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Video For Delivery Of Distance Education:
A Canadian Perspective

By

Ron Harrington
"VIDEO FOR DELIVERY OF DISTANCE EDUCATION

A CANADIAN PERSPECTIVE ABSTRACT"

By

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Population distribution, geographic barriers, economic fortunes, government policy and the rich electronic market-place have all been forces in our Canadian television and video environment.

Distance education in Canada has a long and rich history with its roots in a surface post print-base model. Television has been used to support "school broadcasts" for thirty years in Canada but the situation has changed and those of us charged with delivering education at a distance have had to adapt.

In Canada virtually every household has access to television - 54% of our homes have more than one set. Video cassette recorder/players are a part of 42% of Canadian homes, and this figure is growing very rapidly. The most common means of receiving programming is not direct off air but through community cable systems designed to provide access to distant specialty and foreign television signals. Currently, 84% of our British Columbia population receive varied combinations of commercial, public, pay and educational television via these cablevision systems. It is not uncommon to receive twenty different television channels via such a cable system. But by and large, the programming diet on such services would consist of sitcoms, soap operas, sports and news with occasional cultural offerings from our national CBC or the US Public Broadcasting System.

In our province on the west coast of Canada, our Network enriches that sparse television diet by delivering general education materials to a public audience along with video course materials to students. Let me introduce you to our Electronic Highway - the Knowledge Network through this video overview.

Video "Electronic Highway" 9:29
Video for the Delivery of Distance Education - A Canadian Perspective

In Canada video materials to support learning at a distance are delivered primarily in two ways, broadcast television and by video cassette. Broadcast available to virtually every Canadian citizen who wants to receive the signals. As a complement to live distribution of video signals most every school, college, learning centre and a high percentage of Canadian homes have video cassette recorders. It is difficult to imagine a scenario where a Canadian student could not have access to a VCR within their own community.

While the 3/4" video cassette was the dominant delivery format for use in schools, colleges and industry in the past, the current overwhelming penetration of 1/2" VHS machines now make it the most common distribution format for video cassette materials. (The Canadian market is split 80% VHS, 20% Beta in home format penetration.) While the video disc has been available for more than five years, the optical versions have virtually faded from the North American marketplace. Strangely enough the laser disc with its magnificent interactive capability has yet to achieve a significant penetration outside major corporations' in-house training.

Broadcast and Satellite Delivery of Video for Distance Education

In Canada the national Canadian Broadcasting Corporation has played a role in the production and delivery of learning materials that began in the days of radio and carried forth into television in the late 1950's and 1960's. But the broad mandate of any national broadcasting system will tend to submerge various sub-groups of programming because of the inherent clashes that take place between groups of program interests vying for space on a single channel. In Canada the number of broadcast windows available to deliver educational materials on the CBC were never adequate to meet the needs of our scattered population. In the mid to late seventies the Federal Government through Communications Canada sponsored a series of demonstrations that made satellite time available to provincial government educational television systems at nominal or no cost.

These Hermes and Anik B satellite experiments provided the opportunity to test the viability of satellite delivery of educational television programming in Canada. They were so successful that the national Canadian Broadcasting Corporation no longer plays a significant role in the delivery of radio or television for educational purposes. Today four provincial systems utilizing 12/14 GHz regional spot beams of Telesat Canada's Anik C satellite deliver education services to Quebec, Ontario, Alberta and British Columbia. In Atlantic Canada educational materials are also delivered by satellite, but in that case a time-share agreement exists with a commercial network to carry programming 20-24 hours per week.

The Knowledge Network is the province of British Columbia's Educational Telecommunications Authority. We were created by the provincial legislature in 1980 to assist and collaborate with universities, colleges, provincial institutes, school districts, ministries and agencies in the development, coordination and delivery of education programs and materials to be used in Open Learning. The Knowledge Network is currently being amalgamated with British Columbia's Open Learning Institute to form the new Open Learning Agency. This new Open Learning Agency will consist of an Open University component, an Open College component and the Knowledge Network. Discussions are now underway to determine the manner in which our public school system's
correspondence branch could participate in O.L.A. as the Open School. As well as supporting the endeavours of our own O.L.A. components, the Knowledge Network works with the province of British Columbia’s three universities, 15 regional colleges, four institutes and the public school system in support of their distance education offerings.

Our 16.5 hour daily broadcast schedule has been effectively "zoned" to meet the needs of our various target audiences. Student feedback, audience surveys and system needs are all weighed in the process of creating our tri-seasonal schedules. Institutions in our province are encouraged to use commercial style messages to promote registration in their distance education offerings. The Knowledge Network's staff assist in the creation of these infomercials that air in station breaks between our major programs. This multi-media form of advertising courses has definitely raised the awareness of our half million person weekly audience. (In a normal week 20% of the people in the province of British Columbia will view programming on the Knowledge Network.) In our case we pay approximately $1,000,000 US per year for our satellite uplinking and transponder space. This allows us 24 hours per day use of half a transponder to serve our million square kilometer coverage area. I don't think that the Knowledge Network would exist if it were not for the cost effective availability of satellite time. This is because traditional microwave and multiple transmitter links would have represented too high an initial capital and ongoing maintenance cost for our provincial government sponsors to bear in our sparsely populated and extremely rugged geographic environment. The fact that four similar systems exist in Canada would point to the fact that the communications satellite is a very major piece in the puzzle in the use of video for distance learning in our social/technological environment. (There are 34 satellites within the North American portion of the viewing area serving Canada.)

There is a basic circumstance in our Canadian environment that has had a significant effect on the development of contemporary broadcast distribution networks. In the mid to late 1950's most Canadian homes began to subscribe to community cable systems. For a small monthly fee, these systems provided both local and distance signals to homes in both metropolitan and smaller centres. When our Knowledge Network any other Canadian educational services were started they were provided space on these existing distribution systems by Federal Radio and Television Commission laws. We could therefore have access to a relatively high percentage of the population of British Columbia without installing a traditional transmitter network. In this set of circumstances a set of basic channels, including the educational networks in each province, are provided for the base cablevision service fee. Subscribers can then sign up for additional specialty movie, sports or music channels according to their tastes and the depth of their pocket-book.

When an agency charged with the delivery of educational materials has access to a satellite transponder as we do, there are some additional video and telecommunications service options that are possible. For example, data and audio can be inserted into subcarriers on the transponder (one-way transmit only).

We have also inserted slow-scan (freeze frame) video pictures into a line of our television signal's vertical interval (the black bar at the top of your television picture). This narrow-band system carried an entirely separate video lesson from our principle program.
The Colorado Video Slo-scan insertion and decoding equipment we employed was capable of transmitting three or four distinct images within the vertical interval of a television signal without compromising the main broadcast signal. The audio for these alternate programs could then be carried in the subcarriers of the television signal or delivered via the public telephone system.

This sort of narrow-band service allows the use of interactive freeze-frame, but high quality video, to a range of clients whose materials did not lend themselves to broadcast television. Obviously, the relatively high programming production cost for full motion video does not exist when only freeze-frame images transmitted every 8 seconds are utilized. The cost of encoders ($25,000) and decoders ($3,500/site) to employ such a slow-scan system are such that target audiences would likely have to gather in central receive sites such as hospitals or learning centres to view the programming.

There is an additional satellite non-video application that the Knowledge Network will pilot in the fourth quarter of 1987 using Band-edge and VSAT (Very Small Aperture Terminals) technology for two-way data communications. This experiment will be mounted in cooperation with Communications Canada’s research group and Microtel Pacific, a Canadian manufacturer of telecommunications systems. Microtel's VSAT is a development of their earlier Spacetel package that provided portable satellite delivered telephone and data services to remote Canadian communities.

The VSAT interactive data transmissions are also expected to be accommodated within the spectrum that we are currently leasing from Telesat. We anticipate eventual utilization of VSAT’s by schools, hospitals, training agencies and government departments for both training and management purposes.

While I have varied from my topic of video applications in distance learning in exploring some of the other benefits of satellite delivery of programming, I am sure that social planners proposing the range of telecommunications options that can be aggregated through the use of a satellite transponder would have a higher possibility of achieving their objective in receiving government’s funding than submissions that proposed television delivery only.

My company, the Knowledge Network uses a variety of media, mixed and matched to serve the needs of the end user and their circumstances. No delivery model employing any technology will work unless it meets the end user criteria.

**Live Interactive Television**

From the beginning the Knowledge Network has employed a mixture of live and pre-recorded program materials. While we acquire world class general interest programs such as documentaries, and broadcast world-class pre-produced telecourses we generally employ a "live" or "live plus tape" production model for our institutional or community agency programming.

We produce weekly episodes of university level English and Psychology courses for a regional college as they lack dedicated production resources of their own. These productions can be done simply and effectively live in our three camera studio with a six person technical crew. Students and the general public can interact with the instructor live via the public telephone system. People throughout our million square kilometer coverage area call in toll-free via dedicated WATTS lines. Thousands of students have participated in these
live telecourses offered by North Island College. We produce this style of programming for under one thousand dollars ($1,000) per episode when two live sessions per day can be accommodated in our studio. The sessions are simply "talking heads" with simple production values but they meet a need for Open Learning even in our multi-channel television marketplace.

When we produce programming for community groups such as Foster Parents or the Arthritis Society we use a mixture of videotape materials shot film-style on location and studio based live-interactive sessions that feature experts to field public discussion. The cost of production using this approach rapidly escalates to the thousand or fifteen hundred dollar per minute range, with variables being the size of project team, production crew, travel costs and shooting ratio. The documentary/live model has been quite effective in serving the community agency sector within our distance education mandate. The pre-recorded documentary elements generally become an ongoing resource for the sponsoring agency to use in non-broadcast applications.

Major institutions within British Columbia have tended to adopt either enhanced studio lecture models or field and studio documentary models for production. These lessons are all pre-recorded. Interaction between the students throughout the province and campus-based instructors is accomplished through one-to-one telephone sessions or on the Knowledge Network's multi-line audio-conferencing bridge. We have found over the years that we could shorten the television sessions considerably by using non-broadcast interaction for the students. But even when courses are interactive on our Network, instructors and tutors use a telephone office hours concept to provide support to students.

I must make it clear that none of the telecourses I have mentioned here have the production values of the Annenberg Foundation sponsored, American produced ones that are popular in many areas. There simply is not the population base or economic resources in our region to justify such costly production. However, a consortium of colleges in our province provides support materials and credit for courses that often include those world-class telecourses. In these cases our institutions purchase the rights to the courses and we telecast them within our overall schedule. There is no cost to our colleges or universities to broadcast pre-recorded materials on our system.

During the experimental phase that demonstrated the effectiveness of satellite delivered educational television lessons, some of our instructors felt that the concept of "contact hours" that existed in campus delivered instructional situations ought to be a part of this new mode too. This literal translation approach of classroom delivery style was terribly boring and an ineffective use of the new medium. Particularly when the classroom "coffee breaks" resulted in dead air on television.

In the last six years, we have worked with our province's institutions assisting educators to better understand video media. We assumed that instructors could adapt to the new medium with some front-end planning and coaching in more effective use of television, and in most cases we were proved correct. Our television staff and their educational clients have made regular progress toward our goal of effective and efficient use of television.

One of the most effective vehicles in raising production standards was peer pressure and competition between institutions. Once one institutions
instructors began to use television more effectively on our system the others began to follow. Many staff hours were spent by production, technical and learning design staff to convince Distance Educational Coordinators within various institutions to invest in higher quality, better presented materials. In the end, rejection of the materials by institutions in other provinces proved to be a major force in causing our institutions to use television effectively. If the institutions were making an investment they needed a financial return. The potential of that return was used to justify a greater production investment up front.

**Videotape for Distribution of Distance Education Materials**

If the telecommunications satellite was voted the number one tool in our video distribution kit bag the videotape machine would certainly be a close number two. Whether we are talking about the new broadcast level or industrial equipment that allows us to capture and embellish our program productions or the home or school systems that permit the end user to view cassette tapes in their preferred environment, the impact of these technologies in distance education has been nothing short of phenomenal.

A piece of visual resource material that cost hundreds of dollars a copy to distribute on film can now be provided at a cost of under ten dollar on a quantity basis on videotape. This duplication cost along with the over sixty percent penetration in British Columbia homes of VCR’s makes the videotape an immensely powerful distribution medium. Many of our public libraries and schools are building inventories of video cassette materials that are loaned to the public and students as books have been in the past.

Evaluation documents from teachers and nurses for example have shown that many professionals enrolling in their discipline’s upgrading courses offered on the Knowledge Network have used video cassette recorders to allow them to record their lessons at a different time than they chose to view them. This time-shifting capability of the VCR allows busy professionals wishing to upgrade their qualifications an opportunity to better manage their time. We encourage our viewers on air and within course packages to record our broadcast programming on their home videotape recorders.

In non-broadcast hours we have used our system to feed previous programming to screening committees. The members of these committees used automatic timers to activate their recorders in our overnight window. This downloading of programming provides even greater economic advantage to a satellite delivery model.

**Videotape in Educational Production**

Two of three universities in our region have broadcast quality one inch standard videotape facilities in-house to produce the video support packages for their distance educational offerings. The third university uses private sector production houses to create their television course offerings. British Columbia’s universities all produce their television delivered video courses to meet what would generally be referred to as broadcast technical and production standards. This approach was adopted after out of province institutions refused to buy their course materials produced on the 3/4” u-matic format. Smaller cassette based formats are used in production where broadcast distribution or sales to other institutions are not contemplated (i.e. on campus situations).
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The Sony Betacam format and the Panasonic M and MII formats allow a compact high quality videotape recorders to be mounted on the rear of state-of-the-art video cameras. These devices are relatively light in weight and are therefore highly portable and flexible units. The Betacam system has come to dominate electronic field production in Canada. The Knowledge Network currently employs Sony's Betacam system for the production of all our field materials. We have found that the component video format Betacam pictures are similar in quality to one inch at least in the first generation.

In our operating circumstances the lightweight portable camera has added the ability to reflect any region of our province in a production. These units allow our crews to fly, travel by car or even Zodiac to reach their subjects. If one of the principle advantages of television is taking the learner where they could not otherwise go then the modern electronic field production unit is a most valuable tool to add new and powerful visual experiences to educational video materials.

Post Production Techniques

While we at Knowledge Network do not use film in production, it is common in Canada to shoot film but to do post production on videotape particularly for commercials. In this situation 16 or 35 mm film is used to shoot the material in the field or studio. The film is processed but not printed. The negative (16 or 35mm) is run through a flying spot scanner with the polarity reversed. Scene by scene colour correction or even reframing or cropping of scenes is done and stored in a computer while the film is being previewed. When this process is complete the film negative is transferred to one or more broadcast videotape machines. If more than one tape machine is used in the original transfer all dissolves or effects transitions are greatly simplified. Post production of film on videotape is extremely cost effective particularly when distribution of the end product will be on videotape for broadcast or use in home or institutional video cassette machines. All titles and effects are added in the video post production process so film optical and print costs are eliminated.

All educational telecommunications authorities in Canada rely on one inch type C for post production. All four of the production agencies use time-code based computer editing on-line. Component formats are gaining popularity in field situations but studio production is virtually all done utilizing one inch type C. There is a significant trend to inter-format production utilizing component recording in the field with studio one inch segments. At the Knowledge Network we do this regularly and find it impossible to distinguish between Betacam and one inch materials. In our region virtually all non-film field production from industrial production to drama is done on Betacam.

Off-line Editing

To further reduce post production costs we provide our writers, directors and content specialists with VHS copies of all of the tapes from their productions. Each video frame has time-code, a numerical identification system composed of a code of hours, minutes, seconds and frames super-imposed over the video. This time-code is identical from the master field tape through all screening and work tapes. We also super-impose the tape number of the original material over each frame of video as a further reference.
Our production project team members can then view the footage in their offices or at home. By using the time-code numbers they can make editing notes accurate to a thirtieth of a second using the pause mode of the VCR. These notes then form the basis of a paper edit of the materials to be incorporated into their production. If this process is combined with the use of a complete transcript of the audio a producer's editing decisions can be speeded up considerably. From the office or home VHS machine we move our directors to an off-line edit suite. Here they use a Convergence Edit Controller to cut a "rough" then a "fine" cut of their production. We use Vertical Interval Time-code to keep two audio tracks free. The off-line process allows educators and project managers to sign-off on the television treatment before the somewhat higher costs of on-line production are incurred. Our off-line system cost under $35,000 to install.

Our production staff now complete their time consuming decision making process on this inexpensive system. Once sign-off has been obtained on the content treatment the project moves to on-line editing where the equipment and operating costs are more than ten times the off-line ones. Here all of the original footage is conformed with the approved cutting copy to create a mastertape. In some facilities all edit decisions from the small format editor are automatically listed on a floppy disc. Though our current off-line system does not allow us to take our edit decisions to the on-line arena on a computer disc, that is the direction we will pursue in the next year. Off-line editing concepts have been used in various forms for some time but the drop in costs of the equipment are moving the systems from the BBC and other major players and production facilities to the hands of the educational production unit. These systems have already improved our decision making and approval process and have cut post-production costs by a third to a half in some cases.

Advanced Post Production Techniques

In the late 1970's and early 1980's digital creation and manipulation of television images became a reality. Digital video effects systems and graphic creation devices made it possible to create electronic models to convey concepts that only extremely costly film animation could have made possible in the past. While character generators that permit electronic title creation have become common place in all levels of post production and production facilities, more sophisticated graphics systems have not yet reached educational users. It is a certainty that prices will continued to fall on these graphics units until they too become an every day part of production.

Cooperation with the Private Sector

We are fortunate to have access to a number of high end post production facilities that were designed and equipped to serve the needs of advertising agencies creating stunning commercials. We have always found that these facilities will quote our educational projects on a fixed price basis if we can fit our time lines around the "need it yesterday" world of advertising. I would recommend that producers and directors of video projects who want to expand their resource horizons talk to the production houses and commercial television stations. The devices that help sell hamburgers and soap can often be put to use to more effectively explain concepts or to provide a new and distinctive look to our educational programming. There is often no need to go without contemporary approaches or expend capital dollars to purchase high end production systems if they can be rented on an hourly rate elsewhere. Our guiding principle in equipment capital programs has been if it is used everyday we should own it - if it is not, lease it or rent it by the hour.
Advanced Production and Distribution Systems

There are two major advances in video production systems that I have not mentioned; Digital Recording Systems and High Definition Television. High quality Digital Recording Systems are available now in both disc or cassette based formats. Their costs are three to five times that of the current one inch Type C equipment that forms the foundation in most production centres. The advantage of the digital video recorder is its transparent multi-generation production capability. The power of these devices is awesome, particularly when digital art and camera images are combined with many layers of special effects. These systems are being used for very high-end commercials, rock videos and program titles, but I do not think they have any present applications for distance learning that are cost effective. High Definition Television utilizing over 1100 lines of information rather than the NTSC’s 525 or the PAL and SECAM systems 625 lines has been shown throughout the world for some years. The quality of the pictures on such a system is similar to 35mm. Because the means of distributing product is limited at this time, again, I do not think such systems have application in producing video for distance education. But the images are just superb!

The Future

In our circumstances, I see a continued development in broadcast, closed circuit and narrow-band technologies for delivery of video based programming.

As an educational broadcaster I suspect that we will continue to follow the technological pack in the delivery of programming as there is no justification to fund a leadership position in publically financed television.

In narrow-band delivery technologies I see a range of tools including interactive personal computers and slow-scan video. The pace of universal adoption of I.S.D.N. (Integrated Services Data Networks) by the telephone companies will determine the extent of distribution of digital video information sharing via the telephone system. I expect a wider use of component and digital production devices in the coming years, but the fully digital production facility for education would seem to be more in the ten year horizon than the five year one.

The eight millimeter cassette will likely see wider use for distribution of video materials employed in open learning, but the end distribution format of materials will be one of the last decisions made as it is essentially a marketing decision based on user need.

If the price of workstations for interactive laser discs fall from the current level then the units will enjoy a greater penetration than they do now.

In the next five years still-frame video and text will likely be widely distributed on CD-ROM devices. This format will likely be most attractive for video versions of reference material where high speed random access will be an advantage. Self-paced video cassettes will likely provide basic interactivity for individualized learning situations.

Earlier, I made reference to using private sector production resources to augment institutional ones. I believe this is fundamental to cost effective use of video media. Only a private sector production facility can begin to keep up with the latest bells and whistles, but the capability of such facilities can be utilized by the educator very inexpensively on an hourly basis.
From the beginning our Network has had a mandate to foster and encourage relationships with private sector producers and facilities in the production of video materials. We feel this is the only way to obtain original state-of-the-art materials for distribution without the extremely high cost of a fully staffed traditional state-owned facility.

The tools to produce and distribute video productions are increasing in quality and reliability while continuing to fall in price. It seems that video is well placed and well priced to take a greater role in Open Learning.

Our Network as part of the province of British Columbia’s Open Learning Agency has an important role in assisting our population to engage in life long learning in a manner that has never before been possible. I look forward to discussing with this group the structure and potential of such a system.

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Canada.