

UTILIZING VIDEOTEX TECHNOLOGY FOR DISTANCE EDUCATION

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ABSTRACT

Improving the access of adults to higher education has become a major priority of continuing education in Canada. Distance education programs face a constant challenge to provide an educational experience for part-time students which meets cognitive learning objectives as well as affective needs. The University of Manitoba's continuing education division has been experimenting with videotex technology as a means of bridging distances and enhancing services for correspondence education. This paper will discuss several CAI projects the division has undertaken in conjunction with the first domestic field trial of Telidon in Headingley, Manitoba, conducted by the Manitoba Telephone System. In addition, the paper will examine the potential of videotex technology to revolutionize distance education.

RÉSUMÉ

Une des principales priorités des systèmes d'éducation canadiens a été d'améliorer l'accessibilité des adultes à l'éducation. Les programmes de formation à distance doivent faire face à un défi constant pour fournir une expérience éducative aux étudiants à mi-temps qui répond à des objectifs cognitifs d'apprentissage de même qu'à des besoins affectifs. La Continuing Education Division de l'Université du Manitoba a fait l'expérience de la technique videotex comme moyen de réduire les distances et d'améliorer les services au niveau de l'enseignement par correspondance. Le document traite de plusieurs projets CAI que la Division a entrepris conjointement avec le premier essai du système Telidon à Headingley au Manitoba sous la direction de la société téléphonique du Manitoba. De plus, le document examine la capacité de la technique videotex de révolutionner l'enseignement à distance.

Introduction

The decade of the Seventies witnessed a phenomenal growth in distance education delivery throughout the world. There is no evidence at present to suggest this trend will abate. The growing social awareness of the need for lifelong learning, the financial burden of traditional schooling methods, the systematic application of sound instructional design, and the development of new media delivery systems are factors which should contribute to the continuing improvement and expansion of learning opportunities via distance education.

This paper will identify some of the current issues confronting distance education administrators and the roles which videotex technology could perform for distance learning programs in order to address these concerns. The paper will conclude by discussing some considerations regarding the application of media in general, and specifically the use of videotex systems, to enhance educational programs.

Distance Education

"Distance education" connotes a form of self-study in which the teacher and the learner are not in direct physical contact and therefore must rely on media to help them to communicate over a distance. Although this term is being used more and more there is no universal consensus regarding its meaning. Ronald Hull (1973) identified an alternative four-part typology for distance learning activities (Individually Diagnosed and Prescribed Learning, Self-directed Learning, Personalized Learning, and Independent Study) determined by three criteria: the locus of control for selecting the content, the learning objectives, and the media used. The term correspondence study or education was restricted at one time to mean "teaching in writing, in the course of which the student and the teacher regularly write to each other" (Holmberg, 1967, p.9).

Lars-Olof Edström has attempted to modernize the meaning of the term correspondence education. He has redefined the term to mean "a form of teaching that combines an organized course of self-study with a two-way communication over a distance between student and teacher" (1970, p.16). Self-study, Edström argued, does not mean that students are on their own. Edström has identified the following features in all correspondence instruction:

- (1) Correspondence education is a system comprising many components: specifically and methodically pre-produced courses (not necessarily written material) for self-instruction, a two-way communication

between teacher and student, individual help and guidance for the student, assessment of the student's results and an administrative organization for preparing courses and/or handling communications (not necessarily by mail) with the student.

- (2) Correspondence education is used to bridge the distances between student and tutor/adviser.

- (3) Correspondence instruction is, for reasons of economy, a means of mass education, although there is nothing, from a theoretical point of view, to prevent the establishment of correspondence instruction only for a handful of students.

- (4) Correspondence education is very flexible. It can be combined or integrated with most other forms of education in order to form an instructional system, and it can be adapted to suit local conditions and needs. Although in itself a system, it can very easily be absorbed into systems mainly based on other forms of teaching.

(1970, p.119)

My personal preference is to acknowledge that the term "correspondence" conjures up a stereotype image of two-way learning over a distance by writing and, therefore, I like to utilize the newer term "distance education" which does not generate images of any particular delivery medium, format or locale. Distance education is a versatile term, I feel, which is in keeping with the pedagogical flexibility characteristic of the process it defines.

Distance education methods provide several advantages when compared with traditional face-to-face delivery. They can be more flexible to accommodate the needs of people unable to attend regularly scheduled lectures; they can reduce unit costs of instruction; they can permit self-pacing of instruction to suit individual learning needs; they address the principle of equal opportunity of access to educational resources; and they help to overcome the spatial distortion of educational services (Elliott, 1975). Distance education programs are now capable of instructing a diverse range of subject matter (Fakes, 1973).

The first known correspondence study program was initiated in England in 1840 by Isaac Pitman for the instruction of shorthand (Holmberg, 1974; Edström, 1970). Since this modest beginning until only recently correspondence education, and its derivative, distance education, have been held in low esteem by the schools of orthodox educational philosophy. John Lowe (1975) explained this disdain was due to an assumption among the orthodox educational establishment that distance education was "incompetent", and that the predominant

ance of private companies in this sector resulted in a service industry motivated solely by greed. In recent years numerous steps have been taken to overcome both of the above objections. Today, in Canada, the US, England, Sweden, New Zealand, Australia, France, Germany, the USSR, South Africa, and many Third World countries, correspondence and distance learning programs have become established components of the educational scene, recognized not only as cost-effective but as highly efficacious.

In many nations it is now possible for people to study by distance methods toward both their elementary and high school diplomas, as well as university certificates, undergraduate and graduate degrees, and technical certificates. Many associations and societies now provide a wide variety of distance delivered programs in support of continuing professional education and pre-service training. These offerings are augmented by a vast selection of private correspondence and distance study companies. The public's concern for quality control and ethical practice within this latter sector has resulted in much stricter government regulation of the private companies in many countries.

Apart from the various formal means of pursuing educational objectives, Allen Tough and his co-researchers have attracted attention to the issue of self-directed informal adult learning (1979). This form of learning, Tough maintained, comprises about 70 percent of all adult educational activity. Though this learning occurs outside of the realm of control of professional adult educators and cannot be strictly defined as two-way distance education, one similarity at least warrants an examination of this learning form. Various electronic and print media are the primary vehicles supporting self-directed informal continuing education. Tough suggested the major barriers to more successful self-directed educational projects were the problems of a lack of access to resources, an incomplete knowledge among prospective participants of where to locate the resources they might require, and insufficient planning of the learning activity. These shortcomings also hinder distance learners who are seeking the appropriate formal accreditation for their study.

Design and Delivery Challenges

Greater attention in recent years to the pedagogy of distance education has resulted from the employment of more qualified staff and the systematic application of instructional design principles grounded in psychological learning theory. Problems of design and delivery have emerged which, though not exclusively

characteristic of distance education courses, nevertheless, pose major challenges to the field. New approaches to the instructional design of distance learning packages have become a focus of intense experimentation in an effort to overcome the existing limitations. Teleconferencing, teletutorials, radio, audio and videocassettes, videoconferencing, satellite feed and ITV (instructional television) are common techniques now used to supplement print materials in an effort to increase student-teacher interaction, improve the learning process in distance education, and thus to increase the student retention rates.

There are about seven main aspects of distance education instructional design and delivery which educators have been attempting to improve. First, there is the sharp break in the two-phase learning process between the learner's completion of an assignment, and the instructor's evaluation of that assignment and decision concerning which parts of the lesson should be reviewed and relearned by the student. Second, there is the need to take account consistently in the syllabus of the learner's individual needs. Third, the external motivation of the distance learner has been largely ignored. Fourth, the isolation of most distance education programs for the learner, the lack of interpersonal familiarity between student and instructor, the miscommunication associated with a lot of written communication, the distances and costs involved in attempting any personal contact, and the perception of faculty accessibility, act as barriers which inhibit effective and frequent student-instructor communication. These in turn can contribute to a fifth problem, that learners may proceed through their studies after developing an important misunderstanding early on which could require weeks before the instructor can identify the problem and then try to rectify it. This places an inordinate pressure on the syllabus designer to express all ideas clearly, so that not only can the ideas be understood but also so there is less chance of the ideas being misunderstood.

People interested in obtaining information about alternative programs of study encounter a sixth problem of distance education which is also communication related. The problem of the lack of access to information and counselling support is widespread. Seventh, correspondence materials are costly and time consuming to produce which in turn militates against revising a syllabus as required in order to remain up-to-date with the rapidly changing ideas and approaches in a discipline. The traditional print formats often become an incentive for entrenchment and the dissemination of obsolescence (Childs, 1962).

One further design consideration which is affecting all adult education programming is the learner-centred approach. While educational institutions are continuing to provide those services which they feel they can offer or which they believe adult populations should be interested in, the learner-centred strategy is resulting in thorough market research, needs identification surveys and closer cooperation with community education advisory groups. These and other strategies are affecting both the form and the content of adult education programs. The need for more flexible means for providing access to all adult education services has been one key element identified by various groups of learners.

The concept of lifelong learning is not new to human society. This concept, as embodied in the image of a "learning society" championed by adult educators, maintains that learning which begins in school must continue throughout adulthood. Learning in such a society will occur through and be encouraged by all social organizations, and the economic system will place as high a value on learning as it does on productivity (Lowe, 1975; Faure, 1972).

Distance education programs have been identified as a crucial means of increasing adult participation rates in lifelong learning activities. The design difficulties identified above must, however, be resolved if the potential of distance education is to be fully realized. For many adults their first contact with schooling as children has imprinted numerous unpleasant memories associated with learning, and many adults have developed poor self-images of themselves as learners. This personal view often is reinforced by western society's stereotype image of adults as incapable of learning (Kidd, 1970; Knowles, 1970; Bischof, 1976; Abramson, 1976). The objectives to stimulate adult awareness of and motivation for re-education or training whether on a formal or non-formal basis, to help adults to develop and to embrace a positive self-image of themselves as learners, and to support their efforts as they engage in new learning activities, are a paramount challenge in a distance education program. There is a growing expectation, however, that new telecommunications systems can significantly assist adult educators and instructional designers in their quest to overcome the challenges and the limitations associated with distance education.

Videotex as an Educational Medium

Videotex technology is a form of computer-based telecommunications (informatics) which was developed in Europe and North America during the Sixties. Videotex technology was engineered to utilize the versatile cathode ray tube of the home television set in order to create a mass market for information data bases. There are two basic formats.

Teletext can be obtained as both a non- and pseudo-interactive videotex system, while viewdata is an interactive system. Teletext is broadcast through the air like a regular TV signal. Viewdata operates only in a transmission mode over voice-grade telephone line, coaxial cable or fibre optic lines. Information for both systems is stored in a computer (Sigel, 1980; Godfrey and Parkhill, 1980; Hurly and Davis, 1981).

Videotex systems show great potential to create a mass market for a variety of information services (Woolfe, 1980). One aspect under intense scrutiny by several Canadian universities and provincial communications authorities is the application of videotex to education, particularly distance education delivery. A list of possible roles would include the following: computer assisted instruction (CAI) (drill-and-practice and programmed instruction); computer managed instruction (CMI); experiential or discovery learning; programming and algorithmic formulation; problem solving; simulations and modeling; visualization by accessing computer, motion, still, microfiche or videodisc media; and information retrieval and processing (Aiken and Braun, 1980; Hurly and Davis, 1981).

The Integrated Home Information System concept could allow learning to occur in a variety of forms. Using programs stored either in a mainframe computer or in a video-disc library file, learners enrolled in formal courses could progress through their lessons employing distance or independent study models. Education could occur in the home, office-- anywhere a terminal was available (Hiltz and Turoff, 1978). Most educators agree, however, that CAI will remain an adjunct to correspondence or teacher-based instruction.

Telidon, a Canadian videotex technology which can be used in either a teletext or viewdata mode, will offer several features by 1982 which excite distance education course designers. An electronic mail service would allow learners to send their assignments rapidly to the instructor for grading. Terminal-to-terminal communication would add an important interactive component to instructional tutoring in distance education. An audio-graphic capability will also facilitate simultaneous voice

and image instruction. Since videotex systems like Telidon do not require the reproduction of materials, and Telidon can reproduce high quality graphics, it represents a significant tool for distance educators to help keep down the rising costs of media production.

Education also fulfills a social function, and research has shown that optimal learning occurs when two to three people can interact regarding CAI materials. Thus the promotion of group learning in homes and community resource centres equipped with terminals and other hardware could be an important future continuing education direction. Confederation College in Thunder Bay has been experimenting with microcomputer and teleconferencing networks to reach groups of learners in remote centres in a cost efficient, learning effective continuing education program (Frewin, 1980). Similar programs have been utilized in California for several years.

The library service has long been identified as a user of high technology for its administrative systems. The library of tomorrow can facilitate lifelong learning activities by developing open learning systems based on computer technology (Davis, 1980). Libraries could loan software and courseware to the public, perhaps even terminals and other hardware, and could expand their reference services and place these on a public data base.

Keeping in mind the need to promote and to support self-directed study a videotex system could be used as a "non-human planner" (Tough, 1979) to help people to initiate their own learning programs. The CHOICES program provided by the Canada Employment and Immigration Commission via CSG Limited of Calgary offers the person seeking career counselling access to a vast computerized library of employment information. If such a service were available on a videotex network it would potentially be open to thousands of households. Vast amounts of how-to-do-it and other information, plus lists of resource people, on a videotex data bank could potentially open up a whole new realm of employment opportunity and learning activity for millions of learners of all ages.

But before educators run out helter skelter and embrace videotex as the next *deus ex machina* it is essential that they evaluate videotex thoroughly and examine all possible consequences.

Weighing Some Considerations

The educational sector has been generally plagued over the years with its own infestation of carpet baggers and con artists who bilked the naive before melting back into the landscape. Educators also have been as susceptible as any group of mortals of reaching for panaceas or jumping on band wagons. There thus may be a precedence for educators to be wary of computer salespeople as potentially part of a long tradition of education camp followers.

Nevertheless, the least appropriate response by educators would be to abandon the field of CAI to the electronics and computer firms and private educational businesses. This could plunge distance education development back to the period when unregulated private companies exploited the needs of learners for their own financial gain. This could also result in the potential loss of a tremendous opportunity which could deny traditional institutions of a potential means to transcend their present physical limitations.

Universities and colleges in Canada, in particular, will be fighting for their survival during the Eighties. It is estimated that participation rates at universities will have to increase by 16 percent or more to offset the projected decline by 1986 in the number of previously eligible people in the 18-24 age bracket (Leslie, 1980). Whether videotex will or will not be able to play a role in the mid-Eighties, institutions of higher education in Canada must continue to search for ways and means of boosting their participation rates, including increasing learning opportunities for part-time students.

Another consideration is that a good technique, even a revolutionary innovation like videotex, will not in and of itself improve education. Our current educational institutions and curricula were shaped by the Industrial Revolution of the 18th and 19th centuries. Yet our society is now allegedly entering a new era through a Post-Industrial Revolution (Bell, 1973) which could radically transform our modes of economic production and our social systems (Toffler, 1980; Martin, 1978). The Council for Educational Technology of the United Kingdom and France's Ministry of Education have stressed the urgent need for education to begin to help people to develop skills which would enable them to adapt to our rapidly changing world (Large, 1980; Hebenstreit, 1980). Yet the old patterns still persist.

Educational institutions today basically perform a transmission or mediation function through their teaching role. This process assumes, of course, that there is a direct

cause and effect relationship between teaching and learning. By and large the use of computers in education has been compatible with this philosophy, as well as with the impersonal, autocratic nature of educational institutions (Ackoff, 1974). There are some notable exceptions to this, such as Dr. Steve Hunka's work at the University of Alberta. Yet in the face of current financial restraints, other pressing policy issues, and unsophisticated design techniques, computer systems like videotex may be no closer to individualizing learning than any previous media or methods. Recent research has also raised important questions regarding the impact of media on learning, as well as the rigour of earlier studies. A great deal more work will be needed to dispell the myths associated with the use of media and to establish reliable data demonstrating that media can produce positive significant results in an educational program (Rakow, 1980).

Educational institutions have been accused of adopting an add-on, patch-up approach to curriculum and structural reform (Williams, 1974). Until society seriously deals with the primary deficiencies of the formal educational system, the addition of media like videotex and computers will merely reinforce traditional patterns and purposes.

A further consideration is that policy makers and educational enterprises have long shown a preference to maximize the "scale of aggregation" of an educational product in order to maximize savings or to increase profits. The development of a variety of materials to meet the learning needs of diverse groups of individuals usually succumbs to the cost savings inherent in mass-produced education. Telidon right now is not an effective CAI medium. In order for Telidon to become a useful instructional vehicle it will require better, more sophisticated hardware, software, and well designed, tested courseware. If distance learning is to gain the maximum benefit from having a Telidon system in place in Canada then policy makers will have to wrestle with the problem of making "the transition from perceived needs unmatched by firm demand to an effective market capable of supporting diversity on a continuing basis" (Oettinger and Zapol, 1972, p.18)

While some sectors might applaud the Canadian government's policy of technology transfer to private industry which has been practiced most recently with Telidon, experiences in Manitoba as part of the Manitoba Telephone System's Project Ida field trial have generated some cause for concern. Private industry and service firms have demonstrated a strong willingness to demand that the public

utility and information providers such as educational institutions offer their full support for an experimental service yet all the while have charged the maximum the market will bear. Decisions which would enhance Project Ida and specific educational applications have been downgraded in preference to activities which will generate a more immediate cash flow. While it is necessary to acknowledge the dynamic tensions within private enterprise fueled in particular by the need to survive and grow at a time when videotex is clearly a fledgling, the long-term implications for a national videotex network could be severe. Governments will need to review their regulatory powers with regard to maintaining broad public access and to ensure that monopolistic control within the free enterprise sector does not stifle the great potential which Telidon has to generate public participation in information creation and exchange. Provision for third party access, reasonable billing rates for a broad social cross-section, a wide variety of services, and the establishment and maintenance of set of high quality standards, will benefit equally the videotex industry and the user. Regretably North American private enterprise has to date demonstrated a willingness to sacrifice some of the above principles of production in return for short-term profit maximization (Morioka, 1980; Smirle, et al, 1980; Bochmann and Gecsei, 1980; Madden, 1979).

There are important lessons to be learned by educators and policy makers in the use of videotex systems from the gradual diffusion of cable television (CATV) throughout North America, and its use for instructional purposes. The educational use of large scale, expensive media requires strong political support and the long-term amortization of costs (one hour of good CAI can require 3-500 person hours to create); a high degree of skill and competence; a large infrastructure; access costs which will optimize participation, especially if a 'mass', not exclusively upper class, clientele is to be served; and a broad educational support system (Cory, 1980; Purdy, 1980). If videotex is to meet the needs of remote learners then Canadian public utilities must also overcome the "spatial distortion" factors which prevent equitable services from reaching rural populations (Elliott, 1975). The regulatory labyrinth in Canada and the US could also significantly impede the dissemination and effectiveness of videotex systems, despite the measure of public protection which it might provide (Grundfest and Baer, 1978).

There are also some general considerations which could affect the public acceptance and utilization of videotex services. Two crucial points will be the public's perception of what

danger, if any, on-line viewdata systems like Telidon may pose to individual privacy and confidentiality (Salton, 1980), as well as the user public possessing the requisite skills and psychological predisposition to interact with a computer-based information processing system.

Summary

Distance education has become an area of rapid growth in the Canadian educational scene. The introduction of media and telecommunications technology has been recognized as a means of overcoming some of the delivery problems and barriers to effective student-instructor interaction. Videotex is a new medium which has shown great promise in Canada in the form of Telidon as an adjunct instructional system especially suited to support distance learning.

Such a system could provide users with access to CAL, CMI and other computer-based learning experiences, as well as other media-based libraries of data or services which could enhance the counselling process. If Telidon is to realize its fullest potential as a public educational medium many policy questions will have to be dealt with. Some of these include the issue of public versus private control; the cost of the service; the provision of adequate hardware, software and courseware; the provision of sufficient funds for educational program development and evaluation; and the application of effective instructional design for the medium. Media do not always solve communication problems. They can create them as well. Ultimately, the effectiveness and relevance of a videotex instructional network will depend upon the merits of the educational system on which it is based.

References

- Abramson, Jane. Motivation and learning. The Teaching of Adults Series. Saskatoon: University of Saskatchewan, 1976.
- Ackoff, Russell L. Computer and education. In M. Marois (Ed.). Man and computer. New York: American Elsevier Publishing Co., 1974, pp. 127-36.
- Aiken, Robert M. and Ludwig Braun. Into the 80s with microcomputer-based learning. Computer, July 1980, Vol. 13, No. 7.
- Bell, Daniel. The coming of the post-industrial revolution. New York: Basic Books, 1973.
- Bischof, Ledford J. Adult psychology. New York: Harper & Row, 1976.
- Boschmann, G. v. and J. Gecsei. Towards videotex standards. Videotex, viewdata and teletext. Northwood Hills, England: Online Publications, 1980.
- Childs, Gayle B. Problems of teaching by correspondence study. Report of the conference on newer media in correspondence study. Austin, Texas: Division of Extension, University of Texas, 1962.
- Cory, Genevieve H. Television experiences in other nations. In, Martin N. Chamberlain (Ed.). Providing continuing education by media and technology. San Francisco: Jossey-Bass Inc., 1980.
- Davis, Virginia. Telidon: Information teaser of the future? Manitoba Library Association Bulletin, Sept. 1980, Vol. 10, No. 4, pp. 3-10.
- Edström, Lars-Olof, Renée Erdos and Roy Prosser (Eds.). Mass education: Studies in adult education and teaching by correspondence in some developing countries. Uppsala, Sweden: The Dag Hammarskjöld Foundation, 1970.
- Elliott, Charles. Patterns of poverty in the Third World. New York: Praeger, 1975.
- Fakes, Jenny (Ed.). Technical education at a distance. Cambridge, England: International Extension College, 1973.
- Faure, Edgar, et al. Learning to be. Paris: Unesco, 1972.
- Frewin, Carlos. Outreach. Thunder Bay: Confederation College, 1980.
- Godfrey, David and Douglas Parkhill (Eds.). Gutenberg two (2nd edition). Toronto: Press Porcipic Ltd., 1980.
- Grundfest, Joseph and Walter Baer. Regulatory barriers to home information services. In Hervert S. Dordick (Ed.). Proceedings of the sixth annual telecommunications policy research conference. Lexington, Mass.: D. C. Heath and Comp., 1979, pp. 323-27.
- Hebenstreit, Jacques. L'enseignement assiste par ordinateurs en France etat de l'art et perspective. Proceedings of the third Canadian symposium on instructional technology. Ottawa: National Research Council of Canada, 1980, pp. 77-92.
- Hiltz, Starr R. and Murray Turoff. The network nation. Reading, Mass.: Addison-Wesley, 1978.
- Holmberg, Borge. Distance education. Malmo, Sweden: Hermods, 1974.

- Hull, Robert. Selecting an approach to individualized instruction. Phi Delta Kappan, Nov. 1973, pp. 169-73.
- Hurly, Paul and Virginia Davis. Lifelong Learning and the Post-Industrial Revolution. Proceedings of the 19th annual association for educational data systems convention. Minneapolis, Minn.: AEDS, 1981.
- Kidd, Roby. How adults learn. New York: Association Press, 1970.
- Knowles, Malcolm. The modern practice of adult education. New York: Association Press, 1970.
- Large, Peter. The micro revolution. Glasgow: Scotland: Fontana Paperbacks, 1980.
- Leslie, Peter. Canadian Universities, 1980 and Beyond. Ottawa: Association of Universities and Colleges of Canada, 1980.
- Lowe, John. The education of adults. Paris: Unesco Press, 1975.
- Madden, John. Videotex in Canada. Ottawa: Minister of Supply and Services, 1979.
- Martin, James. The wired society. Englewood Cliffs, N. J.: Prentice-Hall, 1978.
- Morioka, F. K. An experiment with computer-based educational services in a general public environment. Videotex, viewdata, & teletext. Northwood Hills, England: Online Publications, 1980.
- Oettinger, Anthony and Nikki Zapol. Will technology help learning? Teachers College Record, Vol. 74, No. 1, 1972, pp. 5-52.
- Purdy, Leslie N. The history of television and radio in continuing education. In Martin N. Chamberlain (Ed.). Providing continuing education by media and technology. San Fransisco: Jossey-Bass, 1980.
- Rakow, Joel. The audiovisual myth in America: Filling the cracks of educational technology. Journal of Education, Vol. 162, No. 8, 1980, pp.34-54.
- Salton, Gerard. A progress report on information privacy and data security. Journal of the American Society of Information Science, March 1980, pp.75-83.
- Sigel, Efrem (Ed.). Videotext: The coming revolution in home/office information retrieval. White Plains, N. Y.: Knowledge Industry Publications, 1980.
- Smirle, J. C., Y. F. Lum and H. G. Bown. International videotex standardization: a Canadian view of progress toward the wired world. Videotex, viewdata & teletext. Northwood Hills, England: Online Publications, 1980.
- Toffler, Alvin. The third wave. New York: William Morrow and Comp., 1980.
- Tough, Allen. The adult's learning projects. (2nd edition) Toronto: Ontario Institute for Studies in Education, 1979.
- Williams, David C. The spectre of permanent schooling. Teachers College Record, Sept. 1974, Vol. 76, No. 1, pp.47-62.
- Woolfe, R. The emerging markets for videotex. Videotex, viewdata and teletext. Northwood Hills, England: Online Publications, 1980.