Using Video-On-Demand for Educational Puposes: Observations from a Three Month Experiment

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Abstract: Mosf recent technological developments in the field of communication and telecommunication seem to relate, one way or another, to the much heralded Information Superhighway metaphor, this electronic Infobahn of the future which promises to link us all to a universal global village. One such technology is Video-On-Demand (VOD), a technology that allows viewers to watch an audiovisual document of their choice, at their convenience. Among the companies advocating the introduction of Video-On-Demand is Stentor Resource Centre Inc., a consortium of Canada's lorgest telephone companies. In January 1994, Stentor and Bell Canada launched an experiment involving fhe transmission of video content over telephone lines. The trial was conducted with the collaboration of Carleton University und the University of Ottawa. At both universities, students used the technology as part of an official course curriculum. This paper describes the quasi-experimental conditions in which 17 students from the University of Ottawa were involved. Over a three-month period, users' reactions toward the system were examined. The results indicate a definite occurrence, over time, of the Hawthorne effect, as students rated the technology much more positively at the beginning of the trial than they did at the conclusion. The VOD system as tested holds some interesting potential in many applications. Future developments of the technology must be sensitive to the needs of the user in order to maximize its educational merits and competitiveness.

Résumé: Le concept d'autoroute électronique est rapidement devenu un véritable paradigme en voie de conditionner une bonne partie de lu recherche et du développement reliés aux secteurs des communications et des télécommunications. Il semble en effet que le village global, loin de ressembler aux villages romantiques d'antan, sera vraisemblablement irrigué pur une infrastructure électronique comparable aux INFOBAHNS sur lesquelles on peut filer sans limitation de vitesse. Encouragées pur les gouvernements qui ont avalisé le projet, plusieurs entreprises se bousculent pour revendiquer une priorité d'accès à cette fameuse voie rapide de l'information. Les principales compagnies canadiennes de téléphonie, regroupées sous l'égide du consortium Stentor Resource Centre Inc., participent à la course. Le système Vidéo-à-lu-demande, une technologie qui permet à l'usager de visionner à son gré les documents audiovisuels de son choix, constitue l'un de ces premiers véhicules actuellement mis à /'essai. Stentor et Bell Canada lancèrent la foute première expérience canadienne de transmission vidéo entièrement numérique pur fils téléphoniques en janvier 1994. L'opération a été

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conduite dans la région de la capitale nationale en collaboration avec l'Université Carleton et l'Université d'Ottawa. Des étudiant-e-s inscrit-e-s à chacune de ces institutions partenaires ont été invité-e-s à utiliser le système dans le cadre de cours qui faisaient partie de leur programme respectif. Nous faisons état ici de l'expérience menée à /'Université d'Ottawa où les réactions de ces premiers utilisateurs ont été observées durant une période de trois mois. Les résultats confirment clairement l'effet d'Hawthorne selon lequel l'enthousiasme original se dissipe progressivement au fur et à mesure de la fréquentation d'une nouvelle technologie. Si le prototype présente d'indéniables atouts sur le plan des applications éducationnelles, il n'en demeure pas moins que ses promoteurs devront être attentifs aux besoins des clientèles potentielles s'ils veulent se maintenir dans le peloton de fête.

INTRODUCTION

Judging by the nature of the discussions that took place among the Group of Seven industrialized countries at their February 1995 summit in Brussels and at the Canadian Radio-television and Telecommunications Commission public hearings in Hull, QC the following month on the structuring of the Canadian Information Highway, the roads of the future will rest upon intricate networks of fiber optics, microwaves as well as cable, telephone and cellular networks (Industry Canada, 1994b). It appears as though every new technological development in the field of communication andmultimedia areas is connected in one way or another to this infrastructure, which is supposed to lead us into the 21st Century. Ostensibly, any company with an interest in communication technology will try its best to get a part of the multibillions of dollars that have been promised to be injected in this global telecommunications project. The current situation in the Canadian long-distance telephone market is a most eloquent example. It is not surprising that Bill Clinton emphasized the Information Highway concept inhislast Presidentialcampaign. In the United States and in most other Western countries, where thousands of jobs are being lost, foreign and local investors are frugal, and most sectors of the economy are stagnant. As an incentive to restore confidence in the economy, the Clinton administration proposes a global infrastructure project that is akin to the building of the interstate highway network of the '60s (Information Infrastructure Task Force, 1993). The Information Highway project has been touted as a way to stimulate the economy, and it is already showing signs of paying off. Major corporations are spending billions of dollars in an attempt to place their wares on the expressway (Stentor, 1994). In order to be the first to "put some rubber" on the Infobahn[1], the big multimedia companies are entering into strategic alliances with infrastructure providers (cable companies, telecommunications companies).

Aside from deciding which enterprises will provide the services, communication regulatory bodies are also trying to determine what kinds of services are to be offered, and at what price. Possible services include home-shopping, telebanking, video games, information retrieval and dissemination services, electronic mailing, and à-la-carte entertainment (Industry Canada, 1994a). In this plethora of multimedia services, Video-On-Demand (VOD) consistently

figures inmost blueprints. Such a system would allow users to watch any movies at their convenience. VOD, in its current state of development, offers ample possibilities for situations where the use of audiovisual documents is commonplace. A variety of applications can be devised around VOD systems and this partly explains why so many promoters are including this type ofproduct in their first Information Highway development plans. One such corporation is Stentor a consortium comprising Canada's nine largest telephone companies. In collaboration with Bell Atlantic in the United States and their respective research and development sibling organizations, Stentorpioneered a new prototype technology which allows the transmission of an audiovisual signal through standard telephone lines.

In Canada, as well as in the United States, telecommunications providers have always been forbidden to transmit video signals and own cable systems. In July of 1992, the US Federal Communications Commission (FCC) ruled that telecommunications providers should be allowed to transmit video signals on a trial basis. The service, which the FCC referred to as Video Dialtone had to be offered in a nondiscriminatory manner to any content provider. This ground-breaking ruling immediately triggered a series of trials conducted by different phone companies, most of them using fiber optics for the transmission of their video signals. Bell Atlantic, which is currently the only company in North America to use the same technology as Stentor, is now running a trial project among 300 of its employees in Northern Virginia. The trial has been running since May of 1993 and the video service is scheduled to be offered commercially in late 1994 or early 1995. Meanwhile, the Canadian Radio-Television and Telecommunications Commission (CRTC) startedapublicconsultationprocess on the matter in March 1994 (Public notice 1994-33) and a final decision is still pending.

It was this more relaxed regulatory context which allowed Stentor to position VOD trial as falling under the telecommunications jurisdiction. From January to April 1994, Stentor held phase 1 of the trial at two Ottawa-area universities: Carleton University and the University of Ottawa. The study described in this paper was conducted during the trial at the University of Ottawa. The system Stentor was testing was based on a technology jointly developed by two research and development companies, Bell-Northern Research in Montreal and Bellcore in the United States. The access technology called Asymmetric Digital Subscriber Loop (ADSL), uses state of the art modulation technologies to provide a bandwidth of 1.5 million bits per second, i.e. approximately 95 pages of text can be transmitted every second, over standard telephone wires. Coupled digital video compression standard called MPEG-1 (Motion Pictures Expert Group), ADSL allows the transmission of a VCR-quality signal (as opposed to broadcast-quality) over traditionaltwisted-pair copper wires. The difference in quality between the VOD signals and cable television signals lies mainly in the resolution of the picture. For phase 1 of the trial, Bell-Northern Research devised a computerized interface which allows users to select the movie they want by choosing from a list presented on the computer screen. The VOD

software features VCR-like controls (fast-forward, rewind, pause, play, and stop) which considerably increase the flexibility of the viewing session. Since the navigation program was conceived in the Microsoft Windows environment, students involved in the project could use other concurrent software, namely word processing, to take notes on the movie while they were watching.

VIDEO-ON-DEMAND AS A PEDAGOGICAL ASSISTANT

There are two primary ways in which VOD could be used in a classroom as a learning aid: either as a teaching resource to present videotaped material or as an independent learning system, either showing linear videos or interactive video segments. While numerous experiments have been conducted with the use of video for instructional purposes, be it with the use of television, VCR or the computer, the unique contribution of the trial held at the two Ottawa universities is the fact that for the first time, users had complete and instantaneous control not only over the content they wanted to view but also over the pace of their learning session.

In a study conducted at Ball State University, Fissel(1993) reported that the use of video material to teach first year university classes had contributed positively to students' acquisition of some of the course's materials. The system used at Ball State University provided networked distribution of video signals in a number of rooms on campus. Teachers videotaped computer graphics and audiovisual material and then showed them in class. Students said the use of computer graphics helped them synthesize what was important and allowed them to do more efficient note-taking. The use of video material seemed to make the textbook more understandable and gave visual cues that students were able to remember more easily both during study and exams.

Aside from its use as a teaching resource, VOD can also be used as a tool for interactive video learning. Through the years, many educators have used video material in class to facilitate various aspects of learning, in particular in the general field of media education (Buckingham, 1990). As a forerunner to VOD, the development of videodisc technology has opened up novel learning applications in which students get complete control over the playback of interactive video modules. Although with the latter technology students are limited by the range of materials encoded on a single videosdisc, its educational potentials and similarities with VOD are nonetheless worth noting.

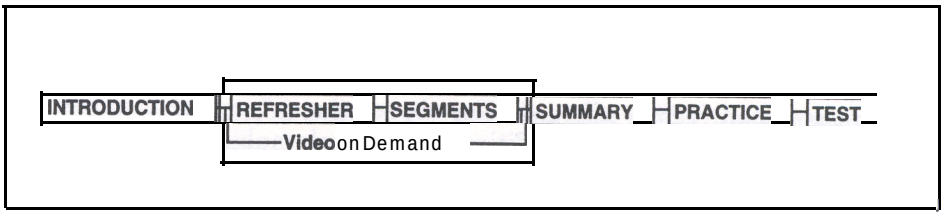
Studies show that the use of video material in which the learner controls the pace of the viewing session can be a great learning aid. Switzer and Switzer (1993) present the results of a study using courseware designed for university-level biology teaching, stating that "students who used the interactive video system scored significantly higher on a reliable post-test than students who received the instruction from classroom lecture and textbook.

The average total study time required by the videodisc group was 37 percent less than the time required by the classroom group" (p. 314). Another study sponsored by IBM Corporation compared student retention in a traditional lecture-based classroom to retention in an interactive video environment. " Students using interactive video demonstrated a 50 percent greater retention of the material. The percentage of students reaching mastery (80% on the post-test) increased over 300 percent with the use of interactive video" (Switzer & Switzer, p. 315).

Switzer and Switzer (1993) further list the benefits of interactive video as: " participation increases learning, feedback from the computer aids learning, repetition increases learning, information taken in through more than one sense is more readily learned" (p. 314). As mentioned before, many of these characteristics were present in the VOD experiment conducted at University of Ottawa, including the number of times a segment was shown.

In agreement with the definition provided by Sweeters (1994), the VOD trial described in this article can be categorized as a tutorial learning tool, in the sense that it "can be used to replace a lecture, for self-learning, or for remediation" (p.48). The tutorial model presented by Sweeters in Figure 1 relies on Robert Gagnes Events of Instruction (Gagne, Briggs, &Wager, 1992). Gagne is a scholar generally credited with having spelled out the necessary functions of a learning system. The standard tutorial model developed by Sweeters is instructive for our discussion of VOD as a learning tool in that it helps visualize precisely where VOD differs from other traditional models.

Figure 1.
VOD's Tutorial Model



Because of the specific documentary nature of the contents that were used in the University of Ottawa's experiment, some components of Sweeters' model do not apply to VOD. Such is the case with the introduction, summary and test units of the model, that are better suited for structured, didactic material and which were generally covered by the professor responsible for the VOD trial. As we see in the figure above, what VOD adds to a tutorial model is a feedback loop that allows the learner to review any given segment at will. This feature of VOD that favors a flexible, accurate and user-friendly to-and-fro movement between the different sections of a document makes it a learning system where user control is at the forefront.

However, as the "Overall Assessment" section onp. 72 will indicate later, the biggest challenge in developing learning tutorials of this type consists in

matching the teaching objectives with the specific learning requirements of a variety of users. Our results confirm Sweeters' (1994) observation that " when used extensively, tutorials sometimes exhibit standard patterns of design which students find repetitious or boring" (p. 48). Whether the contents are offered on demand or not, the fact remains that redundancy in the presentational aspects can have detrimental effects on both the evaluation of the system and on the propensity to use it.

A word of caution is in order at this point with regards to positioning VOD, and similar recent technological developments, as being a truly interactive system. As far as the system's hardware is concerned, Heeter (1989) proposes 6 criteria upon which we can establish the relative degree of interactivity of a given system. These criteria are:

- the complexity of choices presented to the user;
- the amount of effort needed to access information;
- the degree to which a media responds effectively to the user;
- the monitoring capacity of the system;
- the possibility for the user to add information to the system;
- the capacity for the system to facilitate communication between its users.

Analyzed under this specific set of criteria, we can see that the VOD system tested at the University of Ottawa cannot be considered purely interactive, as the last two items in the above list have not been implemented in this system. It must be noted that interactivity lies not only in the technology, but also in the user's behaviouralpatterns. Interactive television systems were studied by Jun (1986) who came up with two fundamental aspects of interactivity: a technical aspect whichcorresponds to the specific media, and a motivational factor linked to the willingness of the user to get involved in the system's bidirectional communication paths. Chen (1984) offers similar observations: " we begin to see that passivity and interactivity are qualities of individuals making use of media, not the media themselves " (p. 284). It is thus fundamental to evaluate whether the system addresses a specific need for which the user would be ready to become active in the communication process.

If we use the word "interactive" with a more restrictive notion of interaction, then there are many cases in which the use of interactive video seems the perfect alternative to traditional teaching. For instance, when the subject is of an abstract nature, video documents may help by providing visual cues to the learner. Interactive video is also very useful in cases where hands-on experience with the subject taught would be costly or dangerous. Students can become more responsible for their learning if they can work when they want, thus adding a flexible dimension to their acquisition of knowledge in the process.

This form of self-controlled learning has been primarily restricted to videodisc systems which allow students to interact on an individual basis with the content of the video material. Lately, some software programs, such as

QuickTime, have allowed the development of multimedia products running on CD-Roms. VOD holds promise as a replacement or as an extension of the videodisc. The VOD system tested in the present study allows users to select the document which is viewed and to control the pace of the viewing session. The use of an interactive video learning system such as VOD allows for simultaneous access to dozens of video service providers, whereas videodiscs must be purchased in advance and must physically reside in every location where they are used. VOD has another major advantage over videodiscs. Different users of VOD can access the same document at once at their individual workstations and independently screen the film as they please, whereas there must be one videodisc for every concurrent user. In addition, content providers can instantaneously upgrade their material on a VOD system, a flexibility that is not possible with videodiscs, since new videodiscs must be produced when the content is revised. Since VOD systems are still in the early phases of their development, it is still premature to comment with any reasonable certainty about their level of reliability and possible uses. There is no question, however, that they are unlikely to replace videodisc systems, at least in the immediate future.

CONTEXT OF EXPERIMENTATION

Carleton University's participation in the experiment was conducted through the Department of Philosophy. Over the semester, 36 modules of 45 minutes, each dealing with symboliclogic, were videotaped and made available to students through four computers. Three hundred and forty students (340) were registered in the course, and about 90 of them (26.5%) actually used the VOD system at least once over the duration of the course. The users had total control over when they chose to attend their classes and the duration of their viewing.

At the University of Ottawa, the trial was held under the auspices of the Department of Communication. For the Department, VOD represented an opportunity to integrate the trial in a course dealing with the social impacts of new communication, information and entertainment technologies. After negotiating an agreement with the National Film Board of Canada (NFB), the Department secured permission to use, free of copyright fees, some 40 films from the National Film Board catalogue. From the NFB standpoint, this type of partnership was conceived as an occasion to explore new ways to promote its catalogue of documentaries and fiction movies. In addition, the joint venture with Stentor and the University of Ottawa was considered by NFB authorities as a high profile experiment that held encouraging potential for the advancement of audiovisual distributionsytems. Because of storage and cost constraints imposed by the trial's video server, the computer which stores the digitally encoded video material, the University of Ottawa was allocated approximately 48% of the server's total capacity (32 gygabytes). This capacity enabled up to 32 hours of NFB video content to be stored on the server for the

duration of the trial. The selected material for the trial at the University of Ottawa addressed a variety of topics, such as society, media, women in media, new technologies and work, children and the media, and journalism. Most of the titles chosen dealt, to some degree, with the impacts of new technologies on different aspects of contemporary life. The videos were accessed in the computer program through a tree-like structure splitting the titles first into French and Englishentries, and subsequently intovarious categories.

Seventeen students (17) were enrolled in the course CMN 4515: New Communication, Information and Entertainment Technologies and Private Life. From a methodological standpoint, our inquiry would be best described as quasi-experimental. In the official course outline distributed to students at the outset of the semester, they were informed that the course would contain an experiment to test the pedagogicalpotency of VOD. As part of their assignments, students were required to watch one movie per week and submit a one-page critical essay on the subject matter dealt with in the movie. This weekly assignment was designed to ensure a regular use of the VOD technology so that students could make an informed assessment of it. Students also were required to make two class presentations using excerpts from the movies available on the system. This protocol allowed them to experiment with the VOD system as an independent learning vehicle as well as a teaching resource that would serve to illustrate certain key points in the students' exposes.

Another Mass Media communication class of thirty students also had sporadic access to the system. They used VOD primarily to experiment with the technology within their course curriculum. These students were asked to consult two documents made available through the system. We collected data on their experience for comparative purposes.

METHODOLOGY

The purpose of this study was to assess the educational potential a new communication technology like VOD might have in the marketplace. More specifically, we wanted to see how users, in this case students, would react to the introduction of this device in the classroom. Although that specific perspective had very little, if any, bearing on the way the actual experiment was conducted, one must nevertheless acknowledge the system provider's point of view in this trial. Stentor was, naturally, very concerned with how the system behaved and responded to the frequent modifications that an experiment inevitably entails. As we mention in the next section, this state of affairs cannot be discounted as it might have affected the way some students perceived the system.

A series of three questionnaires was administered to students enrolled in both the New Technologies and the Mass Media courses at the University of Ottawa. A first questionnaire was given to students before they had any contact with Stentor's VOD system. This questionnaire was designed to provide a profile

of student characteristics including age, sex, former experience with technologies, current use ofcommunication technologies and their preconceptions about technology in general. The secondquestionnaire was distributedone month after the introduction of the system. It asked students about their overall experience using the system: user-friendliness of the software, relative satisfaction and thoughts about how the system could be used and improved. At the end of the trial, in April 1994, the finalquestionnaire was distributed. This questionnaire was similar to the second one, except that it included a series of questions on the user's vision of the future for the VOD technology.

This series of three questionnaires was complemented by two focus group sessions which were held in the classroom. In these sessions, students were asked about their feelings regarding the VOD technology. They were encouraged to voice their comments for and against the system, and were asked to describe the system's main problems and how they thought these problems could be solved. Finally, an on-screen questionnaire was used. Throughout the three months of the trial, every third student using VOD would get to answer a brief on-screen questionnaire asking about their appreciation of the system. By presenting the questionnaire to every third student, a random sample was obtained.

DESCRIPTION OF THE EXPERIMENTAL GROUP

The results presented here are from two different pools of respondents. Unless otherwise stated, all of the information discussed in this section originates from the class where VOD was tested. In some cases, data obtained from another communication class will be brought up to accentuate certain tendencies or conversely, to signal dissonant results. To avoid any confusion between the two groups, we will refer to this latter class as the "comparison group". It is worth repeating that in both these groups, VOD was construed as an emerging technology whose pedagogical efficacy was the prime element of investigation.

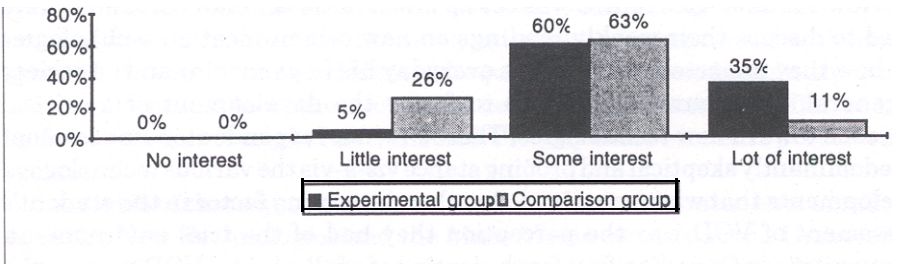
It must be emphasized that the trial involved a limited number of students in a particular setting. The trial group included 17 students, most of them in their third or fourth year of a bachelor's degree in Communication Studies. The New Technologies course was set up much like a seminar. Students were asked to discuss their weekly readings on new communication technologies and how they impacted on the user's everyday life in particular and on society in general. The course's goal was to foster the development of a critical approach toward new technologies. Therefore, our respondents came to adopt a predominantly skeptical and probing stance vis-a-vis the various technological developments that were examined. Another determing factor in the student's assessment of VOD was the perception they had of the trial environment. Because it was a Canadian first for the testing of a fully digital VOD system, the trialreceived substantial media coverage and many journalists came during or

around class time to obtain students' comments. A Stentor representative was often on the site during lectures to check progress and to ensure that the system was working adequately. This situation clearly gave students a double message: on the one hand, they felt somehow flattered to be receiving so much media attention as they were part of a select group of students fast becoming experts on VOD. On the other hand however, some expressed a certain degree of annoyance at having frequent visits from external parties for what was perceived to be a "check call" to verify the performance of a major financial and public relationsinvestment.

With this experimental context in mind and the limited number of users (n=17), this study purported to evaluate the nature of the interactions that users established with the first-generation of the VOD system and to assess the educational potential of using this technology in a classroom setting. The scope of the results presented here is possibly limited by a host of factors: the relatively smallsize of the sample; the limited choice of video documents users could access; and the fact that respondents were fully cognizant of being part of an experiment on a technology that was being fine-tuned before going to market. Hence, the numbers presented below are to be construed as indications of the dominant tendencies expressed by the first educational users of VOD and must be limited to the group under study.

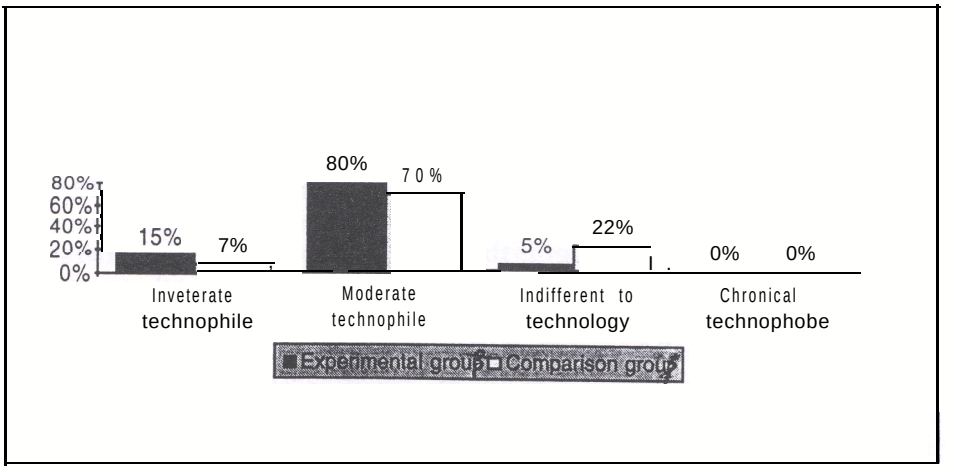
Our prime[2] sample group (n=17) was mostly composed of women (59%), and 76% of these respondents were under 25 years of age. The two important parameters that define this sample group are the interest students show toward new communication technologies and how they perceive themselves vis-a-vis the technologies. On both questions, 95% of the students said they had either some interest (60%) or a lot of interest (35%) towards new technologies (Figure 2), while the same percentage said they were either a moderate technophile (80%) aninveterate technophile (15%) (Figure 3).

Figure 2.
Interest Toward New Technology



Our comparison group out shares basic demographic descriptors with the experimental group. The main area on which the two groups differ is the relative level of interest shown towards technology, where students from the comparison group expressed having either some interest (63%) or a lot of interest (11%) (see figure 2), whereas our experimental group's combined total in these two categories was 95%. Whenasked to describe themselves withregard to technology, only 77% of the students in the comparison group consider themselves either moderate or inveterate technophiles, while it was 95% for the experimental group (Figure 3). Another distinction between the experimental group and the comparison group was that the course the latter group was taking is a compulsory course, whereas students in the experimental group had freely chosen to enroll in that course. For students who elected to take the New Technologies course, it is safe to assume that they did so primarily because they had a keen interest in the subject matter, and were possibly more committed toward owning, using and reflecting upon new technologies.

Figure 3.
Propensity Toward Technology



We wanted to assess to what degree our respondents were familiar with various communication and information technologies, thus giving us some background information on their predispositions toward yet another communication innovation. Most of the respondents were rather familiar with technology, with 88 % of them subscribing to cable, owning a VCR and a computer[3]. Granted that owning a technology does not equate to using it, the fact that we are dealing here with university-level communication students more or less warrants a functionalknowledge of both VCRs andcomputers aspartofthe generaltraining they obtain during the course of their education.

Since the generation of VOD system that was tested at University of Ottawa is based on a computer, it is interesting to observe that 80% of the students that own a computer use it at least 4 hours per week, with 27% of them using it for

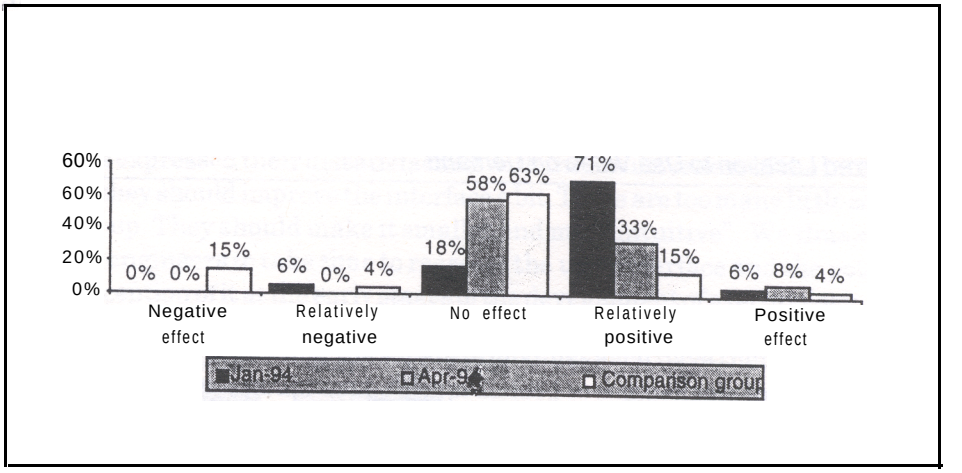
more than 13 hours per week. This propensity toward interacting with computers should contribute to facilitate the navigation procedures within the VOD architecture. Among those who had a computer (n=15), 40% had a modem and 47% had a fax. In addition, 82% of the students owned a compact disc player, 94% had an answering machine and 47% subscribed to one of Bell Canada's specialized telephone services, with call waiting being by far the most common service subscribed to within that group (87.5%). When asked about their entertainment habits, a little over a third of the students (40%) said they watch a movie in a theater twice a month or more. A large majority of them (88%) spend less than $20 a month in expenses related to video entertainment, and 65% rent a movie twice or more per month.

From a transmission standpoint, since VOD has the technical potential to compete with what is currently offered by cable companies, respondents were asked what they thought of what is typically shown on television. A little over half of the sample (60%) think that the choice of programs presented on television is adequate, while 94% of respondents find that the quality of the programs shown on television is good.

OVERALL ASSESSMENT

We also wanted to assess whether VOD had had an influence on the user's learning over the course of the semester. When first asked about it after one month of usage, 77% of the students said that it had a positive influence on their learning. At the end of the semester, however, the percentage went down some 36 points to 41% (Figure 4). This seems to indicate that the initial enthusiasm that students experienced towards the use of a new technology faded over the three months of use, and that a more critical position was taken at the conclusion of the experiment, a situation fairly common in research known as the Hawthorne effect. In all fairness to the technology though, one cannot discount the "fatigue factor" which certainly affected negatively the evaluation of VOD. For the majority of the users, the novelty of going to a laboratory to view an NFB document on a 14 inch computer screen rapidly wore off. In retrospect, based on the comments expressed by the participants, had larger monitors been used or if students could have accessed the system from their home, this fatigue factor could have been lessened. Similarly, had VOD had a wider variety of documents from which students could choose, their evaluation of the system might have been different. On the other hand, it must be noted that students in the comparison group gave somewhat more mitigated answers, with 63% indicating that VOD had no effect on their learning after one month of use, and only 19% claiming that it had a positive influence. This can most likely be explained by virtue of the fact that students in the comparison group had had a rather sporadic contact with VOD and hence had not been given adequate opportunities to assess thoroughly the relative merits of the system compared to other more traditional means of learning

Figure 4.
Effect of Video on Demand on Learning



Another factor that affected the students' assessment of the technology is the physical setup in which the trial took place. The four computers made available to students were grouped in two rather small rooms. The chairs were normal classroom chairs and the confined space forced the students to sit not only very close to the screen but also to each other. At the end of the trial, one out of three (33%) students answered negatively when asked if the physical environment was adequate for viewing and/or learning. The discussion during the focus groups often centered on the physical environment, as many students expressed dissatisfaction regarding the chairs, proximity of the screen from the viewer relative smallness of the room and discomfort from the headset. " I can't listen to a movie on a chair with headphones not loud enough. I don't find it comfortable, I don't find it pleasing. "is a typical example of the comments heard. Ostensibly, some of the ergonomic elements of the system seem to have contributed negatively to the overall assessment of VOD as well as detracted from a more frequent and beneficial use. With regard to the ideal location where they would prefer to access the system, studentslisted their home (lOO%), in a library (50%), and in other places (83%) -including at the office (Figure 5).

The overall tendency towards the manifestation of the Hawthorne Effect and the attenuation of the level of enthusiasm via-a-vis VOD that surrounds it, is confirmed by many variables. In all questions that pertain to the user's appreciation of the system, we see a generalized shift towards a more neutral position. In a question where students are asked about their overall satisfaction with the system so far, the answers went from 88% saying they were generally satisfied (82%) or very satisfied (6%) after one month of use to 66% at the end of the semester (Figure 6). Those results must not be interpreted as a disenchantment with VOD as much as a somewhat natural tendency toward a more balanced appraisal over a three-month long exposure to it. Although it is

impossible to identify the individual contribution of the contents in the overall assessment of VOD, one must nevertheless recognize that the limits imposed by the sole selection of NFB entries could have contaminated somehow the overall evaluation of this VOD trial by creating in the minds of users a strong bond between the technology and the paucity of film offerings at that particular stage.

Figure 5.
Preferred Location to Use Video on Demand

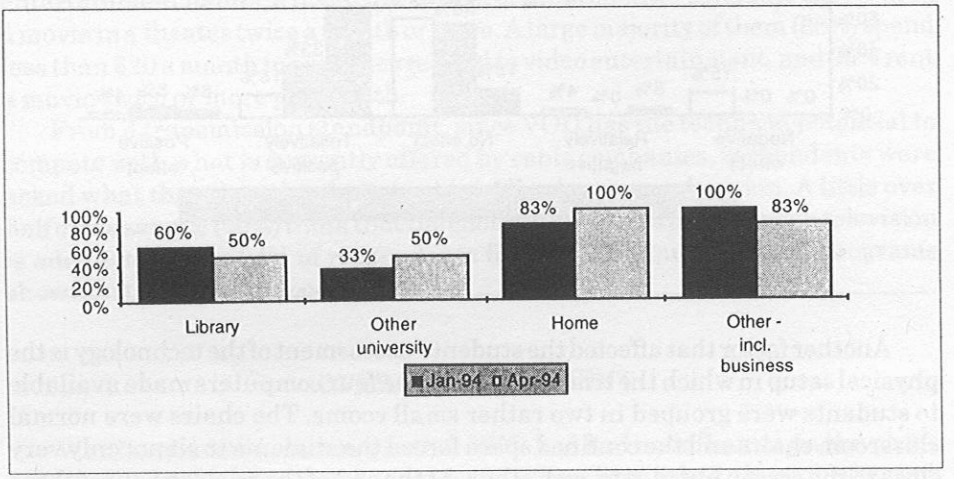
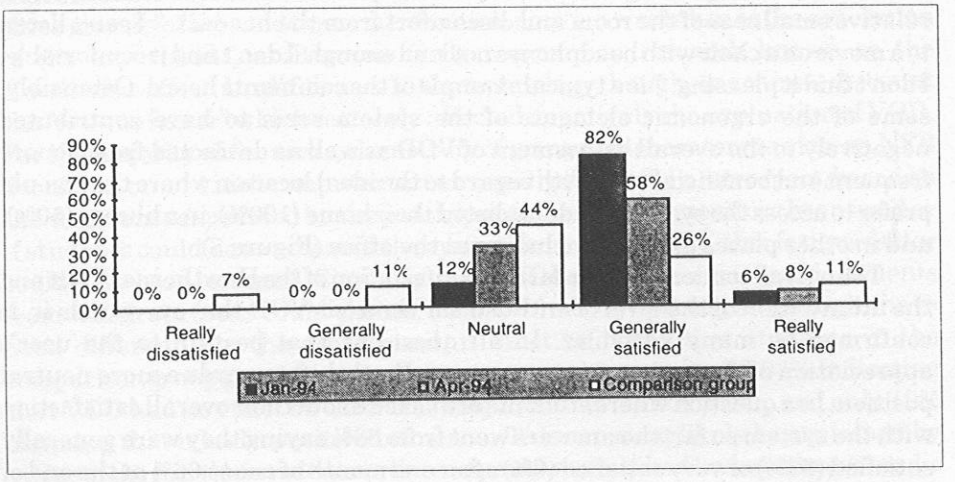


Figure 6.
Overall Satisfaction Toward the System



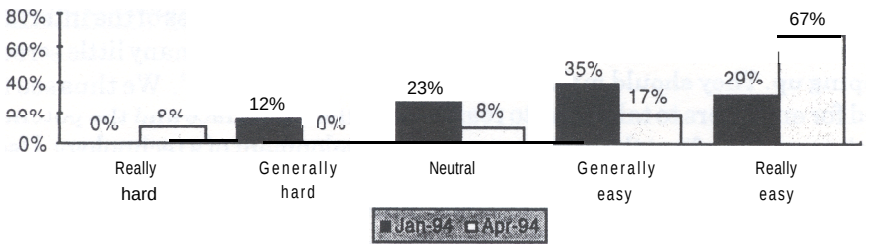
USERINTERFACE

The way the user interface was designed caused many problems and may account for some of the lower scores on the satisfaction scale on the final questionnaire. The users felt the interface was cluttered and that too many windows were "floating around", making it difficult to give commands to the program and organize the windows on the screen. During focus groups, many students expressed their dissatisfaction with the intuitiveness of the interface: "I think they should improve the interface a bit. There are too many little screens popping up. They should make it smaller and more intuitive". We thus see the need for engineers to take time to reassess the user interface and the potential user's reception of it at the early stages of the development of a technology. Users wished to have every command integrated in one window, but the program was designed in such a way that the separate modules each have their own window. The user interface should not be compromised to compensate for delays in the implementation of a trial program since the technology will inevitably be assessed upon its interface, which is the part the user is in contact with the most and the only part the user really is knowledgeable about.

It is relevant to mention at this point that, subsequent to the end of the trial, Stentor used the feedback provided by students at both universities tore-design the interface. The changes resulted in minimizing the number of windows present at any one point on the screen as well as integrating all commands, such as VCR controls, audiovisualcontrols, access to word-processing, etc., in a single integrated menu toolbar at the top of the screen.

With regard to their competence at handling the system, users seemed to gain a better familiarity with the controls throughout the trial period. On a question dealing with the entry/exit procedures of the system where users were asked to quantify the intuitiveness of those procedures on a scale going from 1 (very hard) to 5 (very easy), 64% of the respondents answered either 4 or 5 after one month of use. Furthermore, that number climbed to 84% at the end of the trial (Figure 7). Although users became more acquainted with the commands and controls, half of them (50%) said, after three months of use, that the controls in the program were less easy to use than those on their VCR. We must note however that despite a 15 point-drop from the results obtained on that same question in January, this remains a relatively high percentage of dissatisfaction. This fact can be explained by the problems that were experienced with the use of the rewind, pause and fast-forward functions, whichsometimes showed erratic behaviour wheninvoked. Here again, Stentor has since addressed this problem.

Figure 7.
Intuitiveness of Entry/Exit Procedures



When studying users' reactions to the various control functions, it seems that a majority of users (65% at the beginning of the semester, 100% at the end of the semester) find that the " jump to " command is very useful. This command allows the user to select any point in the movie from which to start the viewing session. At any time during the session, the user can also modify the current location and jump to another part of the movie. There again, the higher score obtained at the conclusion of the trial period can be attributed to users becoming more comfortable with the system's components. These results show one of the main advantages VOD has over traditional VCRs: complete control over the viewing sequence and in addition, a much faster and more precise access to any given segment of the document. While traditional videocassettes are generally viewed in a linear sequence and are not designed to easily locate any given sequence on a tape, VOD video segments can be viewed in any order, instantly jumping from one segment to another. This feature makes VOD a potentially powerful learning tool that can be used to present video sequences in an order chosen by the learner and/or instructor. When reflecting upon the way VOD was used during the trial period, they did not really perceive how it differed from what they could already accomplish with their VCR. Students acknowledged the potential of the technology but thought, at this present stage, that they were underutilized.

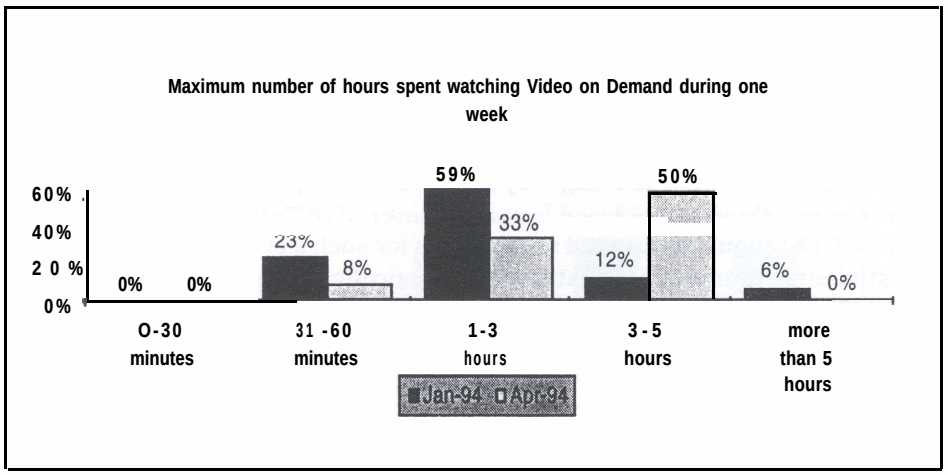
One exception is worth mentioning. Notwithstanding the nature of the consensus that users arrived at when comparing the potentials of VOD and a VCR, one of the most technologically inclined students in the group managed to exploit the referential potential of VOD in an original manner. When submitting his weekly critical essays on the NFB title that he had seen that week, the student used the " time bar " in much the same way quotations are traditionally used in a paper. The student would indicate that a given passage in his essay related to the segment shown" at the 12 minutes 26 seconds mark "in the video.

This indexing capability of VOD can indeed have a high degree of pertinence for instructional purposes.

Concerning future developments of the technology, almost 6 out of 10 students (58%) thought that the system would benefit from more interaction between the user and the video. The VCR-like controls were thought to be an important feature for 69% of the users. As for content, all considered multimedia documents (documents that combine text, sound, film, graphics and pictures much like CD-ROMs), as being very important to be provided by VOD (100%) whereas two thirds considered learning material (67%), or informative documents (64%) should be treated as priorities for such a system. We can see that the students in our group are rather technologically inclined as they are familiar with the concept ofmultimedia and would like to benefit from the possibilities the use of the computer as an interface brings forth.

At the end of the trial, users seemed to appreciate the potential VOD has as a learning tool. On the first questionnaire, only 12% of the students said they would prefer accessing VOD servers through a computer screen versus through a televisionset. On the second questionnaire, one third (33%) of the students said a computer screen would be their preferred mode. It appears users began to realize the potential of a well-designed interface that would allow bridging the power of the computer with the power of a video distribution system like VOD. This openness toward what the system can potentially achieve is visible in the fact that, at the conclusion of the trial period, close to six respondents out of ten (58%) stated they would be willing to spend between 3 and 5 hours a week using the VOD system versus only 12% at the beginning of the trial (Figure 8). This more favorable perception of VOD is, however, toned down by some remarks that were voiced during the focus group sessions pertaining to the power of the computer as well as the quality of the interface. Indeed, the lack of pixel resolution on a computer screen seems to hinder the time one would like to watch a video document on a screen to a maximum of a couple of hours at a time. This factor is however directly dependent on the type of computer and monitor used to both run and display the video material.

Figure 8.
Maxirnum Number of Hours Spent Watching Video on Demand During One Week



STUDENTS' PERCEPTIONS OF NEW TECHNOLOGIES AND VIDEO-ON-DEMAND

The questionnaire that students filled out at the end of the semester included a series of statements about new technologies, the information highway, and VOD. The 17 students that took part in the trial were asked if they agreed or disagreed with each statement. The statements that received the highest percentage of agreement (i.e. combining the scores of "somehow" and "totally in agreement") are illustrated in the following table 1: " I like to be able to select what I want to watch when I want to watch it. " with which 100% of the users agreed, " VOD is a technology in search of an application " (92%), "I cannot imagine viewing a film for more than an hour on a PC screen (84%),", "VOD will give people a better control on their viewing habits " (83%), and "The CRTC will do everything in its power to facilitate the diffusion of this technology" (64%).

TABLE 1
Statements which Received the Highest Percentage of Agreement (n=17)

	Partly in agreement	Totally in agreement
I like to be able to select what I want to watch when I want to watch it	75	25
Video-On-Demand is a technology in search of an application	67	25
I cannot imagine viewing a film for more than an hour on a PC screen	42	42
Video-On-Demand will give people a better control over their viewing habits	75	8
The CRTC will do everything in its power to facilitate the diffusion of this technology	46	18

The statements whichreceived the highestpercentage ofdisagreement (i.e. combining the scores of "partly" and "totally disagree") are listed in table 2: " The cable companies must have a monopoly over video broadcasting " (100%), " I would like to attend classes through VOD " (100%), " With the advent of VOD, I would cancel my cable subscription " (91%) and " VOD will help me save money on my entertainment expenses " (73%).

The results presented in table 2 indicate a persistent degree of attachment toward traditional means of entertainment and education. The participants in this trial clearly do not conceive of VOD, at least, *at this current stage of its development*, as a replacement technology that could eventually supplant what they are used to get via their cable service provider. Nor do they think that because of what VOD can offer, they would have less of a need to either go out to see a film, play or concert, or rent a video and in the process, end up spending less for their entertainment activities. As for the educational prospects of VOD, significant improvements will need to be implemented on both the ergonomic and content aspects of the system before students begin to show any firm inclination toward using VOD as an alternative to physically attending a lecture.

TABLE 2
Statements Which Received the Most Disagreement (n=17)

	Partly disagree	Totally disagree
The cable companies must have a monopoly over video broadcasting	*58*	*42*
I would like to attend classes throughvideo-On-Demand	*33*	*67*
With the advent of Video-On-Demand, I would cancel my cable subscription	*45*	*46*
Video-On-Demand will help me save money on my entertainment expenses	*46*	*27*

CONCLUSION

From the results collected for the present study, we can project a series of observations from the VOD system to a number of other recent technologies. The main conclusion to be drawn is the risk involved in evaluating a technology in the preliminary stages of its commercial development. The evaluation process addresses not only the technology in itself but also a collection of external variables, often out of the direct control of the developer and/or promoter, which affect the user's perception. In the specific case of the VOD trial, those factors include the physicalenvironment in which the trial tookplace, the content made available through the system, the relative technicalunreliability of a system still in the early stages of its development, and the fact that the user interface was not corrected over the three-month period according to the user's "wish list".

There is a tendency that follows the introduction of new technologies for the public to see the new tool as a new " toy ", a glimpse of the future that they would really like to experiment with. The initial amazement gradually wears off when the innovation becomes part of the public's everyday life and it becomes what it was designed to be: yet another technology. In the Stentor VOD case, this phenomenon is confirmed by the results obtained. The novelty effect wore off when students came to see the VOD system as just another study tool rather than as an innovation that could significantly affect the way they go about collecting information and knowledge. The external factors cited previously contributed to the dissipation of the novelty effect, particularly the fact that users did not see any significant changes in the technology over the semester. The content stayed the same and limited the possibilities for the users to experiment with the

system. The software also remained the same over the trial period, and many users expressed some concerns with the interface. In retrospect, based on the feedback obtained in the focus group sessions, if subtle yet visible improvements to the VOD system had been made, it is likely that users would have perceived VOD as an evolving technology and hence may have expressed a more positive evaluation of it.

As a pedagogical tool andeveninother applications, VOD holds some wide-ranging potential. The possibility for users to interact with a video document server opens a window ofpossibilities which could be filled by appropriate user-end software. Such systems could be used in industry for in-house training software. Travel agencies could use VOD systems to promote destinations. Included in phase 2 of Stentor's trial is a project, developed in collaboration with Mentor Networks Corp., which will provide continuing education to physicians in hospitals. It is nevertheless clear from the results of this study that users view VOD primarily as another means of transmitting information and entertainment services and not as a replacement for traditional media and entertainment practices. The main challenge for the developers of such a system will therefore be to find applications for VOD where the demand originates from a considerable segment of the population and to develop partnerships to market those applications into commercial services.

Already in Canada, there are a number oftechnologicalventures whose main objective consists in designing systems where multimedia educational material would be accessible to all Canadians. Certainly one of the most-talked about issues surrounding the Information Highway is to what measure we will enable Canadians to be effective users of the various contents available. There is no question that the pace at which new technologies are being proposed to various groups of users contributes significantly to endowing multimedia developments with a sort of magical, all-powerful aura. Notwithstanding their fundamental virtues, what this and other experiments on pedagogical multimedia innovations reveal, is the importance of designing systems that have readily observable advantages over existing alternatives that sustain the test of time. It is possible that the promise of empowerment that seem so dear to the promoters of the Information Highway may be more applicable to people who use technologies for business-related purposes. However, it may not be as apparent for those who use those same technologies to further their learning.

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NOTES

1 The use of the term Infobahn to describe the Information Highway is becoming more and more common inliterature devoted to the information age. It refers to Germanautobahns or highways, where no speedlimit exists, and implies that the Information Highway should be kept free of regulations that infringe on the free flow of information. The term also suggests an idea of globalization, i.e. the free circulation of information all over the world, a central feature of the Information Highway metaphor.

2 The descriptor "prime" is being used here to differentiate this group from the other Mass Media course, referred to in this text as the "comparison" group, which only sporadically experimented with Video on Demand. A more adequate term for the "prime group" would be "experimental" but we do not feel that the comparison group was submitted to sufficiently rigorous conditions to warrant a true scientific comparison between the two groups.

3 Although the percentage is 88 in all three cases, it is not always the same eighty-eightpercent thatpossesses those technologies.

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