The Use of Communication Satellites for Distance Education: A World Perspective

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October 1957 and the launching of the first artificial satellite, Russia's Sputnik I, is generally taken as the beginning of the space age. In the relatively short time since then more than 25,000 satellites and space probes have been launched by governments and private organizations (Wigand, 1980). They provide most urban dwellers, and increasingly those in rural areas as well, with many communication services now taken for granted such as international telephone calls and telegrams, radio and television news reports. Direct participation in political, entertainment and sports events as they happen - virtually anywhere on the globe - has become commonplace.

In addition to broadcast and telecommunication services, satellites are used to forecast weather and climate patterns, to assess the health of food crops, to search for new sources of oil and minerals, to evaluate hurricane and tornado damage, to study the growth of cities, to search for aircraft or ships in distress, and to provide educational opportunities. The list of satellite applications seems unending, in line with their proliferation. In 1979, some 5,000 satellites were in orbit; by 1985 it is predicted that this number will rise to 10,000.

One hundred and six nations are currently members of the International Telecommunications Satellite Organization (INTELSAT). The majority of countries use these satellites for sending and receiving international telephone and telegram messages and radio and television signals in major urban centres. Some twenty-four countries also lease capacity from INTELSAT to service their internal national communication requirements. Several other countries have launched their own domestic vehicles. Canada led the way in 1972 with ANIK A-1, the world's first domestic geosynchronous satellite. Situated some 36,000 kilometres over the equator (above the Galapagos Islands), it maintained the same orbital speed as the planet Earth so that is remained in a fixed position relative to the earth's surface. This pattern was followed quickly by the United States and Japan. In the developing world, Indonesia was the first country to launch a domestic satellite in 1976 (PALAPA); India successfully deployed INSAT 1-B in 1983 and China launched its first domestic communication satellite (CHINASAT) in early 1984. A consortium of Arab countries, Mexico, Argentina, and of course Brazil are in various stages of planning and implementation. Indications are that because of limited orbital slots available, and costs of building and launching satellites, the majority of the third world countries will be associated with either international or regional systems during the 1990s. Developing countries that will operate domestic systems **per se** will be relatively few, and probably less than 10.

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COMMUNICATION SATELLITE CONFIGURATIONS

There are basically three types of satellite systems: point-to-point satellite systems, distribution satellite systems, and direct broadcast satellites (UNESCO, 1972). The maximum area of coverage of a point-to-point satellite situated in a geosynchronous orbit at 36,000 kilometres above the equator is one third of the earth's surface. The major function of this type of system is thus to move high density communication signals such as transoceanic telephone and television over large distances. The primary disadvantage of this system is that since the satellites are of relatively low power, the signal they send back to earth is weak. Consequently the receiving dishes must be very large and powerful, tending to make them expensive for individual countries to operate.

Most operating systems are of the distribution type where the land area to be covered by any one satellite is greatly reduced in comparison with the point-to-point system. The signal emitted by the satellite is consequently much stronger and less powerful earth stations are required to receive it. Estimates place the cost of this type of receiver compared to the point-to-point type in the order of 1 to 10. Most satellites of this type operate in the 4/6 GHz mode and are mainly used to relay signals for re-distribution through terrestrial systems. Used in this combination, they become much less expensive than through operating a terrestrial system alone (Polcyn, 1981). ANIK A and D (Canada), INSAT 1-B (India), PALAPA (Indonesia), and SBTS (Brazil) are all examples of distribution satellite systems.

Of more recent origin is the direct broadcast satellite. These are designed to transmit powerful television signals which can be received on small and inexpensive dishes (about 1 metre in diameter). This type of satellite holds the greatest potential for distance education efforts which generally serve large areas of low population density, and utilize receivers. The combination of the one metre receiving dish (which may be collapsed like an umbrella) and battery operated television sets has created truly "transportable" earth stations capable of receiving signals anywhere in the area covered by a direct broadcast satellite. Its use in peripheral, isolated areas for information and educational purposes appears particularly noteworthy. Currently operating in the 12/14 GHz frequency range, examples of this type of satellite include HERMES (Canada and U.S.A.), ANIK B and C (Canada), CHINASAT (China), and ARABSAT (Saudi Arabia). The ATS-6 satellite launched by the United States in 1974 and used for educational experiments in Alaska and India presently slated for use in Brazil's SACI project) was the forerunner to the current generation of direct broadcast satellites.

In summary, the relatively short history of satellite development, particularly development of the direct broadcast satellite, appears to hold substantial promise in extending both formal and non-formal educational opportunity on a worldwide scale. Where, for whom, and how satellites have been used in distance education thus far should provide useful background to those countries and institutions currently planning new applications.

REGIONAL APPLICATIONS

The University of the South Pacific

One of the more imaginative uses of satellites for post-secondary education has been developed by the University of the South Pacific (USP). USP was established in 1967 in Suva, Fiji, the most populous country in the region, to serve as the centre of higher education for the countries and territories of the South Pacific.

The area served includes 11 small island countries (Fiji, Cooks, Gilverts, Tokelau, Solomons, Niue, Tonga, Western Samoa, New Hebrides, Nauru and Tuvalu), with a total population of 1.5 million people spread over 11 million square miles of ocean. Because of the distances and costs involved in student travel it was decided early on that a single campus would not meet the needs of the region. Extension Centres were therefore developed and currently are functioning in nine of the member countries. In addition, an Agricultural Campus was built in Western Samoa. And since 1974, USP has used the ATS-1 satellite to link the main campus in Suva with the Extension Centres (Balderston, 1979).

Distance education courses are offered through the School of Education Services in three main areas: 1) Pre-University courses aimed at enlarging the number of potential university students; this has been expanded to include the first or foundation year of university; 2) Teacher education and in-service training through courses in the Certificate or the Diploma in Education Programs; 3) Individual courses in areas such as administration and accounting. Each centre has a full time local staff of administrators and tutors. The main elements in the program include delivery of course materials to students (textbooks, audio-visual materials, teacher evaluations), availability of an on-site tutor to provide administrative assistance and course support, and contact between students and professors or subject matter experts. Since professors are in short supply in the Pacific Islands and travel costs from island to island prohibitive, the satellite service is used to extend the expertise of available experts through audio-conferences and tutorials to students who meet for classes in the centres. The system also provides for rapid feedback to students on their assignments and advice to tutors from professors, both of which would be very slow through the mail service.

The audio conferencing system uses the satellite to link and share a single audio-channel between the main campus and the extension centres. University professors in Suva conduct lectures and tutorials. The interactive nature of the facility allows both teachers, students and tutors to ask and answer questions, not only between the main campus and a given centre but also between the centres themselves. Anyone in the system can talk to anyone else by using simple-push-to-talk microphones (Casey-Stahmer and Lauffer, 1982). Recent additions have included micro-computers at each site for transmission of hard copy and for building data bases; slow scan video units have also been added in Fiji, Tonga and Western Samoa. A typical satellite weekly schedule includes 14 hours of activity ranging from formal course lectures and tutorials and in-service teacher education, to weekly administrative staff meetings. The satellite network is also used for administration of distance education materials such as verifying the distribution of course materials and transferring enrollment data and grades.

The success of the project is perhaps best illustrated in student enrollments. The pre-1977 data suggests that the average annual enrollment (two semesters combined) in the Extension Centres was about 1000 students. This increased to over 1400 students by late 1977. By 1981, the enrollment in the Extension Centres alone had reached over 4000 student registrations (Hudson, 1981). Current statistics suggest a 1984 enrollment exceeding 9,000 registrations in credit courses alone. The factors that have most contributed to the success of the project are the quality of feedback from the tutors and the rapid turn-around time on tests and assignments. Both of these elements are directly attributable to the creative use of satellite audio-conferencing. Current planning includes a continued emphasis on satellite technology as an integral component in extending university education throughout the South Pacific.

The University of the West Indies

A similar project to that described above for the South Pacific has recently been initiated by the University of the West Indies (UWI). The University's principal mandate is to provide all major fields of educational specialization for the 14 English-speaking Caribbean Islands. The overall population of the area to be serviced is about 4.5 million; less than 1% of the labour force is university educated, hence the strong need to increase the university capacity to extend educational opportunity.

Three main campuses have developed - in Jamaica, Trinidad and Barbados - with university centres maintained in the other 11 territories. Each of the smaller centres is staffed usually by only one university tutor. A limited range of courses and services is offered, augmented occasionally by staff visits from the main campuses. Again, because of the distances to be covered and the costs for both students to attend the main campuses and professors to conduct face-to-face courses in the far flung centres, distance education alternatives were considered. A two month pilot project using the ATS-3 and ATS-6 satellites was initiated in 1978 wherein the university set up video and audio teleconferencing interconnections between Jamaica, Barbados and St. Lucia. This led in turn to a two year feasability study. The subsequent recommendations were to set up a satellite-based audio-conferencing system which would initially connect the three main campuses with St. Lucia and Dominica.

The "University of the West Indies Distance Teaching Experiment" project as it has come to be known, began its operations during the autumn of 1983 with two primary distance teaching applications: 1) First year university bachelor degree courses, and 2) In-service teacher training courses for up-grading classroom skills and subject matter knowledge. The first of these objectives is to enhance a program that began in 1977 which allows students who are not studying at one of the three UWI campuses to take their first year examinations in their home territory. In order to earn a bachelor's degree, all students must pass examinations at the end of the first year and during their final year of a three year program. For the first set of examinations students must choose subjects from six basic areas namely, Introductory Economics, Sociology, Accounting, Politics, Mathematics and Statistics, and History of the Caribbean. The University began its distance teaching operation with four classes; economics, sociology, accounting and history of the Carribean. Lecturers are located in Jamaica, Barbados and Trinidad, dependent upon the discipline offered by a particular campus. Interestingly, the courses are offered not only to students in St. Lucia and Dominica but also for on-campus students in the three University locations.

The second objective is to provide extended opportunities for teachers in the region to up-grade their teaching qualifications through obtaining a Certificate of Education Program diploma. Prior to 1983, this one-year program was offered only on the Jamaica campus. Subject matter specialization included reading, mathematics, science, English, physical education, social studies, creative arts, Spanish, and teaching deaf students. For its initial year of operation, the distance education system offered in-service courses leading to a Certificate in Education for teachers of the Hearing Impaired and Reading (Lalos, 1984). Participants were selected from all five countries with courses offered at convenient times over an eighteen month period. Both of these operations are intended as a type of proving ground to a full scale expansion

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of an "open university" in the region (Academy for Educational Development, 1983a).

Each location in the system has a teleconferencing room large enough to hold 30 people with appropriate audio receive and transmit equipment. Like the USP system, it is also completely interactive so that students, tutors and instructors at any of the locations are able to talk and be heard by all of the participants at all of the locations.

Other planned applications of the system include in-service training for nurses, health professionals, laboratory technicians, pre-school teachers, and professionals in business and public administration. Agricultural extension information is also projected as an important component for development. Regular weekly conferences are scheduled for project coordinators and tutors. The system, like its counterpart in the South Pacific promises to provide valuable lessons to other regional satellite applications such as those being planned for the 21 Arab league nations (ARABSAT).

NATIONAL APPLICATIONS

Indonesia

Indonesia was the first developing country to establish a domestic satellite system with the launching of the first PALAPA satellite in 1976. Television was to be used by the government as a vehicle for modernizing the country and promoting national development. This was no small order in the "largest archipelago in the world", a nation composed of 13,677 islands, stretching 4300 kilometres from east to west and 1500 kilometres from north to south, with a population of almost 140 million. Through the use of the satellite, the government has the means to effectively reach the entire country to promote a sense of national identity and coordinate efforts toward national development. The system developed consisted of 40 ground stations, one for each of the 27 provinces and 13 for large industrial centres. PALAPA A had a capacity for transmitting 12 one-way color television channels, and 400 two-way telephone circuits or 800 one-way telephone circuits. Since it was of the "distribution" system variety, the relatively weak signals were picked up by the earth stations, amplified and rebroadcast to antennas in surrounding homes.

Until 1982 the satellite was used mainly to broadcast news/information programs (22%), non-formal education and religion (23%), art and culture (23%), entertainment (22%), commercial messages and other promotions (10%). The program schedule ran from 17.00 to 23.15 from Monday through Saturday and from 10.00 to 23.15 on Sunday. Most of category of Education was taken up with children's programs (music, and songs, cartoons, plays); for older students a quiz show competition between various schools was very popular. Language development for all segments of the population was also stressed. A 1981 study concluded that television was having an appreciable effect on the comprehension of the national language by different language groups and that messages of modernization and development were being widely dispersed (Alfian and Chu, 1981). Current plans call for the establishment of an educational television centre to introduce formal instructional television at all levels (and utilize the programming hours available during the day). These plans also include and open university system with students to be drawn from all parts of the country. An educational technology centre is already in place to support both developments.

Parallel with these plans has been the establishment of a satellite based audio-teleconferencing system to meet a critical need in training professionals to support agricultural development. The project developed by the Eastern Islands University Association presently has ten locations spread out over 1600 miles or 2100 kilometres from East to West to serve 30,000 students. Shortages of trained faculty, notable in the basic agricultural sciences, combined with increased enrollment pressures has necessitated this new approach since moving faculty members from one campus to another is time consuming, expensive and disruptive of other coursework (Academy for Educational Development, 1983b).

The new system will link all ten campuses of the Eastern Islands University Association and an Agricultural Institute on the main Island of Java through interactive audio-teleconferencing links. Each site will have a room large enough for 50 people for this purpose. The system will provide direct instruction for students, research coordination, and administrative and policy coordination among the participating professors. The project will be closely monitored and evaluated as a potential model for the comprehensive open university.

India

The most extensive use of satellites for education undertaken in the developing world thus far occurred in India with the Satellite Instructional Television Experiment (SITE). For one year (August 1975 to June 1976) television programs were transmitted via the ATS-6 satellite to community television receivers, manufactured locally, in some 2,400 remote villages in 6 of the most undeveloped states of the country. The experience was also noteworthy in that India was the first country to pioneer the use of direct broadcast satellite technology for community television. The project was designed primarily as an opportunity for Indians to gain and share expertise in the daily operations of producing, disseminating and managing a satellite operation (Mody, 1979) in preparation for a national satellite operation in 1982.

Programs were broadcast four hours per day in four languages in two primary blocks: Ninety minutes of in-school broadcasts during the morning hours (twenty-two and one-half minutes per broadcast) for primary school children; and 150 minutes in the evening intended for the general audience (divided into a 30 minute news and public affairs program in Hindi, the national language, and three programs of 40 minutes each in alternating languages appropriate to each of the six states). In-school broadcasts were targeted to children in grades I to V (ages 5 to 12) and concentrated on language skills and science. General audience educational programming covered topics such as health, nutrition, family planning and agriculture. Tests taken before and at the end of the satellite transmissions indicated significant gains in children's language development and a greater interest in acquiring knowledge when compared to children who did not view the instructional programs (Shukla, 1979). Overall, the experiment showed that developing countries like India could design, manage and operate advanced communication technology for development purposes. The experience gained during this project was intended to serve as the basis for launching India's first domestic communication satellite (INSAT 1-A), which had national coverage, during 1982.

As background to India's deployment of a national satellite for educational and development purposes, it is useful to survey the current situation which would necessitate this type of technological solution. India's population by 1985 will be about 760 million people. Out of this total some 180 million children in the 6-14 group will be eligible for primary school enrollment. Current estimates suggest that about 60% of this number of 110 million children could be accommodated in the traditional system; the remaining 40% of 70 million are intended to be handled under a non-formal education program (UNESCO, 1981). More realistic estimates suggest that a maximum of 75% of the primary school population will be able to be accommodated under both the formal and non-formal programs combined. This would leave at least 45 million children without any direct access to education.

The problem of drop-outs is equally severe. Out of 100 children who enter the first grade, 60% will have dropped out by the end of the 5th grade (lower primary) and 75% by the end of the 8th grade (upper primary). The tasks facing the government in providing increased quality of education to those having access to primary education and basic education for those outside the system and drop-outs are thus formidable. They would be practically impossible to achieve without the use of distance education through television and radio for both in-school and out-of-school primary age group audiences.

Rural primary school teachers have been identified as the third target group for a focussed distance education paradigm. Typically, primary school teachers have 10 or 11 years of formal schooling, with another two years of professional training. The schools in which they teach generally consist of one or two rooms. with virtually no access to teaching aids. Indeed, about 40% of all schools have been classified as unsuitable. In-service programs could be particularly directed at up-grading teacher skills in the teaching of science, mathematics and languages. Television could, as a teaching supplement, also assume more of the direct loads in these areas as it becomes better developed in the country.

The INSAT satellite is also planned to be used to improve the teaching of literacy skills to the vast number of illiterates in the country. National literacy rates are 36% (47% male and 25% female), and at least 100 million adults have been targeted as the primary audience in the productive 15-35 year age group. In addition, special programs will be produced for adult education instructors at the village level who will help coordinate the literacy classes as well as projects on health, agriculture, nutrition, family planning and rural development.

India's attempt to provide access to primary education for children and basic education for adults is to be achieved through a concerted national effort. To this end, at least 34 earth stations will be constructed to redistribute satellite relayed programs through terrestrial networks. In addition, receiving dishes similar to the type used in the SITE experiment will be installed in villages and connected to community television receivers in remote sections of the country.

INSAT 1A was launched during the spring of 1982 but because of technical problems in fuel supply it was declared unuseable in September of the same year. Its successor, INSAT 1B was deployed during the autumn of 1983 and will take up the tasks described earlier. It has two television transponders, one of which will be used for national distribution and the other for regional programming on a time sharing basis. The latter component is particularly important given India's diverse linguistic (15 official national languages) and religious groups (six major religions). The project emphasizes India's commitment to "universalizing" and up-grading the quality of education for its people, and to harnessing the potential of satellite technology in meeting these goals. In this, it will be closely watched as the third world prototype for development of this scale and magnitude.

CANADA

Inuit Broadcasting Corporation

Canada has had a very positive attitude toward the use of satellites, not only as a distribution system but as a means of reaching its widely scattered populations. Canada is the second largest country in the world but most of its 25 million people live within a 450 kilometre band along the U.S./Canadian border. Beyond the 60th parallel, fewer than 100,000 people occupy a land mass that is larger than all but a few countries of the world. The costs of providing communication services through conventional terrestrial networks have been prohibitive and until the advent of the ANIK A satellite in 1972, most of the electronic communication was in the form of short-wave radio.

The ANIK A satellite signalled a revolution in exposing the larger communities in the Arctic to television programs produced by and for the people of southern Canada. Since most of the northern communities are populated with native Inuit (Eskimos), this type of television represented a dramatic cultural incursion into their lifestyle, since it brought them into direct exposure, for a maximum total of sixteen hours a day to programming largely irrelevant to their deeply-rooted social customs and particular environment. The older people in the community were especially concerned about the impact of this type of programming on their children. Surveys taken before the introduction of satellite television and one-and one-half years later showed that these fears were well founded. Children had departed considerably from traditional social-psychological postures of their parents, particularly in their use of the Inuit language an desire to remain in the Arctic as opposed to moving to urban centres in the south (Coldevin, 1977). A follow-up survey in 1980 revealed much the same pattern with entrenchment of the effects noted earlier (Coldevin and Wilson, 1981). The survival of the Inuit language and culture were thus being seriously eroded by the "magic in the sky" as it was called from the south, and it became apparent that something had to be done to stem this pattern - and quickly.

The opportunity came with the launching of the ANIK B satellite in December of 1978. ANIK B was the world's first hybrid satellite having 12 television channels in the 6/4 GHz "distribution system band", and 6 channels in the 12/14 GHz, "direct broadcast band". The Inuit reasoned that the most important way to counteract the influence of southern television would be with "northern" television, produced for and by their own people. The direct broadcast satellite provides an immediate vehicle for distributing relevant programming into remote Arctic communities.

A pilot project under the title of Inukshuk began during November, 1978. ("Inukshuk" refers to the stone beacons which the Inuit made to mark their hunting routes, and hence became their first northern communication aids).

Funding was received from the Federal Government of Canada to train Inuit staff in television production, to establish a studio and production centre in Frobisher Bay and to set up television receiving dishes, teleconferencing centres and audio transmit facilities in 5 Arctic communities. The satellite service which began in September, 1980 and continued to May 31, 1981, had three basic educational objectives: inter-active teleconferencing meetings, adult education and children's programming. Each community was able to receive one-way video and two-way audio; meeting rooms were equipped with large screen television receivers, audio microphones and speakers. Inukshuk had access to the ANIK B satellite for 17 hours per week. About half of this time was taken up with interactive meetings; altogether some 379 local groups participated in sharing ideas, and discussing problems on such diverse topics as hunting and fishing, to issues associated with alcohol control and better health conditions. An example of adult education programming included a 10 part series on how to cook food from the land and its nutritional value. Children's programming focussed mainly on exploring awareness of community life in each of the participating centres. The general program schedule also included news, public affairs and cultural topics of special interest to the Inuit population, broadcast in their own language. The fledgling network was hailed as a success and received funding and a revised mandate to continue under the new title of the Inuit Broadcasting Corporation in the Autumn of 1981. It currently transmits programs out of Frobisher Bay throughout the north, including Northern Quebec, and is becoming increasingly popular (Valaskakis and Wilson, 1984). It serves as a valuable exercise in the harnessing of satellite technology to serve the specific needs of a region and its unique population.

KNOWLEDGE NETWORK

British Columbia, while comprising a smaller area than the Eastern Arctic shares the characteristics of a widely dispersed population. The Knowledge Network is an innovative approach to the problem of providing learning opportunities for British Columbians of all ages regardless of where they live. Established in 1980, the Knowledge Network utilized the experimental ANIK-B satellite for three years until the launching of the ANIK-C satellite in December 1982. It then became the first full time direct broadcasting service to use the newly placed satellite. ANIK-C was designed as a direct broadcast satellite used to deliver television signals over a large geographical area with signals to be received by small dishes and retransmitted to cable television. Presently 140 communities in British Columbia are able to receive Knowledge Network programming. In November 1982, there were 375,000 regular viewers throughout the province. In addition, some communities in the Yukon and Northwest Territories, Alberta and the northwestern section of the United States are able to tune in to Knowledge Network transmissions.

The Knowledge Network provides educational and general interest programming for children and adults, telecourses and live interactive educational broadcasts, constituting a total of 98 broadcasting hours per week. Fifty-nine percent of the programming is produced in British Columbia, the majority of which originates with educational institutions responsible for post secondary and continuing adult education. The number of educational institutions, government ministries and agencies which provided and supported educational programming on the Knowledge Network in 1983 totaled 33 and include the University of British Columbia, the University of Victoria, Simon Fraser University, 15 two-year colleges, and several learning institutes.

The Knowledge Network is thus not a separate Distance Education institution, but rather one working part of the total commitment to "Distance Education" in British Columbia. The term "Learning System" is used to describe what happens when the existing educational structure including government plus universities, community colleges and provincial institutes strive to cooperate to expand educational opportunity through the use of a variety of technological efforts, chiefly the telecommunications satellite (Forsythe and Collin, 1983).

Integral in the organizing principle of the "Learning System" are the Learning System Working Groups, consisting of representatives from the participating educational institutions. The Knowledge Network assists the members by providing the opportunity for the cooperation and problem solving necessary to further development of the educational network.

At the community level, Learning Centres, part of local colleges when possible, have been established in 67 locations throughout the province. The Centres offer local residents a variety of services relating to Knowledge Network courses as well as other "Distance Education" efforts. Such services include audio conferencing opportunities to facilitate interaction with instructors and other students, special library services for degree students, etc.

During 1982-83, 8,000 students enrolled in various degree and continuing education courses offered through the Knowledge Network by cooperating educational institutions. Analysis of student enrollments indicate that students residing in the more sparsely populated areas of the province and thus beyond physical accessibility to the three Universities located in the southern part of the province are participating "Distance Education" students tend to be approximately 10 years older than full-time on-campus students, are employed full-time and have families. Educational opportunities are therefore being provided and more importantly accepted and used by those who otherwise might not be served.

A new phase of development has been completed by a subsidiary corporation, the Knowledge-West Communications Corporation. It now operates as a broadband closed circuit service which links five teaching hospitals and the universities with two-way video, audio and data units. The Knowledge-West also acts as a Developmental Directorate for new ventures in closed-circuit satellite video conferencing, data network and electronic publishing (Forsythe and Collins, 1982). The implications of this work are interesting and promise future development.

CONCLUSIONS

As can be readily noted from this brief overview, the primary uses thus far for satellite communications have primarily been in areas of extending preparatory and first year university courses (USP, UWI, Knowledge Network) in-service teacher training (USP, UWI, KN), continuing education (USP, KN) and in-service professional training (e.g. agriculture, health; UWI, Indonesia, KN). Non-formal education at all levels was attempted in both the Canadian and Indonesian projects. The only country to attempt formal instruction at the primary level was India (SITE project as a prelude to INSAT 1-B). Another particularly beneficial use of satellite technology was in the use of audio teleconferencing systems for direct instruction, tutorial counselling and project administration (USP, UWI, KN, and to be included in Indonesia). In the case of the IBC, this system (video transmission from central site and audio feedback) also proved useful as a decision making forum for adults concerned with mutual regional problems. While effective at the adult level, however, the literature suggests that teleconferencing systems may not be viable for larger-scale education endeavours such as support for in-school primary education (Casey-Stahmer and Lauffer, 1982).

Thus while the current use of satellite technology for distance education is relatively limited, the literature is almost uniform in suggesting two major trends within the next twenty years: 1) The expansion and use of satellite technology will render the accessibility to television and radio almost universal within the next twenty years but the major trend for applying information and educational services in the third world will remain with radio (Block, 1983), and 2) the nations that could profit most from satellite technology for both formal and non-formal educational development are those that can least afford them, because they lack the finances, industrial base and technical infra-structure to maintain a comprehensive system (Polcyn, 1981). Small-scale terrestrial based projects will remain the norm for most of the developing world for some time.

But for those countries currently on the edge of exploiting satellite television technology such as China, Brazil, Mexico, Indonesia, Saudi Arabia and India, the foreseeable prospects are encouraging. The major challenges to be faced by these nations are those of software development, orchestration of human resources, and activities at the receiving end (feedback and motivation factors), whether it be school, home or village community centre based. These are precisely the problems faced by the major developed nations and there is little reason to expect that developing countries will be different although the circumstances may warrant different solutions. Canada, for example, is able to supply its own technology, has adequate financial resources, and target audiences which are relatively small from an international prospective. It is therefore free from many of the overwhelming concerns facing developing nations and able to explore a variety of issues which will refine the use of satellite technology for education.

Satellites can provide the technical means to distribute educational material over large distances at increasingly affordable costs but harnessing the technology to equalize educational opportunity will require careful planning if this potentially major innovation is to be successfully exploited.

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TELIDON

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to load the Telidon created pages to the action task software.

Student access to the instructional materials was provided through Telidon terminals located in the Library and in the Audio-Tutorial Laboratory of the Ontario Veterinary College. Students were issued with a course identification number and a personal password and signed on the system initially like a regular GRASSROOTS subscriber. The course IDs, however, were set up as a closed-user group and the students by-passed the standard menus to be taken directly to the appropriate materials for the assigned course. Telecommunication between the terminals at Guelph and the Winnipeg database was achieved through the University's computer network to which the dataroute concentrator ports were linked.

The instructional materials took two basic forms. The course in Zoology used a resource reference approach. Here many of the overhead visual materials used in class were available for reference and review on the terminal. Interactive features were introduced so that the student could contrast and compare different cell structures or order the way in which an illustration was presented. In the other courses in Neuroanatomy, Ornithology and Psychology a test and feedback approach was used. Here students were presented with multiple choice or short answer questions. In some tests a second try was allowed after an incorrect response while in others the next item was presented immediately.

The system described worked reasonably well but there were problems. Operating on a large database with a fluctuating user demand caused the system to have a variable response time. During periods when the 1500 GRASSROOTS subscribers accessed the Chicago Board of Trade commodity prices, a noticeable slowdown in the response time of the system provided an aggravation to a student who had to wait up to 30 seconds (sometimes longer) for recognition and feedback to an entered response. The University's computer network was being expanded during the time of the trial and this led to occasional failures in gaining access or being "dumped" during a session. Similarly, occasional interruptions of the GRASSROOTS system led to the same result. A frequent problem was the volume of traffic on the three University access ports which led at times to delays of up to 45 minutes in signing on.

While this instructional system was being used for on-campus students it was emulating a distance education mode. Any terminal on the GRASSROOTS system, with the appropriate ID and password, could access the instructional materials. When it is considered that the system services users in Alberta, Saskatchewan, Manitoba and Ontario, as well as those in GRASSROOTS America, the potential for a serious distance educational application can be appreciated.

Student Reaction

Surveys were conducted in the Winter Semester of 1984 among students using the system and a second survey was taken of students at the end of the first module in the Fall Semester of 1984. They reported the system as basically easy to use, the colour graphics of value and expressed a desire for continued use.

In the following tables the results of the Winter and Fall Semester surveys are shown.

TABLE 1

STUDENT RESPONSES TO TELIDON USE IN COURSES IN NEUROANATOMY AND INTRODUCTORY ZOOLOGY

		Neuroanatomy	Zoology
Number of enrolled students		20	600
Response rate		95%	33%
Previous awareness of Telidon		65%	22%
Previous use of Telidon		20%	6%
Number of sessions used		1-3	1
Nominal duration of sessions		30 min.	30-45 min.
Found system easy to use		92%	78%
Value of colour graphics		100%	86%
Accuracy of colour graphics		92%	68%
Would you like to see the system used for marked examinations	Yes -	77%	58%
	No -	23%	27%
	undecided -	-	15%

The above results come from two different types of student. The Neuroanatomy course is a fourth year Biological Science course which enrolled majors and the high level of positive response may be associated with this group's broad exposure to a variety of methods over its academic career and its members' relative maturity. The Telidon materials used were designed for the first year Veterinary Medical students and were used by them in the previous semester. This course was not offered in the Winter Semester and the students were not available at the time of the survey. The content of the Biological Sciences' course in neuroanatomy was similar to the Veterinary course. The use of the Telidon test materials by a different instructor and the positive acceptance by the students suggest an interesting example of sharing and exchange of costly resources.

The Introductory Zoology course presented a different student group. Here first year students generally are regarded as less flexible and more dualistic in their thinking (Perry, 1970). They do not have the degree of experience with a variety of methods as upper class students. As a group they were much less aware of the Telidon medium than the fourth year students and were generally less secure with its educational value. While those expressing negative views of its use in marked examination are approximately the