the creation and use of regional host computers serving local needs, but with the capability of linking into provincial or national networks. However, given the nascent quality of all these networks (provincial or local), it is too early to state definitively if any trend is emerging. What is emerging, however, is a distinct shift in the perception of Telidon/videotex as a mass market service, to a perception that it is more immediately viable for use as a closed- or special-interest group service (with customized information services). Thus, the concept of Telidon as a large, centralized mass market service is taking on a lesser role in the planning of future developments in applications (whether commercial or educational).

Telidon and teleconferencing

Research has continued in the area of Telidon as applied to teleconferencing. The research has taken three different directions: the use of a single line, direct connection between users with a Telidon/audio switching device at the convenor's end; the use of a central "Meet-Me" bridge facility at the local telephone exchange into which users are connected; and the use of twin or dual lines (one for audio, one for the Telidon code).

In July, 1983, 14 rural locations received Telidon decoders which were electronically interfaced with the existing teleconference facility at the University of Calgary, to give instructors and students in the Faculty of Continuing Education a two-way audio/Telidon system for learning and motivation.

Trans Canada Telephone System (TCTS) has worked with Bell Canada on a system called Conference 500. This system offers an electronic slide presentation via Telidon, on one line, while a twin line supplies the audio portion of the presentation. While TCTS views the service as primarily for business use, it will have some application to education.[37]

Each of these systems represents research into Telidon teleconferencing that can be used to connect remote groups of people for training and education. As more research and testing are done in this area, the use of Telidon teleconferencing in distance education applications is likely to increase and become an on-going trend.

Videotex/Telidon systems in operational use for education

As well as the emergence of special-interest, or local-area networks, there are two major on-going operational (as versus field trial) education networks that have been started and are province-wide in scope - one in Ontario and one in Quebec. While each service network is planned for long-term or permanent use, the future of each depends upon its success in providing quality, cost-effective educational services, and in providing this effectiveness in justifiable terms to maintain public funding to subsidize the services.

In 1982, TVOntario made the transition from a Telidon field trial to the first steps in operating a Telidon network for education throughout the province, providing both broadcast (teletext) and online videotex services. The latest multimode Telidon terminal, which is capable of receiving teletext and videotex, as well as ordinary data from electronic databases, and which has an extra memory for storing pages in a stand-alone mode, has been put in 75 secondary schools, 15 youth employment centres, and 10 public libraries across Ontario. The project has been jointly funded by the provincial Ministry of Education, the federal Department of Communications, and TVOntario. The videotex database includes educational learning materials and the Ministry of Education's Student Guidance Information Service (SGIS) converted to the Telidon system by TVOntario. SGIS describes over 1,000 occupations, the training requirements for them, and the courses and institutions that offer the necessary training or necessary education. The database runs on Infomart's enhanced system software, and offers access to information by career title, by basic groups of careers (e.g., careers in education or health), by the academic subject required for a career, and by general subject keywords (e.g., careers related to machinery, farming, etc.). The student may access information directly by keyword or may browse through the system by using the information on career groups or academic subjects. Although this service has not yet been evaluated formally, the initial response from teachers and students has been favorable. Likewise, the topical range of information provided by the teletext service has also received positive support.

In Quebec, as mentioned briefly before, the Télé-université du Québec à Québec has started a distance education service for the province. The service is designed for self-paced learning, utilizing a network of terminals linked to a central host at the main university campus. Through the combination of PLATO (a computer-assisted/managed instruction system) and Telidon graphics, the service will offer students a wide selection of lessons on a variety of educational topics, and will be capable of keeping track of students' input and performance. This service will also offer students an electronic mail function to enable them to communicate with their professors and other students throughout the network. It is expected that by the Summer of 1984, 350 user terminals will be in operation at five remote locations throughout the province of Quebec.

Policy developments

The CVCC Education Subcommittee. The CVCC Education Subcommittee has continued as an educational advisory group to government and industry. In 1983, it recommended that the federal and provincial governments continue their funding, particularly for the development of software and applications.

The recommendations reflect the major issues and concerns that face Telidon in education. The following is a summary of these recommendations:

- Support for research on the impact of new technology on education and information.
- Support for information and education-based content development, and marketing services for domestic and international applications.
- Revision of the copyright law to include new technologies such as videodiscs, microcomputers, and Telidon systems.
- Establishment of new regulations governing access to public and personal information, including privacy codes.
- Development of a telematics policy to regulate the flow of information and introduce common production standards.
- Examination of policies and funding criteria of Canadian research councils.
- Development of free standarized software for public-sector research councils.
- Development of bilingual databases for the general public.
- Development of open networks for information and educational purposes, and technology sharing.[37]

Inter-Provincial Agency for Telematics and Telidon (IPATT). The CVCC Education Subcommittee has subsequently become the Inter-Provincial Agency for Telematics and Telidon (IPATT). One of the Agency's first tasks is to establish a consortium

for the creation and exchange of Telidon materials. The consortium is to coordinate the establishment of educational databases, and to act as an advisor for the formulation of policies on Telidon and telematics in education.

Summary of educational issues

The development of content applications. The active participation of educators has been critical to the development and evaluation of educational content. Their involvement in the many Telidon trials has highlighted such issues as:

- The need for formal teacher training in developing content.
- The need for local, rather than central, access to page creation facilities - and hence the need for inexpensive equipment.
- The need for standards of quality and a mechanism for ensuring that standards are met.
- The question of who decides what type of content is developed; for example, should it be a personal decision by an individual teacher for his or her own classroom use, or should a central body, such as a ministry, set curriculum guidelines for this new medium, or should a local school board, etc.?
- The need to revise copyright laws to cover these new media.
- How the creation and distribution of content is paid for and the distribution of content is effected (through a centralized database network; a regional or local database network; or a cooperative mix of central and regional networks).
- The need for more research, development, and evaluation of Telidon in distance education, special education, and in the broader field of computers in education.

Utilization of the technology. Enthusiastic teachers are the key to the acceptance and use of the technology, but if it is to be accepted by teachers, there must be support materials and resources provided, such as manuals and workshops, and the educational establishment must support the integration of the technology into the curriculum.

Access to information. The price of accessing videotex information is a serious social question, i.e., who will be able to afford this service and how much access, if any, should be subsidized, and by whom, and through what mechanism. Also of concern is the issue of privacy of information that may be collected about individuals who use the system (e.g., academic records).

This has been a brief look at only some of the issues that are of concern to educators considering the role of Telidon/videotex systems in education. On a broader scale, there are other issues associated with videotex that should be mentioned.

Broader social issues

As with other computer technologies, there are a number of social issues which, although not peculiar to education, are worth mentioning briefly. What socially beneficial services could be offered by a publicly accessible videotex system? How can individuals shape the technology and its services to their needs? What will the effects be on privacy, employment, and industrial development? Is our society capable of adapting to technological change? Is social isolation a possible effect?[38]

While a number of these "social impact" issues were investigated and evaluated as aspects of most field trials, the overall findings remain inconclusive. For example, in many field trials the researchers had difficulty in formulating clear statements of social impact hypotheses to be tested; and all trials were based on small sample user populations over varying lengths of time.[39] As a result, investigators assessing the overall results of the field trials in Canada have concluded that: "Thus far there is very little real evidence to clearly denote trends with respect to the identification of social issues."[40]

Nevertheless, as they do point out, "if Telidon eventually becomes a much heralded information utility, it will have widespread social consequences affecting the nature of our institutions, social and personal relations, as well as cultural and political structures."[41] They conclude that more rigorous research into the social impact of videotex is clearly required - a perspective not difficult to share. The need for such research will remain as a priority for those policy-makers in government, industry and education who are concerned with the introduction and impact of new technology on society.

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