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ABSTRACT

This discussion of research and evaluation issues in the application of satellite communications to education highlights the potential uses of this technology for the educator and points out what educational researchers and administrators can learn from past endeavors. The major projects known collectively as the Health/Education Telecommunications Experiments (HET)--conducted as a joint venture of NASA and HEW--are reviewed, including the Alaska education and health demonstrations, the Appalachian Educational Satellite Project (AESP), the Rocky Mountain Educational Project Satellite Technology Demonstration (STD), the Veteran's dministration experiments, and the Washington-Alaska-Montana-Idaho WAMI) experiments. The SITE experiment in India is briefly discussed as an example of satellite communications in another country. Conclusions from ATS-6/HET experiments are related to future uses of telecommunications and criteria for evaluating satellite technology in education are offered. (RAO)

THE USE OF SATELLITE TECHNOLOGY IN EDUCATION: AN EVALUATION PERSPECTIVE

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THE USE OF SATELLITE TECHNOLOGY IN EDUCATION: AN EVALUATION PERSPECTIVE

Experiments concerned with the application of communication satellites to social services and education have been in existance for almost ten years now. One of the earliest such experiments involved the use of the ATS-1 satellite in Alaska to maintain audio communication between paramedics in isolated villages and physicians in urban centers in order to improve health care services to the rural population. Since that time, numerous experiments and demonstrations in a broad range of educational and health-related areas have occurred.

While detailed data have been collected through these various satellite demonstrations to assist those in the field, these data have not been analyzed and reviewed in a manner that would assist the educational researcher and/or administrator to make informed decisions concerning the appropriateness of such technology in meeting their educational goals and objectives. This paper is designed for the potential user who is new to satellite communications to highlight the potential uses of satellite communications for the educator and to point out what educational researchers and administrators can learn from the past endeavors. Finally, future research and evaluation issues which should be addressed by the user will be discussed.

Educators have often been too ready to jump on the bandwagon of new instructional or technological innovations which appear to offer easy answers to educational problems. In order to make the most effective use of satellite technology, decision-makers and user groups must be informed of the educational merits of the delivery system as well as the technological aspects. They must then carefully determine their own educational goals and objectives and examine cost-related issues. Only then should they begin to address the questions of what methods of delivery or type of instruction best fits their needs. E. E. Polley has summarized the role of the user in educational technology stating "The marriage between techology and need is an iterative process and one which must be managed by the user - not the technologist (1977, p. 6)."

In summary, the active role of the user grc.p, which includes the educational administrator and research-evaluator as well as the learners, is central to the success of educational technology. This paper will provide those decision-makers with a start in this process.

A Review of Major ATS-6 Projects

In 1974-1975, the National Aeronautics and Space Administration (NASA) and the Department of Health, Education, and Welfare administered a joint venture to demonstrate the uses of satellite communications in social services using the ATS-6 satellite. The projects involved in this venture were known collectively as the Health/Education Telecommunications (HET) experiments. As the emphasis in the ATS-6/HET experiments was on demonstration; this orientation overshadowed research and evaluation issues which might have been concurrently addressed. This orientation has limited the conclusions to be drawn from the projects and has hindered current planning for the next phase of satellite communications (Law, 1978).

The major ATS-6/HET experiments have been selected as the focus for this review as they represent the most intensive period of experimentation with satellites and, as such, reflect a wide and diverse range of educational applications. In addition, the diverse activities of the experimenters illustrate the strengths and weaknesses of satellite technology as a delivery system for education and, hence, the problems and concerns which must be addressed in considering satellite communication as an option in an educational system. Since, 1976, other telecommunications projects have been initiated, and some of the original ATS-6 demonstrations have continued or expanded, on either ATS-6 or other satellites; however, these projects have not been as extensive as the HET experiments and have not demonstrated major new applications in their use of the technology. Thus, for the novice to the field, the ATS-6/HET experiments provide a good overivew of potential satellite applications.

The major ATS-6/HET experiments to be reviewed here are the Alaska education and health demonstrations, the Appalachian Educational Satellite Project (AESP), the Rocky Mountain Educational Project Satellite Technology Demonstration (STD), the Veteran's Administration experiments, and the Washington-Alasks-Montana-Idaho (WAMI) experiments. In addition, the India SITE experiment will be reviewed briefly as an example of applications in other countries.

(The India SITE experiment was conducted in 1975-1976 using the ATS-6 satellite through an agreement with the United States.)

For comparison purposes, each project was reviewed for its stated objectives, region of the demonstration, number and type of receiving sites (sites where people could receive and/or transmit information via satellite), target population, type of activities demonstrated, programming mode, and innovative applications. (See Table I for overview.)

Alasks Education and Health Demonstrations

As opposed to other areas of the country, the communications system in Alaska has been relatively primative. The extreme problems in communication are due to Alaska's mountainous terrain and sparsely distributed population. Other problems in the delivery of education and services are created by the cultural and linguistic diversity of the people (Office of Telecommunications, 1975). The state government in Alaska has actively supported the use of satellites for communications through the Governor's Office of Telecommunications. Many state officials see satellite distribution as the only feasible method of bring services to the rural population. As such, the state of Alaska's stated primary objective for participating in the ATS-6/HET experiment was "to install and operate an experimental satellite system to give the state technical experience from which to plan future state-wide satellite communication systems. (Office of Telecommunications, 1975, p. 12)." This institutional

TABLE I

MAJOR ATS-6/HET EXPERIMENTERS

Project	Region	Receiving Sites	Target Population	Activity	Programming Mode	Comments
Alaska Education	Alaska	14 Intensive* 4 Comprehensive**	1. Pre-school 2. Elementary 3. Adults - general 4. Teachers	Education Variety	Lecture and Seminar	Developed good model for local involvement
Health		1 Intensive 4 Comprehensive	1. Community Health Aides	Communication	Consultation	Compared results with ATS-1 (audio only). Video not appreciably more effective
AESP	8 states in Appalachia	5 Intensive 10 Receive only	1. Teachers	Education	Lecture and Seminar	Developed regional system for cooperation
STD	8 states in Rocky Mountains	24 Intensive 32 Receive only 12 Public TV	1. Junior High 2. Adults - general 3. Teachers 4. Other adults	Education - Variety	Lecture and Seminar Library	Library format well-received
VA	VA Hospitals in Appalachia	10 Receive only (with phone linkage)	1. Medical staff - Physicians 2. Patients	Education Consultation	Lecture and Seminar Consultations	Tested wide variety of pro ams for hospitals
WAMI	4 states in Northwest	2 Comprehensive 1 Intensive	1. Medical students 2. Faculty 3. Medical staff 4. Administrative Staff	Education Consultation	Lecture and Seminar Consultations Conferences	Compared satellite delivery to on-site visits

* - These sites have capability for receiving audio and video signals and transmitting audio signals

** - These sites have capability for receiving and transmitting audio and video signals.

support and long-term commitment was unique among the ATS-6/HET experiments and undoubtedly contributed to the wider variety of activities that were addressed by this project during the demonstration.

Two experiments took place in Alaska during the demonstration period; one was educational in nature, the other was health-related. The major programs for the educational project were diverse in both the content of the programming and the audience. Programs were developed and delivered in the areas of oral language development (audience: 4-7 years), health education (audience: 8-10 years), general interest topics on Alaska (audience: adults - general), and learning motivation (audience: teachers, in-service). All except the last were developed and produced by the project. The last program was a commercially-available series. Each program consisted of a taped or filmed portion followed and/or interspersed with periods of live interaction with a panel in the studio. During the live interaction, learners could ask questions of the panel via satellite.

The development and delivery of these programs revealed several important findings. Through use of the satellite, children and adults received educational information they probably would not have received through other means. In addition, the opportunity for interaction was provided. As part of the objectives of this project were to deliver education programs which were suited to the particular linguistic and cultural values of Alaskans, the project used consumer committees to assist in the program development and production. Due to short timelines and other problems, these committees did not play as active of a role as hoped, but the development of this model for a consumer role in programming via satellite has been cited as one of the major contributions of the Alaskan Education Experiment.

Major problems encountered in the experiment were low attendance in the adult and teacher in-service programs. Lack of advance publicity and, in the case of the teacher in-service program, lack of interest in the pre-packaged program hindered attendance, but those findings do suggest precautions should be taken in planning programs for adult non-captive audiences. A more serious problem was the minimal use of interaction by the audiences. There was some indication that as learners became more familiar with the program format and equipment interaction increased, but not to any significant degree. As the interaction capability is the major unique instructional characteristic of satellite delivery, this failure was a significant one.

The Alaska health experiment was designed to allow communication between isolated community health aides and physicians in Anchorage. This project was a continuation of a similar system with ATS-1 which had only audio capabilities. With ATS-6, aides were able to transmit audio and video signals to Anchorage; physicians in Anchorage could then return audio instructions. The primary purpose of the project was to allow aides to consult with physicians on specific patients. These consultations helped avoid unnecessary visits to doctors or transporting of patients to hospitals. Conversely, urgent cases were quickly identified. In addition to the consultation, some in-service training for the aides was conducted.

Evaluation results indicated most of the goals for the project were achieved both in improving the health care system and increasing patients' and aides' confidence in the system. The only major problem encountered was scheduling with the satellite. Communication could only take place when these experimenters had arranged for satellite time. This schedule did not always conform to medical emergencies. While this was a major drawback, it might be remedied with more sophisticated multi-channel satellites. The evaluation study also compared the findings with ATS-6 with those from the earlier ATS-1 experiment. Results indicated that the additional video capability with ATS-6 was not appreciably superior to the audio-only communication capability with ATS-1 (Foote, Parker & Hudson, 1976).

Appalachian Education Satellite Project

The Appalachian Education Satellite Project (AESP) was funded through the auspices of the Appalachian Regional Commission. Thus, AESP did not have the advantage of the Alaska Project in terms of institutional support (from State governments) nor long-range commitment. However, like Alaska, the Appalachian region was faced with similar communication problems in its mountainous terrain and rural population. It should be noted that these problems are not as extreme in Appalachia as in Alaska as communications systems are established in some areas and the distances are not as great.

Nevertheless, the communication problems in some areas of Appalachia are sufficiently severe to merit consideration of satellite technology as a means for delivering education services.

The primary objective of AESP in the demonstration period was to upgrade the skills of teachers in Appalachia (Morse, 1978). Thus, primary concerns were programmatic and organizational, rather than technical. The satellite demonstration was seen as a means of delivering training programs to teachers in rural areas.

Four graduate-level courses were delivered to teachers at 15 sites in Appalachia located in eight different states. Content areas were reading and career education. Courses were developed by AESP with extensive on-site filming being done. A typical course consisted of a series of 3 or 4 taped programs followed by a live program (seminar) in which teachers could interact with a panel in the studio. The format for one course was all live seminars. All courses had extensive print materials and activities to be used in conjunction with the satellite-delivered program.

A major accomplishment of the project was the initiation of inter-state cooperation to use satellite technology for delivering instruction. This cooperation was, however, primarily between local or regional organizations (RESA's) and AESP. State government institutions were not involved; hence, the state support seen in Alaska did not emerge. Rather, an emphasis on "a grassroots approach" in developing programs and assessing needs stimulated cooperation at local and regional levels. Successes were also noted in the programs which were developed and college and university accreditation which was received. Weaknesses were again noted in the use of the interactive capability. The scope and frequency of interaction by satellite was limited; the course which was based totally on seminars was the least well-received (Morse, no date; Syracuse Research Corporation, 1975).

Rocky Mountain Education Project: Satellite Technology Demonstration (STD)

STD was a major program in the HET/ATS-6 experiments in terms of both size and diversity and was the first project to become part of the experiment. The STD was sponsored by the Federation of Rocky Mountain States, an organization of six states formed "to explore problems in the region and to promote orderly development of its resources (Law, 1975, p. 9)." Its communication problems are similar in nature to those faced by Appalachia, i.e., mountainous terrain, rural population, relatively sophisticated communications system. As in Alaska, the population is relatively diverse. The Rocky Mountain population consists of large groups of Natural Americans and Mexican Americans. While the Federation of Rocky Mountain States had been interested in the potential for satellite communications in their states for several years, the commitment by the organization was not as strong as that in Alaska given the less severe need.

In contrast to Alaska and AESP, but perhaps more in line with the stated purposes of HET/ATS-6, the objectives of STD were primarily technological in nature. Their stated objectives were to demonstrate the feasibility of a satellite-based delivery system for rural populations and assess user acceptance and cost of different modes. As STD personnel were most interested in the technological capabilities of the satellite, they originally planned to test some of the more sophisticated applications (two-way video, computer interaction, multi-channel capability). These plans and the objectives of STD were hindered by changes in federal directions during the negotiation for the demonstration. Thus, while STD did not meet its own objectives, it did, nevertheless, test more of the technological capabilities of the satellite than other projects (Law, 1975).

STD had 68 receiving sites of three different types (see Table 1). Programs were developed and delivered in career education (audiences: junior high students and teachers), and on general interest topics (audience: adults). The format of the career education and adult program consisted of pre-recorded programs followed by a period of interaction. The programs for teachers were in the seminar format with a live panel and interaction. As with the AESP teacher education programs, teachers received graduate credit for participation. In addition to these programs, the STD had a materials distribution service (MDS). This service made use of the satellite to transmit a library of films and videotapes to receiving sites, programs were recorded to be replayed at a later time.

The most successful aspect of the STD was the library distribution system. This service was quite well received by users. With the education programs, a comparison of user reaction at intensive sites with reaction at other sites revealed higher ratings at intensive sites (Law, 1975). These results were interpreted as support for the interaction capability by STD, but external evaluations suggested the more positive reactions at intensive sites were due to greater attention received by these sites (Syracuse University Research Corporation, 1975). (This was the only attempt in HET/ATS-6 to compare intensive sites with those without the capability for interaction.) As with the Alaska adult general interest program, the STD general adult series suffered from poor attendance. The junior high program was accepted by students, but support for continuation by teachers was not demonstrated. External evaluations found support for continuation only for the MDS system (Syracuse University Research Center, 1975).

Veteran's Administration Experiments.

The Veteran's Administration became an experimenter in the HET/ATS-6 demonstration as a result of their desire to link rural and urban Veteran's Administration Hospitals and, in so doing, to improve health care delivery in rural hospitals. The objectives of the VA in participating were similar to those of Alaska; they saw the demonstration as a means for assessing the utility of satellite technology in creating this link before making a larger investment (Caldwell, 1976). Programs were delivered by satellite and two-way communication was maintained by phone-lines to Denver where programs originated.

With their objectives of assessing the utility of a satellite delivery system to meet the diverse communication needs of the VA, the project delivered a number of different types of programs: video seminars; grand rounds; out-patient clinics; teleconsultations; and computerized events. Each program consisted of varying degrees of pre-recorded material, live presentations, and interaction.

All the programs were quite well-attended (200 - 400 per program) and well-received by patients and staff (Caldwell, 1976). (The high attendance differs markedly from the low attendance with other non-captive audiences. This is probably due to the fact that the programming met special informational needs of the audience.) Evaluation results suggested the programs had created a new "gestalt" among staff, fostering innovation and improving morale in the hospitals. Comparisons with control hospitals were invalidated as the tapes became so popular they were sent to other hospitals! Given the positive reaction to the program, these results suggest that satellites could be used to deliver a number of different types of information to users in hospitals. Data on interaction was not reported (Caldwell, 1976).

Washington - Alaska - Montana - Idaho (WAMI) Experiment in Regionalized Medical Education.

Since 1970, Washington, Alaska, Montana, and Idaho have cooperated in a pilot project in regionalized medical education for training medical students. This project had evolved as a result of increasing demands for medical education in the area, the uneven distribution of physicians, and the high cost of constructing new medical school facilities. To meet these needs, the project developed a decentralized system of medical education with the University of Washington (UW) serving as the central medical campus. Part of the first-year of education took place at "home" universities with instruction coordinated through UW; in addition, during the third and fourth years of clinical training, students spent time at community clinical units throughout the region.

All these activities were taking place before the ATS-6/HET demonstration, but they required extensive faculty time and travel to provide the necessary supervision. WAMI thus saw the satellite as a means for reducing travel time and costs and improving the monitoring and supervision of the clinical program. A secondary objective was increasing interaction with physicians in the rural clinical programs (Dohner, Cullen and Zinser, 1975).

The WAMI experiment consisted of two parts: a university phase and a community phase, corresponding to the two types of decentralization (first year - university;. third and fourth year - clinical). Many different uses were made of the satellite with both phases. A few will be mentioned here. The university phase consisted of a linkage between UW and the University of Alaska. Both sites were capable of receiving and transmitting audio and video signals. (This was the only experiment in the demonstration that made use of two-way audio and video). Lectures by both UW and UA faculty with interaction were the predominant activity for the university phase; however, administrative conferences (faculty, admissions, counseling) and teleconsultations for direct patient care were also conducted.

For the community phase links were made between UW and the Family Medical Center in Omak, a community clinical unit where students were placed. Activities for this phase consisted of student case presentations to UW faculty, UW faculty programs to students on patient care, continuing education programs by both UW faculty to Omak staff and vice versa, and medical consultations between Omak and UW mental health staff.

The evaluation for WAMI was the most comprehensive and innovative of the many evaluations done of the ATS-6/HET experiments In the university phase, a high number of interactions per minute were observed. While the frequency of interactions was not compared to interactions which took place during visits, the number of interactions via satellite was certainly more impressive than in other experiments. Whether this finding is due to the two-way audio and video or simply the fact that only two sites were interacting, as opposed to much larger numbers in other projects, is not clear. Students were found to learn as much via satellite as in class and the conference mode was found to be more effective than in-person meetings, i.e. decisions were reached more quickly, etc. (Dohner, Cullen, and Zinser, 1975).

Evaluation of the clinical phase again indicated success with the interaction. (The results of the evaluation comparing various aspects of the quality of interaction on-site versus via satellite may be of interest. The reader is referred to the report for details.) User acceptance was quite strong on the part of faculty and medical staff in the clinical units. Students were less supportive, preferring face-to-face interactions. Some problems were noted in acceptance of the technology and equipment.

The results of this experiment and the evaluation in general support the use of satellite communications for this type of effort. In addition, the utility of the satellite in many different types of situations was demonstrated. The main weakness was the relatively small size of the project which limits the conclusions one can draw on the effectiveness of the technology and transferability of findings. The project was, however, successful enough for the four participating states to decide to continue after the demonstration using another satellite and state funding. Thus, additional data will be available to supplement the findings from the demonstration year.

Satellite Instructional Television Experiment (SITE): An International Example.

In August 1975, the ATS-6 satellite was moved to India to be used for one year for SITE. The India project illustrates the major differences between domestic and non-domestic satellite uses. In many ways, satellites are uniquely suited to rural developing countries. They can provide countries with primitive communications systems with the means to rapidly develop a communications system which meets many diverse needs, i.e., telephone, television, radio, education, health care, etc. Thus, in developing countries the satellite may serve as the backbone for the entire communications system (Block, 1976). This situation differs from that in the United States where the communications system has developed slowly and the satellite represents only one piece of that system.

SITE and the use of ATS-6 provided India with the means for experimenting with satellite technology for education. This experience would provide data for planning with future satellites and would develop a work force in India familiar with satellite technology. (India's domestic satellite INSAT will be launched in 1981.)

SITE programs were received in 2,332 villages. Low cost receiving equipment ($1,200 per site) was developed for this purpose. Programs were delivered in three areas: general programming to adults, in-service training to teachers, and enrichment instruction for elementary (5-12 years) students.

The project was quite extensive in size and scope, and details will not be presented here. (The reader is referred to Mulay, 1976 and other India Space Applications Centre, Research and Evaluation Cell Reports for specific findings.) Rather, SITE is presented here because of the R & D approach it used. Results were analyzed for technical, managerial, and programmatic implications. A large research unit was established at the planning stage. This unit continued actively throughout the project to collect data on various issues ranging from the utility of the technology to the social ramifications of the technology on the people of a developing country. This R & D approach and the support of the Indian Government and space research organization has been cited by those closely involved as one of the critical factors in the success of the project (Black, 1978). The data collected are now being used in the planning for INSAT.

Post ATS-6/HET

Since the conclusion of the ATS-6/HET experiments in 1975, the projects reviewed here have taken different directions. Alaska is now using an RCA satellite to continue deliveries in health and education. The satellite has been seen as the most feasible way for educating secondary students without removing them from their rural villages. Alaska is relying primarily on audio communications, having found video not worth the cost. AESP resumed using ATS-6 when it returned from India. It has increased its number of sites to approximately 60 in Appalachia and programming has been expanded to include short workshops and educational deliveries to other adult groups (nurses, farmers). It is now moving into an operational phase with decreasing federal funding. STD has not continued. WAMI has continued its activities on the CTS (Canadian) satellite.

Other smaller, more diverse experiments have continued on ATS-6. These experiments have included increased use of the teleconference capacity and training of special groups. ATS-6 users have ranged from religious groups, firefighters, and paramedics to Congressional staff. Other on-going satellite-related activities demonstrate the continued and growing interest in the use of telecommunications to improve the delivery of social services. The Public Service Satellite Consortium, (PSSC), an interest group of satellite users formed by some of the original experimenters on ATS-6, has over 90 members from various public services areas (Bransford and Potter, 1978).

Conclusions from ATS-6/HET: Future Uses for Telecommunications

The ATS-6/HET experimenters succeeded in demonstrating the feasibility of using satellites in rural areas to deliver services. Small, inexpensive ground stations were established and people were able to operate the equipment with minimal training. Programs were delivered and interaction took place. Health and education services and programs were received by people who might not have been able to receive such services by other means. ATS-6/HET also demonstrated some of the problems which future users may encounter.

Some of the major conclusions which may be drawn from the ATS-6/HET experience which are relevant to future users are listed below.

1. Sufficient planning time in order to assess needs, establish agency linkages, and, if appropriate, develop and produce quality courseware is essential. The planning period for ATS-6/HET was extremely short; the demonstrations suffered as a result.

2. The importance of agency cooperation and support from appropriate institutions and/or groups cannot be overestimated. Projects which were most successful were those in which the sponsor group(s) showed strong support for the project and had a long-term commitment to satellite communications as a means of delivering high-priority problems, i.e., Alaska, VA, WAMI, India SITE. Again the need for lead time to develop this cooperation and support is evident.

3. High quality programs which meet the needs of the target audience and high quality reception are necessary to attract and maintain the target audience.

4. In the area of education and training, programs which are delivered to captive audiences and/or provide some carrot (course credit, CEU's) for attendance are most successful. Educational programs for general audiences fared poorly. Training for special

technical and professional adult groups appears to be the most promising use of satellite technology in education and training. Some experts believe the education/training area is an unlikely market for telecommunications due to the traditional conservatism of the field, and the difficulty of instituting change (Polcyn, 1978; Bransford and Potter, 1978). Training in military, business and industry, and the health professions is seen as more promising (Polcyn, 1978).

5. Satellite communications to improve the delivery of health services is promising. The success of the health experiments (Alaska, VA, and WAMI) illustrate some of the potential uses of telecommunications by substituting communication for travel and maintaining voice contact with emergency medical services.

6. Some of the higher technology aspects of satellite communications may have been overrated. The interaction capability was often not usefully employed. This was particularly true in some of the larger educational settings where perhaps more fruitful interactions could take place on-site. The programming delivered by satellite would serve as both the foundation and stimulus for discussion. In smaller programs, i.e. WAMI, the interactive capability was vital. More experimentation needs to be done with the interactive capability before definitive conclusions can be drawn; however, care should be taken in matching needs with technology in this regard.

7. Similarly, adequate testing of audio-only formats has not been done. The results of the Alaska Health Experiment indicated that, in that case, video signals were not viewed as worth the additional cost. Alaska is now planning on using audio-only formats in new telecommunications projects. Again, the highest technology is not always needed to match user needs.

8. The library mode, tested only by STD, was received quite well and has been seen by others as a major use for satellite communications (Syracuse, Research Corporation, 1976). This mode can be cost-effective and does not involve the scheduling problems encountered with other fixed-time delivery modes, i.e. the program can be re-played at the convenience of the user. Potential problems with this mode may be encountered with new copyright laws.

9. Conferencing via satellite was found to be effective. The utility of this mode has been demonstrated in the increased use of teleconferencing with ATS-6 in recent years.

10. The technical aspects of the satellite can limit or expand its uses. ATS-6/HET experimenters were often required to modify objectives due to technical constraints. This limited their flexibility and the extent of the demonstration (Filip and Johansen, 1977). Future users should lobby to prevent this from happening again; PSSC has this as a primary objective.

Given these general considerations the following section will address issues which the evaluator of potential user groups should ex-

examine in assessing the value of satellite technology for his/her organization.

Considerations for the Evaluator

As with any large project, front-end analysis is essential before making a commitment to satellite technology. In considering whether to use satellite technology this is particularly important given the costs involved. The above list suggests some of the issues which should be addressed in this analysis. Other considerations are:

1. Carefully define the objectives for satellite-delivery. Make sure that these objectives are shared and/or understood by all participating groups, e.g., funding sources, cooperating agencies, institutions, users. Lack of clarity in objectives and conflicting objectives created many problems in ATS-6/HET.

2. Carefully survey the needs of potential user groups <u>and</u> determine if the market is there. Problems can be encountered if needs are unrecognized, i.e., target audience is not motivated to satisfy the identified needs. If users will be paying for services, the strength of the market is very important.

3. Having determined needs, examine alternative means for meeting these needs in terms of both cost and quality. The cost factor is of primary concern here. (See Syracuse Research Corporation, 1976 for discussion of costs of various delivery modes.)

4. If an existing satellite will be used, investigate its technical capabilities and scheduling constraints to ensure it will match projected and current needs.

5. Investigate and determine the necessary linkages between cooperating agencies. Who determines scheduling? Who takes care of technical difficulties? What has been the experience of other users?

6. If after this, the satellite mode of delivery is selected as most appropriate, careful consideration should be given to the programming mode(s) which will best meet user needs, i.e., library, lecture, seminar, consultation. To make most effective use of the technology, it is suggested that more than one format be used. Again, selection should be based on the best match between user needs and the characteristics of each mode.

7. In conjunction with step six, the evaluator should investigate and determine the best match between user needs and technology. (Preliminary considerations in this regard would have been made in Step 4, i.e., to determine if the satellite had the technical capability to meet needs. Step 7 is to determine which of these capabilities will be used.) Is interaction an essential component? Is video necessary? One-way or two-way? Again, the evaluator should not assume higher technology is necessarily more effective.

8. If programming is to be developed, consideration should be given to appropriate media mixes in such programming. How much will be live? Should any filming be done on-site? Will print materials be developed? Which objectives should be addressed by print and which by programming? These are only a sample of the questions the evaluator should address at this stage. These questions enter into the area of traditional curriculum development formative evaluation, and the reader is referred to other references in that area.

These questions represent some of the major front end analyses questions which the evaluator should address. This stage is seen as one of primary importance in making decisions for program implementation and in maximizing the benefits to be gained from satellite technology.

Conclusions

This paper has focused on a review of major satellite experiments in order to familiarize the reader with this area. The ATS-6/HET experiment succeeded in demonstrating that satellite technology could provide educational services to diverse populations. However, the emphasis on demonstration resulted in a relative neglect of research and evaluation issues. As NASA, Hughes Corporation and others plan for the next phase of public service satellites, it is important for educators and evaluators as potential users of satellite communications to become informed for two reasons. First, educational researchers and evaluators, as user groups, must become informed so they can have input into the directions for the next phase of satellite technology. The necessity for this input is evidenced by the demonstration-orientation of the previous phase. The opportunity to collect information on the larger system configuration and utilization questions was largely overlooked. Current planning is hindered by this neglect. Secondly, educational administrators and evaluators must become informed of the specific uses for satellite communications so that they can make knowledgable decisions concerning the appropriate match of educational needs and technology in their own educational system. In addressing this issue, Ernest Polley has written that "The history of modern education is littered with the trash of technology left behind by unrealistic purchases, naive users, and vendor representatives working on a quota system (Polley, 1977, p. 5)." The responsibility of educational evaluators is to provide information to decision-makers so that appropriate decisions can be made. Unfortunately, most previous attempts at informing educators have been limited to educational technologists. This paper is designed as an introduction to the options available in satellite technology and the policy considerations which must be addressed by the educator.

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