1988

A conceptual framework for the design and delivery of a university-level credit course by communications satellite

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Order Number 8825896

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Iowa State University, 1988

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A conceptual framework for the design and delivery of a university-level credit course by communications satellite

by

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A Dissertation Submitted to the

Graduate Faculty in Partial Fulfillment of the

Requirements for the Degree of

DOCTOR OF PHILOSOPHY

Department: Professional Studies in Education
Major: Education (Curriculum and Instructional Technology)

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

Iowa State University
Ames, Iowa

1988

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ACKNOWLEDGEMENTS

This dissertation is the culmination of ten long years of work toward a Ph.D. in instructional technology. It could never have been completed without a tremendous amount of assistance and encouragement from a large number of knowledgeable, supportive, and caring individuals. There were too many to list individually, but I wish to acknowledge the foremost among them here.

First of all, Dr. Michael Simonson, my major professor, guided me through the Iowa State University portion of my degree program and suggested the topic for this study. He was a constant source of information, support, and encouragement. I also wish to thank the other members of my committee -- Dr. Richard Warren, Dr. John Wilson, Dr. Charles Connolly, and Dr. Edwin Jones -- for their help. Dr. Elaine Jarchow and Dr. Robert Crom also served on my committee before leaving the university. Their assistance is also gratefully acknowledged.

I would be remiss if I did not offer thanks to the professors responsible for the Arizona State University portion of my doctoral program. Dr. Vernon Gerlach, Dr. Norman Higgins, and Dr. James Carey contributed much to my

understanding of the instructional development field and helped establish the foundation for whatever professional success I have achieved.

I am especially grateful to my supervisors and colleagues in the ISU Media Resources Center. Robert Lindemeyer and Al Kent, in particular, were extremely understanding and supportive, and they were always ready to grant me time off when I needed it to complete degree obligations. Dr. Don Rieck, who completed his Ph.D. within the past year, provided much peer support and a slight sense of friendly competition. Matt Darbyshire, who will be next to finish his doctorate, also provided welcome peer support.

There were many others who contributed to the dissertation itself. First of all, I wish to thank the thoughtful and interested persons who completed my questionnaires and returned them to me. I discovered that satellite-based instruction in postsecondary education is burgeoning. There are many institutions that are discovering the potential of satellites for expanding their educational services. In conducting this study, I was able to make acquaintance with a number of other individuals with similar interests, and the outcome is likely to be a valuable networking system.

Dr. Edwin Jones, the Iowa State University liaison for the National Technological University, and Dr. Kathleen Stinehart, Credit Programs Manager in the ISU Office of Continuing Education, reviewed the NTU and non-NTU questionnaires, respectively, during the development stage and provided many valuable suggestions for improvement. In addition, I wish to thank my other professional colleagues at Iowa State who evaluated the questionnaires and suggested modifications.

Two individuals helped enormously in cutting down the scope of the survey, saving me a significant amount of time and expense. I was initially prepared to begin my survey by contacting all institutional members of the National University Continuing Education Association (NUCEA) in an attempt to identify those currently using satellite technology for delivering instruction. Eleanor Kniker alerted me to a directory being compiled by NUCEA in which those colleges and universities were already identified. Sue Willis of the University of South Carolina, editor of the directory, was gracious enough to provide me a photocopy of a galley proof in which those institutions were listed. My "population" was suddenly reduced from over 250 to 33.

I will forever owe a deep debt of gratitude to my family. My parents, Walter and Patricia Albright, were constant sources of encouragement, as were my brothers

Geoffrey and John, and my sisters Anne and Carolyn. As the first college graduate in my entire known genealogy, I hope that my achievement of a Ph.D. will serve as inspiration to others in my family to set high goals.

Above all, I am most grateful to my wife Shirley, whose love and devotion gave me the encouragement to continue when my educational goals seemed unachievable. She sacrificed so much to give me the support I needed at home. My children, Laura, Gregory, and Kathryn, have never known what it was like to have a full-time Dad. My time with them has been fragmented by doctoral study for virtually their entire lives. It is to the four of them that I dedicate this work.

Michael J. Albright
Ames, Iowa
July 1988

CHAPTER ONE: INTRODUCTION

In its widely-circulated 1972 report on instructional technology, the Carnegie Commission on Higher Education predicted that by the year 2000 at least 80 percent of off-campus instruction conducted by America's colleges and universities would be delivered by emerging informational technologies. Furthermore, the Commission noted that the capabilities of new delivery systems would make off-campus instruction of adults "the most rapidly expanding and the most rapidly changing segment of postsecondary education" (p. 4).

A little over half the period between 1972 and the year 2000 has now elapsed. Evidence indicates that the Commission's predictions may be realized. In a flier promoting a 1986 conference, The Open Learning Institute of British Columbia estimated that, on a worldwide basis, as many as 20 percent of all postsecondary students, approximately 10 million persons, were completing at least a portion of their studies through some "distance education" technology. The Institute confirmed that distance education had indeed become the fastest growing area of postsecondary education in the world.

In this country, Tate and Kressel (1983) referred to "a revolution in the use of communication technologies in education" (p. 1) involving broadcast and cable television, videotext, videodiscs, low power television, microcomputer networks, and satellite technology. They reported that $30 billion was spent on communications technology in 1980, and that figure was expected to climb to $150 billion by 1990. Munshi (1980a) pointed out that a burgeoning of technologies coupled with an increased emphasis on continuing education in recent years have presented educators with a "dazzling array" of options (p. 1). Feasley (1983) described the potential impact of distance education technologies for attracting and delivering instruction to non-resident students as "enormous" (p. 1). In an editorial in the newly-established American Journal of Distance Education, Moore (1988) noted that "the end of the eighties sees us on the threshold of a new phase in ... the application of communications media in education" (p. 1).

The past few years have seen increased interest in the use of communications satellites to deliver postsecondary instruction. Teleconferencing consortia such as the National University Teleconferencing Network (NUTN), the national distribution of college-level courses by The Learning Channel and the Public Broadcasting System's new Adult Learning Satellite Service (ALSS), and the transmission of entire degree programs by the National Technological University, the Virginia Cooperative Graduate Engineering Program, and the California State University, Chico, all are based on satellite delivery systems. The 1987 Satellite Directory identified at least 39 video-capable "uplinks," or video transmitters aimed at satellites, owned and operated by postsecondary institutions, up from 23 identifiable university-owned uplinks in the 1986 directory. These are deceptively low figures, since many uplinks owned by the Public Broadcasting System are actually located on university campuses and could be used for delivering instruction.

Statement of the Problem

The present study was conceived because educators in general have had an undistinguished record of using emerging technologies effectively. Polley (cited in Fitzpatrick, 1979) once noted 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" (p. 25). Since satellite-based instruction is so heavily dependent upon the video channel, it is a matter of particular concern that instructional television (ITV) itself fell into disfavor with students, teachers, and administrators alike in the late 1960s (Purdy, 1980). In the absence of innovative and dynamic teachers, ITV turned out to be pretty boring once the novelty effect disappeared. The medium made a comeback only with the emergence in the 1970s of a new quality control methodology for ITV producers called the "systems approach" to instruction, as well as availability of portable recording equipment and easy-to-use editing systems that greatly expanded the capability of an individual teacher or media specialist to produce videotapes meeting specific classroom needs.

These two factors -- sound educational design using the systems approach and incorporation of made-to-order video (and other media) components, as appropriate, to facilitate the learning process -- can help educators using satellites to strengthen the quality of their courseware. Other concerns must also be addressed. For example, support systems need to be established, not only for instructors teaching satellite-based courses but also for the students enrolled. Administrative support must also be secured if satellite courses are to be successful on a continuing basis.

A review of the literature describing past use of satellites by higher education institutions reveals many deficiencies in the procedures used for course design and delivery. A very important question is whether present users of the technology have avoided these mistakes. Do the satellite courses of today provide the best possible learning environment for students, or do they resemble the uninspired, underutilized instructional television of the 1960s? If the latter should be the case, the possibility exists that, once the novelty of a satellite-based delivery system wears off, the medium will cease to be viable for all but the most highly motivated students. The present study was designed to identify the colleges and universities that have used satellites for delivering instruction for academic credit to off-campus students during the decade of the 1980s and to assess the procedures followed by these institutions in designing, delivering, and evaluating their satellite courses.

The Statement of the Problem section of Chapter One will begin by establishing the context for satellite-based instruction as distance education, adult education, and instructional telecommunications, because these three fields of study provide the literature base from which the recommended procedures to be assessed have been drawn. This context provides a perspective that can be helpful in understanding the case histories of past satellite course projects and descriptions of current applications that follow. The section will then conclude with a discussion of the deficiencies observed in evaluation reports of past projects, using as an organizational structure a systems-based model for distance education.

The Context of Satellite-based Instruction

The design and development of courses to be delivered by satellite is a very complex process, one that needs to be governed by bodies of literature in three relevant areas. First, the use of communications satellites by educators falls into the category of "distance education." Second, these courses are a form of instructional television. Courses delivered by satellite differ from those broadcast by terrestrial means only in that the use of a satellite as a relay station permits a wider dissemination of the signal, that reception is limited to those with access to the proper receiving equipment, and that the distances involved restrict use of some instructional techniques. Third, much of satellite-based instruction at the postsecondary level appears to be directed toward in-service, graduate-level training of professionals, such as engineers and educators. Therefore, valuable guidance can be obtained from adult education literature.

Satellite-based Instruction As Distance Education

Keegan (1986) defined distance education as a form of instruction characterized by five essential elements: (1) the physical separation of instructor and student during the learning process; (2) the sponsorship of an educational organization; (3) the use of technical media to provide the course content; (4) the presence and use of a two-way communication system permitting interaction among students and instructor; and (5) the quasi-permanent absence of a learning group throughout the length of the learning process

In addition, Keegan identified two socio-cultural determinants that he felt were necessary preconditions and consequences of distance education. One he termed the "privitization of institutional learning" (p. 50), referring to the independent and personal nature of the learning setting. The other was the "presence of more industrialized features than in conventional oral education" (p. 50). The concept of "industrialization" was based on Peters' (cited in Holmberg, 1980) view that systematic development of instruction for distance education follows a basic model for industrial production, including a division of labor, mass production, mechanizing, planning, organizing, controlling, and checking. Keegan used the term to indicate that the systems approach should be applied to course development in distance education.

Keegan's fifth criterion was questioned by Garrison and Shale (1987), who felt that groups interconnected by electronic media and physically separated from the instructor also constitute distance education. Such would be the case with graduate courses in engineering and computer science delivered by satellite to corporate sites such as by the National Technological University.

Satellite-based Instruction As Adult Education

The mean age of students enrolled in distance education courses through colleges and universities is between 30 and 35 (Feasley, 1982). Knowles (1970) differentiated between the practices of teaching children (pedagogy) and methods for the teaching of adults, to which he applied the term andragogy. Knowles described a wide range of characteristics of adult learners that he felt rendered some pedagogy-based instructional strategies inappropriate for use with adults.

According to Coldeway (1982), the concept of andragogy has a direct bearing on the design of learning environments for distance education, although andragogical methodologies are infrequently practiced in courses provided via distance education technologies. Coldeway pointed out that while adult learners have become conditioned to pedagogical systems and may find it different to adapt to an andragogical approach, andragogical procedures should be employed in distance education whenever appropriate.

Satellite-based Instruction As Instructional Television

In most of the satellite-based, postsecondary credit courses described in the literature in the United States and Canada, the video signal carried the primary burden for content presentation. It is interesting to compare this use of the medium with current trends in the design and delivery of university courses by broadcast television. For many years, instructional television (ITV) featured the "talking head" instructor whose classroom happened to be the TV studio. The burden of instruction was placed on the video component, with the textbook (if any) and other readings playing a supplemental role. The format, for the most part, was lecture and demonstration, as if the viewer at home had a seat in the front row of the lecture hall.

Although the preponderance of research indicated that such courses were successful in facilitating learning (Chu & Schramm, 1967), producers had little concept of systematic course design because the field of instructional development did not emerge until the late 1960s (AECT, 1977). Purdy (1980) reported that the decline in popularity of instructional television in the 1960s was due in part to great variations in quality from one course to another, uninspired teaching, and general underuse of the medium's capabilities. Zigarell (1984) pointed out that the convention of putting a professor in front of a camera "barely scratched the surface" (p. 31) of the teaching potential of television and added that both students and teachers had become disillusioned with their ITV experiences.

The availability of the "systems approach" to course design, which provided a methodology for analyzing and solving instructional problems (AECT, 1977), soon led to dramatic changes in the appearance of teaching on broadcast television. "Telecourses" used the medium in a substantially different manner. Gripp (quoted in Munshi, 1980b) defined a telecourse as

> "...an integrated learning system that employs television and various print materials. This system is specifically designed to involve a variety of learning strategies to forge a complete educational unit to the student in the convenience of his home...It is an examination and presentation of a body of knowledge and information through the use of sight, sound, color, movement, and print in a manner designed to stimulate, motivate,

clarify, and quantify" (p. 3).

Telecourses were seen as a vast improvement over the old "talking head" productions (Whittington, 1987). Dirr (1985) observed that "In the past five years, both the academic and production quality of [telecourses] has increased significantly. Today's television courses combine both good television viewing and the best scholarship available" (p. 93).

A typical telecourse is developed by a team, including content specialists, instructional designers, video production specialists, and educational writers, and is marketed to institutions as complete instructional packages. Whereas the British Open University model for telecourses places its learning emphasis on the print materials, with the broadcast component consisting of no more than 10 percent of the student's study time (Bates, 1984a), American telecourses utilize the video component as their centerpiece. Most telecourses in the United States are produced by Public Broadcasting System (PBS) affiliates or a consortium of colleges and universities known as The Telecourse People.

No suggestion has been made that courses designed for delivery by satellite should conform to the production values of telecourses intended for PBS viewers. In fact, Stephen (1986) argued that high design and production standards simply cannot be justified in the case of graduate-level and continuing education courses in fields where the knowledge base changes rapidly. However, the characteristics that distinguish telecourses from conventional instructional television, such as application of the systems approach to course design, the use of course development teams, and attention to an appropriate mix of technologies to provide optimum learning experiences for students, have been prescribed repeatedly in the literature on satellite course development.

The Use of Satellites in Distance Education

Although communications satellites are often referred to as a "new" or "emerging" technology for higher education institutions, their use for credit course delivery dates back almost two decades. Federally-funded projects, both in the United States and Canada, established the viability of the medium for college-level instruction in the mid-1970s. The period between 1977 and 1984 saw relatively little activity in this country, but interest in satellite use has mushroomed in the past four years. Following is a summary of significant applications of satellite-based instruction for college or university credit, past and present.

PEACESAT

Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) was conceived as a research project by John Bystrom, a communications professor at the University of Hawaii, in 1969. Not only did it become the first education satellite project in the world (Bystrom, 1975), it also produced the world's first college credit course delivered by satellite, the first international educational satellite network, and the first satellite library network (Bystrom, 1976).

PEACESAT was proposed as a way "to demonstrate the benefits of currently available telecommunications technology when applied specifically to the needs of sparsely populated, less industrialized areas of the world" (Morgan, 1976, p. 14). Bystrom felt that an effective communications network, using primarily audio and facsimile transmission, could be established throughout the South Pacific using small radios and antennas and inexpensive earth stations costing less than $7,000.

When he first invited Pacific Basin higher education institutions to participate in the project, they declined, citing skepticism that such a low-cost project was feasible. Bystrom then turned to his own administration for funding and received support for a pilot test involving sections of speech classes at the university's two campuses in Honolulu and Hilo (Bystrom, 1975). The National Aeronautics and Space Administration (NASA) provided use of the Applications Technology Satellite 1 (ATS-1), with audio-only capability, without charge (Norwood, 1978).

The initial study, conducted in 1971, was designed to explore whether students separated by distance but interconnected by satellite could work together in learning and problem solving. The results indicated that students were able to get acquainted and communicate among themselves successfully, to solve problems in a group setting with group members interconnected only by radio, and to achieve statistically significant cognitive gains (Byers, 1975).

The University of the South Pacific, with its main campus in Fiji, and the University of Hawaii collaborated via PEACESAT to offer a course in comparative Pacific education in Spring, 1973. Students at both institutions participated on a credit basis. The format, with topics presented on a rotating basis by each institution and an emphasis on active student participation, provided cross-cultural experiences that could not have been acquired at either university alone.

The course was heavily mediated. Print materials, slides, and audio tapes were exchanged in advance and were found to contribute greatly to student understanding of the course content. Both students and faculty members exhibited an air of excitement throughout the course. Some was attributed to the novelty of the medium, but much was due to the opportunity to interact with and to learn from fellow students from the actual cultures and educational traditions under study (Stueber, 1975).

National Education Association (NEA) Experiment

During the 1973-74 and 1974-75 school years, the NEA conducted four experiments with ATS-1 in an attempt to improve professional communications among teachers. One of these was a series entitled "Satellite Seminar," directed toward teachers in remote Alaskan villages with few opportunities for professional development. Although the course began in the Fall semester 1973, details of the project were not determined until August 23 of that year, when the NEA called a meeting of interested parties in Anchorage. The near absence of advance planning plagued the experiment throughout its duration (NEA, 1975).

Initially, 40 teachers indicated that they would sign up for the course as a University of Alaska School of Education seminar. Enrollment forms were not distributed until after the first program had aired, and only 12 persons actually registered. Just a week before the course was to start, the university switched faculty members. The new instructor had no experience in teaching via broadcast media and was provided a minimal amount of training before the first session.

The course requirements included application papers, a semester project, and an open-book final exam. Of the 12 enrollees, only two completed all three assignments by the end of the term. Five completed the application papers, two submitted the project, and five took the exam, although several completed their remaining requirements the following summer. Of the 12 participants, only half ultimately received a passing grade (NEA, 1975).

The Health/Education Telecommunication (HET) Experiments

The original plans for NASA's powerful Applications Technology Satellite 6 (ATS-6) in the late 1960s were focused around technological and engineering experiments such as spacecraft positioning, weather forecasting, thermal control, and television and radio frequency interference tests. In 1970, the U.S. Department of Health, Education, and Welfare (HEW) realized that the satellite had potential for providing services in the social sciences, services that had been delivered by satellite only to a limited degree anywhere in the world. The result was a number of projects known collectively as the Health/Education Telecommunication

(HET) experiments (Filep & Johansen, 1977).

The late entry of the HET projects into the experimental agenda for ATS-6 created two important problems. First, final approval to conduct the demonstrations on ATS-6 was not obtained until the Fall of 1971. Since the experiments were to be conducted during the 1974-75, a minimal amount of time was available for adequate needs assessment, proposal development, funding negotiation, and project design and implementation (Cowlan & Foote, 1975).

Second, by 1970 the ATS-6 was in the final stages of production and could not be modified to add capabilities that may have been of interest to educational experimenters. For example, although the ATS-6 had four audio channels available per transponder, problems in the proposed use of certain audio frequencies necessitated the use of the ATS-1 and ATS-3 satellites for audio interaction during the actual experiments (Filep & Johansen, 1977). Consequently, one common criticism of the HET venture was that the projects were planned around the existing capabilities of the medium and did not follow commonly accepted models for sound educational design (Cowlan & Foote, 1975).

Ultimately, those HET experiments that tested educational applications received $17 million in funding from the National Institute of Education (NIE) and were called the Educational Satellite Communications Demonstration (ESCD) (Porter, 1976). There were three projects in the ESCD: (1) the Satellite Technology Demonstration (STD), conducted by the Federation of Rocky Mountain States; (2) the Appalachian Educational Satellite Project (AESP) run by the Appalachian Regional Commission; and (3) the Alaska Education Project, coordinated by the State of Alaska Department of Education. All three included components in which college-level instruction was delivered by satellite.

Satellite Technology Demonstration. The Satellite Technology Demonstration was the first project to become part of the ESCD. The primary goals of the STD were to (1) test the feasibility of delivering instructional materials via satellite to 68 participating school sites scattered throughout an eight-state region; (2) develop an information gathering and field service system requiring cooperation among state, district, and local institutions; and (3) test the effectiveness of an interactive audio system linking an instruction center in Denver with the remote sites (Filep & Johansen, 1977).

As the result of a needs assessment conducted by project personnel, career education was selected as the focus of STD programming, and junior high school students were identified as the primary audience. The project had four major components: (1) "Time Out" was a series of career education programs running 35 minutes daily for a semester; (2) "Footprints" was an evening series directed toward an adult audience; (3) the "Materials Distribution Service" transmitted films and video tapes, under an agreement with the Great Plains National Instructional Television Library and the Encyclopedia Brittanica Educational Corporation, on a request basis throughout the system at scheduled times. Schools were permitted to tape up to two hours per week for later use; and (4) "Careers in the Classroom: A New Perspective for Teachers" was designed as a training adjunct to the "Time Out" series and directed toward teachers and administrators (Cowlan & Foote, 1975; FRMS, 1975).

"Careers in the Classroom" was intended to interest school personnel in career education and to encourage them to incorporate its principles into the curriculum. Sixteen programs were prepared on such topics as honest self-assessment, values and strategies in decision-making, job security, overcoming biases in counseling students, and career guidance resources. The format was basically the same for all programs -- guest authorities lectured for 10-30 minutes, followed by a question/answer session and interaction for the remainder of the 55-minute period. Prior to each broadcast, participating teachers and administrators received an information packet, including a biography of each speaker, lecture outline, and other materials, as appropriate (Cowlan & Foote, 1975; FRMS, 1975).

The need for continuing education to meet recertification requirements motivated many teachers to participate in the project. Five hundred fifty-four teachers ultimately received college credit and 322 received recertification credit from state departments of education (Filep & Johansen, 1977).

Appalachian Education Satellite Project. The Appalachian Education Satellite Project (AESP) was the only ESCD experiment that focused exclusively on the delivery of university-level instruction for credit. The AESP was conducted by the Appalachian Regional Commission (ARC), an agency established in 1965 to promote economic and educational development throughout the 13-state Appalachian area (Morse, 1975).

A needs assessment conducted in the early 1970s indicated that teachers throughout the area were in need of additional coursework in reading education and career education. Many teachers were unable to commute to universities where those courses were available because of the distances involved (Cowlan & Foote, 1975).

Four courses were developed for the experiment. Graduate courses in reading in the lower primary grades and in career education in the elementary school were offered in Summer 1974. During the 1974-75 school year, an advanced reading education course and a course in career education at the secondary school were broadcast (Morse, 1975). While the coordinating and production center at the University of Kentucky did not employ a formal "team approach" in course development, Cowlan and Foote (1975) observed that close cooperation appeared to exist between educators and producers. In addition, project personnel constantly monitored feedback from participating teachers, and course alterations were frequently made to adjust for teacher needs (Morse, 1975).

Each of the courses involved 16 broadcasts. Participants received a packet of instructional materials, and a small library of support materials was established at each of the 15 participating sites. The format of the video component varied among the courses. Only in the secondary career education course did the schedule consist of 16 live seminars with no pre-taped components. The other three courses all incorporated taped segments, along with traditional "lectures" supported by audiovisual materials. Many of the classes included demonstrations involving videotapes of teachers applying the concepts being discussed. Class periods were 60 minutes long, including time for interaction among the faculty and participants (Cowlan & Foote, 1975; Filep & Johansen, 1977; Morse, 1975).

A 15-minute, audio-only practice and feedback activity followed each of the non-seminar broadcasts. Participating teachers were provided individual headphones and a four-button keypad. As a group, they heard descriptions of problematical situations and were asked to respond in a multiple choice format. Each individual teacher then heard confirmation or corrective feedback, depending upon the response selected. After a short pause, all were provided the next common question (Cowlan & Foote, 1975; Morse, 1975).

Approximately 1,200 teachers and administrators enrolled in at least one of the four courses and received credit from one of 14 area universities (Williams, 1977). Although post-test results were tempered by the fact that 60 percent of the pre-test items were answered correctly (Filep & Johansen, 1977), most of the participants were able to respond accurately to at least 70 of the 80 post-test questions for each course (Williams, 1977).

Alaska Health/Education Telecommunications Experiment. The Alaska ATS-6 Health/Education Telecommunications Experiment was designed to overcome distance and communication barriers in this sparsely populated state where two-thirds of the 264 villages, towns, and cities had no access to highways and more than a hundred lacked round-the-clock telephone service (Norwood, 1981). Seventeen sites were selected for participation, each equipped with a terminal capable of receiving a video signal via ATS-6 and transmitting a return audio signal via ATS-1 (GOT, 1975).

Programming was prepared and delivered for four separate target audiences. A series entitled "Amy and the Astros" was directed at the 4-7 year-old age group as part of a language stimulation program called BOLD (Basic Oral Language Development). The series "Right On" provided health education information for mid-primary age children. Two evening public affairs programs were developed for adult viewers (Cowlan & Foote, 1975; Fitzpatrick, 1979).

The fourth target audience was in-service teachers, administrators, and paraprofessionals. Originally, four programs in a project component entitled Teacher In-service Training (TIST) were conceived. When initial plans for the BOLD series were scaled back, additional transponder time became available, and TIST was expanded to thirty-two 30-minute programs. A task force established by the Alaska Department of Education (DOE) was charged with determining program objectives and planning the TIST series. Reading instruction was selected as the series topic. In August 1974, a Juneau production company contracted with the DOE to design, script, and produce the entire series of 32 programs in less than three months (GOT, 1975).

Almost immediately, the funding situation began to change, and so did the focus of the series. The decision was made to acquire an existing series of videotapes entitled "Motivating Children to Learn," that was to be packaged with in-studio panel discussions permitting interaction with viewers. The Alaska Governor's Office of Telecommunications (GOT) ultimately took charge of production.

The first program was produced in September and broadcast on October 10. After the first few programs were aired, it became evident that the topic was of little interest to the audience. Only a few of the participating teachers took advantage of the opportunity to interact with the in-studio hostess and guests. As a result, more revisions were made, and the remaining programs were planned on a one-by-one basis in a series of weekly meetings between

DOE personnel, the GOT technical director, and the program hostess. Some programs were based on teacher requests, while others involved panel discussions and interviews with particularly innovative teachers. The series, entitled "Tell and Show," concluded after 28 broadcasts (GOT, 1975).

<u>CTS/Stanford-Carleton Curriculum Exchange</u>

The Communications Technology Satellite (CTS), nicknamed "Hermes" after its launch in January 1976, was a joint venture of NASA and the Canadian Department of Communications (DOC). The main objectives of the Hermes program were technological in nature and required little use of the satellite's transponder capability. Therefore, DOC solicited applications for educational and social communications experiments to be conducted between 1976 and 1979. A total of 49 proposals were reviewed, and 37 projects were accepted and conducted during this period (Kerr, 1985). The only experiment involving the delivery of complete courses for university-level credit involved a unique curriculum exchange between Carleton University of Ottawa and Stanford University in California (Richmond & Daniel, 1979).

Five courses in engineering and computer science were selected for sharing during the Fall 1976 term, three originating at Stanford and two at Carleton. Just as the term began, a solar eclipse damaged Hermes, and the satellite was shut down for six weeks. Arrangements were hurriedly made to videotape the lectures and ship them between campuses, but the tapes frequently arrived late and out of sequence. Print materials that were to have been shared were either lost or held up in customs.

As a result, 31 of the original 47 Stanford students withdrew from one Carleton course, and 18 out of 29 withdrew from the other. Carleton students generally stuck with the Stanford courses, but their enrollments were not high at the beginning. Enthusiasm for the project diminished rapidly on both campuses. According to Richmond and Daniel (1979), these setbacks appeared to have had a devastating effect on the curriculum exchange and severely limited the generalizability of the evaluation results.

Hermes returned to operation on October 19, 1976, and the remainder of each course was delivered by satellite, as scheduled. Each university utilized a classroom that had been designated for use in videotaping or broadcasting lectures. Each student station was equipped with easy access to a monitor and microphone. Remote control cameras were utilized to follow movements of the lecturers around the room. At Stanford, the lecturers employed the same style used for delivering instruction to industrial viewers in the Silicon Valley area via the Stanford Instructional Television Network (ITN), and, in fact, the courses were actually broadcast simultaneously over the ITN. Neither of the Carleton lecturers had any prior experience with the telecourse format, and they spent considerably more time in course preparation than did the Stanford instructors (Richmond & Daniel, 1979).

Two additional courses were shared in the Winter 1977 term, but just two Stanford students enrolled in the Carleton course (Richmond & Daniel, 1979). Another component of the project involved the linking together of Stanford, Carleton, and Ames Research Center personnel in three-way videoconferences. According to Norwood (1981), this was the first demonstration of the economic feasibility of videoconferencing as an alternative to participant travel.

Subsequent Canadian Applications

With its immense territory and sparse population, Canada has been using satellites for delivering instruction regularly since the Hermes experiments. Slobe (1986) described activities in several provinces. The ACCESS Network of Alberta transmitted 84 hours of educational programming by satellite per week in 1985-86, including evening credit courses originated by several colleges and universities in the province. In Quebec, the Tele-universite du Quebec, Mount St. Vincent University's Distance University Educational Television (DUET), and the Atlantic Association of Universities all distributed credit courses by satellite. TVOntario provided educational television services by satellite to over 90 percent of the province's residents.

Satellites have been used extensively in British Columbia. The University of Victoria originated the first credit course transmitted by a Canadian university by satellite to Canadian students in 1979, an undergraduate course in educational administration (Martin, 1981). In May 1980, the provincial government established the Knowledge Network of the West (KNOW) communications authority to provide a coordinating and delivery system for courses originated by British Columbia's three universities and 14 community colleges. About 90 percent of the homes in B.C. are wired for cable, and cable systems are required by law to carry the KNOW channel. Thus, KNOW has made possible widespread distribution of college and university courses throughout the province (Haughey, 1983; Haughey & Murphy, 1984; Potter, 1981).

The Learning Channel

Upon completion of the ESCD, the Appalachian Education Satellite Project initiated a second phase with support from both private and public sectors (Mertens, 1977). By 1980, the endeavor was so successful in providing continuing education to teachers in rural areas that it changed its name to The Learning Channel, went nationwide, and greatly expanded its programming in an attempt to reach potential students in the public service, health, and business fields, as well as educators (Parr, 1984).

Although individuals can receive The Learning Channel through home satellite antennas, most students view its programming on local cable channels. By early 1988, the service was carried by over 900 cable systems in all 50 states, reaching nearly 12 million homes. Over 100 postsecondary institutions were offering its 20 college telecourses for academic credit, through arrangements negotiated with course originators. The Learning Channel filled the remainder of its 20-hour per day broadcast schedule with business/career self-improvement programming, programs for schools, and hobby-related, entertainment, and documentary programming (P. MacEwan, Affiliate Relations Manager, The Learning Channel, personal communication, June 8, 1988).

International University Consortium

The International University Consortium for Telecommunications in Learning (IUC), headquartered at the University of Maryland University College, originally provided entire undergraduate degree programs to its member institutions. The initial IUC course offerings were acquired from the British Open University (BOU), with majors in management and technology, behavioral and social science, and humanities. The IUC did not offer the courses itself but made them available to institutional members of the consortium, which scheduled and managed them according to their own needs (Fehnel, 1982).

The consortium no longer offers entire degree programs, although BOU courses are still in its catalog. However, the IUC has since added a large inventory of courses produced in cooperation with member institutions or acquired from other sources. According to the Winter 1988 IUC newsletter, 10 new courses carrying either three or six credit hours each will be made available for the 1988-89 academic year.

Until recently, the video components of IUC courses were transmitted from the Maryland campus by satellite direct to local cable systems. It was the responsibility of members to make arrangements with cable operators to receive the signal and either carry it live over an educational channel or tape it for replaying at a specified time. With satellite reception antennas becoming more common on college campuses -- a recent Public Broadcasting System (1988) survey discovered that over 750 colleges and universities owned such "downlinks" -- the IUC now bypasses cable systems and transmits its video course components directly to its member institutions. Most of the video materials are distributed during the early morning hours, when satellite costs are the lowest. IUC members videotape the transmissions and make their own arrangements for local distribution (G.E. Miller, Executive Director, IUC, personal communication, February 25, 1988).

California State University, Chico

The California State University, Chico, located 100 miles north of Sacramento, has maintained an extensive Instructional Television Fixed Service (ITFS) network since 1975 for delivering engineering and computer science courses via terrestrial means to students throughout northern California. The success of the program led university officials to explore the possibility of transmitting the same courses via satellite to a larger audience.

In 1984, the university entered into an agreement with the Hewlett-Packard Company to provide an entire master's degree program in computer science to Hewlett-Packard's corporate locations in five western states (Urbanowicz, Meuter, & Wright, 1986). According to the promotional materials for Chico courses, Bently Nevada, Texas Instruments, General Dynamics, Alcoa, and the Grass Valley Group have since joined the program. The university now offers a rolling schedule of 20 courses, leading to the M.S. degree, by satellite. Five courses are transmitted each semester, so that a student can enroll at the beginning of any term. The total number of students enrolled has been as high as 140 and was about 100 for the Fall 1987 semester. These students were located at more than 20 sites in 11 states, including Colorado, Texas, Arkansas, Tennessee, Virginia, and Pennsylvania.

National Technological University

The Association for Media-Based Continuing Education for Engineers (AMCEE) is a consortium of 33 of the major engineering colleges and universities in the United States, founded for the purpose of providing non-credit continuing education programming for engineers at their work sites. In 1984, AMCEE joined with 16 large corporations to establish the National Technological University (NTU). Headquartered at Colorado State University but without a campus of its own, NTU was the first university in the world founded to provide entire graduate degree programs by telecommunications media. NTU has received institutional accreditation from the North Central Association. During 1984-85, all courses were distributed by videotape, but in August 1985 the university switched to the GSTAR-1 satellite as its primary delivery system (Baldwin, 1986; Stephen, 1986).

Masters degree level programs have been offered in five disciplines: computer engineering, computer science, electrical engineering, engineering management, and manufacturing systems engineering. NTU recently announced that a sixth curriculum, in management of technology, would be available beginning in January 1989 ("NTU's MOT Degree," 1988). The 1987-88 NTU bulletin listed 455 courses. Most originated at the 24 universities that comprise the consortium, but some are also contributed by AMCEE member institutions not formally connected with NTU. Enrollment was 1,200 in 1985-86, 1,800 in 1986-87, and was projected to be 3,200 in 1987-88 and 4,500 in 1988-89. The number of receiving sites grew from 36 in 1985-86 to more than 90 in 1987-88 and was projected to be about 125 in 1988-89 (NTU, 1987a). Stephen (1986) predicted that NTU would be the largest producer of master's degrees in the United States by the mid-1990s.

The majority of NTU courses are videotaped in advance in "candid classroom" (Dean, 1982) settings, in which the recordings are made unobtrusively in a live classroom environment and subsequently uplinked to non-resident students. However, many courses are offered live, with two-way audio links providing opportunities for the instructor and remote students to interact during the class sessions. Students normally participate at their work sites during the work day. Cooperating employers include Hewlitt-Packard, AT&T, General Electric, GTE, Honeywell, Motorola, RCA, Tektronix, and Rockwell International (Baldwin, 1986; "NTU Offers," 1985).

Virginia Cooperative Graduate Engineering Program

The Virginia Cooperative Graduate Engineering Program is a cooperative effort among the University of Virginia, Virginia Polytechnic Institute and State University (Virginia Tech), the three urban universities in Virginia, and 25 industrial sites throughout Virginia and in neighboring states. The program evolved from an off-campus graduate engineering program initiated in 1970 by Virginia Tech, which has offered a thousand courses to over 16,000 students at off-campus sites, including 66 courses by television (Virginia Tech, 1987).

According to promotional materials, the Virginia Cooperative Graduate Engineering Program was begun in 1983, and satellite uplink capability was added in the summer of 1986. Uplinks are located at both Blacksburg and Charlottesville, with Virginia Tech transmitting 24 courses per year and the University of Virginia 16. Through this program, courses are available in nine different majors leading to master's degrees in engineering.

PBS Adult Learning Satellite Service

The Public Broadcasting System (PBS) initiated its Adult Learning Service (ALS) in 1981 to assist colleges and universities in offering academic credit for the many program series in its broadcast schedule that were developed as telecourses. By 1988, nearly 1,300 postsecondary institutions had offered ALS courses to well over 150,000 students nationwide (PBS, 1987, 1988). A limitation of the ALS system was that colleges only had access to those courses that were broadcast by local PBS affiliates.

In response to "the growing demand by colleges for convenient and cost-effective access by satellite to a broader range of educational programming than is currently available" (PBS, 1988, p. 1), PBS introduced its Adult Learning Satellite Service (ALSS) in early 1988. The ALSS will provide approximately 12 telecourses per semester, beginning in Fall 1988, by satellite directly to colleges and universities for local distribution via broadcast, cable, ITFS, or videotape, according to negotiated licensing agreements. The courses will be selected from the most successful and highly respected in the ALS catalog. About a dozen "special events," including teleconferences, workshops and seminars, classroom enrichment programs, lectures, and other forms of programming of interest to higher education institutions, will also be offered each semester (PBS, 1988).

Deficiencies in Satellite-based Courses

A fairly substantial body of literature was compiled as the result of American experiments with the ATS-1 and ATS-6 satellites, Canadian trials with the CTS, and subsequent courses originating in British Columbia. Included are project reports and evaluations of those reports. When placed into the context of established models for distance education, adult education, and telecourse design and production, the results of these studies indicated that problems were encountered when these models were not followed.

These deficiencies may be organized according to Kaye's (1981a) model that identified and listed the roles of four subsystems comprising a distance education system. The regulatory subsystem consisted of the management, decision-making, planning, funding, and evaluating processes, normally the responsibility of administrators of the program and of the institution. The course subsystem included course design and the production, distribution, and reception of the learning materials. The student subsystem was responsible for admitting students and then managing and controlling their progress through the course. The logistical subsystem included the purchasing and maintenance of equipment and the employment and training of personnel. As in any system, each of the subsystems must function effectively, both independently and in synchronization with the other subsystems, for the system as a whole to operate as it should.

Regulatory Subsystem

The very conception of both the ATS-6 and CTS projects came under severe attack. In both cases, the educational applications were intended from the beginning as demonstrations of the medium. In the case of the ESCD, Cowlan and Foote (1975) asserted that "the satellite was there and had to be used by a certain date" (p. 153); therefore, the planning that went into the projects was not concerned so much with whether instruction by satellite should be incorporated into an educational system, but how. Richmond (1977) raised the same questions regarding the Canadian CTS demonstrations, pointing out that they were designed to meet the needs of the participating institutions, rather than the needs of the students.

Needs assessments were sometimes inadequate or not done at all (Fitzpatrick, 1979). Cowlan and Foote (1975) felt that when needs assessments were conducted, in some cases they more closely resembled market surveys, in which the public was asked if it would accept what planners had already decided to do. The absence of a needs assessment was seen as one of the primary reasons for low attendance in the Alaska Teacher In-Service Training (TIST) course (GOT, 1975). Richmond and Daniel (1979) observed that it was difficult to determine the worth of the Stanford-Carleton curriculum exchange because the need for the exchange had never been established.

Insufficient time for planning and conducting the projects was a problem encountered as early as the first PEACESAT experiments (Byers, 1975). Filep and Johansen (1977) and Fitzpatrick (1979) both commented that the ATS-6 demonstrations were handicapped by a short planning period. The Appalachian Education Satellite Project (AESP) actually had only nine months' "lead time" before its first course was transmitted (Morse, 1975). A criticism leveled at the Stanford-Carleton curriculum exchange project was that the professors who taught the courses were not involved in the planning process (Richmond & Daniel, 1979).

Funding was a problem in the CTS experiments. Daniel (1977) reported that some projects were supported exclusively by institutional budgets. According to Daniel, Cote, and Richmond (1977a), Canadian experimenters were forced to devote considerable energy to fund-raising, a hurdle not encountered by their U.S. counterparts. However, Hooper (cited in Daniel, 1977) noted that educational projects heavily dependent upon outside funding generally have survival rates lower than those supported by internal sources. Therefore, Daniel saw the funding situation in Canada as being healthy for the projects, for the long term.

Project evaluation was criticized by Cowlan and Foote (1975) and Richmond and Daniel (1979). In both cases, the complaints were directed at the type of information obtained. Richmond and Daniel lamented that the system's effect on learning was totally ignored in the Stanford-Carleton exchange. Cowlan and Foote observed that ESCD evaluators focused almost exclusively on attitudinal data, instead of determining whether students had had achieved any significant cognitive gains. These deficiencies regarding summative-type evaluation were in addition to an almost total lack of formative evaluation in these projects. This problem will be described in the next section.

Course Subsystem

Cowlan and Foote (1975) were particularly concerned that the technology seemed to drive the system in the ATS-6 experiments. Little attempt was made to seek alternative technologies that might have been just as effective at a lower cost, because it had been predetermined that a satellite-based system was to be used, even before needs had been assessed and content identified. Fitzpatrick (1979) noted that the use of video was not justified in some portions of the Alaska project and that audio alone would have sufficed. Students in a course taught by satellite in British Columbia felt that the programs could just as easily have been presented by videocassette or telex (Carney & Lawrence, 1977).

The management system for course development in the ATS-6 projects was criticized by Cowlan and Foote (1975), who found lines of responsibility to be blurred or overly complex. They also discovered frequent occasions in which content specialists and production personnel either did not or could not communicate, resulting in programs that were of high technical quality but not entirely related to the educational objectives.

Instructional design factors frequently came under fire. Richmond and Daniel (1979) noted the lack of instructional design in the Stanford-Carleton project. They complained that most of the CTS projects seemed to view the satellite system as an extended classroom. Although the Canadian experiments were modestly successful, Richmond and Daniel felt that more innovative instructional methodologies could have been employed. Cowlan and Foote (1975) observed that course designers frequently prescribed inappropriate or unrealistic supplemental activities, given the constraints of the instructional situations. They also noted that print materials summarizing content presented by video often were not provided.

One of the major complaints levied at the NEA's Alaska experiment was that the homework assignments were "too involved, too theoretical, and required too much written work..." (NEA, 1975, p. 28). Even objectives were the target of complaints. Fitzpatrick (1979) believed that many problems in the ATS-6 demonstrations were caused by unclear or conflicting objectives.

Although production quality was generally good in the ATS-6 projects, Cowlan and Foote (1975) were critical of overly-done dramatic vehicles, humor, the use of elaborate sets, and slick production techniques that appeared to be irrelevant to the instructional goals. The need to keep the sessions sufficiently interesting to maintain student attention was acknowledged, but it was felt that such techniques should have been subordinate to innovative and effective instructional methodologies. According to Cowlan and Foote (1975), virtually all of the ATS-6 projects allowed too little time for production of video software. Richmond and Daniel (1979) found problems with live telecasts in the Stanford-Carleton project. They felt that Carleton's camera work was faulty and that some diagrams and written materials had poor resolution.

The near absence of formative evaluation was seen as a serious problem. Time was the major culprit, as frantic production schedules in the ATS-6 demonstrations simply did not permit testing and revision of materials (Cowlan & Foote, 1975; Morse, 1975). As Cowlan and Foote observed, "speed and quantity [were] more important than quality" (p. 61), although they did acknowledge some attempts at peer review of early tapes by fellow educators. The pace was somewhat more relaxed in the Stanford-Carleton exchange, but Richmond and Daniel (1979) noted that opportunities to modify the courses in progress were missed because of the lack of a formative evaluation effort.

Audio difficulties frequently disrupted the radio-based projects, PEACESAT and the NEA's Alaska experiment (Byers, 1975; NEA, 1975). Audio problems were also manifest in the ATS-6 and CTS experiments, although the video components of these demonstrations worked well. Daniel, Cote, and Richmond (1977b) reported that echos and garbled sound frequently required speakers to repeat their messages.

One of the mandates given ATS-6 experimenters was to test the interactive capabilities of the satellite system (Cowlan & Foote, 1975). Evaluators determined that interaction was not usefully employed in either the ATS-6 demonstrations (Fitzpatrick, 1979) or the Stanford-Carleton project (Richmond & Daniel, 1979). Richmond and Daniel attributed the lack of interaction in the Stanford-Carleton exchange to the technical problems and the lecture-style presentation methods to which the instructors were accustomed. Original plans to experiment with various questioning techniques and uses of interactive seminars in this project were ultimately abandoned, and the curriculum exchange assumed the characteristics of a standard broadcast format.

Cowlan and Foote (1975) felt that interaction was counterproductive in some cases. Younger students appeared to be bored by it and stopped paying attention. Interactive sessions seemed to be more valuable in university-level courses, with adult students, when the activities were carefully structured.

A final course subsystem problem related to course administration. Richmond and Daniel (1979) reported several administrative snags in the Stanford-Carleton project, such as non-concurrent class terms, determination of student evaluation standards, and course scheduling problems due to time zone differences, but these were unique to a situation in which courses were shared by two rather different universities with unique academic systems.

Student Subsystem

The student subsystem includes the processes of student enrollment and support through the duration of the course. Cowlan and Foote (1975) traced many problems in the ATS-6 projects to failures in administrative communications related to the course and student subsystems. Daniel (1977) found inefficient "housekeeping" communications to be an important weakness of the CTS experiments, as well. Remote sites frequently did not receive critical information regarding broadcast schedules, delivery of materials, equipment adjustment, and course management, and course originators often did not receive the necessary feedback from remote sites. Cowlan and Foote recommended establishment of a separate audio channel dedicated to administrative communications.

Logistical Subsystem

Problems were encountered in the ESCD when field personnel were not sufficiently trained in operating and maintaining the receiving equipment. Cowlan and Foote (1975) reported that in some cases systems were rendered inoperable because no one knew how to change a fuse. In areas where trained technicians were accessible, equipment breakdowns were far less common.

In case of Carleton University in its course exchange with Stanford (Richmond & Daniel, 1979) and in the NEA experiment (NEA, 1975), faculty members appointed to teach the courses had no prior experience with broadcast media. Although project evaluations did not suggest that this inexperience was a barrier, the professors themselves expressed concern. The Carleton faculty in particular complained of an increased workload in preparation, faster class periods because of less interaction with students, and an imposed rigidity that was unlike the normal classroom.

Recent Assessments of American Distance Education Courses

With the demise of the ATS-6 and CTS satellites, along with the evaporation of large-scale public funding, most experimentation with educational applications ceased. After a brief hiatus, however, the technology has re-emerged. It may be asked whether current users of satellite systems have learned the lessons of the 1970s.

The existing evidence indicates that deficiencies still exist, particularly in the area of instructional design. Knapper, Lumsden, and Stubbs (1985) observed that distance education courses are frequently prepared by an individual professor, as in conventional university teaching, with "little systematic course design, minimal effort at formative evaluation, and little attempt to assess the effectiveness of the course in relation to the learning needs of the students" (p. 3).

Winn (1985) noted that far too often distance educators become so intrigued with the impressive capabilities of their delivery systems that they "lose sight of the simple yet essential principles that underlie effective communications and effective instruction" (p. 2). Stephen (1986) complained about the lack of quality in video-based distance education courses produced for engineers in the United States, including those distributed by satellite by the Association for Media-Based Continuing Education for Engineers (AMCEE) and its National Technological University (NTU). Stephen felt that their courses consisted mostly of "conventional chalk-and-talk and overhead projector illustrated lectures" (p. 135).

Moore (1987), in his editorial in the inaugural issue of the American Journal of Distance Education, decried the "chequered history" (p. 2) of television in American education, and he placed the blame at the feet of educators, not televison personnel, for failing to use the medium properly.

> It is we educators, not television, that are culpable if we have failed to add the newest media to our traditional methods of facilitating learning. There is no point in attacking the messenger because television has not delivered the messages we would like; it is for we, who are teachers in higher and continuing education ...to make better use of the media (p. 2).

Moore cautioned educators to avoid what he termed "single medium fixations" (p. 3).

> Even more important than education through any ...single media is education through systems that employ a variety of the media mentioned here. There is no single super medium....For distance education, the learners' needs determine the use of media, and the media must be suited to the educational message (p. 3).

Moore considered it most important that educators "develop techniques for planning and delivering educational programs that integrate media use to meet well researched learner needs" (p. 3).

Statement of Objectives

The purpose of this study was threefold: (1) to determine the most appropriate procedures, in the form of guidelines, for developing and delivering postsecondary courses by communications satellite; (2) to gain some assessment of the degree to which this technology has been used by colleges and universities since the end of the experimental era of the 1970s; and (3) to ascertain the actual practices of these institutions in relation to the guidelines. Four specific objectives were as follows:

1. Develop a set of guidelines for the design, delivery, and evaluation of postsecondary credit courses by communications satellite, based upon theories of distance education, adult education, and instructional telecommunications, as well as the published evaluations of past satellite-based credit courses.

2. Identify those colleges and universities in the United States that have used communications satellite technology for the dissemination of credit courses to non-resident students during the decade of the 1980s.

3. Determine the actual practices of these

institutions in developing, delivering, and evaluating those courses.

4. Compare the practices identified with the guidelines to determine the degree to which instructional procedures dictated by existing theory have been followed.

All institutions contributing courses to the National Technological University (NTU) were asked to complete one version of the questionnaire. Colleges and universities that have uplinked at least one credit course not part of the NTU curriculum were asked to complete a different version of the survey instrument. Since many colleges and universities offer credit courses that were procuded <u>at other institutions</u> but delivered by satellite, the following criteria were provided to help respondents determine whether their participation in the study was desired:

1. Students completing the course successfully received academic credit from their own institutions (the college or university being surveyed).

2. At least a portion of the instruction was delivered from that institution directly to the students via a communications satellite.

3. <u>That institution originated the course</u>.

4. The course was not offered in conjunction with the National Technological University.

In addition, descriptive information regarding the courses, students, and faculty were collected and compiled for the purpose of publication.

Limitations of the Study

Two limitations are apparent. One, the descriptive information regarding users and their projects will become dated rather quickly. The technologies are changing rapidly, and the lineup of institutions using the medium also changes. Therefore, the picture obtained represents the profile at a particular point in time.

Two, the study depended upon a self-reporting survey instrument. Such questionnaires rely upon the motivation of the respondent to read the questions and answer as completely and accurately as possible. While most of the persons who completed the questionnaire responded in a thorough and thoughtful manner, several gave it cursory attention at best.

Significance of the Study

The incorporation of communications satellites into instructional delivery systems by colleges and universities is growing rapidly on virtually a world-wide basis. The movement may even be approaching bandwagon proportions, as more and more postsecondary institutions acquire the necessary uplinking equipment and as the number of perceived instructional needs continues to multiply. Evidence indicates that some satellite course producers take a "quick and dirty" approach to course development, with little thought given to sound educational design and use of an optimum mix of technologies.

One reason for this approach may be lack of knowledge of the proper procedures to follow. No comprehensive, theory-based guidelines appear to exist, providing producers and instructors with an effective conceptual framework for course development, delivery, and evaluation. The present study was intended to help fill that void.

In addition, a thorough review of the literature yielded no single reference summarizing the experiences of colleges and universities in using satellite-based instructional delivery systems since the era of large-scale Federal funding concluded. Such a summary could be a valuable source document for researchers in this field and could also vastly improve the ability of practitioners to identify and communicate with each other. A secondary outcome of this study was intended to be a data base from which such a reference can be developed.

CHAPTER TWO: REVIEW OF THE LITERATURE

Organizational Structure

The organizational structure for the literature review will consist of a synthesis of key elements of two models and two checklists related to the design, development, and delivery of distance education courses. Kaye's (1981a) systems model for distance education was described in Chapter 1. Vest (1975) conceived a systems model for an educational satellite. Holmberg (1981) compiled a checklist for a systems approach to distance education course development. Dick (1981) adapted a list of 10 common components of instructional design models from an earlier list developed by Andrews and Goodson (1980). Each of these sources contributes to the formation of a conceptual framework for a satellite-based instructional system.

Vest's Systems Model for an Educational Satellite

Vest's (1975) model was intended to apply to a system in which courseware was sent from a single course development/transmission facility by satellite to an unspecified number of receiving sites. The system was hypothesized to demonstrate how instructional materials could be disseminated on a widespread basis to existing K-12 classrooms. All of the subsystems appear to have relevance to satellite-based course delivery at the postsecondary level, as well. The model consists of six primary subsystems and three auxiliary subsystems.

Design and Production Subsystem

This subsystem includes the design and development of all course learning materials, including those intended for transmission by satellite, as well as supplemental materials distributed by terrestrial means for use in conjunction with the satellite programs. Vest intended that course management materials, such as instructor's guides, be prepared as part of this subsystem.

Transmission Subsystem

The transmission subsystem includes the facilities and equipment for transporting the broadcast signal from the studio to the satellite, via the uplink.

Satellite Subsystem

The space component of the model consists of the satellite itself and its own systems, such as those for receiving, transmitting, and generating power, that determine the satellite's capabilities.

Reception and Distribution Subsystem

This subsystem receives the signal from the satellite and transports it to the classroom. Essential components include the receiving dish, related amplifiers, and cables and/or microwave relay equipment.

Classroom Subsystem

This is the component in which the course content, including the content presented by satellite, and the students interact. In this subsystem, students interact with the satellite teacher, experience the supplemental materials, and are evaluated. When the setting is a traditional classroom, the resident teacher assumes more of a managerial role.

Evaluation Subsystem

While student evaluation is a function of the classroom subsystem, the evaluation subsystem is more concerned with materials and system evaluation. In Vest's model, the output of this system serves as a feedback loop to the Design and Production Subsystem.

Maintenance Subsystem

The first auxiliary subsystem, the maintenance subsystem, is primarily concerned with maintenance of the system hardware. An important component is the training of support personnel at the receiving sites to maintain the reception equipment.

Administrative Subsystem

The administrative subsystem includes hiring personnel, scheduling the system, and the functions of planning, budgeting, and controlling.

Logistics Subsystem

Vest's view of logistics appears to be rather narrow. This subsystem consists primarily of transporting the supplementary instructional materials and teacher training/ support materials to the classroom sites and returning feedback materials.

Holmberg's Systems Approach to Course Design

Holmberg (1981) advocated the use of educational technology, and in particular a systems approach, during the development of courses for distance education. He described such a procedure in nine steps, most with sub-steps.

1. Define the goals and objectives of study.

    1.1. Conduct a needs assessment.

    1.2. Define goals.

    1.3. Break down goals into specific objectives.

    1.4. Re-appraise objectives in relation to the goals, the total educational or training program, and the requirements of students and society.

2. <u>Study the target group</u>.

2.1. Analyze background and entering knowledge of students.

2.2. Analyze societal environment for course.

2.3. Analyze student attitudes and motivation.

2.4. Analyze student characteristics such as ability and capacity, age, and professional and social experiences.

2.5. Re-appraise 2.1 to 2.4 to determine implications for teaching strategies.

3. <u>Contents and structure</u>.

3.1. Determine course content, based upon objectives.

3.2. Determine the appropriate sequence for the content.

3.3. Determine needs for student motivation.

3.4. Make initial decisions regarding modes of presentation.

4. <u>Organization and administration</u>.

4.1. Determine basic conditions under which students will receive course content.

4.2. Organize counseling for prospective and current students.

4.3. Organize procedures for enrolling students in course.

4.4. Organize tutorial service.

4.5. Organize facilities for course development.

4.6. Make arrangements for group meetings and activities, if desired.

4.7. Provide for interaction between students and instructor and among students themselves.

5. Choice of media.

5.1. Consider methods and media available and their potentials for course.

5.2. Make appropriate selections.

6. Two-way communication in distance study.

6.1. Arrange for student counseling.

6.2. Determine procedures for didactic communication initiated by the institution, including collection and assessment of student assignments and provisions for feedback.

6.3. Determine procedures for communication initiated by students.

7. Course construction.

7.1. Make all decisions regarding use of facilities, distribution of study materials to students, and formats for instruction.

8. Evaluation.

8.1. Plan formative evaluation to monitor student progress and identify need for course modification.

8.2. Plan summative evaluation to determine student performance in relation to course goals and objectives.

9. Revision.

9.1. Revise courses based upon findings of 8.1 and 8.2.

Dick's Common Components of Instructional Design Models

Andrews and Goodson (1980) analyzed 40 different models for instructional design and identified the major components of each. Dick (1981) then determined the 10 components that were most commonly prescribed in these models.

1. Assessment of needs, consideration of alternative solutions to instruction, formulation of a system, and identification of constraints.

2. Formulation of broad goals and detailed, observable subgoals.

3. Development of pretest and posttest that match goals and subgoals.

4. Analysis of goals and subgoals for types and sequencing of subskills.

5. Determine learner characteristics such as age, grade level, prior learning experience, special aptitudes or disabilities, and specific entry behaviors.

6. Formulation of instructional strategy to match subject matter and learner requirements.

7. Selection of media to implement strategies.

8. Development of courseware based on strategies.

9. Formative evaluation of courseware with learner population to diagnose learning difficulties and to revise courseware based on the diagnosis.

10. Development of materials and procedures for installing, maintaining, and periodically repairing the instructional program.

Juxtaposition of Models

Figure 1 illustrates a juxtaposition of the key concerns of each of these four authors. None of the four provides a complete list of factors to be considered in developing and delivering a college course by satellite. Kaye and Vest were concerned with the delivery system as a whole, while Holmberg and Dick focused on course development. However, when these factors are viewed collectively, an organizational framework emerges. Following are the topic headings for this chapter:

Kaye	Vest	Holmberg	Dick
Course subsystem	Design and prod subsys		
	Learning/supplemental materials		
Design		Define goals/objectives	
		Needs assessment	Assessment of needs
		Definition of goals	Formulation of goals and objectives
		Definition of objectives	
			Develop pretest/posttest
		Study target group	Learner characteristics
		Content/structure	Task analysis
			Instructional strategy
		Choice of media	Selection of media
Production		Course construction	Development of courseware
	[1]		
Distribution/ reception	Transmission subsystem		
	Satellite subsystem		
	Reception/distribution subsystem		
	Classroom subsystem		
Student subsystem			
		Organization/admin	
Admission		Application/enrolmnt	
Tutoring		Tutorial service	
Counseling		Counseling	
		[2]	
Record-keeping			
	Interaction	Two-way communication	
		Evaluation	
Assessment	Student evaluation	Student evaluation	
Regulatory subsystem			
Decision-making			
Planning			
		[2] Institutional planning	

Evaluation	Evaluation subsystem		
		Summative evaluation	
	Delivery system		
	Materials		Formative evaluation
		Revision	
	[1] Teacher's guide		Installation of materials
	Administrative subsystem		
	System scheduling		
	Business functions		
Logistical subsystem			
Personnel	Personnel		
Maintenance	Maintenance subsystem		
Purchasing			
	Logistics subsystem		
	Materials delivery		
	Materials return		

Figure 1. Juxtaposition of four models related to the design and delivery of distance education.

Note. The numbers [1] and [2] refer to model components that were repositioned to conform to the general structure of this figure.

- Course subsystem
  - Course design
    - Needs assessment
    - Goals and objectives
    - Task analysis
    - Learner characteristics
    - Instructional strategy
    - Media selection
  - Production
    - Materials development
    - Formative evaluation
- Student subsystem
  - Student support services
  - Interactivity
  - Student evaluation
- Regulatory subsystem
  - Planning/management
  - Budgeting
  - Evaluation
- Logistical subsystem
  - Faculty support services
  - Field support

Review of the Literature

Course Subsystem

Course Design

Needs assessment. The primacy of a needs assessment in a course development model is well documented. Richardson (1980) described eight factors important for success when adult learners are served by telecommunications; the first was that the teaching-learning system be designed and coordinated with needs of the learners as its focus. Zigarell (1984) identified needs assessment as the first step in the telecourse design process. Slobe (1986) listed seven key factors that determine success or failure of technological innovations in distance education; the first was responsiveness to learner needs.

Richmond (1977) stressed that the high cost of hardware, software, and personnel required to provide educational services by satellite mandates some sort of needs assessment to ensure that the services address genuine educational problems. Richmond recommended the gathering of data regarding demographic characteristics and educational goals and needs of the target population, as well as the range of instructional methods and delivery modes deemed to be acceptable by the user groups. Richmond felt that such a process provides "a legitimate mechanism for involving users in the planning, development, and delivery of the proposed educational services" (p. 163), an important consideration in adult education. Moreover, a needs assessment yields a baseline that can be used to evaluate the effectiveness of a course upon its completion (Richmond, 1977).

Holmberg (1981) suggested additional sources to be consulted during an analysis of needs, including the opinions of practitioners in the field under study, wishes and needs of employers, opinions of past students, official policy statements, and existing syllabi, curricula, and textbooks. Seaborne and Zuckernick (1986) recommended interviewing or surveying professional organizations, special interest groups, and training officers in business and industry. The type of information sought and the structure of specific questions must be carefully considered to avoid the problem encountered in the ATS-6 experiments, where "needs assessments" more closely resembled market surveys (Cowlan & Foote, 1975).

Goals and objectives. There is an underlying assumption in any instructional television program that the viewer is expected to learn something (Carl, 1976). Therefore, the establishment of specific goals and objectives identifying that "something" is an essential step in the development of a course for delivery by telecommunications. Shanks and Hocheimer (1982) listed three benefits of objectives in the production of televised instruction:

1. The writing of objectives forces the instructor to engage in pre-production planning, increasing the likelihood that the broadcast will be instructionally sound.

2. Objectives help both instructor and producer to organize and sequence the course content, resulting in more logical groupings of content units in each broadcast.

3. Students find objectives useful in cueing them to the most important information in each program.

As in the case with assessing needs, the students (or prospective students) themselves should be consulted when determining objectives. This practice has been recommended for audiences in a distance education setting (Holmberg, 1980), when the learners are adults (Bonner, 1982), and in particular when telecommunications are used to teach adults at a distance (Shanks & Hocheimer, 1982). University-level courses transmitted by satellite are more likely to be viewed by non-traditional adult learners. Course faculty and producers must be especially sensitive to the needs and expectations of these students when developing objectives

(Bonner, 1982). Bonner urged that objectives be kept realistic so that they can be challenging but achievable.

Care must be taken with the wording of objectives. Daniel, Cote, and Richmond (1977a) found that objectives written for the Canadian CTS experiments sometimes represented "an art form divorced from real life" (p. 13). They cautioned against using the kind of "rarified metalanguage" (p. 13) that led to confusion and misunderstandings during actual course production. Objectives should be clearly written so that they can be easily understood by instructors, students, and production personnel.

Task analysis. Task analysis, or instructional analysis, involves the systematic study of each objective to determine the content and skills necessary for its achievement. A task analysis permits a course designer to identify all the essential information, in its most appropriate sequence; to determine prerequisite knowledge and abilities; and to obtain some clues regarding the psychological processes to be required of the learner (Carl, 1976). In Carl's study of instructional television course development practices in the mid-1970s, it was determined that most of the time the task analysis, if conducted at all, was assumed to be the faculty member's responsibility.

Dick and Carey (1978) described three different procedures for conducting an instructional analysis. A procedural approach is appropriate when the objective describes a process that is essentially a series of steps to be performed in sequence. Learning to use a word processing package is a good example. A hierarchical approach is necessary when the mastery of a skill depends upon mastery of one or more subordinate skills, such as in buying and selling stock at the right time to maximize profit. In reality, many objectives require a combination approach, in which both procedural and hierarchical elements appear. For example, the application of a complex mathematical formula to solve an engineering problem requires not only step-by-step procedures but a thorough knowledge of the principles and concepts involved.

Student characteristics. Shanks and Hocheimer (1982) observed that reports of the most successful instructional television projects invariably described exhaustive efforts to determine audience composition and characteristics. Carl (1976) concluded that such surveys for broadcast television were less concerned with learner analysis than with audience analysis. That is to say that greater attention was given to determining what type of instructional programming would attract the largest audiences, and that only cursory attention was given to learners' educational needs.

Cavert (1974) provided comprehensive guidelines for analyzing the characteristics of learners in a distance education setting. Cavert's model included both individual and environmental factors. Individual considerations included social characteristics, such as ethnic and geographic factors; imposed characteristics, including age and ability level; and natural characteristics, such as physical disabilities and interest areas. The environment in which the learner operates includes space and time factors, the availability of resources, the grouping of learners, availability of professional personnel, cultural influences, societal influences, and influences of the academic process. The latter includes requirements of the academic program in which the learner is enrolled and the influences of the learner's own experience and beliefs in relation to the course content and activities.

It was noted above that the mean age of students enrolled in college-level distance education courses is between 30 and 35 (Feasley, 1982). Knowles (1970) identified four assumptions about the characteristics of an adult learner that render some pedagogy-based instructional methodologies inappropriate for use with this learner group:

> 1) his self concept moves from one of being a dependent person to one of being a self-directed human being; 2) he accumulates a growing reservoir of experience that becomes an increasing resource for learning; 3) his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles; and 4) his time perspective changes from one of postponed application of knowledge to immediacy of applications, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness. (p. 39)

Shanks and Hocheimer (1982) advocated andragogical, self-directed learning when using instructional television for the continuing education of engineers. They felt that input and feedback from learners should be actively solicited, and that course content should be made as applicable as possible to the needs of engineers in their work settings. In an article directed toward engineering education programs, Knowles (1978) confirmed that the andragogical approach should be effective with learners in highly technical specialties such as engineering and mathematics.

Individual differences among learners have received increased attention in recent years. Coldeway (1982) felt that the idea that different students may need differing treatment had important implications for distance education. Although the diversity of learners and the physical separation between instructor and students make accommodation difficult, Coldeway argued that attempts to individualize courses could help instructors cope with these differences. Providing tutorial support and presenting course content through a variety of media and methods were two suggested approaches.

One long-time concern of distance educators has been attrition. The addition of video components to traditional correspondence courses has led to dramatic increases in retention rates, because regular television broadcasts served as pacing mechanisms and helped students maintain steady rates of progress (Feasley, 1983). The adoption of andragogical methodologies also seems to have potential for reducing attrition, because greater attention is given to the learner's personal needs, thus increasing student motivation to continue (Coldeway, 1982). Once these needs have been met, however, adult students often drop out. Several studies have shown that learners often withdraw from distance education courses and programs not because of dissatisfaction but because their needs have been fulfilled

(Feasley, 1982; Zigarell, 1984).

<u>Instructional strategy</u>. Guidelines for the development of courses for delivery by instructional telecommunications (e.g., Hudspeth & Brey, 1986; Mason & Goodenough, 1981; Mittelstet, 1979; Seaborne & Zuckernick, 1986) generally follow the procedures suggested by Dick's (1981) compilation of common components of instructional design models, described above. These guidelines include the usual steps of identifying goals and objectives, analyzing the target audience, conducting a task analysis, and so forth. At the point at which the instructional strategies must be devised, the guidelines typically refer to the need for a variety of materials representing different technologies and then describe the procedure by which the course content is converted to a video script and to printed matter. Attention is rarely given to the actual events that must take place for the student to receive and learn that content.

Gagne (1970) theorized a model of instruction including nine events that should occur for effective learning to take place:

1. Gain attention.
2. Inform the learner of the objective.
3. Stimulate recall of prerequisites.

4. Present the stimulus material.
5. Provide learning guidance.
6. Elicit performance.
7. Provide feedback.
8. Assess performance.
9. Enhance retention and transfer.

According to Briggs (1977), some of these events can be designed into the instructional materials themselves, some may be supplied by the instructor or the learners themselves, and others may take place during individual or group activities. In the case of more sophisticated learners such as adults, more of the responsibility for these events can be assumed by the learners themselves, such as identification of objectives and application of the content through practice activities.

Baath (1979) described how the events of instruction can be incorporated into printed distance education materials, which is important since courses delivered by satellite ought to incorporate substantive printed components. Bonner (1982) identified espects of the nine events that are applicable in the teaching of adults. A summary of their observations follows.

Gain attention. Since learners in a distance education setting frequently study alone, an attention-grabbing device of some kind may be necessary to emphasize the importance of the course content, arouse curiosity, and stimulate student interest (Baath). With printed materials, this can be accomplished to some extent through careful design and production, thus enhancing aesthetic appeal. With either print or video, such "vehicles" as case histories and testimonials, illustrating how the course information was used to solve problems with which the learners can identify, can serve this purpose. Video has also been shown to be quite successful in motivating learners by modeling the desired behaviors and demonstrating the breadth and variety of course content (Jacobson & Albright, 1983).

Inform learner of the objective. In the case of adult education, the learners should have been consulted regarding the objectives during the course development stage, and the objectives should reflect their needs (Bonner). Once established, the objectives should be stated in the printed materials (Baath).

Stimulate recall of prerequisites. Adult learners have a wealth of life experiences and knowledge that can greatly assist them in understanding and assessing the meaning of new course content. It is necessary for learners to recall the relevant cognitive structure so that the new content can be compared with and added to the foundation of previously stored knowledge (Bonner). In printed materials, written summaries of prerequisite information or recall suggestions can serve this purpose. Throughout the content presentation in either printed or video materials, reminders such as, "You'll remember from..." at strategic points can have valuable impact (Baath).

Present the stimulus material. Neither Bonner nor Baath addressed this event, which simply refers to the presentation of course content. Several authors have described the need for an appropriate "technological mix" in presenting the content, emphasizing the effectiveness and efficiency of various delivery alternatives. These issues will be discussed in the following section.

Provide learning guidance. This event refers to the process of providing assistance to help students with the coding of the new material. Although Gagne's intention was that this event should follow the presentation of content, Bonner suggested that pre-learning guidance was also appropriate with adult learners. Advanced organizers might be very helpful to the student in classifying and organizing information. The development or refinement of specific learning strategies might be required. Bonner also pointed out that many adults need to "unlearn" certain ideas and practices before they interfere with the learning of new information or skills, and that assistance may need to be provided in that area. Baath proposed that, following instruction, appropriate activities providing learning guidance include (1) reviewing the broader context of information into which the new learning material fits; (2) frequent use of illustrations, examples, and non-examples; and (3) engaging the students in some form of intellectual manipulation of the information through study questions and exercises.

Elicit performance/provide feedback. It is essential to provide activities for students to apply the new information through assignments for submission, self-help exercises, and opportunities to apply the content under real-life conditions (Baath). Feedback must be provided to allow students to receive some assessment of the correctness of their performance. In distance education systems, in cases in which feedback cannot be provided within the course printed materials, as with submitted assignments, the immediacy of feedback is frequently lost.

Assess performance. Neither Baath nor Bonner discussed assessing learner performance. This topic will be addressed below under "Student Evaluation".

Enhance retention and transfer. Bonner pointed out that this is the event most likely to be omitted from a lesson, since adults frequently engage in educational experiences for a specific purpose; that is, they intend from the beginning to apply the course content to meet some personal need. According to Bonner, course designers should provide opportunities for learners to plan and rehearse the application of course information to their personal lives. In the course materials themselves, retention and transfer can be enhanced by use of periodic reviews, questions and exercises that require the application of accumulated knowledge, by providing a variety of examples and illustrations, and by relating the course content to contemporary events and issues (Baath).

Media selection. One of the first important questions to be resolved when considering a satellite-based delivery system is whether the satellite is really necessary at all. According to Pelton and Filep (1984), factors to be included in deciding among communications technologies include the nature of the communications requirements, the size of the user community, the types of services to be provided, and budgetary constraints. They pointed out that a combination of satellite and terrestrial technologies would be appropriate in the majority of cases, and there may be many situations in which the use of satellites would be totally inappropriate.

The decision whether to use a satellite-based system would normally be made during the planning stage, to be described below. There appear to be five specific criteria would need to be met to justify the use of a satellite.

1. Visualization through video technology is essential to student learning of the course content.

2. The number of receiving sites, frequency of the video transmissions, or time sensitivity of the educational material, such as in a current history course, make the distribution of video tapes impractical.

3. The use of a satellite is more cost-effective than the use of a terrestrial system, or a suitable terrestrial system is not available.

4. The intended audience has access to the appropriate reception equipment.

5. The budget permits satellite use.

While the opportunity for interactivity is frequently advanced as an advantage of a satellite-based system, interactivity in itself is not sufficient reason to use a satellite because it can often be conducted less expensively by terrestrial means.

If the use of a satellite has been justified, the media selection process must focus upon what media are to be used, and how. Bates (1980) distinguished between _strategic_ and _tactical_ decisions regarding media selection. Strategic decisions are those that determine _which_ technologies are to be used and are normally based on matters of access, audience characteristics, and finance. Tactical decisions are those that determine _how_ the technologies are to be used once initial investment decisions are made. These involve variables such as choice of appropriate educational functions, use of what Bates refers to as the program "ingredients" (p. 402), and production quality.

Bates listed three strategic decisions that he considered extremely important regarding the use of video in a distance education system. One is the appropriateness of television for meeting the needs of a particular target audience. This question relates to whether the receiving equipment is even available to the target audience, an important factor in satellite use. The second decision regards the use of other media that can potentially be used in conjunction with television. Bates (1980) wrote,

> ...generally television is more likely to be successful if it is supported by or integrated with other media....It is my view that only in exceptional conditions will television be effective educationally as the <u>main</u> medium of instruction. Generally, it will be more effective when used in conjunction with other forms of teaching. (p. 399)

Bates' third strategic decision concerned the actual method of integration with other media.

> I would argue that television will be more effective when it is closely integrated with other media. This means that television has a special role to play, not identical to roles provided by other media, but strongly related to the material covered in other media....[It] is likely that courses that are designed from the outset with the knowledge that television will be used in conjunction with other media are likely to result in more effective use of programmes than teaching where programmes are added to an existing course or where the programmes stand alone. (p. 399)

Tactical decisions, those involving the specific utilization of media, are very important in the design of a course to be delivered by any video-based system. At the British Open University (BOU), for example, television resources are allocated on a competitive basis. Those course teams awarded the greatest amount of production and air time are those best able to argue that the functions they propose to teach through television cannot be achieved as economically or conveniently through any other delivery system. The BOU Broadcast Subcommittee maintains a list of 18 functions that are acceptable, including demonstrations; illustration of principles; use of animation, slow motion, or time-lapse techniques; and utilization of primary resource material, such as films or recordings of actual events (Bates, 1980).

Decisions regarding program "ingredients" relate to the actual content; modes of representation, or the manner in which the content is presented, including such factors as structure, pace, complexity, and "treatment;" and symbol systems, defined as "a set of elements, such as words, numbers, shapes, or musical scores, that are interrelated within each system by symbolic rules or conventions, and are used in specific ways in relation to fields of reference" (Goodman, cited in Bates, 1980). The concept of symbol systems, when perceived as the visual attributes of the medium, enables course producers to recognize what video does well (e.g., depict motion) compared with what it does not do well (e.g., present text.)

The need for quality is emphasized repeatedly in the literature on instructional telecommunications. According to Pelton and Filep (1984),

> ...it is critical that the materials be of high quality to create a positive first impression....The materials must motivate, but they also must show clearly that there is a commitment to excellence and quality from the outset. (p. 162)

Bates (1980) felt that the key issue in determining quality is the degree to which the program achieves its educational objectives. Such attributes as imagination, creativity, and professionalism are important, according to Bates, but what matters most is how these factors are applied to the educational tasks, rather than the aesthetic appeal of the program. It would appear from this perspective that producers of telecourses developed for the relatively limited audiences of satellite delivery systems would be in a better position to emphasize educational quality than producers of telecourses for public broadcast, where aesthetic appeal is necessary to attract mass audiences.

Video and print are not the only media forms available to distance educators. Audio cassettes, slide sets, computer programs, home study kits, laboratory activities, and telephone study opportunities all are employed by universities specializing in distance education programs (Kaye, 1981b). Kaye observed that,

> The question of media choice is only relevant when a project has the good fortune to be able to use several different media, each accessible to the students, and within the project's budget. The question then arises of which learning objectives to associate with which medium, since each has particular pedagogical [sic] and motivational characteristics which can be optimally exploited. (p. 49)

Most models for media selection state that the nine events of instruction should be planned prior to the selection of media. Alternative media forms can then be considered according to their potential effectiveness in conducting each instructional event (Reiser & Gagne, 1982). For example, providing specific feedback about practice activities can be better accomplished by interactive media such as computers or telephone than by audio or videocassettes. Printed text may be more efficient at presenting certain types of stimulus material than video.

Production

Materials development. The need for adequate time and resource allocation for product design, production, and evaluation is well documented in the literature. According to Pelton and Filep (1984), for example,

> ...the success of tele-education projects will be in jeopardy if [course developers] do not devote a large part of their budgetary resources to software development, do not create and test educational programming materials in interactive networks, do not involve teachers in the creation and the revision of educational program materials, and do not devote considerable time and energy in obtaining the support of the educational system where these materials are to be utilized. (p. 181)

In any production endavor utilizing the team approach, it is essential that team members work together as collaborators and not as antagonists or isolated individuals or subteams. Cowlan and Foote (1975) reported instances in the ATS-6 experiments where the lack of effective communication between the academic consultant, instructional designer, and production team resulted in videotapes of technical excellence but questionable educational value. Bates (1984a) reported similar problems in the British Open University, where video and print components for the same course were produced at different times and places by different people. As a result, one of the primary criticisms of students toward the courses was the lack of linkage between the television programs and text.

Forman and Richardson (1977) pointed out that the instructional materials in a distance education course must substitute for a live teacher, providing not only as complete an explanation as possible of the course content but also providing intangibles such as enthusiasm for the content. They provided a list of guidelines for the design and development of courses at the now-defunct University of Mid America.

1. The materials must engage the student as an active learner.

2. The materials must raise interesting and exciting questions.

3. The materials must have provisions for the application of knowledge gained in the course.

4. The materials must be carefully structured, and precise study directions need to be given.

5. The materials, if divided into units or weeks' work, should be consistent in terms of time, difficulty, and student requirements.

6. The materials must be carefully edited to eliminate undefined terms and excessive use of jargon, and to include pictures or visualizations whenever possible.

Bonner (1982) described more specific criteria for designing mediated materials for adults. Since vision gradually declines after the age of 18, particularly between 40 and 45, adults benefit from visual materials in which the subject is large and clearly highlighted. Contrasts should be more pronounced than in materials produced for younger audiences, and more time should be provided to view the critical components of an image. Hearing also declines as a person grows older. As a result, producers of materials containing audio components need to make sure that speech and other sounds are clearly audible, that the faces of persons speaking in video tapes can be seen whenever possible, and that background noises are reduced. Since older adults often have memory deficiencies, printed materials should contain summaries or outlines of the critical content presented by audio and/or visual media. Bonner emphasized that some adults have difficulty learning by reading alone; therefore, use of a variety of media and learning activities was recommended where feasible.

Formative evaluation. An instructional design model commonly includes two different types of evaluation. Formative evaluation is conducted during the course development phase for the purpose of identifying weaknesses in course materials and instructional strategies. Information obtained from formative evaluation becomes the basis of modifications to the materials and/or strategies before the instructional program is actually implemented. Summative evaluation is normally conducted after the course has been developed and delivered. The resulting information is used to document the degree of effectiveness of the course, but no further modifications are intended unless major deficiencies exist. Both formative and summative evaluations provide decision-makers with essential information regarding student experiences, both cognitive and affective, in relation to course goals and objectives (Carl, 1976).

Pelton and Filep (1984) identified the need for formative evaluation as one of six critical factors in the development of courseware for delivery by satellite. Formative evaluation was also listed as an essential step in the preparation of video-based courses for the continuing education of engineers (Shanks & Hocheimer, 1982).

According to Cambre (1981), formative evaluation was rarely attempted during the development of courses for instructional television until the rise of the systems approach in the late 1960s. Even as late as the mid-70s, most ITV production agencies advocated formative evaluation, but it was a stage undertaken with intensity by only the largest producers (Carl, 1976). Cambre (1981) reported that formative evaluation appeared to be have been taken more seriously by ITV producers in recent years.

Shanks and Hocheimer (1982) identified three types of information that should be collected during formative evaluation of televised instruction: expert opinion, achievement of objectives, and audience appeal. The two primary sources of this information are representatives of the target audience and content and production experts who can provide subjective data on the appropriateness and quality of the materials. Formative evaluation typically includes tryouts of the course materials and methodologies with representative students in small groups. Pretest and posttest measures allow assessment of student achievement, and interviews and questionnaires can be used to determine audience appeal. Carl (1976) emphasized that formative evaluation should not be an afterthought but should be incorporated into the course design process at its outset.

The evaluation model developed by the University of Mid America (Aversa, 1983) provides for collection of expert opinion and audience appeal data. The model is based upon three categories of criteria -- content, design, and aesthetic quality -- corresponding to the three primary individuals involved in the course development process: the content expert, instructional designer, and producer. Information is obtained from a variety of sources, including content advisors and learners.

The model provides a list of questions for each category. For example, under content criteria, questions are asked regarding accuracy, ambiguity, importance, amount, and appropriateness of the content for the target audience. Design criteria include questions on whether the program achieves its purpose, organization and sequencing of information, the use of examples, and integration of the program with other course components. Aesthetic criteria include pacing and continuity, appropriateness and effectiveness of the audio and video elements, and visual appeal.

Student Subsystem

Student Support Services

Students enrolled in distance education courses should be entitled to the same support services as on-campus students. These include admission to the institution (if enrolled in a degree program), registration and records services, bookstore availability, and access to library and computer services. These types of services are provided by most colleges and universities offering distance education courses (Munshi, 1980b).

However, students in a distance education setting frequently face problems not encountered by conventional students. Robinson (1981) described three general areas of concern.

Problems relating to study techniques and learning difficulties. The need to acquire or re-acquire study skills presents a significant barrier for many distance education students. Problems often experienced include managing time effectively to accommodate course attendance and study needs, redeveloping facilities in written expression that may have been dormant for years, and sharpening reading and comprehension skills.

Problems arising from trying to interact with a distant and sometimes impersonal institution. According to Robinson,

> In a distance learning system the student is more likely to experience isolation, even alientation, from the institution. He (or she)

> may be geographically remote from the central institution or its local centre, and either living at some distance from fellow students or unaware of their existence, even if they do live nearby. The distant student may be uncertain of how the system in which he has enrolled functions ...or whom he should approach with requests for further information and advice. (p. 142)

Personal problems. Distance education students encounter many of the same problems faced by part-time and commuter students who attend on-campus classes.

> He may have no suitable place to study at home, no access to libraries, or his working hours may prevent attendance at meetings or local centre events. He may have domestic problems of one kind or another, including those arising from the conflicting demands on his time of full-time employment, family commitments, and study requirements. (Robinson, 1981, p. 142)

A substantial commitment has been made toward student support in many institutions established for the purpose of distance education, such as the British Open University (BOU) and Athabasca University in Canada. For example, in 1981 the BOU allocated nearly 30 percent of its total budget to maintaining an extensive and elaborate student support system (Robinson, 1981). However, Robinson observed that some colleges and universities offering distance education programs provide minimal support in these areas.

Robinson identified personal contact as one of the primary means of helping students to overcome these barriers.

> Problems of isolation and lack of direct communicaation with the course writers point to the need for contact: human contact with a tutor in the system to help the student maintain motivation and overcome particular learning problems; and personal contact, either written or verbal, which provides the student with feedback on his written work and his progress generally. (p. 144)

Robinson's perspective was that of the print-oriented British Open University. However, the need for personal contact appears to be equally important in a video-based course.

The provision of two-way communication is one of the six essential components of a distance education system, as defined by Keegan (1986). Robinson (1981) saw the key figure in this system as a tutor, situated in a location accessible to the learner and available as needed to assist the student in learning the material and solving other course-related problems. Robinson felt that tutoring could be a valuable method of contact and may even be less expensive than personal visits if travel expenses were considered. The means of communication appears to be inconsequential as long as regular contact is established.

While tutors can help students resolve content-related problems, counselors and advisors are equally important in solving non-content related issues. McInnis-Rankin and Brindley (1986) differentiated between the services provided by counselors and advisors. Advising services are more problem-centered than person-centered and deal with such concerns as helping students plan coursework, locate financial aid, resolve administrative problems, and develop or refine study strategies. Counseling services assist students in solving personal and social problems such as resolving role conflicts, relating to the environment, overcoming learning difficulties, goal setting, and making decisions. McInnis-Rankin and Brindley recognized that the distinction between these two types of services was a vague one and that on many campuses the same staff may serve both functions. Regardless of how these services are classified, they appear to be as important to non-resident students as to resident learners, and perhaps even more so.

Interactivity

While tutoring, counseling, and advising certainly involve two-way communication, this section deals with the specific issue of interactivity during the actual presentation of instruction. Slobe (1986) felt that interactive capability was a vitally important component of an instructional telecommunications system. Referring specifically to satellite-based delivery systems, Pelton and Filep (1984) argued that

> ...the system must allow for interactive interchange. A truly effective program will have provision for interactive audioconferencing among [learners], and, in a number of cases, will also allow for interactive audioconferencing in which students are allowed to ask questions and receive answers. (p. 179)

Curiously, the ineffective use of interactive capability has been a frequent criticism of satellite-based instructional projects. In the Satellite Technology Demonstration conducted as one of the ESCD experiments, interaction was "admittedly not creatively explored as an instructional technique" (Filep & Johansen, 1977, p. 56). As a result, attempts at two-way communication were determined to be neither essential nor economical, and the project wrote off interactivity as "of little consequence in future systems" (Filep & Johansen, 1977, p. 56). Richmond and Daniel (1979) viewed interactivity in the Stanford-Carleton currriculum exchange as "underutilized" (p. 114).

Martin (1981) attempted to explore the interactive capability of satellite-delivered instruction in an educational administration course taught to 65 teachers in five remote locations in British Columbia. She found the experience to be frustrating. Although students readily interacted with her and with other students at their own sites, they rarely spoke with students at other locations, even when given an assignment to react to reports given by groups at the other sites. Martin felt a high level of anxiety because the one-way video system did not permit her to detect non-verbal feedback from students. As a result of these and other factors, she felt the need to exert far more instructor control than was deemed desirable when teaching a class of adults.

Wiesner (1983) believed that the lack of a theoretical base was largely responsible for the misuse or lack of use of interactive capability in telecourses. According to Wiesner, instructor's guides developed by course producers typically provide assistance concerning the mechanics of interactive systems but rarely explain how, when, or why two-way communications should take place.

In the traditional classroom setting, instructor-initiated questions are very effective in stimulating discussion of the course content among students, keeping students alert, reviewing important points, and diagnosing students' level of understanding of the topic (Hyman, 1982). It is an excellent means by which Gagne's (1970) fifth instructional event, providing learning guidance, can be accomplished. Interactivity may be even more important for the distant learner, not only for the reasons listed above, but also for the purpose of what Forsythe (1984) described as "offsetting the debilitating loneliness of distance education" (p. 63).

Winn (1985) further explained the value of two-way communication in the distance education setting.

> Simply, the instructor adapts the course to the feedback the students give during the session. In this regard, the aim is to re-create as closely as possible the situation that exists in an ordinary classroom. A good teacher, once made aware that there is a lack of relevant existing knowledge, or of literacy, or of

ability, or of interest, can do something about it....Only in interactive systems can problems be identified and dealt with on the spot, and then usually only if the student speaks up. (p. 4)

Lauffer and Casey-Stahmer (1982) cautioned that the usefulness of interactivity decreases as the size of the audience increases. There is a limit to the number of sites and individuals that can benefit from interactive activity, both in terms of technical restrictions in the case of terrestrial audio systems, particularly with the number of audio inputs at the course transmission site, as well as in the number of persons who can realistically participate in interactive activities. It is a great irony that while satellite communications can expand the potential audience for an educational program virtually to worldwide dimensions, opportunities for each individual student to participate in meaningful discussion diminish as the size of the class grows.

Student Evaluation

One of the common criticisms of distance education courses is that because the students and instructors are physically separated throughout most, if not all, of each course, compromises are made in course quality. As a result, it is assumed that these courses are less rigorous and therefore do not meet the same academic standards as on-campus instruction (Connors, 1981). The matter of student evaluation illustrates this concern. When instruction is provided by terrestrial means, such as broadcast television, students are likely to be brought to learning centers for the administration of exams and other course-related activities (Hudspeth & Brey, 1986). The British Open University has always followed that model (Connors, 1981).

Even with satellite-based delivery systems, groups of students may meet at centralized locations for reception of the incoming signal and group learning activities, such as with the graduate engineering and computer science courses transmitted to corporate sites. At these locations, course activities such as group discussion, tutoring, and test administration can be conducted by qualified site monitors. As a result, students at the remote locations and instructor at the host institution may be separated by many hundreds of miles, but the course may not be significantly unlike one provided on campus, and instructional integrity is upheld.

The credibility of the course is more likely to be questioned when students cannot be convened in groups. Feasley (1983) recommended frequent written assignments to be submitted for evaluation and the use of open-book, take-home type of examinations. However, Connors (1981) pointed out the possibility that the actual work might be done by someone other than the person enrolled. Connors suggested that a viable alternative might be to have the student arrange to take course examinations in the presence of a trustworthy local individual, such as an educator, public official, or minister, who could certify the conditions of the test on letterhead paper and mail the exam to the grader.

A fundamental question is whether adult learners would be motivated to cheat in the first place. If adults engage in academic coursework for the purpose of acquiring knowledge that can be put to practical use, as Knowles (1970) suggested, then they would appear to have more incentive to achieve the course objectives and to participate in course activities. It would not seem to be to their advantage to falsify assignments and test responses. Knowles proposed a different type of evaluation system for adult learners, one based largely on a self-evaluation agreement negotiated between the instructor and each individual student.

Regulatory Subsystem

Planning/management

Planning for educational use of satellites requires a long-term institutional commitment. According to Slobe (1986),

> Institutions which would use the new technologies to serve both on-campus and off-campus learners must make an early and continuing commitment to a long-range transistion programme if they are to be successful. Unless learners, educators, and the public clearly see that institutions and government are confident in and committed to these changes, they will be reluctant participants in the exercise. (p. 230)

Richardson (1980) called for commitment and active leadership from the top levels of the administration on down in the establishment of telecommunications-based educational services.

The success of a distance education program depends to a great degree upon its compatibility with the system in which it operates (Aversa, 1983). Even with administrative support, any instructional innovation representing a significant change from "the way things are done here" will likely meet resistance and ultimately fail unless both the university and the individual faculty member are "ready" for the innovation (Abedor & Sachs, 1984). In other words, there must be readiness on the part of the instructor, determined by that person's attitude, value system, skills, and knowledge, as well as readiness on the part of the institution. The structure, reward system, norms, resources, and policies determine the university's level of readiness. Abedor and Sachs felt that faculty and organizational development activities may need to precede course development if the appropriate readiness conditions have not been met.

Planning and management at the course or program level is closely integrated with the course development process, described above. For example, needs assessment, while the first step in course design, is in reality a planning function. Once specific needs have been identified, a team of professionals should be assembled to plan the course and guide it through the development, delivery, and evaluation stages. Although there is a general lack of agreement regarding the composition of the team, typical members include a project director/manager who may be an administrator or an experienced producer of telecourses, with expertise in both instructional design and video production; a subject matter specialist, who is frequently the faculty member responsible for the course; an instructional developer; an evaluation specialist; a video producer; a graphics consultant, who takes responsibility for the development of all print components of the course; a media specialist, if the course materials include audiovisual media other than video; and an instructional computing specialist if the course contains a computer-supported learning component (Hudspeth & Brey, 1986; Richmond & Daniel, 1979; Zigarell, 1984).

It is vital that these personnel work as a team to provide necessary input into each other's area of responsibility. Although the team approach can be a slow and cumbersome process, Perry asserted that "there is no doubt that a course produced by this method will inevitably tend to be superior in quality to any course produced by an individual" (cited in Zigarell, 1984, pp. 34-35). Richmond and Daniel (1979) urged that the project staff "should be full-time, psychologically committed to the project, and have clearly-defined roles and responsibilities" (p. 118).

Richmond and Daniel (1979) provided the following guidance for the development of a project management plan.

> A detailed management plan specifying the activities for each stage of the project, milestone events, and personnel, financial, and

other resources required should be prepared and adhered to or systematically modified as the project develops.

The project management plan should anticipate and provide contingency plans for systems failure, site failures, and other possible contingencies.

All members of the project should be kept informed of progress and should have frequent meetings for planning and problem solving.

Evaluation should be included as an integral part of the project management plan from the earliest stages. (p. 118)

Budgeting

Designing, developing, and delivering university-level courses by satellite can be very expensive. Richmond and Daniel (1979) identified specific line items that must be considered in budgeting satellite-based instruction, including satellite system costs, instructional development costs, instructional delivery costs, and administrative costs. Richmond and Daniel recommended basing the budget on four phases: planning, pre-operations (systems development, program development), operational (program delivery, program evaluation, revisions and development), and post-operations.

Satellite system costs, according to Richmond and Daniel, include lease of the space sector; the cost of purchase and/or lease and operation of each earth station, both receiving and transmitting; all video equipment for origination of each transmission; maintenance costs; and site development. Lease of a satellite transponder varies between $250 and $700 per hour, depending upon the time of day and day of the week. Slobe (1986) pointed out that while the front-end costs of purchasing studio and uplink equipment normally represent a significant capital expenditure, they can be amortized over a fairly long time and many course transmissions. As an alternative, institutions may wish to lease studio and uplink facilities. Uplink costs vary according to the market. For example, WOI-TV at Iowa State University rents its uplink for $115 per hour and its studio for $100 per hour (R. Helmers, Manager, WOI-TV, personal communication, October 14, 1987).

Goldschmidt (1984) noted that "software is the most critical component of an educational technology system, yet it has generally been the weakest link" (pp. 206-207). Goldschmidt called for adequate funding and a genuine commitment to the development of quality courseware for satellite-based courses. According to Slobe (1986), "the operational costs associated with courseware development and maintenance are recurrent and substantially larger over the longer term than are the hardware costs" (p. 230). Instructional development costs include material acquisition and copyright; salaries for course development personnel; the cost of raw materials such as videotapes, graphics supplies, and paper; costs associated with software production; office materials and supplies; and testing and evaluation materials (Richmond & Daniel, 1979).

Instructional delivery costs consist of salaries for instructors, tutors, and field staff; site operations and caretaking; exam administration and scoring; telephone and travel; program evaluation; and student registration and counseling. Administrative costs include the costs of meetings, training sessions, and teleconferences; project evaluation; course promotion and public relations; project documentation and reporting; secretarial and support services; computing services; and library services (Richmond & Daniel, 1979).

The budgeting of satellite-based instruction raises some fundamental questions. For example, how should initial capital investment and course development be funded? How much of the cost should be borne by the students as opposed to other funding sources? Hooper (cited in Daniel, 1977) observed that educational projects receiving their initial funding from outside the institution frequently were not continued once external funding ceased. However, external grants may permit capital expenditures that would not be possible otherwise. Course development and revision on a continuing basis is another matter. Hershfield (1983) noted that departmental budgets rarely permit the large-scale development of video-based courses, and that institutional funding can be justified only if large numbers of students were attracted.

Summative Evaluation

The degree to which students are able to achieve course objectives at the end of instruction should be a basic concern of any summative evaluation. However, it is only one of many questions that must be answered. According to Coldeway (1986), the success of a distance education course must be evaluated from three different perspectives: those of the student, the host institution, and the funding agency. Student factors include degree of satisfaction with the nature, amount, and appropriateness of the course content; instructional methods and learning activities; and availability and quality of student support such as tutoring, counseling, and information services.

The level of student achievement is one important factor of concern to the institution. Others include the attrition rate, the percentage of students re-enrolling for additional coursework, cost measures, follow-up data describing student success after the course or program, the degree of success of innovative procedures employed in the course or program, and the degree of response from the target population. The funding agency is primarily concerned with the degree to which its own goals were met. It is evident that much of this information can be collected only through attitudinal surveys.

Logistical Subsystem

Faculty Support Services

Feasley (1983) pointed out that teaching distance education courses cannot be equated with teaching classes on campus. The workload may become excessive, since distance education courses are sometimes added as overloads. Teaching these courses may not be given equal weight with campus-based instruction in promotion and tenure decisions. The time required for course preparation and management may reduce a faculty member's opportunities to keep current in his or her field, to conduct research, and to publish.

There are a number of ways in which colleges and universities can provide a supportive environment for faculty members teaching by telecommunications (Sachs, 1983). The campus reward system should recognize the time and energy commitment required to create and deliver well-done, video-based courses. Teaching loads should be monitored to accommodate additional course management requirements of distance education courses. Teaching assistants and tutors should be provided as necessary.

Faculty members using innovative teaching technologies should have the opportunity to meet together in peer support groups to discuss techniques and problems. A higher than normal level of clerical support, in the form of long distance telephone lines, a telephone answering service, a higher budget for postage, and additional secretarial help, may be needed. Verbal support and encouragement from higher echelon administrators may be of significant psychological benefit.

Faculty members also need to be given special training in teaching in a distance education environment. Other members of the course development team should assist the instructor in learning to teach effectively in a live television situation, managing course activities, and understanding the needs and expectations of students. Particular attention must be given to developing faculty skills in using a system's two-way communications capability.

Field Support

Effective field support is essential when learners meet together in groups at the receiving sites. Cowlan and Foote (1975) differentiated between facilitative and substantive levels of field support. Facilitative support includes monitoring technical factors, such as the interactive system and the quality of the downlinked signal, and routine course management activities. Substantive support relates more directly to the educational goals of the program and may include conducting preparation and review sessions before and after, respectively, the satellite transmission; managing on-site learning activities; tutoring; and possibly even presenting part of the course content. While these tasks vary according to course requirements and capabilities of the field support personnel, Cowlan and Foote felt that both facilitative and substantive support activities were needed at most of the group reception sites in the ESCD projects.

Cowlan and Foote (1975) observed a very close relationship between learner satisfaction and the amount and quality of communication between the instructor and field staff in the ESCD demonstrations. A regular audioconference schedule should provide training for site coordinators, confirm the course schedule, discuss learning activities, resolve technical and administrative problems, and discuss other course-related matters. Cowlan and Foote strongly urged that a separate audio channel be available to provide this liaison.

In the case of students participating independently, the handbook suggested above can substitute for many of the functions of a field support person. Personal contact between students and the instructor and/or tutor becomes all the more imperative in the absence of on-site support staff.

Guidelines for Course Development and Delivery

The following guidelines, based on a review of the literature in distance education, adult education, and instructional television, provide a basic framework for the design, development, and delivery of a university-level credit course by communications satellite. These guidelines are organized according to the categories identified in Kaye's (1981a) systems model for distance education.

Course Subsystem

1. The very existence of a satellite-based course should be founded upon clearly established learner needs.

2. Specific course objectives are a necessity from the outset.

3. If adult students comprise an important segment of the target audience, they should be consulted prior to the preparation of objectives.

4. Decisions regarding course design should be based on the specific characteristics and learning needs of the target audience.

5. The course design must provide for each of the "events of instruction."

6. Courses need to be developed as instructional systems, including an appropriate mix of technologies.

7. The use of a satellite can be justified only if it is clearly the most appropriate communications technology available.

8. Adequate time and resources must be allocated for the development of quality instructional materials.

9. Formative evaluation should be conducted during the development of materials for a satellite-based course.

10. Formative evaluation should be conducted during the presentation of a course by satellite, and the results should stimulate appropriate course modifications.

Student Subsystem

11. Students enrolled in a satellite-based course should have access to the same support services available to on-campus students enrolled in the same course.

12. Additional student support should be provided in the form of a contact person available as necessary for tutoring and resolution of course-related problems.

13. Students need to receive training in learning via a satellite-based instructional system.

14. Learning activities must be planned to maximize the opportunities for students to interact, both with the instructor and among themselves, given the constraints of the interactive system.

15. An effective student evaluation system must be devised that is consistent with the needs of the learners and provides a reliable estimate of performance.

Regulatory Subsystem

16. Administrative support, from the highest levels down through the entire organization, is vital to the continuing success of a satellite-based instructional delivery system.

17. The course should be planned, designed, produced, delivered, and evaluated by a team of professionals with clearly defined areas of responsibility.

18. The course management team should meet frequently and maintain open communications throughout the project.

19. A summative evaluation should be conducted to determine the degree to which the interests of the students,

host institution, and funding agency have been met.

20. A course budget should be developed and provided, accounting for satellite system, instructional development, instructional delivery, and administrative costs.

Logistical Subsystem

21. Faculty members teaching by satellite must be given training in using the system effectively.

22. Appropriate institutional support must be provided to faculty members teaching courses by satellite.

23. Effective field support is essential at the receiving sites.

Summary

A synthesis of two models and two checklists related to the design, development, and delivery of distance education courses has been used to provide an organizational framework for the review of the literature. Relevant literature has been summarized from the fields of distance education, adult education, and instructional telecommunications. Twenty-three guidelines, based on the literature review, have been proposed as a benchmark for use of satellites as instructional delivery systems by postsecondary institutions.

CHAPTER THREE: DESIGN OF THE STUDY

Scope of the Study

Chapter One described the use of communications satellites for the delivery of credit courses by higher education institutions in the United States and Canada. Deficiencies in these courses, in relation to theories of distance education, adult education, and instructional telecommunications, were identified. It was pointed out that contemporary users of this medium do not seem to have resolved problems that were encountered during the educational experimentation period with satellites in the mid-1970s.

Chapter Two reviewed the relevant literature in the fields of distance education, adult education, and instructional telecommunications. The review considered factors related to course, student, regulatory, and logistical subsystems, following Kaye's (1981a) systems model for distance education. The chapter concluded with 23 guidelines for the design, development, and delivery of a university-level course by communications satellite.

The next component of the present study involved the collection and analysis of information in an attempt to answer two questions: (1) which colleges and universities have used communications satellites to deliver instruction for academic credit? and (2) what procedures were followed by these institutions in relation to the 23 guidelines? The major outcomes of the study were a summary of the current utilization of this technology and an assessment of the degree to which recommended instructional practices have been followed.

The study focused only on those colleges and universities that have disseminated instruction via uplink facilities and was not concerned with programs only utilizing downlink capability, such as use of courses provided by the PBS Adult Learning Satellite Service or the International University Consortium. In addition, the study was only concerned with instruction for academic credit. Satellites have also been widely used by postsecondary institutions, particularly land-grant universities, for teleconferences and other Extension activities involving instruction not for credit.

While the guidelines related to course subsystem factors certainly apply to teleconference utilization, concerns identified for the student, regulatory, and logistical subsystems, with some exceptions, are generally of lesser importance when the program is of a short-term nature and without the academic rigor required for credit instruction. For example, there is little need for tutoring services or a heightened level of faculty support in the case of a one-time only videoconference on economic development presented by University Extension.

Methodology

Participants

The population consisted of two groups: (1) all universities affiliated with the National Technological University (NTU); and (2) all colleges and universities that have delivered credit courses by satellite not a part of the NTU course schedule. It was considered possible that some universities fell into both groups.

Instruments

A representative of each university identified was asked to complete a booklet containing a series of questions regarding actual practices used in the development, delivery, and evaluation of one specific course offered by satellite. The questions were systematically designed to ensure that the college or university's practices related to each of the 23 guidelines could be assessed. Priorities were provided to assist respondents in selecting the most appropriate course: (1) the course was offered "live" to students, rather than by videotape; (2) the course with the largest enrollment; and (3) the most recent course.

Several of the questions asked of the non-NTU respondents were considered irrelevant to NTU affiliates. For example, since the primary purpose of NTU is the delivery of graduate-level instruction to corporate engineers by satellite, questions such as identification of the target audience and rationale for selecting satellite over other telecommunications technologies were not appropriate. Therefore, two different versions of the questionnaire were prepared, with irrelevant items deleted from the NTU instrument and other items revised to reflect NTU's mission. A panel of eight professionals in the fields of continuing education and instructional telecommunications reviewed the questionnaires to assure their validity.

Since Iowa State University (ISU) is one institution that has offered both NTU and non-NTU courses by satellite (it turned out to be the only one), reliability was assessed by pretesing each version of the questionnaire on the ISU campus. The credit programs coordinator in the Office of Continuing Education, who is responsible for ISU courses offered by telecommunications media, and the NTU administrative contact person on the ISU faculty both completed the appropriate questionnaire form and provided valuable feedback for item revision.

Procedures

The study was conducted according to procedures specified for survey research by Borg and Gall (1983). The following steps were taken.

NTU-Affiliated Universities

The 24 affiliated universities and the names, addresses, and telephone numbers of NTU administrative contact persons on each campus were identified in the 1987-88 National Technological University (1987b) catalog. Each of these individuals was sent a personalized cover letter, questionnaire booklet, and postage-paid return mail envelope in early March 1988. Twelve of the 24 responded within three weeks, a 50 percent return rate on the first mailing. The 12 non-respondents were sent a personalized follow-up letter, second questionnaire booklet, and postage-paid envelope in late March. Seven more responses were received, bringing the total to 19 of 24, or 79 percent.

The remaining five institutions were then telephoned during the third week of April 1988. In each case, it was determined that the booklet had been forwarded to another individual for completion, and promises were received that the booklets would be tracked down, completed, and returned. Two additional questionnaires were returned by the end of

May 1988, bringing the total received to 21 of 24. It was decided that the 88 percent return rate was sufficient for compilation of the data.

Non-NTU Institutions

Identification of non-NTU satellite users and the names and addresses of contact persons for mailing purposes was a much more complex task. As the present study was being conducted, the National University Continuing Education Association (NUCEA, 1988) was compiling a directory of American colleges and universities using telecommunications for continuing education purposes. Information for the directory was obtained from a survey of all institutional members of NUCEA, which included most colleges and universities with continuing education programs in the United States. The directory editor provided a photocopy of a galley proof of a matrix identifying all NUCEA institutions by telecommunications technologies used. A total of 33 colleges and universities were identified in the matrix as using satellite uplinks. However, it could not be determined which were using uplinks for the delivery of academic courses and which were providing only non-credit, teleconference-type programming.

The NUCEA institutional representative for each of these 33 campuses was then telephoned to determine whether credit courses, not related to NTU, had been uplinked by that institution. In many cases, the call was transferred to the campus media or instructional telecommunications center for response. Each college or university representative was asked if credit courses meeting the criteria listed in Chapter One (p. 52) had been uplinked from his or her campus.

In addition, respondents were asked if they were personally aware of any other colleges or universities that had used satellites for credit course delivery. Several institutions not in NUCEA's list of 33 were suggested. These were also telephoned to determine if the criteria were met.

All of the initial telephone calls were conducted during a one-week period in March 1988. A total of 13 universities were identified as having transmitted non-NTU credit courses meeting the criteria: Boise State University, California State Polytechnic University at Pomona, California State University at Chico, California State University at Sacramento, Eastern Washington University, Iowa State University, Old Dominion University, Pennsylvania State University, Texas Tech University, the University of Alaska, the University of New Mexico, the University of Virginia, and Virginia Polytechnic Institute and State University (Virginia Tech). Personal commitments were received from each of the respondents to complete and return the questionnaire.

A personalized cover letter, questionnaire booklet, and postage-paid return mail envelope were sent to each of the contact persons in late March 1988. Eight responses were received by mid-April, a 62 percent return rate. The University of Alaska returned the questionnaire uncompleted, with an explanation that its uplinked courses were pre-packaged telecourses produced elsewhere; therefore, the criterion for local course origination could not be met. The contact person at Old Dominion University (ODU) telephoned to advise that a positive response had been initially provided because of a misunderstanding, and that ODU did not plan to uplink its first course until Fall 1988.

Since only five universities had not responded to the initial mailing, a second, blanket follow-up letter was not considered. All five contact persons were telephoned during the third week of April 1988. Two had misplaced the questionnaire booklet and were mailed a replacement. The other three acknowledged that the booklet had been received and promised to complete and return it. By mid-May, two additional booklets had been returned. A third was apparently lost in the mail, and the required information was obtained from that university by telephone. No response of any kind was received from two of the original 13 institutions. The response rate was therefore 11 of 13 (85 percent), with nine useable, completed questionnaires.

Data Analysis

Data analysis was conducted using descriptive statistics. Inferential statistics were not applied for the following reasons:

1. Inferential statistics are appropriate when testing hypotheses. No hypotheses were proposed for this study.

2. The study surveyed the entire known population of universities in the United States using satellites for the delivery of credit courses by satellite. Therefore, inferences were unnecessary.

3. Had universities in the population been grouped for purposes of analysis by inferential statistics, the cell sizes would have been unacceptably small, particularly for non-NTU respondents.

No attempt was made to assess the effectiveness of the satellite-based instructional programs or to correlate effectiveness with adherence to the guidelines. Printed information regarding uplinked courses, including evaluation reports, was requested from the non-NTU universities. Some material was received, but no evaluative data were included.

CHAPTER FOUR: RESULTS OF THE STUDY

Responses to the Survey

The 30 completed booklets yielded some extremely interesting and useful information about the design, delivery, and evaluation of university-level credit courses by communications satellite. While some respondents did absolutely no more than was asked -- that is, they completed the check-off items and provided cursory answers to open-ended questions -- others were quite thorough in their responses. All respondents were promised summaries of the results if they returned completed questionnaires. At least a dozen other persons contacted during the initial telephoning session also requested copies of the results. Considerable interest in this topic is evident.

Descriptive information regarding the course selected was sought in both questionnaire booklets. In addition, the non-NTU questionnaire booklet contained several questions designed to gain some measure of the scope of satellite use among the responding institutions. This chapter will be divided into two sections, one summarizing descriptive information, and the other reporting responses to questions related to the guidelines.

Descriptive Information Regarding Satellite Use

Growth of Satellite Use

The earliest application of satellite technology for credit course delivery reported by a non-NTU respondent was during the 1984-85 academic year. In all, three of the responding institutions offered a total of 28 satellite-based courses in 1984-85 and 1985-86. Five universities reported offering 40 satellite courses in 1986-87, and seven institutions offered 74 satellite-based courses in 1987-88. Six respondents indicated plans to provide a total of 87 courses by satellite in 1988-89, and four already had scheduled 67 satellite courses for 1989-90. Two non-NTU institutions did not respond to this question, which was not included in the NTU booklet.

Target Geographical Area

Each non-NTU university was asked to identify the geographical area in which it was trying to attract students for its satellite courses. Four of the nine indicated that they were only interested in in-state students. Three more were trying to reach students only in their own states and adjacent states. One was seeking a regional audience (e.g., the Western states). Just one was trying to attract students on a national basis. This item was also deleted from the NTU booklet, since all NTU courses are directed toward national audiences.

Disciplines Involved

Both respondent groups were asked to identify the academic discipline addressed in the course selected for description in the questionnaire. A variety of disciplines were listed by the non-NTU universities, including computer science, electrical engineering, physics, art, fire science, nursing, secondary education, and food and nutrition.

Although all NTU courses were in the engineering field, the courses selected illustrated the diversity of disciplines involved in NTU degree programs. Courses were identified in engineering systems, industrial engineering, materials science and engineering, computer science, civil engineering, aeronautics and astronautics, optical science, electrical and computer engineering, and engineering management. Of the 21 NTU respondents, only one discipline was mentioned as many as six times (electrical and computer engineering), computer science was identified four times, industrial engineering three times, and no other was identified more than twice.

Credit Hours

Of the 30 courses described by the two groups, just five were offered for 4 credit hours. All the rest carried 3 hours of academic credit.

Enrollment and Number of Sites

The number of receiving sites and the size of course enrollment varied considerably, both within and between the NTU and non-NTU groups. Table 1 summarizes these data. The number of receiving sites ranged from 1 to 27 in the 21 NTU courses, with a median of 8. The number of sites in the nine non-NTU courses ranged from 4 to 53, with a median of 10.

A more striking difference was evident in course enrollment. The median enrollment was 13 for NTU courses and 68 for non-NTU courses. The enrollment for each course was divided by the number of receiving sites to determine the average enrollment per site. The median average enrollment was 2.0 for NTU courses, while the corresponding median for non-NTU courses was 5.5.

Academic Level

Of the nine non-NTU courses described, four were offered at the undergraduate level, while the other five were graduate courses. All the NTU courses were offered for graduate credit.

Practices in Relation to the Guidelines

Course Subsystem

Needs assessment. The success or failure of any courseware delivered by instructional telecommunications may

Table 1. Site/enrollment data for NTU/non-NTU courses reported

Item	NTU N	Non-NTU N
Number of courses	21	9
Number of receiving sites		
Lowest	1	4
Highest	27	53
Median	8	10
Course enrollment		
Lowest	5	13
Highest	67	174
Median	13	68
Average enrollment per course		
Lowest	1.1	2.0
Highest	9.6	24.9
Median	2.0	5.5

be dependent to a significant degree upon accurate assessment of learner needs (Richmond, 1977). The non-NTU universities were asked to identify how it had been determined that their courses were needed by the target student groups. Five noted that the course was part of an established degree program, and four indicated that the course had been specifically requested by representatives of the target audience. Three said that a formal needs assessment had been conducted. Three also responded that the course need had been perceived by the academic department or instructor. Multiple responses were acceptable. Because National Technological University courses all were components of degree programs established in conjunction with industry needs, this question was not included in the NTU survey.

Goals and objectives. The establishment of specific goals and objectives is widely recognized as a valuable practice at all levels of education but appears to be particularly important in adult education settings (Bonner, 1982), in distance education (Holmberg, 1980), and in courses involving instructional telecommunications (Shanks & Hocheimer, 1982). Eight of the nine non-NTU respondents indicated that specific learning objectives had been established for their courses, and five confirmed that the objectives had been provided to the students in written form. Although adult education literature recommends that adult students should be consulted prior to the development of course objectives (Bonner, 1982), only one of the five non-NTU universities offering graduate-level courses had consulted with prospective students regarding objectives prior to the course.

The questions on objectives were deleted from the NTU booklet at the suggestion of the NTU field test reviewer, who pointed out that written objectives were rare in graduate-level engineering courses. He noted that "we are apt to enunciate goals, but not objectives."

Learner characteristics/instructional strategies. It is important to design learning activities that are appropriate for the target audience and incorporate sound educational practices (Cavert, 1974). Table 2 indicates the percent of NTU and non-NTU courses that incorporated instructional techniques recommended for adult learners. Input from current or prospective students was not widely sought prior to the course by either group. Past experiences of students were solicited and related to the learning material in 38 percent of the NTU courses and 33 percent of the non-NTU courses.

Course content was routinely related to possible

Table 2. Percent of courses incorporating key instructional techniques

Technique Incorporated	NTU %	Non-NTU %
Input from students used to help determine course content	19	22
Student life experiences solicited and related to course content	38	33
Course content routinely related to possible applications in students' lives	62	78
Advanced organizers provided to students at beginning of course	81	67
Students given opportunities to apply course content through learning activities	81	78

applications in the students' personal or professional lives in well over half the courses in each group. Advanced organizers, such as a comprehensive course schedule, content outline, or course objectives, were provided to most of the NTU students and about two-thirds of the non-NTU students. Practice activities giving students opportunities to apply the newly-learned information, with feedback provided, were common course components for both groups.

Media selection. One of the basic issues of any satellite-based course is the question of whether satellite is the most appropriate delivery medium. Criteria for satellite selection were provided in Chapter 2. Non-NTU respondents were asked to indicate their primary reasons for selecting a satellite-based course delivery system. Their responses are rank-ordered in Table 3. The most common considerations were the need to reach a wide geographical area, the need to reach a large number of students or receiving sites, and interest in using an emerging distance education technology. The cost-effectiveness of satellite versus an appropriate terrestrial system was a concern for some respondents, but the basic need for visualization via a video medium did not seem to be an important factor.

A significant dichotomy emerged regarding the manner in which the two groups utilized the video medium. As Table 4

Table 3. Primary considerations in selecting a satellite-based delivery system among non-NTU respondents, by percent

Consideration	Percent Responding Positively
Need to reach a wide geographical area	78
Need to reach a large number of students/sites	78
Interest in using emerging delivery technology	78
Need for interactivity between students/instructor	56
Specific request from target student group	56
Cost effectiveness of satellite	44
Timeliness of the educational material	33
Efficient use of the instructor's time	33
Non-availability of suitable terrestrial system	33
Need for visualization of content via video	22
Frequency of the class meetings	11

indicates, the majority of NTU courses were not transmitted live, but rather were videotaped and uplinked at a later time. According to one NTU respondent, this was a fairly common practice to take advantage of lower satellite transponder use charges during the early morning hours. Furthermore, courses were often also videotaped at the receiving sites, because workday transmission schedules did not always coincide with student availability. As a result, interaction with the instructor during the lecture was impossible for students viewing by videotape, and group learning activities became more difficult.

It was pointed out by several NTU respondents that the lectures were frequently videotaped during live on-campus classes or were presented live to local area students through terrestrial systems such as ITFS. Students viewing videotapes transmitted by satellite to the remote sites were able to experience some interaction as it occurred during the class sessions, although they were unable to participate.

Live transmission of lecture material was much more important for the non-NTU respondents. None of the lectures among this group were totally videotaped, although some incorporated both live and videotaped segments. In a separate question (not asked of the NTU respondents), it was

Table 4. Primary means of providing course lectures to students, by percent of respondents in each group

Means	NTU %	Non-NTU %
Live lecture uplinked	38	67
Lecture videotaped, videotape uplinked	57	00
Combination of live and videotaped segments	05	33

indicated that non-NTU participants viewed all the lectures live in all but two courses, and even in these cases students experienced at least half the lectures live.

Chapter One described differences between the American and British telecourse systems regarding the media selected to carry the burden of course content. In the British system, for example, the vast majority of content is presented by the printed materials, with the video component generally limited to presentation of information that could not be taught more economically or conveniently through other media forms (Bates, 1984a). Americans are much more likely to place the burden for content presentation on the video component, even though video has less content capacity than print media.

Respondents in both groups were asked to rate the relative importance of lecture, course text, computer-based learning system, and other (optional) delivery techniques. If two or more delivery methods were of equal importance, the same number could be assigned. It can be seen from Table 5 that lecture presented by the video medium was the near unanimous choice as the most important means of presenting course content to students. Textbooks and other reading materials were nearly always identified as being secondary in importance, although three respondents in each

Table 5. Relative importance of course content delivery methods in NTU and non-NTU satellite courses

	NTU				Non-NTU			
	Ranked				Ranked			
Delivery Method	1	2	3	NR	1	2	3	NR
	N	N	N	N	N	N	N	N
Lecture delivered by satellite	19	1	0	1	9	0	0	0
Course text/other reading materials	3	15	1	2	3	6	0	0
Computer-based learning system	0	2	5	14	0	0	2	7
Other	2	0	0	19	2	0	0	7

Note. Scale is 1 = most important, 2 = next most important, and 3 = least important. NR indicates that the delivery method was not ranked by a respondent. Respondents were encouraged to assign the same ranking to two or more delivery methods if they were of equal importance.

group gave 1's to both lecture and text. Computers, when used, were generally ranked third in importance. Only two respondents gave computers a 2 ranking, and no one ranked them as most important. Four respondents identified other techniques as having equal importance with lecture, including personal contact with students, supplemental learning materials, and specially organized demonstrations and visits to research labs.

One of the advantages of using a video-based instructional delivery system is the opportunity to visualize course content. Table 6 reports the frequency by which both NTU and non-NTU courses incorporated some of the most common visual media. Although a number of respondents checked "Unknown" or did not answer at all, it was evident that overhead transparencies or opaque visuals covered by an overhead camera were frequently used by both groups. None of the non-NTU instructors and just 24 percent of the NTU faculty were reported using overheads less often than weekly.

The other media formats were used infrequently if at all, with the exception of fairly regular use of computer output in about half a dozen of the 30 courses. Surprisingly, film and videotapes, either produced for the course described or for another course or purpose, were

Table 6. Use of instructional media within uplinked lectures by NTU/non-NTU institutions, by percent of responding institutions

Medium	Never		Once/ Twice		Monthly		Weekly		Every Period		Unknown/ No resp.	
	NTU %	Non %	NTU %	Non %	NTU %	Non %	NTU %	Non %	NTU %	Non %	NTU %	Non %
Overhead transparencies	05	00	14	00	10	00	10	22	43	56	19	22
Photographs/slides	38	33	14	11	05	00	05	00	10	44	29	11
Computer output	33	33	10	11	14	00	14	22	05	00	24	33
Film/videotape produced specifically for course	52	44	10	00	05	22	10	11	00	11	24	11
Film/videotape produced for another purpose	52	33	10	11	00	11	05	11	00	00	33	33

Frequency of Utilization (column group heading)

Note. "Non" refers to Non-NTU institutions. Rows may not add up to 100 percent because of rounding.

rarely utilized. Only three NTU institutions and four non-NTU respondents incorporated locally-produced videotapes as often as monthly.

Both groups of respondents were asked to identify the videotape producer in those instances in which locally-produced videotapes were incorporated into the courses. Table 7 summarizes the responses. Most often the course instructor produced his or her own tapes. One NTU respondent explained that this was not a preferable alternative, but that production charges levied by the campus ITV center made the professional production of course videotapes unaffordable. NTU faculty members were more likely to turn to video producers in their own colleges, while non-NTU instructors tended to seek production assistance from campuswide or Extension media or instructional television agencies.

The non-NTU booklet included a question asking respondents to identify the roles played by the campuswide or Extension media or instructional television center during the development, delivery, and evaluation of the course. Just two respondents indicated that no significant role had been played by such a center. The most common functions, checked by seven of the nine respondents each, were operation of the video production facility in which the

Table 7. Producer of locally-produced video instructional support materials, by frequency of identification

Source	NTU N	Non-NTU N	Combined N
Course instructor	6	2	8
Campuswide/Extension ITV center	2	5	7
Video specialist in instructor's own college	4	2	6
Faculty colleague	2	1	3
Production source in industry	1	0	1
Independent producer	1	0	1

course originated and operation of the uplink facility itself. Just four provided instructional design consultation, and only three produced instructional materials that were incorporated into the lectures. In all cases in which the center was involved, it was identified as serving a campuswide clientele, rather than Extension/continuing education alone.

Media development. Adequate time and resources must be allocated for the design and development of instructional materials in any telecommunications-based educational system (Pelton & Filep, 1984). Non-NTU respondents were asked if sufficient time and resources had been provided. All but two answered in the affirmative, although it was evident from responses to other items that a relatively minimal amount of materials production had been attempted.

Formative evaluation. Formative evaluation can be conducted at two stages in a satellite-based course. During materials development, it can be used to identify product weaknesses and guide revisions. While the course is in progress, formative evaluation can be applied to determine if mid-course adjustments are necessary to improve the learning environment.

The non-NTU group was asked if either of these types of evaluation had been conducted. Seven of the nine indicated that formative evaluation procedures were not applied during the development of course materials, although, again, materials appeared to have been developed specifically for the course described in only a few cases.

Six non-NTU universities did collect information while the course was underway and used it to make improvements. A variety of changes were reported. Course alterations included adjustments in instructional techniques used by instructors, expanded opportunities for students to communicate with instructors, faster turnaround time on evaluation of homework assignments, and identification of course material requiring further explanation and additional learning activities.

Student Subsystem

Student support services. On-campus enrollees were taught simultaneously with the satellite students in all but one of the NTU courses and in all but three of the non-NTU courses. Under these conditions, an equivalent level of support services should have been available to both resident and non-resident learners (Robinson, 1981). Both NTU and non-NTU respondents were asked to identify those services that were available to both on-campus and satellite students at a comparable level. The results are summarized in Table 8.

Table 8. Services available to satellite course students at equivalent degree as to on-campus students, by percent of respondents

Service	Provided by NTU %	Provided by Non-NTU %	Provided by Combined %
Bookstore services	43	77	53
Peer support opportunities	29	67	40
Academic advising	29	67	40
Computer services	38	11	30
Academic library	14	33	20
Tutorial services	10	22	13
Student counseling services	10	22	13

It must first be noted tht not all these services were required in each course, computer access serving as an excellent example. Nonetheless, neither group reported a particularly high level of support services available to satellite course students.

Bookstore services were available to slightly over half of all enrollees, a rather important concern since bookstores sell much more than textbooks. No other services were comparable in more than 40 percent of the courses. Opportunities to interact with other students for peer support were very limited at sites with low enrollments. Tutorial services equal to the level provided on-campus were reported to have been available for only 4 of the 30 courses. A comparable level of student counseling services was also available in only four courses.

Both groups were asked if any problems were encountered with student services. None of the NTU respondents answered in the affirmative, and only two of the non-NTU group acknowledged that problems had existed. One cited problems in obtaining library books, and the other pointed to the difficulty students experienced in gaining access to the faculty member teaching the course. An NTU respondent noted that occasional problems were encountered with slow delivery of course correspondence by the U.S. Postal Service.

Another observed that library and computer services were the most difficult to provide to off-campus students, and that the ideal situation was for students to obtain these services either at or near their work sites.

Personal contact with students has repeatedly been proposed as an important means of overcoming some of the barriers in a distance education environment (Robinson, 1981). During the field test of the questionnaires, it was pointed out that the National Technological University made heavy use of electronic mail for this purpose. Non-NTU respondents were asked what kind of system was established for their courses to provide a point of personal contact for satellite students. All nine noted that students were encouraged to contact the instructor for help whenever necessary. Five provided toll-free telephone numbers or accepted collect calls. In just three courses were students able to obtain help from on-site support staff. No university assigned students to tutors or teaching assistants as points of contact.

Training programs or materials were recommended as a means of helping students succeed in a satellite-based learning environment. The non-NTU group was asked if such training was provided, and, if so, what it included. Although five universities stated that they had provided training for students, the assistance appeared to be minimal. All five provided instructions on how to contact the instructor outside of class. Only three provided guidance on obtaining library resources and using the interactive system during the satellite transmissions. Just one provided help in basic study skills and instructions on how to obtain computer services or tutorial help. No other topics were identified.

Interactivity. In the past, the potential of interactivity for stimulating the learning environment for students has been largely unfulfilled in satellite-based courses (Filep & Johansen, 1977; Richmond & Daniel, 1979). It was noted above that 12 of the 21 NTU courses had been videotaped prior to transmission, thus negating opportunities for remote students to interact with the instructors during their lectures. Of the remaining nine NTU courses, just six were reported to have been set up with two-way audio communications capability between students and instructor, and only three permitted interaction among students at different remote sites. Among the non-NTU courses, two-way interaction between instructor and students was possible in all nine courses, and interactive capability among students at different sites was present in six of them.

Table 9 illustrates the frequency by which each of four common interaction patterns occurred when two-way communication was possible. (The percentages for the fourth pattern were based on three NTU courses and six non-NTU courses in which interaction could take place among the receiving sites. All other percentages were based on six NTU and nine non-NTU courses permitting live interaction between instructor and students during the lectures.)

It was reported that the instructor attempted to initiate discussion with the students at least weekly in 12 of the 15 courses in both groups combined, and in 10 courses discussion was initiated in every class period. Response and participation was common among the non-NTU students (every class period in two-thirds of the courses) but was less forthcoming for the NTU enrollees. Although NTU instructors tried to stimulate discussion every class period in half the courses, respondents indicated that students did not participate in instructor-initiated discussions that often.

Another rather dramatic difference was noted for the third interaction pattern. Students initiated interaction with the instructor every class period during the satellite broadcasts in six of the nine non-NTU courses, while students originated discussion with the instructor

Table 9. Frequency of interaction patterns during live uplinked lectures in NTU/non-NTU courses, by percent

	Frequency of Occurrance							
	Never		Less than Weekly		Weekly		Every Period	
Interaction Pattern	NTU %	Non %	NTU %	Non %	NTU %	Non %	NTU %	Non %
Instructor tried to initiate discussion with students during the satellite broadcasts	17	00	00	22	33	00	50	78
Students participated in instructor-initiated discussion during the satellite broadcasts	17	11	33	11	50	11	00	67
Students initiated discussion with the instructor during the satellite broadcasts	00	11	67	00	33	22	00	67
Students interacted with students at other receiving sites during the satellite broadcasts	33	33	33	17	33	33	00	17

Note. Percentages for the first three interaction patterns were based on six NTU and nine Non-NTU courses permitting live interaction between instructor and students during the lectures. The percentages for the last interaction pattern were based on three NTU courses and six Non-NTU courses in which interaction could take place among the receiving sites.

during the broadcasts as often as weekly in only a third of the NTU courses. Students tended to interact with students at other sites only infrequently.

Respondents in both groups were asked if the level of interactivity during the satellite broadcasts approached the level that might have been expected had the students been physically present in the instructor's classroom. The response was positive for only 3 of the 15 courses. Both groups were also asked if they felt that instructor interaction with off-campus students was important during the satellite broadcasts. All of the non-NTU respondents answered in the affirmative. Only 8 of the 21 NTU respondents (38 percent) answered "yes." Six responded "no" and seven did not answer the question.

Student evaluation. Accurate evaluation of student achievement is essential in every college and university course. The necessity for precise student evaluation is particularly keen in the case of distance education courses, where compromises in academic standards may damage the integrity of the program (Connors, 1981). Evaluation methods should approximate as closely as possible those used to assess student performance on campus.

Table 10 summarizes the evaluation techniques used in both groups of courses. The methods employed were

Table 10. Methods used to evaluate students in satellite courses, by percent of respondents

Method	Method Used by NTU %	Non-NTU %	Combined %
Homework assignments	81	89	83
Exams given on-site by field staff	71	78	73
Take home exams	24	33	27
Testing conducted via computer	00	11	03
Test given by non-staff monitor	00	11	03

not at all unlike those used for resident classes. Grades were given for homework assignments, term papers, and other student work by 83 percent of the instructors in both groups. Exams administered at the receiving site by field support staff were utilized in 73 percent of the courses. Twenty-seven percent used take-home exams. Just one instructor provided testing using a computer network, and one non-NTU course included exams administered on-site on an individual basis by a trustworthy individual (not identified) serving as monitor.

Four respondents indicated that problems had occurred in relation to evaluation of students. Two stated that exams had been delayed or lost in the U.S. mail or company internal mail systems. One expressed a concern for the rigor of the testing conditions when under the supervision of an on-site monitor. The fourth did not elaborate.

Regulatory Subsystem

Course planning and management. The long-term success of any innovative instructional delivery system, such as one using telecommunications, is heavily dependent on the commitment to such a system among university administrators (Abedor & Sachs, 1984; Richardson, 1980). Table 11 summarizes how that commitment was perceived by members of

Table 11. Level of commitment to satellite-based instruction among administrators, by percent of respondents

Administrator	High NTU %	High Non %	Modest NTU %	Modest Non %	Low NTU %	Low Non %	Indifferent NTU %	Indifferent Non %	Unknown NTU %	Unknown Non %
Department chair	57	89	19	11	19	00	00	00	05	00
School/college dean	71	44	29	44	00	11	00	00	00	00
Vice president for academic affairs/provost	29	67	43	22	00	11	05	00	24	00
President	38	33	24	33	00	00	05	00	33	33
Continuing education dean	76	78	14	22	05	00	00	00	05	00

Note. "Non" refers to Non-NTU institutions. Rows may not add up to 100 percent because of rounding.

both responding groups. In general, the commitment, when known, was seen as modest to high, particularly among department chairs and deans/directors of continuing education.

Engineering college deans were also viewed as being highly supportive by NTU respondents, as were provosts/vice presidents for academic affairs by non-NTU group members. Less appeared to be known about the attitude of university presidents toward satellite-based instruction, but none were identified as having a low level of commitment. The only significant concentration of "low" responses was among NTU department chairs, who may have felt some resentment because NTU courses were frequently assigned as overloads.

The "team approach" has been strongly advocated for the design, development, and delivery of courses by instructional telecommunications (Zigarell, 1984). The team approach appeared to have been utilized, at least to a degree, in the majority of courses described. Forty-three percent of the NTU courses and 44 percent of the non-NTU courses involved collaboration of a content specialist (course instructor), a television producer/director, and an instructional developer or continuing education specialist, who probably provided instructional design input. However, a person specifically identified as a college teaching specialist/instructional developer made significant contributions to just 4 of the 30 courses.

Twenty-four percent of the NTU courses and 44 percent of the non-NTU courses were developed by the course instructor and television producer/director working in collaboration. Other content specialists contributed to 6 of the 30 courses, and two courses involved the efforts of graphic artists. None of the course teams apparently included an instructional computing specialist, even though over 30 percent of the courses required student use of computers.

Although the literature on instructional telecommunications advocates regular meetings of the course planning/development teams (Richmond & Daniel, 1979), periodic meetings were held during just eight (27 percent) of the courses. In two of these cases, the team met only twice during the semester.

Budgeting. Expenses for NTU course delivery are generally absorbed by the participating corporations. Data regarding course costs were requested in the non-NTU questionnaire, and seven of the nine provided useable information. The per-student course costs given were multiplied by the total enrollment to obtain an estimate of bottom-line course costs, which were $11,700, $13,970,

$16,900, $19,180, $28,000, $29,600, and $121,800 for the seven courses. The latter was a large-scale, grant-funded project involving paid on-site adjunct faculty members, an extensive needs assessment, and other budget items that were rather atypical.

The course cost per student in a satellite-based course is dependent upon factors such as enrollment size and course development and delivery costs, which could vary considerably from one case to another. The approximate per-student costs for these seven courses were $180, $200, $400, $411, $548, $700, and $1,300. In four of the courses, charges to students apparently covered the course costs. (The enrollments of these courses were 34, 65, 70, and 148.) In the case of the $121,000 grant-supported course described above, the grant covered all expenses, and no charges were made to students. In the sixth course, special state funding and a grant from a private foundation made up the difference between expenses and revenues, and in the seventh case, the balance was simply absorbed by the university. No attempt was made to determine line item costs, although a comparison of course budgets, if they could have been obtained, would have been a most revealing component of the study.

Summative evaluation. Summative evaluation is highly recommended as a means of determining whether a course achieved its goals and met student needs (Coldeway, 1986). Both groups were asked if their courses were evaluated at their conclusion. Eighteen (86 percent) of the NTU respondents and eight (89 percent) of the non-NTU respondents answered in the affirmative. The factors evaluated are identified in Table 12. Several evaluation concerns were included only in the non-NTU questionnaire.

Four factors stood out above the others: attitudes of both students and instructors toward the course, academic performance of the students, and performance of the delivery system itself. The student attrition rate was evaluated by four of the non-NTU institutions; an NTU respondent noted that attrition was not a significant problem in NTU courses. Surprisingly, only two non-NTU universities included assessment of course cost versus revenues in their evaluations. Satisfaction of course sponsors (e.g., corporations contracting for academic coursework for their employees) or funding agencies (e.g., foundations, departments of state government) was evaluated only for those courses in which such parties were involved.

Table 12. Factors evaluated at course conclusion, by percent of respondents

Factor Evaluated	Evaluated by NTU %	Non-NTU %	Combined %
Instructor attitudes toward course	--	78	78
Student attitudes toward course	67	89	73
Performance of the delivery system	62	89	70
Academic performance of students	57	78	63
Success in reaching target audience	--	33	33
Course cost vs. course revenues	--	22	22
Satisfaction of course sponsor	--	22	22
Student attrition rate	10	44	20
Satisfaction of funding agency	--	11	11

Note. Several factors were not included in the NTU questionnaire.

Logistical Subsystem

Faculty support services. Distance education courses frequently increase faculty workloads and require expanded levels of university support (Feasley, 1983). Current faculty status and past experience in an instructional telecommunications setting influence the amount of support necessary. For example, distance education faculty members in general are more likely to be part-time members of the university staff (Feasley, 1983). However, only one of the nine non-NTU respondents reported that the instructor of the course described was a part-time faculty member. (This question was not asked in the NTU booklet.) Eighty-one percent of the NTU instructors and 44 percent of the non-NTU faculty members had taught prior courses by television, most via ITFS systems or other satellite courses. One NTU respondent noted that only professors experienced in using the university ITFS system were selcted to teach satellite courses at that institution.

Both groups were asked if special training in teaching by satellite had been given to the instructor prior to the beginning of the class. No one in either group answered "no," although 15 NTU respondents, each of whom reported that the instructor had prior ITV experience, left the item blank. The other fifteen respondents in both groups

Table 13. Content of instructor training programs, by percent of respondents

Topic	Provided by: NTU %	Non-NTU %	Combined %
How to use audiovisual equipment	--	100	100
How to perform on television	48	78	57
Aspects of interactive system	33	89	50
Managing course activities	43	33	40
Student needs and expectations	29	44	33
Interactivity as an instructional tool	14	78	33
Course design in distance education	--	33	33
Learning activities in distance education	14	22	13

Note. Two topics were indicated only on Non-NTU questionnaires.

indicated that instructor training had been provided. Table 13 summarizes the content of these training programs. Two items were included only in the non-NTU questionnaire.

The most frequently-provided topics were the ones that might be expected of a training program for instructors in an ITV setting: how to use audiovisual equipment such as an overhead projector in a TV course, how to address the television camera, and how to operate the two-way communications system and interact with students. Topics related to course design and management in a distance education environment were covered in some programs but were not given as high a priority.

An interesting dichotomy was present regarding training in the use of interactivity as an instructional tool. All but one of the programs in the non-NTU group included such training. This might have been expected, given the prevalence of two-way communications systems and the emphasis on live instruction and interaction. Conversely, training in interactive methods was rare at NTU universities, where the majority of the instruction was videotaped before satellite transmission and interactivity with remote students during lectures was not widely considered to be important.

In six of the nine non-NTU cases, training was provided by television personnel. On three occasions, instructional developers conducted training. Extension or continuing education specialists and faculty colleagues participated in the training programs twice.

Members of the non-NTU group were also asked to rate on a scale of 1 (low) to 5 (high) the importance of various kinds of institutional support that could be provided to instructors of satellite-based courses. They were next asked to rate on the same scale their perceptions of the degree to which those services were actually provided on their campuses. The differences between the means of these two ratings gives insight into the areas of greatest need for improved faculty support. See Table 14.

Two areas of potential support stood out among all the others in terms of greatest need for increased institutional support, reduced teaching load and increased recognition of the demands of satellite-based instruction by promotion and tenure committees. Provision for tutors or teaching assistants also seemed to fall far short of requirements. In addition, respondents perceived a greater need for peer support than was available and sought better telephone answering services. Two support areas directly related to faculty-student communications -- the budgets for long distance telephone calls and postage -- appeared to be

Table 14. Non-NTU respondent perceptions of degree of need versus present level of faculty support

Area of Support	Perceived Need Mean	Present Level Mean	Mean Difference
Reduced teaching load	4.14	2.00	2.14
Promotion/tenure recognition	4.00	1.66	2.34
Long distance telephone budget	4.00	3.88	0.12
Additional clerical help	3.75	3.25	0.50
Tutors/teaching assistants	3.71	2.71	1.00
Peer support opportunities	3.71	3.00	0.71
Additional postage budget	3.50	3.87	(+) 0.37
Telephone answering service	3.43	2.71	0.72
Additional travel budget	2.75	2.63	0.12

Note. Support areas were rated on a scale of 1 (low) to 5 (high).

adequately provided on most campuses. In general, respondents perceived a high degree of need for all the support areas listed in Table 14, except for additional travel funds.

Field support. Field support is essential whenever students meet in groups at the receiving sites (Cowlan & Foote, 1975). Persons were designated to serve as field support staff in eight of the nine non-NTU courses. In each case, the primary function of these individuals was to monitor the technical aspects of the system. In six of these eight courses, field support staff also conducted non-instructional course management activities on site, such as conducting registration and administering examinations. Field support personnel conducted instructional activities in only one program, and that was the previously described grant-funded project in which adjunct faculty members were hired at each site to facilitate learning activities. None of the respondents reported that on-site instruction or tutoring had been conducted by field support staff.

Members of the non-NTU group were also asked how often the instructor communicated with field support personnel. Two reported that weekly meetings were held. One responded "once or twice during the term," and the remainder said that meetings were not held on a regular basis but were scheduled "as necessary."

Summary

Responses were received from 32 of the 37 institutions in both groups combined, including 21 of the 24 sent to administrative contact persons at National Technological University (NTU) affiliates and 11 of 13 mailed to universities using satellites for credit course delivery not associated with NTU. Thirty of the responses were useable.

Significant growth in satellite use was evident. The responding non-NTU institutions offered a total of 28 credit courses by satellite in 1984-85, the first year that satellite-based instruction was reported by this group. The number grew to 40 in 1986-87 and to 74 in 1987-88, and plans for at least 87 such courses were indicated for 1988-89. Academic disciplines, geographic range of coverage, and number of participants per site varied widely among the non-NTU programs. Satellite course enrollments at non-NTU universities were much larger, on the average, than they were for NTU courses reported.

Each questionnaire asked for information regarding the development, delivery, and evaluation of one course offered by the responding institutions by satellite. The questions were designed to obtain an assessment of the degree to which the 23 guidelines identified in Chapter 2 had been followed.

The most important findings were as follows.

* All the non-NTU courses were transmitted to students live, while 57 percent of the NTU courses were videotaped prior to transmission.

* All courses in both groups placed a heavy burden for content delivery on video-based lectures, with most using textbooks and other printed materials in a secondary role.

* Course content was most often visualized via overhead transparencies; little use was made of other media forms, including previously-recorded, videotaped components.

* Both groups reported that the level of support services available to remote students was considerably below that level available to on-campus students enrolled in the same courses.

* Minimal efforts were made to train students to learn effectively in a distance education environment.

* Non-NTU universities placed a much higher emphasis in interactivity between instructor and remote students during the lecture transmissions than did NTU affiliates, and non-NTU students were much more likely than their NTU counterparts to initiate discussion with the instructor during the lectures.

* Senior administrators were reported to have had a generally high level of commitment to satellite-based

instruction at most of the institutions surveyed, in both groups.

* Significant discrepancies were noted between the level required and the level provided for three areas of support for faculty members teaching satellite courses among non-NTU institutions. These included the need for recognition of the time and effort required for these courses by promotion and tenure committees, for reduced teaching loads, and for increased help from teaching assistants and/or tutors.

* While most responding institutions provided specific training for instructors of satellite-based courses, training programs generally concentrated on technical aspects of the delivery system and gave little attention to course design factors.

CHAPTER FIVE: DISCUSSION

Discussion of Results

Four specific objectives were established for the current study:

1. Develop a set of guidelines for the design, delivery, and evaluation of postsecondary credit courses by communications satellite, based upon theories of distance education, adult education, and instructional telecommunications, as well as the published evaluations of past satellite-based credit courses.

As the result of the literature review described in Chapter Two, 23 guidelines were established to provide a basic framework for the design, development, and delivery of a university-level credit course by communications satellite. Guidelines were developed for each of the four subsystems identified in Kaye's (1981a) systems model for distance education: course subsystem, student subsystem, regulatory subsystem, and logistical subsystem.

2. Identify those colleges and universities in the United States that have used communications satellite technology for the dissemination of credit courses to non-resident students during the decade of the 1980's.

In addition to the 24 universities that uplink satellite courses as part of the National Technological University (NTU) consortium, 11 additional universities using satellites for the delivery of instruction for academic credit were identified. Nine of the 11 responded to the study. These programs will be discussed in the following section.

3. Determine the actual practices of these institutions in developing, delivering, and evaluating those courses.

Detailed information regarding one course offered by satellite was provided by each of the responding universities. The responses were summarized in Chapter Four. Descriptive information regarding satellite use by the respondents was reported, as were data for each of the categories in Kaye's model.

4. Compare the practices identified with the guidelines to determine the degree to which instructional procedures dictated by existing theory have been followed.

The data reported in Chapter Four will be discussed in Chapter Five. It will be shown that while many of the guidelines are being addressed, at least to a degree, by most of the institutions using satellite technology, little, if any, attention is being given to other guidelines. The implications of these practices will also be considered in Chapter Five.

Present and Planned Use of Satellites for Credit Courses

National Technological University

The lead in satellite-based instruction for credit course delivery has been taken by the Association for Media-Based Continuing Education for Engineers (AMCEE) and its National Technological University (NTU). In its 1987-88 catalog, the NTU listed 455 graduate courses in five engineering majors, available to thousands of students on a nationwide basis. (The scope of NTU's programming was described in Chapter One.)

If the courses selected for description by the 21 NTU respondents in this study were typical, and there is no reason to believe they were not, the use of satellites by NTU exemplifies the potential of the medium. Course enrollments were small, with an average of about two students per receiving site. However, the need for engineers to receive this in-service training was sufficiently great that the participating industries were willing to pay for the costs of having the training delivered directly to the work site by satellite. A satellite-based system made possible advanced training opportunities that might otherwise have been unavailable.

Non-NTU Satellite Applications

Without corporate sponsorship or other forms of external funding, universities have been hesitant to offer satellite-based instruction because of the prohibitive costs involved. The two most successful non-NTU programs meeting the criteria of (1) local course origination and (2) credit awarded by the uplinking institution -- the Virginia Cooperative Graduate Engineering Program and the graduate curriculum in computer science offered by California State University, Chico, each described in Chapter One -- both involved a substantial degree of corporate financial support. However, other universities are gradually entering the satellite arena, offering credit courses in a variety of disciplines, funded by tuition and other charges to students, special state allocations, and grants. Some of the more interesting programs, which were described in materials enclosed with the completed questionnaires, are the following.

California State Polytechnic University, Pomona. In early 1984, Cal Poly at Pomona inaugurated a program it called PolyNet, which was intended to provide university credit courses to high school juniors and seniors in the Los Angeles area using an Instructional Television Fixed Service (ITFS) system. Introductory courses were offered in such disciplines as engineering, art, German, psychology, calculus, physics, and biology. PolyNet became so successful that two courses, in engineering and the visual arts, were transmitted by satellite during the Spring 1988 quarter so they could reach a potential statewide audience. Cal Poly plans to uplink university courses in psychology, philosophy, and anthropology via the PolyNet system in 1988-89, one each quarter.

Texas Tech University. In the Fall 1986 semester, Texas Tech joined with the University of Houston at Clear Lake in a pilot satellite-delivered teacher in-service training program, co-sponsored by the Coordinating Board of the Texas College and University System and the TI-IN Network, a privately-owned service that provides academic courses, enrichment programming, and teacher in-service training to secondary schools throughout the country by satellite. Each university offered one graduate level education course to a potential pool of 110 public school downlink sites, using the facilities of the Region XX Educational Service Center in San Antonio. The Texas Tech course attracted 35 students at 13 sites.

The university's Health Sciences Center plans to have a satellite television network connecting its four campuses in El Paso, Amarillo, Odessa, and Lubbock operational by

Fall 1988. Planning is underway to offer School of Nursing courses through this system, and the university expects to allocate network time to other academic units for possible course delivery.

Eastern Washington University (EWU). Eastern Washington joined with Educational Service District (ESD) 101 of Spokane to present a full range of staff development programming and high school level courses by satellite during the 1987-88 academic year. Two of the courses offered in conjunction with ESD 101, advanced senior English and pre-calculus, were available for academic credit from EWU. The university has also offered its own courses in history, psychology, and speech communication by satellite to students in the Pacific Northwest area. Its most unique satellite course curriculum is an entire Bachelor of Arts degree program in General Studies, directed toward fire science personnel in remote areas of Washington. EWU is also planning a Master of Arts in Teaching (MAT) degree program for educators in rural parts of the state.

University of New Mexico (UNM). New Mexico is another large state with its population centers widely distributed. In an attempt to reach registered nurses who might otherwise not be able to complete the requirements for a Bachelor of Science in Nursing (BSN) degree, UNM initiated a sequence of

13 nursing courses to be transmitted by satellite between 1988 and 1990. The first course, Pathophysiology I, was presented during the Spring 1988 semester.

Virginia Polytechnic Institute and State University. Virginia Tech had contributed 57 satellite courses to the Virginia Cooperative Graduate Engineering Program, described in Chapter One, through the 1987-88 academic year and plans to offer 24 additional courses to the program during each of the next two years. The university is now developing a series of courses for a Master of Business Administration (MBA) program to be transmitted by satellite, beginning in 1989. Courses in foreign languages, education, and agriculture for satellite delivery are in the discussion stages.

Iowa State University. Iowa State recently received Regents' approval to offer its own master's degree program in computer science to corporate locations throughout Iowa. Two courses have already been uplinked. In addition, the university's College of Agriculture is moving ahead with an off-campus Bachelor of Agriculture program that will include courses delivered by satellite. Seminars in that curriculum were offered for academic credit by satellite in 1986-87 and in 1987-88. In addition, the ISU College of Family and Consumer Sciences has also explored an off-campus undergraduate degree program in home economics that will likely include satellite courses.

Other Programs in the Planning Stage. The telephone calls made to identify the universities that have used satellites for credit course delivery revealed that a number of other institutions have plans to use this technology in the future. Oklahoma State University, a leader in high school course transmission by satellite through its Arts and Sciences Teleconferencing Service (ASTS) and headquarters for the National University Teleconference Network (NUTN), will uplink its first university-level credit course in Fall 1988.

Old Dominion University (ODU) also plans to offer its first satellite courses in Fall 1988, intending to "go national" with its coverage. Courses are planned in engineering, education, and nursing, with other disciplines to follow. West Virginia University hoped to have English and mathematics courses ready for satellite delivery by Summer 1988, but personnel shortages threatened to delay those plans. Kansas State University (KSU) is constructing a large educational communications center that will become the hub of a statewide telecommunications network when it is completed sometime in 1989. KSU anticipates that satellite uplinking of courses will be a component of the network.

Others that have had discussions about satellite-based courses but no concrete plans include the Universities of South Carolina, Wisconsin, Georgia, and Iowa.

Practices in Relation to the Guidelines

The results of the study can be compared with the 23 guidelines to provide an assessment of the degree to which the responding institutions followed relevant theory in the development, delivery, and evaluation of their satellite courses. The discussion that follows will relate the findings to each of the guidelines.

Course Subsystem

Guideline No. 1. The very existence of a satellite-based course should be founded on clearly established learner needs.

Because of the high cost of producing and transmitting a carefully-designed course via satellite, it is very important that the content and methodology be consistent with learner needs (Richmond, 1977). Therefore, a needs assessment was highly recommended as a technique for ensuring that genuine educational problems are addressed, and are done so in a manner that will result in the most productive learning.

Only three of the non-NTU respondents acknowledged that a needs assessment had been conducted. One reported that a representative group from the target audience had been brought to campus the preceding summer to assist in the needs assessment and course planning. Four other respondents said that the course had been specifically requested by the target student group. Four also stated that their courses were part of established degree programs.

It is difficult to make the assumption that courses offered solely to meet degree requirements were sensitive to the actual needs of off-campus students, unless representatives of those students had been consulted during course development. The distinction must also be made as to whether it was the course (by title or catalog number) or course <u>content</u> that was specified in the four cases in which requests had been received. University course titles and catalog descriptions do not always guarantee that the desired information will be provided or that the teaching methodologies employed will be appropriate for the learners. The likelihood that the course will match student needs is highest when a needs assessment has been conducted (Richmond, 1977).

Guideline No. 2: Specific course objectives are a necessity from the outset.

Guideline No. 3: If adult students comprise an important segment of the target audience, they should be consulted prior to the preparation of objectives.

Learning objectives were prepared for eight of the nine non-NTU courses, although in the case of the graduate courses the target student group was not routinely consulted in advance, as recommended for adult students by Bonner (1982). Although no evidence was uncovered that the courses surveyed were not responsive to student needs, the practice of consulting with potential students or their representatives prior to the course enhances the likelihood that enrollees will acquire the information and skills they desire.

It is also a matter of some concern that objectives were reported as uncommon in National Technological University courses. Objectives were specifically encouraged for graduate-level engineering courses by Shanks and Hocheimer (1982), who emphasized their value to both instructors and students.

Guideline No. 4: Decisions regarding course design should be based on the specific characteristics and learning needs of the target audience. Of particular concern here was whether universities offering satellite courses to graduate students employed practices suggested by both Knowles (1970) and Bonner (1982) regarding adult learners. Techniques used by faculty members to help assure that the personal and professional needs of students were met include (1) soliciting input regarding course needs from the target student group prior to the beginning of the term, and (2) making the course as relevant as possible to student needs by relating course content to real world applications and maximizing personal involvement. The results indicated that both groups were doing well in some areas but not in others.

For example, a high percentage of both NTU and non-NTU respondents said that the course content was routinely related to possible applications in the students' personal and/or professional lives, and that students were regularly given learning activities enabling them to apply the material in real life situations. However, only about a third of the NTU respondents and just one of the five non-NTU respondents describing graduate courses reported that past experiences of students were solicited and related to the course content. Students were given opportunities to help determine that content in only a few cases.

Guideline No. 5: The course design must provide for each of the "events of instruction." Because of the need to keep the questionnaires at a reasonable length, the degree to which each of the steps in Gagne's (1970) model for instruction had been implemented could not be fully evaluated. Course objectives were routinely prepared by non-NTU universities and provided to students in written form by five of the nine respondents. Students were not normally informed of the objectives in NTU courses. Stimulus material was presented, practice and feedback activities were provided, and student performance was assessed by both groups.

One very important "event" is providing learning guidance, because this step helps students transfer incoming information to long-term memory in retrievable form. Common techniques for facilitating this event include providing opportunities for intellectual manipulation of the material and frequent use of illustrations and examples (Baath, 1979). Homework assignments and regular use of overhead projection or cameras may have contributed to this process in both groups. Since discussion is a common instructional method for providing learning guidance, the dearth of interactivity in NTU courses and infrequent use of other media forms by both groups stimulate doubt as to whether this event was accounted for to a satisfactory degree. Specific instructional methodology in satellite-based courses is an area in need of further research.

Guideline No. 6: Courses need to be developed as instructional systems, including an appropriate mix of technologies. Both Bates (1980) and Kaye (1981b) argued that video is most effective when serving functions such as illustrating and demonstrating course components requiring visualization and conveying primary source materials that would otherwise be unavailable to students. They proposed that print media are far more efficient for the initial presentation of facts. As a result, video should always be used in conjunction with other forms of teaching (Bates, 1980).

The results of this study indicated that although homework and other learning activities were provided, both groups relied heavily on lecture delivered by satellite as the primary means by which course content was presented. Print materials were almost always placed in a subordinate role. A few courses required computer activity, but this medium was always either secondary or tertiary in importance.

Even though most of the courses described appeared to have been well suited for visualization through a variety of media forms, use of media such as photographic slides, films, and videotapes was infrequent. Moreover, use of personal technologies such as half-inch videocassette players, microcomputers, and audiocassette players purchased for use in the home (Bates, 1984b) was nonexistent. In addition, small enrollments at many sites precluded effective use of group learning activities.

Guideline No. 7: The use of a satellite can be justified only if it is clearly the most appropriate technology available. Five guidelines for selection of satellite as the most appropriate medium for course distribution were proposed in Chapter Two (pp. 78-79). The number and geographic distribution of receiving sites, coupled with either the expense of or non-availability of terrestrial delivery systems, seemed to justify the use of a satellite in each case. It was noted above that the the availability of satellite courses made possible professional development opportunities for NTU students that may not have been obtainable otherwise due to lack of sufficient demand at each individual receiving site. The need for visualization by a video-based medium did not appear to be a signficant consideration among non-NTU respondents, but interest in using an emerging delivery technology was an important factor. In all cases, the target audience had access to the necessary receiving equipment, although it could not be determined if other potential students were denied the opportunity to participate because of the lack of downlink access. The budgets appeared to be adequate in all but two of the non-NTU courses.

Guideline No. 8: Adequate time and resources must be allocated for the development of quality instructional materials.

Guideline No. 9: Formative evaluation should be conducted during the development of materials for a satellite-based course.

Responses from non-NTU respondents indicated that the lack of time and resources for materials development was not generally a problem. However, it was apparent that materials development was not a high priority activity in the design of most of the courses. Formative evaluation activity was reported by just two respondents. Concern for these issues was raised by Cowlan and Foote (1975), who observed that inadequate time and resources had been provided for the development of courseware in the ATS-6 experiments. It must be noted that the courses uplinked in those projects included a significant amount of studio production and pre-recording. Few, if any, of the courses covered by the present study involved that level of video production. Due to the survey nature of this study, an in-depth evaluation of the appropriateness of the use of the visual medium in selected courses could not be attempted. However, such an analysis in another study could be of considerable value.

Guideline No. 10: Formative evaluation should be conducted during the presentation of a course by satellite, and the results should stimulate appropriate course modification. Six of the nine non-NTU institutions reported collecting information while their courses were in progress and using it to modify their procedures. All six indicated that significant changes were made, and that students appeared to benefit as the result.

Student Subsystem

Guideline No. 11: Students enrolled in a satellite-based course should have access to the same support services available to on-campus students enrolled in the same course.

Guideline No. 12: Additional student support should be provided in the form of a contact person available as necessary for tutoring and resolution of course-related problems.

Respondents in both groups were asked to indicate which of the following services were available to both on- and off-campus students enrolled in the same course to a comparable degree: bookstore, peer support, academic advising, computer, library, tutoring, and student counseling. It must be acknowledged that some of these services would have been required only under certain conditions. Computer services, for example, were needed only by those students enrolled in courses requiring computer work. Academic advising was necessary only for students interested in additional courses.

With the exception of computer services, which were required for only one non-NTU course, the non-NTU respondents reported a uniformly higher level of student support services than did their NTU counterparts. Peer support opportunities were more broadly available in non-NTU courses because of higher enrollments at each site. At least two-thirds of the non-NTU institutions offered a comparable level of bookstore services and academic advising, compared with much lower levels of service in these areas offered by NTU universities to satellite students.

However, as Table 8 indicated, other services were rarely available to satellite course students to an equivalent degree as to resident students. For example, academic library services were available to just 33 percent of the non-NTU students and only 14 percent of the NTU enrollees. Such a discrepancy could preclude the possibility of assignments involving library work, such as research papers and literature searches, unless adequate resources were available locally to all students.

Of particular concern was the low level of support provided in the areas of tutorial support and student counseling services, which were available to just 10 and 22 percent of NTU and non-NTU students, respectively. Robinson (1981) made a compelling case for these services, pointing out that distance education students are frequently unlike on-campus students in that they are often older, have been away from formal education for some time, and must study and learn under an entirely different set of environmental conditions than on-campus students. Services such as study skills training and counseling to overcome personal conflicts may be extremely beneficial to students in achieving success in distance education courses. Such services were rarely available in the courses surveyed.

Robinson (1981) also pointed out the value of personal contact in overcoming barriers in distance education. Most of the institutions surveyed, in both groups, strongly encouraged students to contact the instructor whenever necessary, and it was apparent that many students did, either by telephone, written correspondence, or electronic mail. However, Robinson strongly encouraged the availability of a tutor or teaching assistant to help students in learning the material and resolving course-related problems. None of the 30 respondents reported that students had been assigned to tutors or teaching assistants as points of contact, and the need for additional teaching assistant support was identified as one of the more significant needs of faculty members teaching satellite courses.

Guideline No. 13: Students need to receiving training in learning via a satellite-based instructional system. The non-NTU respondents were asked if students had been given any such training to help them succeed in a learning environment that was a first-time experience for most of them. Only five of the nine non-NTU universities acknowledged that any training had been provided to students, and the assistance provided appeared to be minimal. Most of the guidance centered around instructions on how to obtain help. Just three of the respondents reported that students had been given training in how to use the interactive system during the lectures, and only one provided help in improving study skills.

Guideline No. 14: Learning activities must be planned to maximize the opportunities for students to interact, both with the instructor and among themselves, given the constraints of the interactive system. This guideline must be modified to add the phrase "and of the learning environment itself." The National Technological University has recognized that many students simply are not available to attend classes at the times they are transmitted because of a variety of other obligations, either at the work site or at home or in the community. In addition, not all NTU course contributors were expected to have satellite transmission facilities before late 1988.

As a result, NTU has made heavy use of videotapes, both at the originating universities prior to class session transmission (many NTU courses have been taped at one university and shipped elsewhere for transmission) and at the receiving sites. The use of videotapes made student interaction with the instructor and students at other sites impossible during the lectures. Even interaction and participation in learning activities with students at local sites was difficult, because the 21 NTU courses reported had a median average enrollment of just two students per site.

By contrast, all nine non-NTU courses were transmitted live, and interaction among students and instructors during the satellite broadcasts was encouraged. Both instructors and students initiated interaction in every class period in at least two-thirds of the non-NTU courses. It must be noted, however, that two of the non-NTU courses with relatively little interaction were engineering and computer science courses delivered by satellite to corporate sites, with learning conditions similar to those at NTU receiving locations.

The distance separating students and instructors appeared to inhibit interaction at most of the 15 courses in which two-way communication was possible during the broadcasts. The level of interactivity was considered to have approached the level expected in a live, on-campus classroom in just 3 of the 15 cases. Wiesner (1983) theorized that lack of interaction in telecourses was due largely to a general lack of instructor knowledge regarding effective use of interaction in any instructional setting, whether the course was offered via telecommunications or was live in a classroom on campus. Seven of the nine non-NTU respondents indicated that instructors had been given specific training in the use of interactivity as an instructional tool, but the depth of that training was not determined.

<u>Guideline No. 15: An effective student evaluation system must be devised that is consistent with the needs of the learners and provides a reliable estimate of performance</u>. Effective evaluation of students is necessary to ensure that the same academic standards apply to both on- and off-campus students enrolled in a course (Connors, 1981). Without an equivalent level of academic rigor required for satellite course students, the integrity of the course may be challenged. Table 10 indicated that the techniques used to evaluate satellite students by both groups were very similar to those used for resident students. Take-home exams were given in a fourth of the NTU courses and a third of the non-NTU courses, suggesting some concern for flexibility in meeting the special needs of those students enrolled in satellite courses. Few problems in evaluating students were identified by either group, and in only one case was the difficulty not logistical in nature. One respondent questioned the trustworthiness of local exam monitors.

<u>Regulatory Subsystem</u>

<u>Guideline No. 16: Administrative support, from the highest levels down through the entire organization, is vital to the continuing success of a satellite-based instructional delivery system</u>. Respondents in both groups

were asked to evaluate the level of commitment to satellite-based instruction demonstrated by five key administrators at their campuses. (See Table 11.) In general, commitment was modest to high in all five categories of individuals, with highest levels of support among NTU engineering deans and continuing education deans in both groups. Department chairs were also reported to be highly supportive in both groups, as were vice presidents for academic affairs or provosts at the non-NTU institutions. Low levels of commitment were noted only in isolated cases. It may be inferred that without commitments from important administrators, these institutions were not likely to have become involved in satellite course delivery in the first place, compared, for example, with those universities not yet active in satellite-based instruction.

Guideline No. 17: The course should be planned, designed, produced, delivered, and evaluated by a team of professionals with clearly defined areas of responsibility.

Guideline No. 18: The course management team should meet frequently and maintain open communications throughout the project.

It was noted in Chapter Two that a satellite course should be developed by a team of professionals including, at the very least, a content specialist (normally the course instructor), a video production specialist, and an instructional developer (Richmond & Daniel, 1979). A continuing education specialist may fill the role of an instructional developer. These three individuals collaborated in the development of 13 of the 30 courses in both groups combined, although a person specifically identified as a college teaching specialist or instructional developer made a significant contribution in only four of these courses. An additional nine courses were prepared by a content specialist and video producer working together.

In the remaining eight courses, seven of which were offered by NTU, neither a video production specialist nor an instructional developer or continuing education specialist made significant contributions. None of the 30 courses involved the input of an instructional computing specialist, although a third of the courses required student work with computers. Furthermore, even though virtually every course made extensive use of overhead transparencies or opaque visuals covered by overhead television cameras, graphics production specialists contributed to just two courses, both in the non-NTU group. The talent pool of professionals likely to have been available on these campuses appeared to be underutilized in most of the courses described.

Members of the course development team should have frequent meetings for planning and problem solving purposes (Richmond & Daniel, 1979). In just six of the 30 courses were the key individuals involved reported to have held more than two meetings during the semester. The absence of regular meetings in the remaining courses is a clear indication that video, instructional development and continuing education specialists, even if initially involved, made relatively few, if any, significant contributions once the courses were underway. The courses appeared to be under the complete control of the instructors in the majority of cases, in both NTU and non-NTU groups.

Guideline No. 19: A summative evaluation should be conducted to determine the degree to which the interests of the students, host institution, and funding agency have been met. Summative evaluation efforts were reported by about 87 percent of the respondents in both groups. Although three of the NTU institutions did not indicate that summative evaluation had been conducted, one NTU respondent wrote that the National Technological University routinely evaluates its courses. The primary areas of concern were instructor and student attitudes, performance of the delivery system, and academic performance of the students. Other areas, such as success in reaching the target audience, course cost, student attrition, and satisfaction of course sponsors and funding agencies, appeared to have been evaluated by universities on an "as necessary" basis.

Guideline No. 20: A course budget should be developed and provided, accounting for satellite system, instructional development, instructional delivery, and administrative costs. Course budgets were not investigated to any depth in the study. However, non-NTU institutions were asked to provide data regarding the approximate cost of the course on a per-student basis, the charge to each student, and an explanation of how the difference was covered if costs exceeded revenues. Two of the nine non-NTU respondents refused to provide this information, and responses from several others were fragmentary. The results were reported in Chapter Four.

It was evident that costs varied widely according to the line items appearing in each budget. For example, such expenses as salaries for instructors and support personnel, uplink and satellite transponder charges, and materials production costs may or may not have been included in the cost figures provided. These figures for any course should be relatively independent of the number of students enrolled (excepting the cost of field support personnel and on-campus tutors and/or teaching assistants). One course enrolling 65 students cost $11,700, while another with 70 students cost

$28,000, and nothing reported in either questionnaire appeared to explain the difference. The costs involved in satellite-based instruction are another area in need of further research.

One fact cannot be disputed, and that is that satellite courses are expensive, and in the absence of external funding they must either attract large enrollments or charge high fees to make them cost-effective. In the one case in which a non-NTU course drew less than 34 students (actual enrollment was just 13), the university was forced to make internal reallocations and "eat" some costs to cover the difference between expenses and revenues. Budget imbalances such as these may force institutions to reevaluate their long-term commitments to satellite use.

Logistical Subsystem

Guideline No. 21: Faculty members teaching by satellite must be given training in using the system effectively. Most of the instructors involved in these courses were reported to have had prior experience in teaching courses by telecommunications media. Each of the universities with instructors inexperienced in ITV provided training programs to prepare these personnel for their courses. The training curriculum included technical factors, such as operating equipment and addressing the television camera. However, relatively little attention was given to course design considerations and the management of learning activities in a distance education setting, particularly in NTU institutions. The need for training in the effective use of interactivity has also been noted.

Teaching in a distance education setting is quite unlike teaching on campus (Feasley, 1983). Student needs and expectations are likely to be different. An entirely different set of conditions exists for maintaining communications with students. New forms of learning activities may need to be developed. Student evaluation conditions are different. Faculty members without prior experience in such a teaching/learning environment should find training in these and other areas quite beneficial. Such training did not appear to be common in the courses reported in this study.

Guideline No. 22: Appropriate institutional support must be provided to faculty members teaching courses by satellite. Each group of respondents was asked to react to a list of potential faculty support services recommended for instructors in television courses by Sachs (1983). Respondents indicated the degree to which they felt each of the services was necessary and then indicated the degree to which each service had actually been provided in the case of the courses reported. The results were summarized in Table 14.

For the most part, faculty appeared to be supported at a satisfactory level by their institutions, particularly in areas related to communication with students. The greatest discrepancies were noted for factors related to the faculty members' status within their academic departments. The largest mean difference between perceived need and present level of support was noted for increased recognition from promotion and tenure committees. The second largest difference, only slightly smaller, was in favor of a reduced teaching load. These are not new issues in distance education (Feasley, 1983), but they seem to be particularly important in the case of satellite courses. Other than these two concerns and an apparent need for higher levels of support from tutors or teaching assistants, faculty members in satellite courses appear to be fairly well supported by their universities.

<u>Guideline No. 23: Effective field support is essential at the receiving sites</u>. Eight of the nine non-NTU respondents reported that field support personnel were available at the receiving sites. For the most part, these individuals performed functions described by Cowlan and Foote (1975) as "facilitative," or technical and course

management in nature. In only one course did field support staff conduct instructional support activities, functions that Cowlan and Foote termed "substantive." Cowlan and Foote felt that both facilitative and substantive support activities could be performed by support personnel at receiving sites. Opportunities for productive learning experiences may therefore have been missed in those courses where field support personnel were not utilized for substantive functions.

Summary of Responses in Relation to the Guidelines

Table 15 provides a summary of the degree of adherence to the guidelines by both NTU and non-NTU groups. It can be seen that most of the guidelines were addressed, at least to a degree, by most of the universities using the technology. Only five of the guidelines apparently were given a minimal amount of attention by both groups, although some exceptions were noted. These five guidelines covered the areas of consulting with the target audience prior to course development, developing courses as complete instructional systems, conducting formative evaluation during materials development, providing training to students in learning in a satellite course environment, and conducting regular meetings of the course development and management team. However, in eight other cases, adherence to the guidelines

Table 15. Adherence to the guidelines by NTU and non-NTU universities

Guideline	NTU	Non-NTU
1. Existence of satellite course must be founded on clearly established learner needs	X	
2. Specific course objectives are a necessity		X
3. Adult students should be consulted prior to development of course objectives		
4. Course design should be based on characteristics and needs of target audience	X*	X*
5. Course design must provide for each of the "events of instruction"	X*	X*
6. Courses need to be developed as complete instructional systems		
7. Satellite justifiable only if it is the most appropriate technology	X	X
8. Adequate time and resources must be allocated for materials development	X	X
9. Formative evaluation should be conducted during materials development		
10. Formative evaluation should be conducted during course presentation	X	X
11. Students should have access to same support services as on-campus students	X*	X*
12. Contact person should be available for tutoring and course problem solution	X*	X*
13. Students need to receive training in how to learn by satellite		

Table 15. (continued)

Guideline	NTU	Non-NTU
14. Learning activities must be planned to maximize interaction		X
15. An effective student evaluation system must be devised	X	X
16. Administrative support is vital to the continuing success of the program	X	X
17. The course must be planned, designed, produced, delivered, and evaluated by a team of professionals	X*	X*
18. The course management team should meet frequently		
19. A summative evaluation should be conducted	X	X
20. A course budget should be developed, accounting for all relevant costs	X	X*
21. Faculty members need to be given training in using the system effectively	X*	X*
22. Institutional support must be provided to faculty members	X*	X*
23. Effective field support is essential at at the receiving sites	X*	X*

Note. An "X" indicates a high level of adherence, an "X*" indicates a modest level of adherence, and a blank indicates little or no adherence.

was partial at best by both groups. The implications of these results will be discussed in the following section.

Areas of Greatest Concern and Recommendations

A review of the findings of this study confirms that many institutions are making conscientious efforts to provide quality educational services by satellite. As indicated above, however, a number of concerns have been raised.

Absence of Needs Assessments

While needs assessments were carefully conducted in some cases, in others there was little, if any, reported effort to collect information that would have helped determine the actual educational needs of remote students. It cannot be assumed that the presence of a course in an established degree program or the simple request for a course, based on a general topic or catalog description, will result in the necessary information and skills being provided to off-campus students. With the increased cost of satellite-based instruction, compared with on-campus courses, it is all the more essential that satellite course producers are sensitive to student needs and provide learning experiences designed to enable students to meet their educational goals.

Use of Videotape/Lack of Interactivity

Although none of the non-NTU institutions uplinked videotapes of classroom lectures, this was a common practice among National Technological University affiliates. It is recognized that many students were unable to participate in live classroom sessions, when available, because of work conflicts. However, the remaining enrollees should have been provided the same opportunities to interact with the professor as afforded students physically present in the classroom. Technical limitations were not the issue, because two-way communications capability existed at all NTU universities with their own uplink facilities.

Interactivity is a critically important element in an effective teaching/learning environment (Hyman, 1982). The absence of opportunities for interaction made it more more difficult for instructors to involve students intellectually with the course content during the class period. In addition, the chances for students to ask questions about the material as they arose were lost.

Instructors of NTU courses need to realize the importance of interactivity in the instructional setting and receive training in techniques for facilitating productive classroom discussion. In some cases, a reorientation away from the "chalk and talk" philosophy of teaching, and toward a more interactive, participatory approach, may be necessary.

Reliance on Video as First Line of Instruction

Virtually all of the respondents noted that video lectures were the primary vehicles for presenting course content to students, and that textbooks and other printed materials were secondary in importance. The video medium is not generally effective for extended presentations containing densely-packed information (Kaye, 1981b). In the British telecourse model, print materials serve as the primary means of providing course information to students, with the video components used to illustrate, amplify, discuss, and provide visualizations that are otherwise not available (Bates, 1980; Kaye, 1981b).

Consideration needs to be given to this course design model by faculty members, video producers, and instructional developers involved in satellite courses. The video medium should be used more for discussion and visualization of course material and less for the presentation of information that may be provided more efficiently to students via print.

Underutilization of Campus Resources

Specialists such as instructional developers, graphic artists, and instructional computing professionals were rarely utilized to any significant degree in the courses reported about in this study. Moreover, video materials for the courses were produced by video production specialists in just 13 of the 30 courses. In some cases, charges for the services of campus professionals such as these appeared to prohibit their involvement. However, in a medium in which sound educational design and well-produced course materials can have such an important impact, producers of satellite courses should call in all the campus expertise that the budget permits.

Limited Student Support Services

Off-campus students studying by distance education media should not be deprived of support services available to students enrolled in the same courses live on campus. Yet, Table 9 indicated that rarely were these services available to an equivalent degree to both on- and off-campus learners. Limited access to university library resources was a particular concern, and tutorial and student counseling services were obtainable by only a very limited number of students.

Lack of access to these types of support services can only enhance the feelings of frustration and isolation among distance education students (Forsythe, 1984), and they restrict the instructional options of faculty members.

Universities offering courses by satellite must make special efforts to make these services available to all.

Limited Training Programs

Programs providing training for faculty members in telecommunications-based courses frequently were limited to such topics as performing in front of the camera and operating the equipment. Only on rare occasions did they offer training in organizing and conducting courses in a distance education environment. It is very important for instructors to be trained in understanding the special needs of off-campus students, in using the video medium effectively to make maximum use of the opportunities for visualization of the course content, and in developing and managing the learning activities of students they are never likely to meet in person.

Universities also need to provide training for students enrolled in their satellite courses. It is not enough to provide information on how to contact the instructor and obtain library resources. Students enrolled in satellite-based education frequently have home situations that are quite different from those attending the same classes on campus. Many of them have been away from formal education for an extended period of time and need assistance in refreshing their study skills. Help in adapting to a distance education environment may also be necessary.

Non-recognition of Course Demands on Faculty Members

Instructors teaching satellite courses do not appear to receive appropriate recognition by promotion and tenure committees. Teaching is not always given the emphasis it should by such committees in the first place. The added demands of teaching in a distance education environment make it all the more important that consideration be given to this type of service.

Another major area of concern among respondents was the need for reduced teaching loads. It was noted in Chapter Four that NTU courses were often assigned as overloads. Such assignments may lead to a distaste for teaching satellite courses, especially among junior members of the faculty who face the additional pressures of achieving promotion and tenure. Consideration should be given to reduced teaching loads if at all possible.

Questions for Further Research

Although the present study has answered many questions regarding the design, development, delivery, and evaluation of university-level credit courses by satellite, many other questions need to be addressed. For example,

1. Why were some of the guidelines not followed by responding institutions? Were the guidelines not relevant

to satellite-based instruction, or were the universities unaware of the need for these practices or simply unable to carry them out? Do any guidelines need to be revised?

2. What is the importance of the visual dimension of a satellite course? Is it enough to see a professor's "talking head," supplemented by occasional overhead transparencies and chalkboard use? Do time and resources permit the production of all the visual components that might be required for a given course? Would the faculty use them if they were available? What are the most appropriate instructional methodologies for use in a satellite course?

3. What is the actual role of interactivity in a satellite course? Is there a need for it at all, as some NTU respondents questioned? Can learning be effective without interactivity during the class periods? What types of interactivity are typically present in situations where it is available, and how do these interaction patterns compare with established models for classroom instruction? Is there an enrollment limit after which interactivity becomes impractical?

4. What are the actual costs of producing and delivering a satellite course? Which of these costs are typically absorbed by existing university funds, and which must be passed on to the students? How do these cost

allocations vary from one satellite course to another and from one institution to another? On a broader scale, who should pay for satellite-based instruction? Is it more appropriate for the student or the student's employer to bear the additional cost of a satellite course? Under what conditions should public funding be provided? What are the policy issues involved?

5. What are the ethical and legal issues involved when a state university provides satellite-based instruction across state lines? For example, should Iowa State University be permitted to transmit a course in beef production to ranchers in Nebraska, in competition with a similar course offered on the University of Nebraska campus?

6. What is the potential for a "national" university in other disciplines, following the model provided by the National Technological University? Could a student sit in Fargo, North Dakota, for example, and take courses in accounting by satellite from half a dozen of the nation's best business schools and obtain an accounting degree from a "national" university? What might the effect be on smaller state universities?

Conclusions

There is little doubt that satellite-based instruction is here to stay. The phenomenal growth observed over the last four years, coupled with exciting future plans at a number of universities, suggest that the promise of this medium has barely been explored in this country. At the international level, the potential was recently emphasized in an announcement issued by an organization calling itself the University of the World.

> We plan in 1988 to hold an international organizational conference, World EDUNET '88, under the aegis of the University of California at San Diego. It will take the necessary steps to put into operation an international electronic university employing state-of-the-art computer, telecommunications, and television technology, which would disseminate courseware, research data, scientific documents, and other materials over a network connecting educational and research institutions globally; i.e., among countries anywhere in the world that are willing to associate with the university for educational and research purposes. (cited in Moore, 1988, p. 5)

Whether satellite-based instruction will follow the path of past technological innovations in education or whether it will achieve its marvelous potential will depend to a large degree upon how we use it during the next five or ten years. It is tempting to suggest that we cannot continue to use it in a manner that fell into disfavor with learners 20 years ago. That proposal would not be entirely valid, because highly motivated audiences appear to be much more concerned with substance than appearance. For example, Russell (1982) reported an instance in which numerous technical difficulties were encountered during the videotaping of one presentation for an off-campus management seminar at his university. That one session was later acclaimed as the best of the series by the participants, who found its content to be of considerable value.

We must be more careful with students that are not as motivated as are graduate-level professional audiences. They will be less tolerant of uninspired instruction, underutilized video, and deprivation of support services. The guidelines proposed in Chapter Two are proposed as a model by which effective instruction by satellite can be realized.

It is one thing to provide these guidelines; it is quite another to follow them in actual practice. Some universities may find it impossible to assemble a course management team and invest in extensive video production to support a satellite course. Resources simply may not be available to conduct thorough formative and summative evaluation. While limited attention can be given to some of the guidelines with minimal damage to course effectiveness, others cannot be compromised.

A satellite-based system should be employed only if it is the most appropriate technology available. A course must be based on clearly-established learner needs, and course objectives must reflect a careful assessment of those needs. If the target audience consists primarily of adults, adult education theory must guide course development. The "events of instruction" must be accounted for in the course design. Courses must be developed as instructional systems, with activities and materials carefully selected to provide the optimum learning environment. Appropriate support systems must be developed and maintained for both students and the instructional staff.

Many of these factors are basic ingredients in any college course. They are even more important in courses delivered to students via communications satellites.

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APPENDIX A

Human Subjects Approval

INFORMATION ON THE USE OF HUMAN SUBJECTS IN RESEARCH
IOWA STATE UNIVERSITY
(Please follow the accompanying instructions for completing this form.)

1. Title of project (please type): A Conceptual Framework for the Design and Delivery of a University-Level Credit Course by Satellite

2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are properly protected. Additions to or changes in procedures affecting the subjects after the project has been approved will be submitted to the committee for review.

Michael J. Albright	11/9/87	Michael Albright
Typed Named of Principal Investigator	Date	Signature of Principal Investigator
Media Resources Center Exhibit Hall South	4-0186	
Campus Address	Campus Telephone	

3.

Signatures of others (if any)	Date	Relationship to Principal Investigator
Michael R. Simonson	11/9/87	Major Professor

4. ATTACH an additional page(s) (A) describing your proposed research and (B) the subjects to be used, (C) indicating any risks or discomforts to the subjects, and (D) covering any topics checked below. CHECK all boxes applicable.

- [ ] Medical clearance necessary before subjects can participate
- [ ] Samples (blood, tissue, etc.) from subjects
- [ ] Administration of substances (foods, drugs, etc.) to subjects
- [ ] Physical exercise or conditioning for subjects
- [ ] Deception of subjects
- [ ] Subjects under 14 years of age and(or) [ ] Subjects 14-17 years of age
- [ ] Subjects in institutions
- [ ] Research must be approved by another institution or agency

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5. ATTACH an example of the material to be used to obtain informed consent and CHECK which type will be used.

- [ ] Signed informed consent will be obtained.
- [X] Modified informed consent will be obtained.

6.

	Month	Day	Year
Anticipated date on which subjects will be first contacted:	11	30	87
Anticipated date for last contact with subjects:	1	29	88

7. If Applicable: Anticipated date on which audio or visual tapes will be erased and(or) identifiers will be removed from completed survey instruments:

Month	Day	Year

8.

Signature of Head or Chairperson	Date	Department or Administrative Unit
[illegible signature]	11/9/87	Dept of Professional Studies

9. Decision of the University Committee on the Use of Human Subjects in Research:

[X] Project Approved [ ] Project not approved [ ] No action required

George G. Karas	11-16-87	PM Keith
Name of Committee Chairperson	Date	Signature of Committee Chairperson

APPENDIX B

Letter Sent to

National Technological University Respondents

March 5, 1988

(name)
(address)

Dear (name):

I am a doctoral candidate in the College of Education, Iowa State University. For my dissertation I am attempting to determine the degree to which communications satellites are being used by colleges and universities to deliver courses for academic credit. In addition, I hope to obtain information regarding the practices of these institutions in developing, delivering, and evaluating satellite-based courses.

The National Technological University (NTU) is, of course, on the cutting edge of this technology. Although I am surveying the practices of all colleges with active continuing education programs, response from NTU-affiliated universities is particularly important in developing a clear picture of postsecondary use of satellite-based instruction in the United States. Since the number of NTU-affiliated institutions is small, your completion and return of the enclosed questionnaire will help ensure that this picture is complete and accurate.

The questionnaire, which asks about specific practices related to the development and delivery of a single course, may take approximately 20-25 minutes to complete. It may be helpful to consult with the professor who taught the course on some items. The study poses no risk except for the time required to complete the form. Specific practices of institutions will be reported only as group data. Confidentiality of individual responses is guaranteed.

If you have any questions, you may reach me during working hours, Central time, at (515) 294-6039. My supervising professor is Dr. Michael R. Simonson, who can be reached at (515) 294-6840.

Return of this questionnaire by March 25, 1988, will be greatly appreciated. Thank you very much for your cooperation.

Sincerely,

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Iowa State University
Ames, Iowa 50011

APPENDIX C

Questionnaire Booklet Sent to National Technological University Respondents

Use of Satellites for Credit Course Delivery:

A National Survey

National Technological University Affiliate Booklet
March 1988

Conducted by
Michael J. Albright
Iowa State University

Instructions:

Dear NTU Administrative Contact Person:

Please answer each question as completely as possible, following directions provided. Information provided in this survey will be reported only in a collective form. No individuals or institutions will be identified in connection with responses to this questionnaire.

Feel free to contact me (515-294-6039) for clarification of questions or any other information regarding this survey. **All respondents will receive a copy of the results when the data are compiled.**

Please respond by **March 25, 1988,** if at all possible. The booklet is pre-addressed and stamped. You need only answer the questions, seal the booklet, and drop it in the mail.

Thank you very much for your cooperation.

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Exhibit Hall South
Iowa State University
Ames, IA 50011

Use of Satellites for Credit Course Delivery

1. Your institution: ____________________

This questionnaire asks for detailed information regarding the procedures followed by your university in offering one specific course that was **uplinked from your campus to NTU students**. If your university has offered more than one such course, please select one according to the following priorities: (1) course offered "live" to students, rather than by videotape; (2) largest enrollment; (3) most recent course. It may be necessary to consult with the course instructor on some questions.

2. Please provide basic information about this course.

Course title: ____________________

Academic department: ____________________

Term offered: __________ Credit hours: __________

Enrollment: __________ Number of receiving sites: __________

3. Please estimate the level of commitment to satellite-based instruction on the part of each of the following administrators (at your **own** institution, **not** NTU!), in the case of the course being described. Circle the appropriate term.

Department chair	High	Modest	Low	Indifferent	Unknown
Engineering dean	High	Modest	Low	Indifferent	Unknown
VP for academic affairs/ provost	High	Modest	Low	Indifferent	Unknown
President	High	Modest	Low	Indifferent	Unknown
Dean/director of continuing education	High	Modest	Low	Indifferent	Unknown

Comments (optional):

4. Please check each of the professionals who made a significant contribution to the development, delivery, or evaluation of the course.

____ Course instructor

____ Other content specialist

____ Television producer/director

____ College teaching specialist/instructional developer

____ Graphic artist

____ Instructional computing specialist

____ Continuing education specialist

____ Other (please identify)

Comments (optional):

5. Did the individuals checked in item 4 above have regular meetings during the development and delivery of the course?

_____ Yes _____ No

If yes, approximately how often? ________________________________

Comments (optional):

6. What was the primary means of providing course lectures to the receiving sites? Please check one.

____ Lecture delivered by satellite

____ Lecture videotaped by your university, videotape transmitted by satellite

____ Other (Please identify) ________________________________

Comments (optional):

7. Please rank, in order of importance, each of the following means of providing information to students in this course. 1 = most important, 2 = next most important, 3 = least important, N/A = not applicable. For example, if the video lectures were the most important means for providing the course information, with the text in a supplemental role, mark lectures with a "1" and text with a "2". If two or more were of equal importance, assign the same number to each.

____ Lecture delivered by satellite

____ Course text/other reading materials

____ Computer-based learning system

____ Other (please identify)____

Comments (optional):

8. Please check those instructional techniques used by the instructor during preparation for and delivery of the course. Check all that apply.

____ Input from students/prospective students was used to help determine the course content

____ Past live experiences of students were solicited and related to learning of course content

____ As it was being presented, course content was routinely related to possible applications at the students' work sites

____ Advanced organizers, in the form of a comprehensive course schedule, content outline, or course objectives, were provided to students at the beginning of the course

____ Students were given opportunities to apply the newly-learned information through on-site learning activities (e.g., homework, group activities), with feedback provided

Comments (optional):

9. Please indicate approximately how often course content was visualized to students using instructional media incorporated into the lectures. Use the following guide: 0 = never, 1 = once or twice during the course, 2 = monthly, 3 = weekly, 4 = every class period, 5 = cannot be determined. Circle the appropriate number.

0 1 2 3 4 5 Overhead transparencies

0 1 2 3 4 5 Photographs/slides

0 1 2 3 4 5 Computer output

0 1 2 3 4 5 Film/videotape produced specifically for this course

0 1 2 3 4 5 Film/videotape produced for another course/another purpose

Comments (optional):

10. If film or videotapes were produced **specifically for this course**, who produced it? Check all that apply.

_____ The course instructor

_____ Another faculty member

_____ Media/video specialist(s) in College of Engineering

_____ Media/video specialist(s) in campuswide media/ITV center

_____ Production source in industry

_____ Independent producer

_____ Other (please identify) ______________________________

Comments (optional):

11. If the course was taught by a "live" instructor (e.g., not videotaped -- students participated at the receiving sites as the lecture was being delivered), was the satellite delivery system set up with a two-way audio communications capability so that the students and instructor could interact during the satellite transmissions?

____Yes ____No ____Not applicable

If yes, was the system set up so that students could interact with students at other sites?

____Yes ____No ____No other sites

Comments (optional):

12. If the response to either question in item 11 was "yes", please estimate how frequently each of the following activities involving interaction occurred during the course. Use the following guide: 0 = never, 1 = less than weekly, 2 = weekly, 3 = every class period. (For courses offered once per week, change 1 to "less than monthly" and 2 to "monthly".) Circle the appropriate number.

0 1 2 3 The instructor tried to initiate discussion with students during the satellite broadcast

0 1 2 3 Students participated in instructor-initiated discussion during the satellite broadcast

0 1 2 3 Students initiated instruction with the instructor during the satellite broadcast

0 1 2 3 Students interacted with students at other receiving sites during the satellite broadcasts

0 1 2 3 Students interacted as necessary with the instructor outside the class, such as by telephone and mail

Comments (optional):

13. Do you feel that the level of interaction during the satellite broadcasts approached the level that might have been expected had the students been physically present in the instructor's classroom?

_____ Yes   _____ No

Do you feel that instructor interaction with off-campus students is important **during the satellite broadcasts?**

_____ Yes   _____ No

Comments (optional):

14. How were the students evaluated? Please check all those that apply.

_____exam(s) administered at the receiving site by field support staff

_____take-home exams completed by students and mailed to the grader

_____students evaluated through testing via a computer network

_____grades given to homework assignments, term papers, and/or other student work

_____other (please identify) ____

Were any significant problems encountered related to evaluation of students?

_____ Yes   _____ No

If yes, please explain.

Comments (optional):

15. Were on-campus students enrolled in the same course, being taught simultaneously with the off-campus students?

____ Yes ____ No

If yes, do you believe that the course was able to maintain the same academic rigor for the off-campus students as it did for the on-campus students?

____ Yes ____ No

Comments (optional):

16. Please check the student support services that the students in this course had available to them to an equivalent degree as on-campus students enrolled in the same course.

____ Academic library

____ Computer services

____ Bookstore services

____ Opportunities to interact with other students for peer support

____ Student counseling services

____ Tutorial services

____ Academic advising

Were any specific problems encountered regarding student services?

____ Yes ____ No

If yes, please explain.

17. Was the course evaluated at its conclusion?

_____ Yes _____ No

If yes, what factors were evaluated? Check all that apply.

_____ Academic performance of the students

_____ Student attitudes toward the course

_____ Performance of the delivery system itself (the satellite and associated equipment)

_____ The attrition rate during the course

_____ Other (please identify) ________________________________

If yes, please describe the procedure that was followed to obtain this information.

Comments (optional):

18. Did the instructor have any past experience in teaching in a distance education/instructional telecommunications setting?

_____ Yes _____ No

If no, was special training in teaching by satellite given to the instructor prior to the beginning of the first class?

_____ Yes _____ No

If yes, what did this training cover? Please check all that apply.

_____ How to perform in front of a television camera

_____ Developing learning activities for students in a distance education setting

_____ Managing course activities in a distance education setting

_____ Technical aspects of the interactive system

_____ Use of interactivity as an instructional tool to promote learning of the course content (e.g., use of discussion, questioning techniques)

_____ Understanding needs and expectations of students enrolled in the course

_____ Other (please identify):_____________________________________

Comments (optional):

Please provide your name, position title, and phone number, so that I can contact you if it is necessary to clarify any of your responses. Thank you.

Name:_____________________________________

Position title:_____________________________________

Telephone:_____________________________________

When you have completed the questionnaire, please seal the booklet shut and drop it in the mail. The return address and postage are on the back page. Thank you again for your cooperation. Please do not hesitate to contact me if I can answer any questions regarding the survey.

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Iowa State University
Ames, IA 50011
(515) 294-6039

APPENDIX D

Responses to

National Technological University Questionnaire

Responses to National Technological University Questionnaire (N = 21)

1. Your institution:

   A complete list of respondents may be found in Appendix H.

2. Please provide basic information about this course.

   Academic department:
   - Electrical and Computer Engineering (4)
   - Computer Science (4)
   - Industrial Engineering (3)
   - Electrical Engineering (2)
   - Mathematics (1)
   - Optical Sciences (1)
   - Materials Science and Engineering (1)
   - Civil Engineering (1)
   - Aeronautics and Astronautics (1)
   - Engineering and Science Management (1)
   - Engineering Management (1)
   - Engineering Systems, Computer and Electrical (1)

   Credit hours:
   - 3 credit hours (19)
   - 4 credit hours (2)

   Enrollment:

10	21	9	58	16	13	12
12	5	50	13	8	30	7
13	9	67	14	6	23	38

   Number of receiving sites:

9	16	8	27	13	8	7
6	3	10	6	5	14	3
2	5	7	9	1	9	17

3. Please estimate the level of commitment to satellite-based instruction on the part of each of the following administrators (at your <u>own</u> institution, <u>not</u> NTU!), in the case of the course being described.

   Department chair
   - High (12)
   - Modest (4)
   - Low (4)
   - Indifferent (0)
   - Unknown (1)

Engineering dean
- High (15)
- Modest (6)
- Low (0)
- Indifferent (0)
- Unknown (0)

VP for academic affairs/provost
- High (6)
- Modest (9)
- Low (0)
- Indifferent (1)
- Unknown (5)

President
- High (8)
- Modest (5)
- Low (0)
- Indifferent (1)
- Unknown (7)

Dean/director of continuing education
- High (16)
- Modest (3)
- Low (1)
- Indifferent (0)
- Unknown (1)

Comments:

-- VP and Pres have increased support verbally over the past 2 years.

-- We are highly decentralized in organization & VP for Academic Affairs is not in the loop. V.P. for Extension is very high on NTU program.

4. Please check each of the professionals who made a significant contribution to the development, delivery, or evaluation of the course.

Course instructor (20)
Other content specialist (3)
Television producer/director (14)
College teaching specialist/instructional developer (2)
Graphic artist (0)
Instructional computing specialist (0)
Continuing education specialist (7)

Comments:

-- Video extension specialist -- very important -- would not be successful without this person!

-- Will begin to involve instructional designer in the process.

-- The course is in progress and hence has not been evaluated.

-- Corp. classroom Admin.

5. Did the individuals checked in item 4 above have regular meetings during the development and delivery of the course?

   Yes (4), No (14), N/R (3)

   If yes, approximately how often?

   -- Much phone contact but no scheduled meetings.

   -- Twice before the actual broadcast date and periodically throughout the session.

   -- Almost weekly. Cont. Educ. people & faculty stay in close contact during course.

   -- Weekly (informal and brief). Instructor is an expert at satellite delivery and has worked with above individuals for years.

   -- Weekly.

6. What was the primary means of providing course lectures to the receiving sites?

   Lecture delivered by satellite (8)
   Lecture videotaped by your university, videotape transmitted by satellite (12)
   Other (1)

Comments:

-- Live for half a semester then taped -- due to irregular time change in Indiana vs. elsewhere.

-- Lecture videotaped and sent to Colorado via Fed Ex for uplinking.

-- Also local microwave receive sites.

-- Our portable Ku up-link needs to stay mobile, therefore we elect to tape and broadcast to satellite from Fort Collins, CO.

-- On a delayed non-live basis.

7. Please rank, in order of importance, each of the following means of providing information to students in this course. 1 = most important, 2 = next most important, 3 = least important, N/A = not applicable. For example, if the video lectures were the most important means for providing the course information, with the text in a supplemental role, mark lectures with a "1" and text with a "2". If two or more were of equal importance, assign the same number to each.

Lecture delivered by satellite
1 (19), 2 (1), 3 (0), N/R (1)

Course text/other reading materials
1 (3), 2 (15), 3 (1), N/R (2)

Computer-based learning system
1 (0), 2 (2), 3 (5), N/R (14)

Other:

-- Conversation of instructor (rated "1")

-- Phone contact (rated "1")

8. Please check those instructional techniques used by the instructor during preparation for and delivery of the course.

   Input from students/prospective students was used to help determine the course content (4)

   Past live experiences of students were solicited and related to learning of course content (8)

   As it was being presented, course content was routinely related to possible applications at the students' work sites (13)

   Advanced organizers, in the form of a comprehensive course schedule, content outline, or course objectives, were provided to students at the beginning of the course (17)

   Students were given opportunities to apply the newly-learned information through on-site learning activities (e.g., homework, group activities), with feedback provided (17)

9. Please indicate approximately how often course content was visualized to students using instructional media incorporated into the lectures. Use the following guide: 0 = never, 1 = once or twice during the course, 2 = monthly, 3 = weekly, 4 = every class period, 5 = cannot be determined.

   Overhead transparencies
   0 (1), 1 (3), 2 (2), 3 (2), 4 (9), 5 (0), N/R (4)

   Photographs/slides
   0 (8), 1 (3), 2 (1), 3 (1), 4 (2), 5 (1), N/R (5)

   Computer output
   0 (7), 1 (2), 2 (3), 3 (3), 4 (1), 5 (1), N/R (4)

   Film/videotape produced specifically for this course
   0 (11), 1 (2), 2 (1), 3 (2), 4 (0), 5 (0), N/R (5)

   Film/videotape produced for another course/purpose
   0 (11), 1 (2), 2 (0), 3 (1), 4 (0), 5 (1), N/R (6)

Comments:

-- This question makes no sense -- "course content was visualized"??? It's a TV course -- the entire course is visual.

-- I used "semi-notes" throughout to guide the lectures.

10. If film or videotapes were produced specifically for this course, who produced it?

Course instructor (6)
Another faculty member (2)
Media/video specialist(s) in College of Engineering (4)
Media/video specialist(s) in campuswide media/ITV center (2)
Production source in industry (1)
Independent producer (1)

Comments:

-- Normally 1/2" VHS tape (home camera grade) produced by faculty in his laboratory. Professional television staff does not like us using this but it is much less expensive than having them do it.

11. If the course was taught by a "live" instructor (e.g., not videotaped -- students participated at the receiving sites as the lecture was being delivered,), was the satellite delivery system set up with a two-way audio communications capability so that the students and instructor could interact during the satellite transmissions?

Yes (6), No (3), N/A (8), N/R (4)

If yes, was the system set up so that students could interact with students at other sites?

Yes (3), No (3)

Comments:

-- Only through being heard on television.

-- Once we have the uplink installed, students can call our regular phone lines to the class site and be heard on a speaker system both in the room and over TV. With 2 lines available, 2 sites could theoretically talk to each other.

12. If the response to either question in Item 11 was "yes", please estimate how frequently each of the following activities involving interaction occurred during the course. Use the following guide: 0 = never, 1 = less than weekly, 2 = weekly, 3 = every class period.

The instructor tried to initiate discussion with students during the satellite broadcast
0 (1), 1 (0), 2 (2), 3 (3)

Students participated in instructor-initiated discussion during the satellite broadcast
0 (1), 1 (2), 2 (3), 3 (0)

Students initiated interaction with the instructor during the satellite broadcasts
0 (0), 1 (4), 2 (2), 3 (0)

Students interacted with students at other receiving sites during the satellite broadcasts
0 (4), 1 (1), 2 (1), 3 (0)

Students interacted as necessary with the instructor outside the class, such as by telephone and mail
0 (0), 1 (0), 2 (5), 3 (1)

13. Do you think that the level of interaction during the satellite broadcasts approached the level that might have been expected had the students been physically present in the instructor's classroom?

Yes (1), No (10), N/R (10)

Do you feel that instructor interaction with off-campus students is important during the satellite broadcasts?

Yes (8), No (6), N/R (7)

Comments:

-- For this course. Actually uncertain in general.

-- They have plenty of opportunity to interact with faculty via phone, mail, and electronic mail.

-- Essential, but hard to implement.

-- No interaction during time of broadcast but numerous questions received subsequently via toll free telephone.

14. How were the students evaluated?

Exam(s) administered at the receiving site by field support staff (15)

Take-home exams completed by students and mailed to the grader (5)

Students evaluated through testing via a computer network (0)

Grades given to homework assignments, term papers, and/or other student work (17)

Were any significant problems encountered related to evaluation of students?

Yes (3), No (17), N/R (1)

If yes, please explain.

-- U.S. mail service is slow, plus company internal mail systems slow down or lose materials.

-- Uncertain about monitoring of exams at local sites.

-- Loss of tests in mail from coordinators.

15. Were on-campus students enrolled in the same course, being taught simultaneously with the off-campus students?

Yes (20), No (1)

If yes, do you believe that the course was able to maintain the same academic rigor for the off-campus students as it did for the on-campus students?

Yes (19), No (0), N/R (1)

Comments:

-- We work hard at this and think we do a good job.

-- Would not offer to off-campus students if this were not the case.

-- Our college is strongly committed to having our video course students feel a part of the school and carry their own weight on course activity and assignments.

-- But the "rigor" for the class as a whole was somewhat reduced by the distance component (i.e., being televised)

16. Please check the student support services that the students in this course had available to them to an equivalent degree as on-campus students enrolled in the same course.

Academic library (3)
Computer services (8)
Bookstore services (9)
Opportunities to interact with other students for peer support (6)
Student counseling services (2)
Tutorial services (2)
Academic advising (6)

Were any specific problems encountered regarding student services?

Yes (0), No (12), N/R (9)

If yes, please explain.

-- U.S. mail service slows down timely response in some cases. VSAT technology could overcome this problem.

-- Library and computer services are the most difficult aspects to make available off site. We have to hope that either at their work site or nearby college, the students can access adequate materials/machines.

17. Was the course evaluated at its conclusion?

Yes (18), No (2), N/R (1)

If yes, what factors were evaluated?

Academic performance of the students (12)
Student attitudes toward the course (14)
Performance of the delivery system itself (13)
The attrition rate during the course (2)

If yes, please describe the procedure that was followed to obtain this information.

-- Review of course grades.

-- Questionnaire completed by the prof.

-- Evaluation forms (2 types).

-- End of semester evaluations sent to our students.

-- Tests, squack cards during semester, end-of-course evaluations, letters asking for comments.

-- College of engineering distributes evaluations to all grad students off-campus and on-campus. Evaluation pertains primarily to teaching performance. The video-based program also sends out evluations to determine performance of delivery system, as does NTU.

-- NTU has a standard questionnaire for this.

-- Evaluation by NTU at (name of university).

-- Departmental evaluation forms, ITV student reaction reports.

18. Did the instructor have any past experience in teaching in a distance education/instructional telecommunications setting?

Yes (18), No (2), N/R (1)

If no, was special training in teaching by satellite given to the instructor prior to the beginning of the first class?

Yes (6), No (0), N/R (15)

If yes, what did this training cover?

How to perform in front of a television camera (10)
Developing learning activities for students in a distance education setting (3)
Managing course activities in a distance education setting (9)
Technical aspects of the interactive system (7)
Use of interactivity as an instructional tool to promote learning of the course content (3)
Understanding needs and expectations of students enrolled in the course (6)

Comments:

-- Only faculty who have taught over our local ITFS setup are selected for NTU courses. Each faculty is encouraged to have a training session on the system. The media service department offers extensive support as required for graphics, screen tests, or other instructor needs.

-- This instructor helps train the new instructors.

-- We give all our new ITV faculty an orientation to teaching on TV. It's won an NUCEA regional award.

-- We do have a videotape and live training sessions for new faculty.

APPENDIX E

Letter Sent to

Non-National Technological University Respondents

March 25, 1988

(name)
(address)

Dear (name):

As a follow-up to our telephone conversation of (date), please let me once again express my appreciation for your willingness to complete a questionnaire regarding (name of university)'s use of communications satellites for delivering credit courses. This survey is being conducted for my doctoral dissertaion in the College of Education, Iowa State University.

The questionnaire may take approximately 20-25 minutes to complete. It may be helpful to consult with the professor who taught the course on some items. The study poses no risk except for the time required to complete the form. Practices of institutions will be reported only as group data, except for general information regarding your university's past, present, and planned use of satellites for credit course delivery. Permission to report this narrative information is specifically requested in the booklet.

If you have any questions, you can reach me during working hours, Central time, at (515) 294-6039. My supervising professor is Dr. Michael R. Simonson, who can be reached at (515) 294-6840.

Return of this questionnaire by April 18, 1988, will be greatly appreciated. Thank you very much for your cooperation.

Sincerely,

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Exhibit Hall South
Iowa State University
Ames, Iowa 50011

APPENDIX F

Questionnaire Booklet Sent to Non-National Technological University Respondents

Use of Satellites for Credit Course Delivery:

A National Survey

Conducted by
Michael J. Albright
Iowa State University
March 1988

Instructions

Dear Colleague:

Please answer each question as completely as possible, following directions provided. Information provided in this survey will be reported only in a collective form, with the exception of items 3 and 4, if permission is granted to share your responses among those completing the survey. Otherwise, no individuals or institutions will be identified in connection with responses to this questionnaire.

Feel free to contact me (515-294-6039) for clarification of questions or any other information regarding this survey. Please note that I will be away from my office on military reserve duty from April 4-15. **All respondents will receive a copy of the results when the data are compiled.**

Please respond by **April 18, 1988**, if at all possible. A self-addressed, stamped envelope is provided for your convenience in returning the booklet. I would be extremely grateful for any printed material that you could enclose regarding your satellite courses, although additional postage may be required.

Thank you very much for your cooperation.

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Exhibit Hall South
Iowa State University
Ames, IA 50011

Use of Satellites for Credit Course Delivery

1. Your institution: ______________________________

The primary purpose of this survey is to collect information about the procedures followed by colleges and universities using communications satellites to deliver courses for academic credit. Courses at your institution would apply if they meet **each** of the following criteria:

a. **Students completing the course successfully received academic credit from your own institution.** This survey is concerned only with **credit courses**, rather than non-credit courses, seminars, or videoconferences.

b. **At least a portion of the instruction was delivered from your university to students via a communications satellite.**

c. **Your own university originated the course.** This survey is not concerned with the use of courses provided to you via satellite from other organizations, such as the International University Consortium or The Learning Channel.

d. **The course was NOT offered in conjunction with the National Technological University (NTU), even if originated on your campus and taken for credit by your own students.** NTU administrative contact persons have also been sent copies of this form for the purpose of collecting information about NTU courses. This survey form should be used **only** to report information about courses **not** offered through NTU.

I. Background Information

2. Please indicate your university's degree of involvement with satellite-based instruction. For each of the academic years identified below, please write in the number of credit courses, meeting the criteria specified above, offered by your university. Remember, courses offered in conjunction with the National Technological University should not be included. (If records are not immediately available, please estimate and indicate by entering "Est.".)

______ Prior to 1980-81	______ 1980-82
______ 1982-84	______ 1984-86
______ 1986-87	______ 1987-88
______ 1988-89 (planned)	______ 1989-90 (planned)

3. **Please provide a brief narrative description of your university's past experiences with satellite-based instruction. (Include the present academic term if appropriate.) In general, what has been done, and with what academic departments? (The description does not need to exceed the amount of space provided here. However, any fliers, reports, or other printed information describing your satellite courses, that you could enclose when you return this questionnaire, would be greatly appreciated.)**

4. If your university has future plans for satellite-based courses, would you please briefly describe them here?

NOTE: In the interests of networking, I propose to share your responses to items 3 and 4 with the other respondents. **Responses to all other items will be reported only as group data.** Please check here if this is acceptable to you.

______ OK to share this page (only) with others ______ keep confidential

5. Generally speaking, In what geographical areas have you attracted students for your satellite course(s). Please check one only.

______ Within own state only

______ Within own state and adjacent states

______ Regional (e.g., Southeastern U.S., Western U.S.)

______ National

______ Geographic distribution of audience has varied greatly from course to course

Comments (optional):

6. This questionnaire Is being sent to all member institutions of the National Technological University (NTU) consortium (different version), Penn State, Virginia Tech, the University of Virginia, Old Dominion, the University of New Mexico, Texas Tech, Eastern Washington, Boise State, California State University at Chico, California State University at Sacramento, Cal Poly at Pomona, the University of Alaska, and Iowa State. If you aware of any other colleges or universities that are using satellites for credit course delivery, would you please identify them here? If you have the name and phone number of a contact person, I would greatly appreciate that, too. Thank you.

II. Course Profile

The remainder of this questionnaire asks for detailed information regarding the procedures followed by your university in offering one specific course by satellite. If your institution has offered more than one course by satellite, please select one according to the following priorities: (1) course offered "live" to students, rather than by videotape; (2) largest enrollment; (3) most recent course. It may be necessary to consult with the course instructor on some items.

7. Please provide basic information about this course:

Course title:______________________________________

Level: ______ Grad ______ Undergrad Enrollment: __________

Academic department:__________________________________

When offered (term):____________________ Credit hours:__________

Target student group:__________________________________
(e.g., in-service teachers, engineers at work site, etc.)

Number of receiving sites:__________

8. What were the **primary** considerations in selecting a satellite-based system for delivery of the course? Check all that apply.

______ The need to reach a wide geographical area

______ The need to reach a large number of students/receiving sites

______ The frequency of the class meetings

______ The timeliness of the educational material

______ The need for visualization of the educational material via a video medium

______ Specific request from the target student group

______ Efficient use of the instructor's limited time

______ The cost-effectiveness of a satellite-based system vis-a-vis a terrestrial system

______ The non-availability of a suitable terrestrial system

______ The need for interactivity between the students and instructor

______ Interest in using an emerging distance education technology

______ Other (please identify):____________________________

Comments (optional):

9. How was it determined that the course was needed by the target student group? Check all that apply.

_______ Specific request from the target student group

_______ Course part of established degree program

_______ Perception of academic department or instructor (unrelated to degree program)

_______ Formal needs assessment

_______ Other (please identify):____

____

Comments (optional):

10. Please estimate the level of commitment to satellite-based instruction on the part of each of the following administrators, in the case of the course being described. Circle the appropriate term.

Department chair	High	Modest	Low	Indifferent	Unknown
School/college dean	High	Modest	Low	Indifferent	Unknown
VP for academic affairs/ provost	High	Modest	Low	Indifferent	Unknown
President	High	Modest	Low	Indifferent	Unknown
Dean/director of continuing education	High	Modest	Low	Indifferent	Unknown

Comments (optional):

11. Please check each of the professionals who made a **significant** contribution to the development, delivery, or evaluation of the course.

_______ Course instructor

_______ Other content specialist

_______ Television producer/director

_______ College teaching specialist/instructional developer

_______ Graphic artist

_______ Instructional computing specialist

_______ Continuing education specialist

_______ Other (please identify):____

Comments (optional):

12. Did the individuals checked in item 11 above have regular meetings during the development and delivery of the course?

_______ Yes _______ No

If yes, approximately how often? _______________________________________

13. Were specific learning objectives established for the course?

_______ Yes _______ No

If yes, please respond to the following:

Were prospective students consulted before the objectives were established?

_______ Yes _______ No

Were the objectives provided to the students in print form?

_______ Yes _______ No

14. Please check the applicable learning setting.

_______ Students viewing independently, with no organized group activities

_______ Students viewing independently, with occasional organized group activities

_______ Students viewing regularly in groups

_______ Other (please identify):____

____

Comments (optional):

15. What was the primary means of providing course lectures to the receiving sites? Please check one.

_______ Live lecture delivered by satellite

_______ Lecture videotaped by your university, videotape transmitted by satellite

_______ A combination of live and videotaped components

_______ Other (please identify):____

____

16. In your estimation, approximately how many of the lectures were actually viewed by students **as they were transmitted**, as opposed to being videotaped at the receiving sites for viewing by students at some other time? Please check one.

_______ Pretty much all of them

_______ More than half, but not all

_______ About half

_______ Less than half, but some

_______ Probably not very many, if any at all

_______ Not known and cannot estimate

17. Please rank, in order of importance, each of the following means of providing the course content to students. 1 = most important, 2 = next most important, 3 = least important, N/A = not applicable. For example, if the video lectures were the most important means for providing course content, with the text in a supplemental role, mark lectures with a "1" and text with a "2". If two or more were of equal importance, assign the same number to each.

______ Lecture delivered by satellite (either live or by videotape)

______ Course text/other reading materials

______ Computer-based learning system

______ Other (please identify):______________________________________

____

Comments (optional):

18. Please check those instructional techniques used by the instructor during preparation for and delivery of the course. Check all that apply.

______ Input from students/prospective students was used to help determine the course content

______ Past life experiences of students were solicited and related to learning of course content

______ As it was being presented, course content was routinely related to possible applications in the students' personal or professional lives

______ Advanced organizers, in the form of a comprehensive course schedule, content outline, or course objectives, were provided to students at the beginning of the course

______ Students were given opportunities to apply the newly-learned information through on-site learning activities (e.g., homework, group activities), with feedback provided

Comments (optional):

19. Please indicate approximately how often course content was visualized to students using instructional media incorporated into the lectures. Use the following guide: 0 = never, 1 = once or twice during the course, 2 = monthly, 3 = weekly, 4 = most class periods, 5 = cannot be determined. Circle the appropriate number.

0 1 2 3 4 5 Overhead transparencies

0 1 2 3 4 5 Photographs/slides

0 1 2 3 4 5 Computer output

0 1 2 3 4 5 Film/videotape produced specifically for this course

0 1 2 3 4 5 Film/videotape produced for another course/another purpose

Comments (optional):

20. If film or videotapes were produced specifically for this course, who produced them? Check all that apply.

______ The course instructor

______ Another faculty member

______ Media/video specialist(s) in the instructor's own department/college

______ Media/video specialist(s) in campuswide or Extension media/ITV center

______ Production source in industry

______ Independent producer

______ Other (please identify):____

____

Comments (optional):

21. What role, if any, did your campuswide or Extension media/ITV center play during the development, delivery, and evaluation of the course? Check all that apply.

_______ Provided instructional design consultation

_______ Produced instructional materials incorporated into the lectures

_______ Produced instructional materials sent directly to students for their use at the receiving sites (other than by satellite)

_______ Provided/operated the video production facility in which the video portion of the course (that portion uplinked) originated

_______ Provided/operated the uplink facility itself

_______ No significant role was played by the media/ITV center

If any of the above items were checked (excluding the last option), please answer the following two questions.

Does this center serve the entire campus, or just Extension/continuing education?

_______ Entire campus _______ Extension/continuing education

What is the name of this center?

____

22. Would you say that adequate time and resources were allocated for the development of course materials?

Time: Resources:

_______ Yes _______ No _______ Yes _______ No

Comments:

23. Were formative evaluation procedures (i.e., tryouts, evaluation, revision) conducted during the development of course materials?

_____ Yes _____ No

If yes, please describe the problems that were encountered, if they have significance for others developing courses for satellite delivery.

24. Was information collected while the course was in progress and used to improve the course prior to its conclusion?

_____ Yes _____ No

If yes, please explain what information was collected and what improvements were made as a result.

25. If the course was taught by a "live" instructor (e.g., not videotaped -- students participated at the receiving sites as the lecture was being delivered), was the satellite delivery system set up with a two-way audio communications capability so that the students and instructor could interact during the satellite transmissions?

_____ Yes _____ No _____ Not applicable

If yes, was the system set up so that students could interact with students at other sites?

_____ Yes _____ No _____ No other sites

Comments (optional):

26. If the response to either question in item 25 was "yes", please estimate how frequently each of the following activities involving interaction occurred during the course. Use the following guide: 0 = never, 1 = less than weekly, 2 = weekly, 3 = every class period. (For courses offered once per week, change 1 to "less than monthly" and 2 to "monthly".) Circle the appropriate number.

0 1 2 3 The instructor tried to initiate discussion with students during the satellite broadcast

0 1 2 3 Students participated in instructor-initiated discussion during the satellite broadcast

0 1 2 3 Students initiated interaction with the instructor during the satellite broadcast

0 1 2 3 Students interacted with students at other receiving sites during the satellite broadcast

0 1 2 3 Students interacted with the instructor outside the class, such as by telephone and mail

Comments (optional):

27. Do you feel that the level of interaction during the satellite broadcasts approached the level that might have been expected had the students been physically present in the instructor's classroom?

______ Yes ______ No

Do you feel that instructor interaction with off-campus students is important **during the satellite broadcasts?**

______ Yes ______ No

Comments (optional):

28. How were the students evaluated? Please check all that apply.

_______ Exam(s) administered at the receiving site by field support staff

_______ Most or all students met at centralized testing site for administration of course exam(s)

_______ Exam(s) administered on-site on an individual basis under the supervision of a trustworthy person serving as monitor

_______ Take-home exams completed by students and mailed to the grader

_______ Students evaluated through testing via a computer network

_______ Grades given to homework assignments, term papers, and/or other student work

_______ Other (please identify)____

Were any significant problems encountered related to evaluation of students?

_______ Yes _______ No

If yes, please explain.

Comments (optional):

29. Were on-campus students enrolled in the same course, being taught simultaneously with the off-campus students?

_______ Yes _______ No

If yes, do you believe that the course was able to maintain the same academic rigor for the off-campus students as it did for the on-campus students?

_______ Yes _______ No

Comments (optional):

30. Please check the student support services that the students in this course had available to them to an equivalent degree as on-campus students enrolled in the same course.

_______ Academic library

_______ Computer services

_______ Bookstore services

_______ Opportunities to interact with other students for peer support

_______ Student counseling services

_______ Tutorial services

_______ Academic advising

Were any special problems encountered regarding student services?

_______ Yes _______ No

If yes, please explain.

31. What kind of system was established to provide a point of personal contact for each student? Check all that apply.

_______ Each student was able to obtain help from field support staff on-site

_______ Each student was assigned a tutor or teaching assistant at the university or regional location to contact for help

_______ Each student was encouraged to contact the instructor for help whenever necessary

_______ A toll-free telephone number was provided for student use on contacting university personnel

_______ No specific system for personal contact was provided

_______ Other (please identify) ____

Comments (optional):

32. If students were given specific training in how to learn effectively within the environment of a satellite-based, distance education course, please check information covered in the training.

_______ No specific training of this nature was given to students

_______ Use of the interactive system during class sessions

_______ How to contact the instructor outside of class

_______ How to obtain library services

_______ How to obtain computer services (if applicable)

_______ How to obtain tutorial help

_______ Basic study skills in a distance education environment

_______ Other (please identify):____

Comments (optional):

33. What was the approximate cost of the course, per student?

____

Approximately what percentage of the course cost was devoted to the development of course materials?

____________________%

What was the charge to each student?

$____________________ per (check one) _______ course
_______ credit hour

If the charge to the students did not cover the entire cost of the course, how was the difference made up?

Comments (optional):

34. Was the course evaluated at its conclusion?

_____ Yes _____ No

If yes, what factors were evaluated? Check all that apply.

_____ Academic performance of the students

_____ Student attitudes toward the course

_____ Instructor attitudes toward the course

_____ Attitudes of continuing education personnel toward the course

_____ Cost of the course, compared with income from the course

_____ Performance of the delivery system itself

_____ The attrition rate

_____ The degree of success in reaching the target student group

_____ The level of satisfaction of the funding agency, if funding provided by an external organization

_____ The level of satisfaction of the sponsoring organization, such as the students' employer

_____ Other (please identify):_____

If yes, how was this information obtained?

Comments (optional):

35. Was the course instructor a full-time or part-time member of the university's faculty?

_____ Full-time _____ Part-time

Did the instructor volunteer to teach the course, or was he/she appointed by higher authority?

_____ Volunteered _____ Appointed

Did the instructor have any past experience in teaching in a distance education/ instructional telecommunications setting?

_____ Yes _____ No

36. Was special training in teaching by satellite given to the instructor prior to the beginning of the class?

_____ Yes _____ No

If yes, what did this training cover? Please check all that apply.

_____ How to perform in front of a television camera

_____ How to use the audiovisual equipment available

_____ Course design for a distance education setting

_____ Developing learning activities for students in a distance education setting

_____ Managing course activities in a distance education setting

_____ Technical aspects of the interactive system

_____ Use of interactivity as an instructional tool to promote learning of the course content (e.g., use of discussion, questioning techniques)

_____ Understanding needs and expectations of students enrolled in the course

_____ Other (please identify):_____________________________

If yes, who provided the training? Check all that apply.

_______ Faculty colleague(s)

_______ Television/media specialist(s)

_______ Instructional developer(s)

_______ Extension/continuing education specialist(s)

_______ Other (please identify):_______________________________________

Comments (optional):

37. Following is a list of types of institutional support that might be provided to instructors of satellite-based courses. For each, please indicate, on a scale of 1 to 5, the degree of **need** for the support, and then indicate on the same scale the degree to which the support was actually provided by the university.

	Needed					Provided				
	Low				High	Low				High
Additional clerical help	1	2	3	4	5	1	2	3	4	5
Long distance telephone budget	1	2	3	4	5	1	2	3	4	5
Telephone answering service	1	2	3	4	5	1	2	3	4	5
Tutors/teaching assistants	1	2	3	4	5	1	2	3	4	5
Additional postage budget	1	2	3	4	5	1	2	3	4	5
Peer support opportunities	1	2	3	4	5	1	2	3	4	5
Reduced teaching load	1	2	3	4	5	1	2	3	4	5
Recognition in terms of promotion/tenure	1	2	3	4	5	1	2	3	4	5
Additional travel budget	1	2	3	4	5	1	2	3	4	5
Other:_______________	1	2	3	4	5	1	2	3	4	5

Comments (optional):

38. While this course was being conducted, were persons designated at the receiving sites to serve as field support staff?

_______ Yes   _______ No

If yes, in what capacity did they serve? Check all that apply.

_______ Monitored technical aspects of the system

_______ Conducted non-instructional course management activities on-site (e.g., conducted registration, administered examinations)

_______ Conducted instructional activities on-site (e.g., served as discussion leader, supervised group learning activities)

_______ Conducted preparation/review sessions for students

_______ Provided some course content (taught)

_______ Tutored students

_______ Provided counseling or academic advising service

_______ Other (please identify):_______________________________________

Comments (optional):

39. Approximately how frequently did the instructor communicate with the field support staff? Please check one.

_______ Prior to each class period

_______ Weekly

_______ Monthly

_______ Once or twice during the term

_______ As necessary, but not regularly scheduled

_______ Never

Comments (optional):

* *

When you have completed the questionnaire, please return it in the envelope provided. Thank you again for your cooperation. Please do not hesitate to contact me if I can answer any questions regarding the survey. (I will be out of my office on military reserve duty from April 4-15.) Return the booklet to me by April 18 if at all possible, or please contact me as soon as possible after the 18th if there will be a delay.

Michael J. Albright
Coordinator for Instructional Development
Media Resources Center
Exhibit Hall South
Iowa State University
Ames, IA 50011
(515) 294-6039

* *

APPENDIX G

Responses to
Non-National Technological University Questionnaire

Responses to
Non-National Technological University Questionnaire
(N = 9)

1. Your institution:

   A complete list of respondents may be found in Appendix H.

2. Please indicate your university's degree of involvement with satellite-based instruction. For each of the academic years identified below, please write in the number of credit courses, meeting the criteria specified above, offered by your university. Remember, courses offered in conjunction with the National Technological University should not be included.

Prior to 1980-81 (0)	1980-82 (0)
1982-84 (0)	1984-86 (28)
1986-87 (40)	1987-88 (74)
1988-89 (planned) (87)	1989-90 (planned) (67)

3. Please provide a brief narrative statement of your university's past experiences with satellite-based instruction.

   (California State Polytechnic University) Cal Poly, Pomona began regular satellite programming in early April 1988 (see attached university courses and Art In-service flyer). The satellite program is an extension of our local microwave network with public schools in the Los Angeles area. The academic departments involved in current satellite broadcasts are the Art Department and all the departments in the College of Engineering. In addition, we are working with the Chemistry and Biology Departments for next year's courses.

   (University of New Mexico) Currently, the university is delivering courses in nursing, insurance, and legal education by satellite. We have had very good support from everyone. All is well if the remote student is willing to pay the prorated delivery fee.

   (California State University, Chico) Beginning in Fall 1984, CSU, Chico began broadcasting, live via satellite, courses leading to the Master's Degree in Computer Science to corporate sites throughout the United States.

These courses are regular, on-campus courses being televised live in a special studio classroom. Students at the receiving sites can telephone the professor during the lecture to ask questions and to interact with the on-campus students.

Beginning with Hewlett-Packard, the program has expanded to include Texas Instruments, the Naval Weapons Center at China Lake, California, the Bently Nevada Corporation, Alcoa Laboratories, MCI, General Dynamics, Pacific Bell, and the Grass Valley Group.

Five computer science courses are offered each semester. Although the schedule of courses does lead to the M.S. degree, professionals do not have to be admitted to the M.S. program to take the Chico courses. Individuals choose classes according to their own professional growth and development plans.

(Iowa State University) Credit coursework has been offered by the Computer Science department and the College of Agriculture. Needs assessments for satellite coursework have been conducted, and program ideas discussed, for the Colleges of Education & Business Administration and the Department of Foreign Languages & Literatures. In addition, our College of Engineering participates in satellite instruction through the Nat'l Tech University (NTU). Some programs originally considered for satellite are now being offered by videotape (e.g., Comp Sci, MBA, some Ag classes).

(Texas Tech University) Texas Tech University and the Univeresity of Houston at Clear Lake participated in a (K-12) teacher in-service course, satellite-delivery pilot project -- co-sponsored by the Coordinating Board, Texas College and University system, and the TI-IN satellite network -- in the fall semester of 1986. Each school offered a graduate teacher education course to 110 public school downlink sites. These courses were presented in the TV studios of the Region XX Educationaal Service Center in San Antonio, Texas. They were "delivered" to the R/O sites through the San Antonio uplink facilities of the TI-IN network. The Tech course was "Models of Teaching (EDSE 5335)."

(Eastern Washington University) History Dept. -- Japan and the Pacific Rim Countries; Education Dept. -- Introduction to Thinking Skills; Psychology Department -- Stress Management; Speech Communication -- Critical Thinking Skills; General Studies -- Portfolio Development; STEPS Project with Educational Service District 101; BA Degree in General Studies for Fire Science Personnel.

(Virginia Polytechnic Institute and State University) The graduate engineering televised project is in its fifth year. We used microwave and ITFS before going satellite. All classes originate in specially designed electronic classrooms and are live with one way video and two way audio. All courses have been at the graduate level in engineering -- electrical, mechanical, industrial, civil, aero, and systems. Students have been pleased with the program, several have graduated with most of their work by TV, and faculty have been very cooperative. We have many fewer technical problems with satellites than with microwave.

4. If your university has future plans for satellite-based courses, would you please describe them here?

   (California State Polytechnic University, Pomona) In general, we see ourselves as program developers and providers, and would like to get out of the network management business. We would hope to affiliate ourselves with a larger consortium, which would handle the logistics of receiving equipment, interaction with site coordinators, etc. Unfortunately, at the moment, we are doing it all.

   (University of New Mexico) (1) Scarce courses for secondary schools in language and math; (2) Star School activity; (3) Specialized data transmission.

   (California State University, Chico) Discussions have begun regarding adding degrees at the bachelor's level in both computer science and electrical engineering.

   (Iowa State University) The College of Agriculture's new off-campus bachelor's degree in ag program is and plans to continue using satellite delivery for some coursework. Since that college also offers a Masters of Ag, the courses most likely to be delivered by satellite are those carrying both upper division undergrad and grad level credit; that way there is a sufficient audience to justify use of satellite.

(Texas Tech University) The Texas Tech Health Sciences Center (TTU HSC) plans to have its four campuses -- in El Paso, Amarillo, Odessa, and Lubbock -- connected with an inter-active (audio and video) satellite television network during the 1988 fall semester.

Each campus will have its own Ku-band, compressed video, uplink and downlink facilities. This will provide highly efficient patient consultation and sharing of other learning and health care activities. The Ku-band, compressed video provides the means to safeguard confidentiality and control all access to the network.

The TTU HSC's School of Nursing probably will be the first to offer courses, for credit, on this interactive telenetwork with a course originating on the campus(es) having the specialization or greatest academic strengths in the subject area(s) being presented. In some cases, all four campuses may participate equally in presenting a course. Each off-campus, receive-only site will require an addressable receiver in addition to the normal Ku-band, compressed-video, downlink equipment.

Excess time on the HSC telenetwork will be sold to other TTU colleges/schools, departments and Division of Continuing Education, and appropriate off-campus organizations for academic and other communication projects.

(Eastern Washington University) We are, of course, working on many different individual courses that can be economically feasible over the satellite technology. Primarily, we are working on refining our BA degree in General Studies for Fire Science Personnel and are finishing our groundwork for a Master of Arts Degree (MAT) in Education for rural educators.

(Virginia Polytechnic Institute and State University) The graduate engineering courses will be continued. An MBA series will begin in 1989. Courses in foreign languages, education, and agriculture are being discussed.

5. Generally speaking, in what geographical areas have you attracted students for your satellite courses?

   Within own state only (4)
   Within own state and adjacent states (3)
   Regional (e.g., Southeastern U.S.) (1)
   National (1)
   Geographic distribution has varied (0)

   Comments:

   -- Most students have been in Virginia. We also have students in Tennessee, Pannsylvania, New York, Maryland, Illinois.

   -- Our engineering degree programs are made available to out-of-state industries only if they are primarily a Virginia employer or have a substantial relationship with the University, principally in terms of research contracts. We have not marketed any of our courses outside Virginia and do not permit them to be offered out-of-state exept in special circumstances. We feel this is necessary for quality control and to maintain the fully interactive nature of our systems.

6. [Question 6 solicited names of other universities with experience in using satellites for credit course delivery. All universities listed had either already been identified or were found not to have uplinked credit courses.]

7. Please provide basic information about this course.

   Academic department:
   - Computer Science (2)
   - Secondary education (1)
   - Electrical engineering (1)
   - Nursing (1)
   - Physics (1)
   - Art (1)
   - Extended Learning (1)
   - Food and Nutrition (1)

Credit hours:
- 3 credit hours (5)
- 4 credit hours (2)
- N/R (2)

Enrollment:

35	70	148	174	N/R (1)
65	106	13	34	

Number of receiving sites:

13	17	7	7	N/R (1)
16	53	4	5	

8. What were the primary considerations in selecting a satellite-based system for delivery of the course?

   The need to reach a wide geographical area (7)
   The need to reach a large number of students (7)
   The frequency of the class meetings (1)
   The timeliness of the educational material (3)
   The need for visualization of the educational material via a video medium (2)
   Specific request from the target student group (5)
   Efficient use of the instructor's time (3)
   The cost-effectiveness of a satellite-based system vis-a-vis a terrestrial system (4)
   The non-availability of a suitable terrestrial system (3)
   The need for interactivity between the students and instructor (5)
   Interest in using an emerging distance education technology (7)

9. How was it determined that the course was needed by the target student group?

   Specific request from the target student group (3)
   Course part of established degree program (5)
   Perception of academic department or instructor (3)
   Formal needs assessment (3)

Comments:

-- A representative group of secondary physics teachers was brought in residence the preceding summer and assisted in the needs assessment and planning for the course.

-- Schools specifically wanted entry-level university courses from a 4-year California institution.

Please estimate the level of commitment to satellite-based instruction on the part of each of the following administrators, in the case of the course being described.

Department chair
High (8), Modest (1), Low (0), Indifferent (0)
Unknown (0)

School/college dean
High (4), Modest (1), Low (1), Indifferent (0)
Unknown (0)

VP for academic affairs/provost
High (6), Modest (2), Low (1), Indifferent (0)
Unknown (0)

President
High (3), Modest (3), Low (0), Indifferent (0)
Unknown (3)

Dean/director of continuing education
High (7), Modest (2), Low (0), Indifferent (0)
Unknown (0)

Comments:

-- The program is managed by an Associate Dean of Engineering and the Director of Distance Learning (formerly with the LRC), who handle logistics, curricular, and technical matters and are the best advocates of the program.

-- We are at the threshold of really getting involved.

-- We are fortunate here at Cal Poly to have had initial positive experiences with distance learning. The President is getting a lot of good PR, and the faculty are getting $ and enjoying themselves.

11. Please check each of the professionals who made a significant contribution to the development, delivery, or evaluation of the course.

    Course instructor (9)
    Other content specialist (3)
    Television producer/director (8)
    College teaching specialist/instructional developer (2)
    Graphic artist (2)
    Instructional computing specialist (0)
    Continuing education specialist (4)

    Comments:

    -- We are a small operation, provide limited instructor training and course redesign, and depend on very good instructors who deliver great (traditional) courses.

12. Did the individuals checked in item 11 above have regular meetings during the development and delivery of the course?

    Yes (4), No (5)

    If yes, approximately how often?

    Weekly
    Once (1 hour)
    2 per semester
    Once a month

13. Were specific learning objectives established for the course?

    Yes (8), No (1)

    Were prospective students consulted before the objectives were established?

    Yes (2), No (6)

Were the objectives provided to the students in print form?

Yes (5), No (2), N/R (1)

14. Please check the applicable learning setting.

Students viewing independently, with no organized group activities (3)

Students viewing independently, with occasional organized group activities (0)

Students viewing regularly in groups (8)

Comments:

-- Depends on the view site and number of students.

-- Some sites had only one or two students.

-- All courses are delivered to electronic receive classrooms designed for this purpose.

-- Small groups (1-10) watch at rural schools.

15. What was the primary means of providing course lectures to the receiving sites?

Live lecture delivered by satellite (6)

Lecture videotaped by your university, videotape transmitted by satellite (0)

A combination of live and videotaped components (3)

Comments:

-- Some students who are remotely situated are receiving their classes entirely by videotape.

16. In your estimation, approximately how many of the lectures were actually viewed by students as they were transmitted, as opposed to being videotaped at the receiving sites for viewing at some other time?

    Pretty much all of them (7)
    More than half, but not all (1)
    About half (1)
    Less than half, but some (0)
    Probably not very many, if any at all (0)
    Not known and cannot estimate (0)

    Comments:

    -- Not all receiving dishes were in place on time.

17. Please rank, in order of importance, each of the following means of providing the course content to students. 1 = most important, 2 = next most important, 3 = least important, N/A = not applicable. For example, if the video lectures were the most important means for providing course content, with the text in a supplemental role, mark lectures with a "1" and text with a "2". If two or more were of equal importance, assign the same number to each.

    Lecture delivered by satellite (either live or by tape)
    1 (9), 2 (0), 3 (0)

    Course text/other reading materials
    1 (3), 2 (6), 3 (0)

    Computer-based learning system
    1 (0), 2 (0), 3 (2), N/R (7)

    Other:

    -- Special demonstration segments and visits to research labs (rated "1")

    -- Supplemental materials were sent (examples of vitas, etc., that weren't in the textbooks nor could they be adequately shown on the TV (rated "1")

18. Please check those instructional techniques used by the instructor during preparation for and delivery of the course.

Input from students/prospective students was used to help determine the course content (2)

Past life experiences of students were solicited and related to learning of course content (3)

As it was being presented, course content was routinely related to possible applications in the students' personal or professional lives (7)

Advanced organizers, in the form of a comprehensive course schedule, content outline, or course objectives, were provided to students at the beginning of the course (6)

Students were given opportunities to apply the newly-learned information through on-site learning activites (e.g., homework, group activities), with feedback provided (7)

Comments:

-- Because our courses are regular on-campus credit courses also, we don't make significant changes because they are being offered to corporate students.

-- This course required students to do homework on a computer.

-- This was the first course in which we also used adjunct faculty from other institutions at each distant location.

19. Please indicate approximately how often course content was visualized to students using instructional media incorporated into the lectures. Use the following guide: 0 = never, 1 = once or twice during the course, 2 = monthly, 3 = weekly, 4 = most class periods, 5 = cannot be determined.

Overhead transparencies
0 (0), 1 (0), 2 (0), 3 (2), 4 (5), 5 (1), N/R (1)

Photographs/slides
0 (3), 1 (1), 2 (0), 3 (0), 4 (4), 5 (0), N/R (1)

Computer output
0 (3), 1 (1), 2 (0), 3 (2), 4 (0), 5 (1), N/R (2)

Film/videotape produced specifically for this course
0 (4), 1 (0), 2 (2), 3 (1), 4 (1), 5 (0), N/R (1)

Film/videotape produced for another course/purpose
0 (3), 1 (1), 2 (1), 3 (1), 4 (0), 5 (1), N/R (2)

Comments:

-- Overheads used only when color and multiple layers of chips were described. Most lectures incorporate printed visuals prepared for the camera and picked up from an overhead camera.

-- Our originating electronic classrooms are specifically designed to be operated by a single technician. They include a lot of technology to facilitate instruction. We do not use a "studio approach." The only videotapes we used were in connection with certain demonstrations and for visits to faculty research laboratories.

20. If film or videotapes were produced specifically for this course, who produced them?

The course instructor (2)
Another faculty member (1)
Media/video specialist in the instructor's own department/college (2)
Media/video specialist in campuswide or Extension media/ITV center (5)
Production source in industry (0)
Independent producer (0)

21. What role, if any, did your campuswide or Extension media/ITV center play during the development, delivery, and evaluation of the course?

Provided instructional design consultation (4)

Produced instructional materials incorporated into the lectures (3)

Produced instructional materials sent directly to students for their use at the receiving sites (other than by satellite (2)

Provided/operated the video production facility in which the video portion of the course (that portion uplinked) originated (7)

Provided/operated the uplink facility itself (7)

No significant role was played by the media/ITV center (2)

Does this center serve the entire campus, or just Extension/continuing education?

Entire campus (6)
Extension/continuing education (1)
N/R (1)

What is the name of this center?
KTXF-TV
Regional R-TV Production Center
Learning Resources Center
Department of Telecommunications and Instructional Resources
Instructional Media Services
N/R (2)

22. Would you say that adequate time and resources were allocated for the development of course materials?

Time:	Yes (7), No (2)
Resources:	Yes (7), No (2)

Comments:

-- Faculty can take advantage of media facilities and resources as much as they like.

-- The production facility was responsible only for the technical production of ITV materials. The College of Ed was responsible for design and content.

-- It is unfortunate that we are under funded to operate the uplink facility. Because of the money structure, we are forced to place courses and degree programs on the air without what I consider adequate time (two or three quarters before air time) to prepare course materials and design.

-- All course materials were produced by the academic department for this course.

-- We use a very conservative model for these courses, The instructor simply teaches his or her regular course, utilizing a few specialized graphics -- What schools in California seem to be looking for is for the college experience, the way courses will be when they enter a university.

23. Were formative evaluation procedures (i.e., tryouts, evaluation, revision) conducted during the development of course materials?

    Yes (2), No (7)

24. Was information collected while the course was in progress and used to improve the course prior to its conclusion?

    Yes (6), No (3)

    If yes, please explain what information was collected and what improvements were made as a result.

    -- Courses are evaluated according to normal University evaluation criteria and questionnaires.

    -- Adaptation of teaching style to be more communicative over the one-way TV medium.

-- Student feedback to the instructor and grad assistants via phone, between classes. Departmental and Office of Continuing Education conversations with local site facilitators. Changes: faster turn-around time on written assignments being graded and returned to students.

-- Evaluative device was constructed and mailed following first program.

-- Instructor used homework assignments to make changes. Also looked at tape of his teaching as a means of improving presentation techniques.

-- It primarily involved feedback from on-site adjunct faculty. It ranged from whether or not students were grasping and understanding information or needed further explanation to logistical matters such as allowing enough time for problem-solving in local wrap-around segments. It also involved responding to student requests for other materials that would assist them in their own teaching.

-- Ongoing evaluation and problem discussion using phone and special forms.

-- We hold regular audio teleconferences with participating schools (instructor absent) and then provide feedback to the instructor.

25. If the course was taught by a "live" instructor (e.g., not videotaped), was the satellite delivery system set up with a two-way audio communications capability so that the students and instructor could interact during the satellite transmissions?

    Yes (9), No (0)

    If yes, was the system set up so that students could interact with students at other sites?

    Yes (6), No (3)

Comments:

-- Call-in audio only. TA's fielded the calls and ran questions in to the instructor.

-- We use a small audio bridge of allowing three sites to interact with the professor or each other.

-- Interaction is through the studio, so everyone hears everyone else.

26. If the response to either question in item 25 was "yes," please estimate how frequently each of the following activities involving interaction occurred during the course. Use the following guide: 0 = never, 1 = less than weekly, 2 = weekly, 3 = every class period.

The instructor tried to initiate discussion with students during the satellite broadcast
0 (0), 1 (2), 2 (0), 3 (7)

Students participated in instructor-initiated discussion during the satellite broadcast
0 (1), 1 (1), 2 (1), 3 (6)

Students initiated interaction with the instructor during the satellite broadcast
0 (1), 1 (0), 2 (1), 3 (6)

Students interacted with students at other receiving sites during the satellite broadcast (N = 6)
0 (2), 1 (1), 2 (2), 3 (1)

27. Do you feel that the level of interaction during the satellite broadcasts approached the level that might have been expected had the students been physically present in the instructor's classroom?

Yes (2), No (7)

Do you feel that instructor interaction with off-campus students is important during the satellite broadcasts?

Yes (9), No (0)

Comments:

-- Depends on the content being taught and the instructor's teaching style.

-- While there is not a heavy number of questions asked, the fact that they can do it is important.

-- Because adjunct faculty were available on-site to answer questions, there may have been less interaction than otherwise with the primary instructor.

-- The instructor is the key element to maintain student interest.

28. How were the students evaluated?

Exam(s) administered at the receiving site by field support staff (7)

Most or all students met at centralized testing site for administration of course exam(s) (0)

Exam(s) administered on-site on an individual basis under the supervision of a trustworthy person serving as monitor (1)

Take-home exams completed by students and mailed to the grader (3)

Students evaluated through testing via a computer network (1)

Grades given to homework assignments, term papers, and/or other student work (8)

Were any significant problems encountered related to evaluation of students?

Yes (1), No (7), N/R (1)

29. Were on-campus students enrolled in the same course, being taught simultaneously with the off-campus students?

    Yes (6), No (3)

    If yes, do you believe that the course was able to maintain the same academic rigor for the off-campus students as it did for the on-campus students? (N = 6)

    Yes (6), No (0)

    Comments:

    -- Same course as taught on campus.

    -- In terms of the course, yes. However, off-campus students not held to as high admittance standards as campus students in this particular degree program.

30. Please check the student support services that the students in this course had available to them to an equivalent degree as on-campus students enrolled in the same course.

    Academic library (3)
    Computer services (1)
    Bookstore services (7)
    Opportunities for peer support (6)
    Student counseling services (2)
    Tutorial services (2)
    Academic advising (6)

    Were any special problems encountered regarding student services?

    Yes (2), No (6), N/R (1)

    Comments:

    -- With getting books on time, with library and counseling.

    -- Convenient access to faculty. It is difficult to reach your advisor by phone when you work all day.

31. What kind of system was established to provide a point of personal contact for each student?

Each student was able to obtain help from field support staff on-site (4)

Each student was assigned a tutor or teaching assistant at the university or regional location to contact for help (0)

Each student was encouraged to contact the instructor for help whenever necessary (9)

A toll-free telephone number was provided for student use on contacting university personnel (5)

No specific system for personal contact was provided (0)

32. If students were given specific training in how to learn effectively within the environment of a satellite-based, distance education course, please check information covered in the training.

No specific training of this nature was given to students (4)

Use of the interactive system during class sessions (3)

How to contact the instructor outside of class (5)

How to obtain library services (3)

How to obtain computer services (if applicable) (1)

How to obtain tutorial help (1)

Basic study skills in a distance education environment (1)

33. What was the approximate cost of the course, per student?

$548	$200	$400	$700	N/R (2)
$180	$1,300	$411		

What was the charge to each student?

$119/course	$300/course
$400/course	$45/credit hour
$600/course	$411/course
$0	N/R (2)

If the charge to the students did not cover the entire cost of the course, how was the difference made up?

-- Usually companies pay entire fees.

-- Formula funding from the state provided approximately $300 per student. We also had a $15,000 grant from a private foundation.

-- This program is funded by the state to pay costs of instructor, satellite.

-- The course was supported primarily by a "Funds for Excellence" grant as well as support by the academic department and college, which included payment of tuition for students.

-- TV station donated studio time; Extension admin picked up uplink rental; Cont Ed covered rest of the loss out of revenues from previous projects.

34. Was the course evaluated at its conclusion?

Yes (8), No (1)

If yes, what factors were evaluated? (N = 8)

Academic performance of the students (7)

Student attitudes toward the course (8)

Instructor attitudes toward the course (7)

Attitudes of continuing education personnel toward the course (2)

Cost of the course, compared with income from the course (2)

Performance of the delivery system itself (8)

The attrition rate (4)

The degree of success in reaching the target student group (3)

The level of satisfaction of the funding agency, if funding provided by an external organization (1)

The level of satisfaction of the sponsoring organization, such as the students' employer (2)

If yes, how was this information obtained?

-- Since this was our second course in this new degree program and no. of students and sites was small, we used telephone calls to collect attitudinal data.

-- A pre-printed computer sheet sent to all distance students, not given to on campus students.

-- From personal interviews and a conference of all of the faculty at the distant sites with the primary faculty. Also, a follow-up, satellite broadcast, evaluative session was conducted about ten months later during which the faculty had an opportunity to discuss with the students how they had incorporated information and materials from the course in their teaching.

-- An external evaluation team has a questionnaire that is completed by the students and info compiled.

-- Two separate evaluation forms were used. One for instructor and course evaluation (developed by the delivering department and one for instructional and course delivery (developed by the Instructional Media Center).

-- (a) formal survey (written); (b) informal interviews with students; (c) observations by instructr; (d) technical personnel evaluated the equipment, service, and organization of services.

35. Was the course instructor a full-time or part-time member of the univesity's faculty?

    Full-time (8), Part-time (1)

    Did the instructor volunteer to teach the course, or was he/she appointed by higher authority?

    Volunteered (3), Appointed (5), N/R (1)

    Did the instructor have any past experience in teaching in a distance education/instructional telecmmunications setting?

    Yes (4), No (5)

36. Was special training in teaching by satellite given to the instructor prior to the beginning of the class?

    Yes (9), No (0)

If yes, what did this training cover?

How to perform in front of a television camera (7)

How to use audiovisual equipment available (9)

Course design for a distance education setting (3)

Developing learning activities for students in a distance education setting (2)

Managing course activities in a distance education setting (2)

Technical aspects of the interactive system (8)

Use of interactivity as an instructional tool to promote learning of the course content (7)

Understanding needs and expectations of students enrolled in the course (4)

If yes, who provided the training?

Faculty colleagues (2)
Television/media specialist(s) (6)
Instructional developer(s) (3)
Extension/continuing education specialist(s) (2)
Other (2)
- TI-IN personnel (1)
- Personnel from Distance Learning Center (1)

37. Following is a list of types of institutional support that might be provided to instructors of satellite-based courses. For each, please indicate, on a scale of 1 (low) to 5 (high), the degree of need for the support, and then indicate on the same scale the degree to which the support was actually provided by the university.

Additional clerical help (N/R = 1)
Needed 1 (0), 2 (1), 3 (2), 4 (3), 5 (2)
Provided 1 (0), 2 (2), 3 (4), 4 (0), 5 (2)

Long distance telephone budget (N/R = 1)
Needed 1 (0), 2 (1), 3 (1), 4 (3), 5 (3)
Provided 1 (0), 2 (1), 3 (2), 4 (2), 5 (3)

Telephone answering service (N/R = 2)
Needed 1 (2), 2 (0), 3 (1), 4 (1), 5 (3)
Provided 1 (2), 2 (1), 3 (2), 4 (1), 5 (1)

Tutors/teaching assistants (N/R = 2)
Needed 1 (1), 2 (0), 3 (1), 4 (3), 5 (2)
Provided 1 (3), 2 (0), 3 (1), 4 (2), 5 (1)

Additional postage budget (N/R = 1)
Needed 1 (2), 2 (0), 3 (1), 4 (2), 5 (3)
Provided 1 (1), 2 (1), 3 (0), 4 (2), 5 (4)

Peer support opportunities (N/R = 2)
Needed 1 (0), 2 (1), 3 (2), 4 (2), 5 (2)
Provided 1 (1), 2 (0), 3 (4), 4 (2), 5 (0)

Reduced teaching load (N/R = 2)
Needed 1 (1), 2 (0), 3 (0), 4 (2), 5 (4)
Provided 1 (5), 2 (0), 3 (0), 4 (1), 5 (1)

Recognition in terms of promotion/tenure (N/R =21)
Needed 1 (1), 2 (0), 3 (1), 4 (1), 5 (4)
Provided 1 (5), 2 (0), 3 (2), 4 (0), 5 (0)

Additional travel budget (N/R = 1)
Needed 1 (2), 2 (2), 3 (1), 4 (2), 5 (1)
Provided 1 (3), 2 (1), 3 (1), 4 (2), 5 (1)

was being conducted, were persons
receiving sites to serve as field

)

apacity did they serve? (N = 8)

anical aspects of the system (8)

-instructional course management
-site (e.g., conducted registration,
examinations) (6)

ructional activities on-site (e.g.,
ussion leader, supervised group
ities (1)

aration/review sessions for

course content (taught) (0)

ts (0)

eling or academic advising service

frequently did the instructor
he field support staff?

s period (0)

ng the term (1)
not regularly scheduled (5)

APPENDIX H

Responding Institutions

Responding Institutions

National Technological University (NTU) Consortium Members

Arizona State University
Boston University
Colorado State University
Illinois Institute of Technology
Iowa State University
Michigan Technological University
North Carolina State University
Northeastern University
Oklahoma State University
Purdue University
University of Alaska
University of Arizona
University of Idaho
University of Kentucky
University of Maryland
University of Massachusetts
University of Minnesota
University of Missouri-Rolla
University of South Carolina
University of Washington
University of Wisconsin-Madison

Responding Institutions Not Affiliated with the NTU

California State Polytechnic University, Pomona
California State University, Chico
Eastern Washington University
Iowa State University (Note 1)
Pennsylvania State University
Texas Tech University
University of New Mexico
University of Virginia
Virginia Polytechnic Institute and State University

Note 1: Iowa State University has uplinked both NTU and non-NTU courses.