A DESCRIPTIVE STUDY OF THE PHYSICS BY SATELLITE PROGRAM AND ITS IMPACT ON RURAL OKLAHOMA SCHOOL DISTRICTS

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CHAPTER I

INTRODUCTION

Students flow from hallways into classrooms, doors close, a bell rings, and another school class period begins. This routine goes on, six or seven times a day, 175 days each school year. Without much alteration, we see essentially the same thing occurring in schools throughout Oklahoma: a teacher standing or sitting in front of a room with 20 to 30 desks, arranged in rows of five or six. Each student opens a textbook, arranges, prepares paper and pencil, and awaits the teacher's lecture. Roll is taken and class begins.

But, this particular classroom is different. A television is placed in a prominent position. The classroom teacher is neither certified nor totally prepared to "teach" the lesson for the day. The lesson instead will be taught by a professor from a modern physics laboratory at Oklahoma State University, over 130 miles away. The professor's name is Dr. Peter Schull, and he is the "real" teacher of this class.

The television set is turned on and the satellite receiver is fine-tuned. At 11:00 a.m., Dr. Schull's image appears on screen and the eight students focus their attention on the television. Dr. Schull introduces the host school (for this lesson, students from the Olive Public Schools have been bused to Oklahoma State University to attend the lesson in the television studio). He gives an update on past assignments and presents the homework assignment for the upcoming lesson. Music of Bach is being played in the background as the students write down details of the assignment.

The professor begins by stating the topic of today's lesson: resonance and frequency. Dr. Schull writes with colored markers on a table-mounted marker board and the words are projected on the T.V. screen in various colors. The colors are used to indicate different emphases as the professor develops the lesson. Dr. Schull gives definitions that are to be used in today's lesson for terms which might be new to the students. The studio is equipped with a demonstration table which is located near the speaker's area and which was arranged by a graduate assistant with visual aids for use as the lesson progresses. On the demonstration table are several wooden organ pipes. Dr. Schull uses these to illustrate the length of the tube and the pitch that each pipe will make.

Twice in the lesson Dr. Schull breaks to a prepared video, from a professor of physics at the University of California at Los Angeles (U.C.L.A.), which aids in developing the lesson. One demonstration of resonance uses a rapidly rotating solid metal wheel which has holes positioned around the wheel. Air is forced through the holes as the wheel turns and the spacing of the holes creates a sound as the air is forced through them. The second video demonstrates frequency through the use of a set of tuning forks and a sounding board of piano wire. Small plastic tabs are placed on the piano wires. The tuning forks are struck and placed in contact with the wires. The wires vibrate only when the tuning fork frequency matches the pitch of the piano wire. At this point, Dr. Schull breaks to a film segment, "The Collapse of the

Tacoma Narrows Bridge, 1940." This is used to strengthen the understanding of the topic. One of the students in the classroom blurts out, "That's awesome!" as the bridge vibrates in a rhythmic fashion and finally collapses.

Twenty minutes into the lesson, Dr. Schull takes a short break for students to catch up with their notes. The break is accompanied by Bach music.

Dr. Schull returns and begins a question and answer time with the six students present in the studio. The questioning techniques are directed toward leading the studio class through the lesson and in so doing will also lead the remote classes through a series of questions and answers. The local classroom facilitator asks for questions from his students, making sure the students understand the assignment before the bell rings to dismiss the class.

During the class sessions, telephone messages may be exchanged between the home school and the production center. These telephone contacts are manned by graduate assistants who may answer the questions directly or refer them to Dr. Schull. There is also a telephone "hot-line" for contacts that need to be made after the sessions are over. All tests and homework assignments are graded using the "Electronic Mail" service which is provided with the total program.

The structure of the program is enhanced with the use of microcomputers and prepared software packages. These programs are designed for the Apple IIc and IIe computers and are recommended for use with satellite programs. Also accompanying the total program is a pre-designed lab kit to be used in the home school laboratory. Students and the classroom facilitator use these aids weekly to help in homework and lab assignments.

Background

Education is big business. When any federal agency reaches cabinet level in political importance, when it claims a substantial share of each state's budget, it is big business. Philosophically, education should be big business. It has always held great importance in the American society. Its impact on individual lives is almost impossible to measure.

As our society continues to grow more complex, to introduce change after change, the pressure and reliance on education grows greater and greater. This period of complexity, rapid change, and greater abundance of and reliance on knowledge requires a new approach to the use of educational technology. While this technology is expensive and difficult to introduce into schools, the one-room schoolhouse of the turn of the century has been replaced in many areas by schools with extensive learning centers, computer enhanced courses, science laboratories with high-tech equipment, and specialty programs for students with widely varied interests and abilities.

There are, however, problems of distance, sparsity, and unequal funding that hamper small and rural schools. In the competitive rush to hire exemplary teachers, rural schools can find themselves left behind their urban counterparts (Hofmeister, 1984). Because of the low enrollment and consequent high costs per student of small school districts, difficulties may be encountered in hiring specialized teachers in areas such as physics and foreign languages.

The use of technology is one means of attempting to assist in providing a quality educational program for students in rural schools. The topic of quality was a central issue in the consolidation of schools that took place in the 1960s and is still a major concern in Oklahoma today.

> Unlike the old style consolidation, ones that have lined county roads with vacant schoolhouses, technological consolidation appears to be the hope for the marginal and small schools. It is one of the strongest solutions available for letting even the poorest and most remote school educate its own Rhodes Scholar (Mercer, 1988, p. 8).

The state legislature has attempted to provide solutions that would give all students in Oklahoma access to a quality education. One measure of that quality educational program would be exposure to as wide a variety of courses as possible. Technology is a vehicle through which Oklahoma Secretary of Education, Sandy Garrett, has sought to implement such exposure (Folks & Garrett, 1988).

In 1985, school districts in Beaver County, Oklahoma, began using the first satellite-based high school-oriented distance learning system in Oklahoma. The teacher was Harry Wohlert, an Oklahoma State University German professor who was located 226 miles from his students and their classrooms (Folks & Garrett, 1988). According to the Teleconference Program Coordinator, Leigh Walters, in 1988-89 there were 232 schools online with the Oklahoma State University Arts and Sciences Teleconferencing Service (A.S.T.S.) programs in 18 states. The course offerings have grown from that single German course to include a second year of that language, a physics course, Advanced Placement (AP) calculus-trigonometry, and American government. Russian, AP chemistry, and basic English are to be added in the fall of 1989 (Walters, 1989).

This is a substantial increase over the 101 schools in six states which participated in 1987.

Those rural educators close to this technology have made supportive statements about the impact. Teachers who serve as facilitators have reported that "the programs are a blessing for small schools" and "it provides experiences the students would not otherwise have" (Weakland 1987).

However, there are other educators who have expressed concerns about the quality of this alternative style of learning.

> Given a reasonably favourable situation, a pupil will learn from any medium--television, radio, programmed instruction, films, filmstrips or others. In general, the same things that control the amount of learning from a teacher, face to face, also control the amount of learning from any educational media. These include relevance and clarity of the content, individual ability, motivation to learn, attention, interest in subject, respect and affection for the teacher, replication of central points and rehearsal by the learner (Schramm, 1977, p. 22).

Schramm has pointed out that there are more crucial issues than which medium of delivery is being used, issues such as instructional strength of the material, appropriate objectives that match the type of delivery system, and student access to resource materials. Critical theorists point out that as technology-based instruction increases a dehumanizing factor develops that causes a less personal approach to learning. Also, expressed is the concern for those charged with the responsibility of providing the classroom environment. Their duties would be reduced to that of housekeeper and classroom monitory.

Whether in a classroom or at home, with a teacher present or visible only on a screen, learning programs need to be evaluated on the procedures, the process, and the content. Those in education are acutely aware that many procedures and processes are non-productive because the delivery systems involved are not effective. Instructional programs, whether they be instructional in the traditional sense or learning by some sophisticated, modern and sometimes futuristic means must be reviewed to determine if the stated procedures, processes, and content are being followed and if the stated goals are being met.

Distance learning has changed since its inception. Today many states and countries are using these concepts in developing learning situations in which the learner and the teacher are separated by some amount of distance. Each alteration or change in the delivery has brought a new phase and a new generation of tools and techniques to be used in distance learning.

Statement of the Problem

The general problem of this study was to determine if the Oklahoma State University Arts and Sciences Teleconferencing Service (A.S.T.S.) physics course met the needs and expectations of students, facilitators, and administrators in rural schools of Oklahoma.

The specific problems of this study were to determine: the decision process administrators used for implementing the program in their schools; differences that might exist in perceptions of high school principals, facilitators, and students who were exposed to the A.S.T.S. physics program; the effectiveness of the mechanics of the program (computer assistance and software, lab kit, time scheduling, certification of facilitator); and students' reasons for enrolling in a course of this type and their attitudes toward the total satellite concept.

To accomplish this the following research questions were developed:

1. What opportunities did this method of instructional delivery provide that were not already provided through more conventional means?

2. Was there a generally stated need to expand course offerings through this type of distance learning system?

3. Has this program fulfilled the needs as proposed by the A.S.T.S. program in physics?

4. What were the reasons the physics program was implemented in the participating districts?

5. What impact has the physics program had on the curriculum in rural schools?

6. Do the mechanics (scheduling, delivery of the computer and lab experiences, etc.) of the physics program need to be reviewed?

7. What impact has the local classroom facilitator had on the program?

8. Could rural schools implement the suggested "college core curriculum" without this type of instructional delivery?

9. Is the distance learning approach, using A.S.T.S., an acceptable alternative method for offering the college core curriculum to students in rural schools of Oklahoma?

Significance of the Problem

"The problem of offering a broad and varied curriculum is one of the most frequent concerns associated with small and rural schools" (Barker, 1987c, p. 3).

In 1987, America had 15,144 public high school districts, 7,329 or 48% of which were considered rural. Many states had an even higher percentage of rural schools. For example, Texas had 1,150 independent school districts of which 66% had fewer than 650 students enrolled (Barker, 1987a). Oklahoma is another state with a majority of its high school districts defined as rural. Rural schools are defined in Oklahoma as those having a student population of 800 or less. In 1989 there were 609 school districts in Oklahoma of which 477 were at or below the 800 enrollment level. This is 78% of the total school districts in the state.

In the financial climate of Oklahoma, many rural schools are hard pressed to provide equity and equality of educational experiences. In the rush to increase curriculum requirements and more stringent college entrance standards, the financial needs of rural schools may have been overlooked. Barker (1987a) and Pease and Tensley (1986) indicated that the satellite-based distance learning system is an acceptable method of overcoming problems of location, size, and financial support unique to so many school districts in rural Oklahoma.

Limitations

Transmission of course material via satellite as an instructional delivery system and A.S.T.S. physics by satellite as a specific course are new for Oklahoma as well as all other participating states. Therefore, any generalizations made from this study will be restricted to only the physics program as described within this research document and will examine only the one instructional delivery system and only the one course. This technology is relatively new and is undergoing constant revisions.

The instrument used in this study was developed by the researcher. It was reviewed by several professional educators in the field of distance learning and was patterned after another study of distance learning in different state (Pease & Tinsley, 1986).

Definition of Terms

Distance Learning - Distance learning involves various forms of instructional delivery in which the educator and the student are not together in the same classroom.

Facilitator - A certified teacher who has been instructed by the Oklahoma State Department of Education in the procedures of the A.S.T.S. physics program and who supervises the classroom activities in receiving districts.

Rural School District - An Oklahoma school district which has 800 or fewer students.

Regular Physics Program - A physics course in which students receive instruction from a certified physics instructor who is present in the classroom.

A.S.T.S. Physics - A physics course in which students receive instruction through satellite-delivered television broadcast and are linked to the Oklahoma State University campus by telephone. This course is provided by the OSU College of Arts and Sciences Teleconferencing Service (A.S.T.S.) and originates from the University's Education Television Service (ETS) campus studio.

College Core Curriculum - A minimum of 22 units of coursework for graduation including: 4 units of English, 2 units of mathematics; 2 units of science; 1 unit each world history, American history, Oklahoma history, fine arts and physical education (Folks, 1988).

Summary

Chapter I has described an Oklahoma rural school physics lesson taught by a university physics professor using the latest technology-based distance learning system. This system, Arts and Science Teleconferencing Service from Oklahoma State University in cooperation with the Oklahoma Department of Education, has been planned to increase course offerings in rural schools. The purpose of this study was to determine if the A.S.T.S. physics course met the needs and expectations of students, facilitators, and administrators in rural schools of Oklahoma.

Chapter II contains a review of the literature, including the development of distance learning through the use of new technologies and studies which have examined the effectiveness of recent distance learning projects. Chapter III presents the methodology to be used in the study and includes the sample and population, instrumentation, and data collection and analysis. Chapter IV contains the results of the survey while Chapter V consists of a summary of conclusions, recommendations, and implications of the study.

CHAPTER II

REVIEW OF RELATED LITERATURE

In the review of the literature on distance learning, particular attention was given to the direction each style of distance learning took as it developed. Also, the purposes and goals of distance learning were reviewed with particular interest given to changes or alterations that were made as more advanced technology became available. This chapter is organized into the following topics: the historical development of distance learning and studies of the effectiveness of distance learning programs.

History of Distance Learning

The concept or term "Distance Learning" has been recently embraced in various parts of the world to describe or illustrate innovative, primarily technology-based instructional delivery systems. The historical development, however, pre-dates these efforts by thousands of years. This chronology closely parallels that of communications technology. Therefore, this review is organized into three segments: print media, audio media, and video media.

Print Media

Plato's teaching, through the written word sent to his followers, was an attempt to transfer educational philosophies to learners located many miles from their teacher (Ruggles et al., 1982). The Apostle Paul used the written word to encourage, train, and teach the followers of Christ. John also wrote to those of his day who were separated from him because of circumstances, "And these things write we unto you, that your joy may be full" (John 1:4). These followers were separated geographically throughout Asia. John also wrote revelations to those that would be separated by time as well as by distance: "Blessed is he that readeth, and they that hear the words of this prophecy" (Revelation 1:3).

As noted earlier, the historical development of distance learning has paralleled the development of technology. Gutenberg's movable-type printing press, developed in the 1500s (Langer, 1972) presented the means of interaction for the participants of correspondence learning (Ruggles et al., 1982).

According to the National Home Study Council, there is evidence of home study programs in the United States as early as 1728 (Valore & Diehl, 1987). However, the concepts of correspondence programming did not develop in Europe until 1856 (Ruggles et al., 1982). Charles Toussaint, a teacher of French, and Gustav Langenscheidt, a member of the Society of Modern Languages in Berlin, worked together to couple the printed text and the mail service. This idea was incorporated in London in 1858 when the University of London became the first major institute of higher education to grant a degree earned through a correspondence program (Ruggles et al., 1982). In 1873, the University of the Cape of Good Hope, South Africa, began the practice of credit by examination (Valore & Diehl, 1987). The University of Chicago, in 1891, was the first in the United States to sponsor a correspondence program, followed in 1906 by the University of Wisconsin, which later developed an extension division specifically for such studies (Ruggles et al., 1982).

British Columbia began using correspondence programs for its widely dispersed population in 1919 (Ruggles et al., 1982). This program expanded to include elementary and secondary education in 1929. The stated purpose was "to overcome the handicap of distance from school and equalization of educational opportunities" (p. 16).

The Home Study Council was formed in 1926 in the United States as an association to promote sound education standards among correspondence schools (Ruggles et al., 1982). One fundamental goal, present in all efforts to provide distance learning, was to recognize "the importance for society to provide individual access to learning" (p. 1).

The use of correspondence courses for the education of secondary and post-secondary students has continued to be a popular option by a large number of universities and other agencies. In the 1940s, the University of South Africa began offering correspondence programs and, in 1951, this school became a correspondence university open to all students in that country (Ruggles et al., 1982).

Thus, as Ruggles and associates (1982, p. 2) noted, "correspondence education has become an accepted educational practice in many countries throughout the world."

Audio Media

The development of distance learning continued to parallel developing technology. In the early 1880s, Heinrich Hertz proved the existence of the hertzian wave or radio wave (Parker, 1983). In 1884, Paul Nipkow patterned a concept that allowed images to be transmitted to another place (Ruggles et al., 1982). While neither of these high technology devices was intended for educational purposes, these devices laid the foundation for more practical applications of distance learning.

The existence of radio waves led to an electrically powered radio which connected households across great distances. Australia has been using radios to promote education in the "outback" for several generations (Hudson & Boyd, 1984). The program, School of the Air (SOTA), began offering educational courses in the "outback" for elementary students who were located hundreds of miles from the nearest schoolhouse (Hosie, 1983). In the 1940s, the Japan Broadcasting Company began broadcasts of educational programs via radio (Ruggles et al., 1982).

During the 1930s, the pliable recording tape and the magnetic recording system made possible a low cost audio-tape player. This development allowed access without broadcast capabilities and information could be replayed at the convenience of the learner. The University of Waterloo, Canada, eventually developed the world's largest catalog of correspondence courses using audio-tapes (Ruggles et al., 1982). This approach was also used in Ecuador by Father Barrigan to create an audio cassette-based educational program called "Radio Mensaje." The University of Wisconsin was the sponsoring school for this project.

Video Media in Foreign Countries

While regular broadcasting of public television began in the United Kingdom in the early 1930s, relatively recent applications of video technology have greatly expanded the opportunities for distance learning. Video media have blended broadcast television, cable and fiber optic transmission lines, satellites, and computers into comprehensive learning programs.

Japan's educational television network began with the program HI-OVIS which coupled television's one-way visual signal with fiber optic cables for two-way audio (Ruggles et al., 1982). One of the stated goals of the project was to "provide increased opportunities for lifelong education" (p. 10). HI-OVIS eventually combined the use of computers, optical transmission lines, and home audiovisual terminals so that programs could be taped and stored in the home for later recall.

In 1976, the Minister of Education in British Columbia initiated the development of a program of distance learning using the latest technology tools, with a goal of reducing or eliminating social and geographic barriers to learning in British Columbia (Ruggles et al., 1982). Following studies which focused on methods of improving the scope and effectiveness of distance learning, the minister in 1979 commissioned implementation of an interactive television micro-wave network. This network was named the "Knowledge Network" and, at a later date, it became part of the Agency for Tele-Education in Canada (ATEC).

The "Cyclops" technology program was developed in the United Kingdom. Its purpose was to connect students in isolated schools with limited course offerings to distant teachers for the purpose of providing a more diverse curriculum (Hudson & Boyd, 1984). In 1981-82, a list of 20 courses was offered in 15 learning centers. Cyclops allowed a teacher to draw or write on an ordinary television screen with a "light pen". The impulse signal was then converted into digital impulses and transmitted over a telephone line. One teacher could instruct from one classroom and provide instruction for students in several distant classrooms. While this was a different approach to distance learning, there were difficulties in implementing the process. As noted by Hudson and Boyd (1984, p. 30), "it works well technically but needs personnel with proper training."

In 1981, the Australian government launched a three-year, $4 million project to provide educational videotapes to homes throughout that country (Hosie, 1983). Each week a selection of school broadcasts would be copied onto tapes and sent to "outback" homes. In 1981-82, there were 106 videocassette recorders and 97 televisions on loan for this program, which involved 272 students. By 1984, this program had grown to 170 families and 327 students.

Also in 1984, Ikipujung Pandang University, Indonesia, began a training program for secondary teachers (Sahide, 1986). These teachers lived in eastern Indonesia, an area where geographical isolation prevented them from attending university classes. A video-based correspondence program was developed that operated from 15 learning centers.

In 1985, the State of Victoria and the State Department of Australia installed two-way radios in 44 remote secondary schools (Conboy, 1986). Computer equipment was also provided, with modems for interaction. This project operated in the Melbourne and Victoria area and began in September of 1985.

Video Media in the United States

While the previous projects indicate a global view through the commitment of leaders in several countries to distance learning, the United States has an equal commitment which was expressed by the National Rural Education Association (1986, p. 3): "to further the improvement of education opportunities for all children in rural areas with additional attention to those for whom opportunities have been severely limited."

The following material contains an overview of the variety of distance learning systems that have developed throughout America. Each system has attempted to utilize current technology and to develop that technology into a model for distance learning. While such earlier media as correspondence courses, radio broadcasting, and audio-cassettes are still being used in distance learning, current American programs are incorporating audio-graphics such as the "Electronic Blackboard" and "Cyclops" (Hudson & Boyd, 1984). Other technology being used in distance learning includes electronic mail and the orbiting communications satellite used to relay educational programs directly to any school with a downlink receiver.

Computers. The merging of the computer with the telephone via a modem has brought a new approach to distance learning (Ruggles et al., 1982). Videotape and videodisc may now be linked to computers for greater capabilities. Coupled with other technologies, computers offer great potential for such teaching efforts.

In 1976, the Minnesota Education Computing Consortium (MECC) linked schools in all sections of the state by computer terminals to a mainframe computer. The state legislature established nine Educational Cooperative Service Units (ECSUs) to develop a relationship between districts for the use of interactive telecommunications (Kissock, 1985). A large library of instructional programs was developed which were available to all schools via computer modem. In the early 1980s, MECC changed the focus from mainframe to microcomputers and became a leading developer and distributor of educational software.

The Mid-Missouri Small School Computer Consortium began operations in the fall semester of 1982. The project involved seven schools in central Missouri with a primary goal of inservice training in computer literacy for teachers. These schools were clustered so that transmission of information was not expensive (Phillips, Nachtiqal & Hobbs, 1986).

Interactive Television. South Carolina Educational Television (SCETV), composed of 10 television transmission stations, as well as six FM radio stations, began using closed circuit television programming to provide a statewide educational network (Hudson & Boyd, 1984). In 1979, SCETV directed 319 teleconferences viewed by 74,000 people. This project produced programming for kindergarten through college-level classes and delivered 176 television lessons on a typical school day.

In 1980, a Minnesota distance learning program began using low power television for the purpose of offering instruction to selected rural schools in the state (Kissock, 1985). This program grew into a two-way interactive television system using fiber optics for student-teacher and student-student interaction. By 1987 this program was known as the Mid-State Educational Telecommunication Cooperative (MSET) and was offering high school courses in Spanish I, German I and II, accounting II, advanced computer, music theory, French I, Advanced Placement English, computer logic, and shorthand (Kitchen, 1987).

The Gemini Electronic Blackboard was a Texas effort to offset a shortage of math teachers (Hudson & Boyd, 1984). A math teacher would write on a pressure-sensitive blackboard which was connected via telephone cables to a television receiver located in one or more neighboring districts. One teacher could thus instruct several distant classes. The teacher's voice was carried on a second telephone line so that there was audio as well as visual transmission.

InterAct Houston provided a system with one-way video and two-way audio signals using closed circuit networking. Fifty-five school districts in the Houston area were involved in this project (Hudson & Boyd, 1984). One of the primary purposes of the project was to provide small school districts with the opportunity to offer courses not otherwise available to them. The talk-back system allowed for student-to-teacher interaction as well as student-to-student contacts, while the mail service courier delivered course materials and examinations.

Satellites. "One of the earliest efforts to apply satellite technology for in-school education in the United States was the Rocky Mountain STD" (Hudson & Boyd, 1984, p. 56). A NASA ATS-6 satellite, during 1974-75, supplied a signal to 68 stations of which 56 were in rural schools (Ruggles et al., 1982) located in Colorado, Idaho, Montana, New Mexico, Utah, Wyoming, Arizona, and Nevada (Hudson & Boyd, 1984). This project covered one quarter of the land mass of the United States. At least three terminals were located in each project state and allowed both video reception and audio transmission.

Another early project, the Appalachia Education Satellite Program

(AESP), was initiated in 1975 (Ruggles et al., 1982). The project, which was directed at college-level classes and teacher training seminars, was funded by the National Institute of Education. The University of Kentucky and various regional education service agencies coordinated the 15 local receiving sites. Also in 1975, the Appalachian Community Service Network (ACSN) coupled its television network, the Learning Channel, with the NASA-6 satellite, "the primary goal being to provide adult education materials that were not available through local educational institutions" (Hudson & Boyd, 1984, p. 58).

In Alaska, a state with a diverse and widely distributed population, Learn/Alaska has since 1981 linked learners statewide with a central learning center (Ruggles et al., 1982). The Alaska Department of Education and the University of Alaska formed this cooperative statewide effort to bring education to villages in remote areas of this large state. More than 100 isolated villages received telephone and broadcast signals via satellite (Hudson & Boyd, 1984).

Each of the systems described was a project that blended the goal of distance learning with then current communication technology. Five new interactive systems using satellites for simultaneous, reliable, and quality full motion viewing with clear audio listening have produced a new generation of distance learning (Barker, 1987b). These include the TI-IN Network from San Antonio, Texas; Oklahoma State University's Arts and Sciences Teleconferencing Service; the Utah State Department of Education System; the Eastern Washington University Telecommunications Project; and the Missouri State School Boards Association Project. According to Barker (1986, p. 3), "Small and rural schools can use these new technologies of distance education to broaden curricular offerings while facing low student enrollment and increased costs."

According to Barker (1987a), perhaps the most impressive effort by any single state has been the TI-IN Networks, Inc. of Texas. This system began in 1985 and used a Ku-band satellite transmission capable of linking any school in the continental United States to the transmitting source (Pease & Tinsley, 1986). The course offerings in 1985-86 included such diverse subjects as calculus, personal business, sociology, and German. Other TI-IN courses were Latin, French, and Spanish; U. S. government; computer science and math; business law; psychology; and trigonometry. At the close of 1986-87, TI-IN was linked to 200 subscribing schools in 14 different states and was offering 23 different high school credit courses (Barker, 1987b).

TI-IN offers five-day-a-week programming for all of its courses. The interaction is live and is made possible through telephone lines. Tests and other materials are sent from TI-IN facilities by way of satellite transmission and received and printed by computer at the local site. This is possible by using a Multi-Function Interface Unit (MFIU) which is provided with the total TI-IN package (Pease & Tinsley, 1986).

> TI-IN does not utilize computer assisted instruction. Instead TI-IN seems to perpetuate the existing--and familiar--model of teacher-present/student-recite pattern of traditional classroom instruction (Barker, 1986c, p. 8).

A similar satellite program began in Oklahoma in the spring of 1985 (Folks, 1988). Although little was known about distance learning using satellite technology, a pilot program was conceived between the Oklahoma State University Dean of Arts and Sciences, Dr. Smith Holt, and Wiley Hinton, a superintendent of schools in Beaver County, Oklahoma. From the original offering of German I by satellite, by 1986-87, 101 school districts in six states were online with Oklahoma State University, and the course offerings had expanded to two full years of German and a full year of physics (Barker, 1987c). In the fall of 1987, the Arts and Sciences Teleconferencing Service (A.S.T.S.) introduced trigonometry and A.P. calculus. "Unlike the TI-IN Network, OSU's satellite courses are broadcast either 2 days or 3 days each week rather than 5" (Barker, 1987c, p. 1).

In the A.S.T.S. German programming, live audio interaction is accomplished by telephone lines. The schedule involves a telecast two days each week with students using computer programs on the other three days. An Apple II or a Radio Schack III/IV microcomputer is used in conjunction with a voice recognition software unit. The instructor, Dr. Wohlert, developed the total programming that is used with this course (Barker, 1987c). A toll-free number, provided 40 hours a week, enabled student contact with the A.S.T.S. learning center concerning homework assignments and assistance. Also an electronic mailbox is provided 24 hours a day for access to the A.S.T.S. learning center. The A.S.T.S. programs provided for individualized contact through a local classroom teacher/facilitator.

In the fall of 1986, Eastern Washington University in Spokane began producing the Satellite Telecommunication Educational Programming Network (STEP). The project began with four high school courses in 15 schools. These courses were Spanish, Japanese, advanced senior English, and calculus (Barker, 1987c). "The operation of STEP most closely parallels the TI-IN Network, except that live instruction is beamed to subscribing high schools four days each week rather than five" (p. 1). Beginning in the school year 1987-88, STEP expanded to other states in the northwest. The offerings had also increased from the original four to seven courses.

In Utah, students began using a satellite link-up to access the Accelerated Learning of Spanish via Satellite Television Project (Barker, 1987c). Bonneville International Corporation and IBM Corporation each contributed to the project. A voice simulator/synthesis computer module was used which was similar to the A.S.T.S. German voice similator/synthesis module. By 1985-86, 27 schools in Utah, Colorado, Nevada, and Arkansas had subscribed to the program (Barker, 1986b). The project grew to six states by 1986-87 but was still offering only Spanish (Barker, 1987c).

In 1987, the Missouri State School Boards Association established a satellite network (Barker, 1987b). At that time 200 downlink satellite dishes had been provided to high schools and elementary schools. The long-range projection was to link most of the state's elementary and secondary schools by the end of 1989. The MSSBA project used a mobile Ku-band unit which would allow transmission from any site in the state.

Printed text, radio, audio-cassette, television, satellite, and computer were each the "high technology" tool that became a part of the growing program called distance learning. Within the past 100 years, distance learning has evolved from the printed text, using the mail service for interaction, to two-way interactive television programs using computers and satellites. Each of the projects has supported directly or indirectly the goal of distance learning: access to an educational opportunity regardless of geographic location. However, what are the educational achievements by students exposed to such distance learning? The remaining section of this chapter will review studies that have been conducted on the use of technology in distance learning and its educational impact on student learning and achievement.

Program Effectiveness

According to Hudson and Boyd (1984), the criteria for educational program evaluation are student performance (achievement, enrollment, retention), performance of hardware and software, cost, level of complexity, relationship of project goals to institutional goals, and attitudes of teachers, learners, and project staff. It is thus important to evaluate not just the efficiency of the technology, but its effectiveness in supporting teaching and learning.

> Numerous technological applications have been unsuccessful--usually not because of the technology itself but because of poor instructional design or insufficient attention paid to teacher-learner needs (Hudson & Boyd, 1984, p. 22).

Crump (1928), in a Columbia University dissertation, measured the comparative performance of extension students. Resident students and correspondence students were given the same final examination for classes that students were allowed to take on campus or by correspondence. This research indicated that there were insignificant differences in knowledge attainment.

The Japan Broadcasting Company conducted an effectiveness study of its educational television and radio programming from 1960 through 1968 (Japan Broadcasting Company, 1969). The age groups studied varied from fourth grade science classes to high school students. The major research question in this study was: "Will an educational effect be improved by utilizing school broadcasts?" (p. 25).

> The best answer we can give to this question is, we feel, that in some cases school broadcasts are very effective and in others they are not very effective. That is to say, the educational effect of broadcasts depends upon many factors--the quality of programs, school teacher's ability of guidance, students' ability and interest, the length of utilization period of programs, and so on (p. 25).

The study found little difference in effect between groups that participated for one year and those that did not participate. However, if the students were involved for two years, the group that listened the second year had a greater gain than that of those who had not listened at all. The conclusion was that, by the second year, the teacher and the student had matured into an understanding of the concepts of the program (Japan Broadcasting Co., 1969). The results also pointed to the preparation of the teacher, who guides the class through the program, as the significant factor involved in student gains. "The TV viewing group showed a remarkable progress in intelligence and achievement in science and social studies as compared to the non-TV viewing group" (p. 26).

In 1983 the Western Australia Education Department began an evaluation of the "Video in the Outback" project through which video-cassette recordings were mailed to students and parents in remote Australian villages. There were 141 parents and 38 teachers involved in an interview and questionnaire study.

> Positive benefits attributed to the program include greater student motivation to learn, increases in general knowledge, reduction in social and cultural isolation, and enhanced parental involvement (Hosie, 1983, p. 1).

Teachers had many negative comments, most of which centered on a cost-benefit analysis: "five itinerant teachers, one from each School of the Air, could have been supplied for three years for the cost of running the Programme in Western Australia" (Hosie, 1983, p. 17). However, this was tempered by a realization that students had gained considerably more than had been anticipated, evidently because of the contact with the video programs. The finding in this study that "a teacher's facilitating role is crucial" (p. 15) has implications that parallel the Japanese studies. However, Hosie indicated that the Australian and Japanese programs were not of sufficient scope to approximate a classroom-quality learning experience.

> Simply exposing a student to a television programme will not ensure that learning gains accrue. Broadcasts are intended to be used as resources not self-contained lessons, a broadcast is not intended to teach a lesson (p. 15).

Extensive evaluation studies have been attempted in regard to two American efforts which have gone beyond the video distribution efforts of the Japanese and the Australians. Officials of TI-IN and A.S.T.S. have attempted to provide lessons that are self-contained. These projects were developed to teach the entire lesson to students located hundreds of miles from the teacher (Pease & Tinsley, 1986).

In Texas, Pease and Tinsley (1986) developed TI-IN, the first private, interactive, satellite-based education system. The first evaluation was conducted by these founders and was directed at the school administrators' judgments of the curriculum and budgetary requirements, the implementation and ease of use of the hardware and software, and cost effectiveness (Pease & Tinsley, 1986). "The overall evaluation of administrators indicate that TI-IN met their curriculum and budgetary requirements" (p. 18). Administrators also indicated that the program was "cost effective and less expensive than hiring a teacher" (p. 13). Of the administrators surveyed, 90 percent reported that TI-IN met or exceeded their expectations. Pease and Tinsley (1986) also found that, among the 300 students enrolled the first year, motivation to do so varied. Among reasons given by students for participating in TI-IN classes were the need to take a course for college acceptance, to graduate from high school, a desire to experience the novelty of taking a course via satellite, and the opportunity to gain a new experience that would be of help in the future.

Barker (1986d) conducted a study that was also directed at the TI-IN programs. In his survey of 31 schools, data were collected regarding grade level of students, GPA requirements, interaction of the students with the teacher, difficulty of satellite courses as compared to traditional courses, and participants' recommendations for improvement. The study found that 65% of the students regarded satellite courses to be harder than regular classes, while 24% said the satellite courses were about the same. Similar findings were reported in terms of homework assignments, and exams and quizzes.

According to another Barker study (1987a), the negative aspects of satellite delivery of instruction were "too much difficult homework," "poor quality of communications over the telephone," and "the inability to contact the teacher by telephone during the lesson broadcast." The study concluded that "more indepth evaluative studies need to be conducted to ascertain how best to use the new approach to delivering instruction" (p. 12).

In 1986-87, the Arts and Sciences Teleconferencing Service (A.S.T.S.), from Oklahoma State University, operated the second largest consortium for the delivery of technology-based opportunities. An evaluation of the A.S.T.S. program was conducted by Barker for the

Oklahoma State Department of Education in May of 1985. German I was evaluated through data gathered from 30 high schools in Oklahoma.

Principals reported that A.S.T.S. provided a foreign language which would not be otherwise available (Barker, 1987a). These principals also reported that, through this technology, students gained not only a cultural experience but also a foreign language experience. The program was considered to promote self-motivation for students and to instill skills of independent study. While the quality of programming was excellent, reported problem areas focused on scheduling, number of broadcasts per week, materials used to provide subject background, turnaround time of testing and reporting scores, and the lost contact with the teacher in the classroom. Most principals noted that a communication gap existed between their schools and A.S.T.S. While 97% of these adminstrators perceived that the facilitator needed inservice training, 80% reported a similar need for themselves (Barker, 1986d).

> Oklahoma is to be commended. It is one of the leading states in the broadcast of interactive television via satellite. German and Physics by Satellite programs--have become a national model of interactive student/teacher/computer learning (Barker, 1986d, p. 7).

> Today televised classes which permit live teacher/student interaction are perhaps the biggest education breakthrough since the computer (Barker, 1987b, p. 2).

CHAPTER III

DESIGN AND PROCEDURE

The general problem of this study was to determine if the Oklahoma State University Arts and Sciences Teleconferencing Service (A.S.T.S.) physics course met the needs and expectations of students, facilitators, and administrators in rural schools of Oklahoma.

The specific problems of this study were to determine: the decision process administrators used for implementing the program in their schools; differences that might exist in perceptions of high school principals, facilitators, and students who were exposed to the A.S.T.S. physics program; reasons schools had for dropping the A.S.T.S. physics program; the effectiveness of the mechanics of the program (computer assistance and software, lab kit, time scheduling, certification of facilitator); and students' reasons for enrolling in a course of this type and their attitudes toward the total satellite concept.

To accomplish this the following research questions were developed:

1. What opportunities did this method of instructional delivery provide that were not already provided through more conventional means?

2. Was there a generally stated need to expand course offerings through this type of distance learning system?

3. Has this program fulfilled the needs as proposed by the A.S.T.S. program in physics?

4. What were the reasons the physics program was implemented in the participating districts?

5. What impact has the physics program had on the curriculum in rural schools?

6. Do the mechanics (scheduling, delivery of the computer and lab experiences, etc.) of the physics program need to be reviewed?

7. What impact has the local classroom facilitator had on the program?

8. Could rural schools implement the suggested "college core curriculum" without this type of instructional delivery?

9. Is the distance learning approach, using A.S.T.S., an acceptable alternative method for offering the college core curriculum to students in rural schools of Oklahoma?

In this study, a descriptive design was used which involved collecting data in order to answer the relevant questions posed for the study. This design takes an established and functioning setting and adds a data collection dimension to explore questions and reach conclusions (Gay, 1981). Because a questionnaire survey can be a very valuable technique in helping to understand the current situation in a particular area (Gay, 1981), a self-reporting survey was used.

The Sample

The population for this study consisted of those schools in Oklahoma which have utilized the Arts and Sciences Teleconferencing Service from Oklahoma State University to implement the study of physics (A.S.T.S. physics). A list of 51 school districts which have utilized the physics by satellite program was developed using data from the

Oklahoma State Department of Education. Group A schools began participating in 1986-87. Group B schools were first listed as participating in 1987-88. Group C schools had entered the program in 1986-87 but were listed as having dropped the program by 1988.

After receiving the survey instruments from participating and non-participating school districts, it became apparent that the list of participating schools obtained from the State Department of Education was not accurate. This conclusion was based on written and verbal responses to the instruments' open-ended questions and on telephone interviews with school administrators. The 37 respondent school districts were thus re-grouped into participating and non-participating school districts as the result of the information received. Participating districts were those 20 districts in which A.S.T.S. physics was being used as of January 1, 1989, while the 17 districts in which A.S.T.S. physics had previously been offered, but which were not involved as of that date, were designated as non-participating.

Instrumentation

Copies of three survey instruments were sent to those schools identified as having used A.S.T.S. physics. One instrument was developed for response by administrators (See Appendix B). A second was developed for response by the facilitators (See Appendix C) while the third was developed for response by students (See Appendix D).

The instruments used for this study were patterned after an instrument design used by the Oklahoma State Department of Education (1987). A similar design had been used by Pease and Tinsley (1986) in their research of the TI-IN-Network Teleconferencing System in Texas.

Their approach incorporated the "decision maker," the "facilitator," and the "user" into the questionnaire. As noted above, a copy of each instrument is included in the appendixes.

To evaluate the draft of each questionnaire, a conference was held with three specialists in rural education: two from the Oklahoma State Department of Education and one from a state university. Each received the instruments and was asked to comment on the structure, nature of the questions, and readability.

Following the revisions of the questionnaire, a draft of each questionnaire was given to three practicing school administrators. The responses from this pilot study were used to construct the final revision of each instrument.

Data Collection

Data were collected in three ways: the survey instrument described above, personal interviews, and classroom observations. In January, 1989, a packet was mailed to each school district identified as an A.S.T.S. physics school. Included in this packet were a letter explaining the study (See Appendix A) and copies of each of the three questionnaires, one for the building administrator (decision-maker), one for the facilitator of the physics program, and one for each of three students who were enrolled in the A.S.T.S. physics (users). The students who completed the survey instrument were chosen by their facilitator. The letter explained the intent of this study and procedures for distribution, completion, and return of the questionnaires.

A phone call was made to each school from which a response had not been received within two weeks of the first mail-out. This was done on February 9th, 14th, and 17th. A second mail-out to those that had misplaced the survey or had not received the survey was done on March 1, 1989. At the time of the second mail-out, 23 of the 51 surveys had been received, 45% of sample schools. By March 17, 1989, the responses had increased to 37 respondents or 72.55% of the sample.

A group of five schools was then selected from which responses had been received and in which students were still participating in the program. A second group consisted of five schools in which students were not participating in the program. The five non-participating schools were contacted by phone for an interview with the "decision-maker" (building principal) and the five participating schools were visited for on-site interviews with the building principal, facilitator, and students (See Appendix E). Due to the geographic location of the 51 schools in the population and travel limitations, schools were chosen for visitation within a 75-mile radius of Muskogee, Oklahoma.

A guide for the interview was developed which focused on the open-ended questions from the survey. Also, the written responses were used to develop interview questions (See Appendix E).

Analysis of Data

Methods of data analysis for this research were descriptive in nature. The data were recorded in tables indicating the numbers and percentages for responses to each research item. In addition, pertinent data acquired through the interview process were included with the narrative regarding questionnaire data.

Summary

Chapter III has included information on how the population of 51 school districts was selected and how a subsequent re-grouping focused on participating and non-participating districts. Three survey instruments for administrators, facilitators, and students, were constructed, tested, and sent to each school district in the population. Interviews were conducted after preliminary analysis of the survey data. The following chapter will include a reporting of the data from the research instruments and responses from interviews and to the instruments' open-ended questions.

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

Chapter IV is composed of the presentation, analysis and interpretation of data collected in the project, and the reporting of these data as outlined by the research questions presented in previous chapters. Areas of concentration in this chapter will include the profile of the selected and the responding districts and presentation and analysis of the data gathered from the survey instruments.

Profile of the Districts

Fifty-one Oklahoma school districts were identified as having participated in the Arts and Sciences Teleconferencing Service physics program from Oklahoma State University. Completed survey instruments were received from 37 of those districts. This is a response rate of 72.55% Administrators from 20 school districts indicated that their districts were still using the program as of January 1, 1989, while those in 17 school districts indicated that they were not using the program as of that date. This information was used to group administrative responses into those from participating and from nonparticipating districts.

Since nonparticipating school districts had neither facilitators assigned nor students enrolled, no survey data from those two groups were received. Thus, information was received from facilitators only from participating schools and was thus grouped together for the purpose of reporting their perceptions and attitudes toward the A.S.T.S. physics program. Responses from the students in participating schools was similarly reported.

Table I provides data regarding all Oklahoma school districts as well as the 51 A.S.T.S. physics districts and the two groups of respondent districts. The respondent school districts did not vary substantially from the total group of A.S.T.S. schools in either size or wealth. While these school districts were both smaller and wealthier than Oklahoma district averages, it is not unusual for smaller districts to have slightly higher levels of per-pupil revenue due to a supplemental funding mechanism applicable to all districts with fewer than 500 students.

Survey Data from Administrators

The information presented here concerns the perception of building level administrators regarding the A.S.T.S. physics program. The following narratives and tables present the responses of those administrators whose districts were participating in A.S.T.S. physics during the school year 1988-89 and of those administrators whose districts were nonparticipants during that year. The material is organized by the research questions and presents the data obtained from the question items from the administrator survey instrument, including the percentage response to each research item and responses to the open-ended questions as well as responses made during interviews with selected administrators. When only one item from the instrument

TABLE I

COMPARISON OF A.S.T.S. PHYSICS DISTRICTS
BY ADA AND PER CAPITA REVENUE

Category	Number of School Districts	ADA Average	ADA Range	Per Capita (ADA) Revenue Average	Per Capita (ADA) Revenue Range
All Oklahoma Districts	610	896.97	37.91-38722.87	$2,883	$2,079-8,754
All A.S.T.S. Physics Districts	51	406.12	122.60- 1532.64	$3,221	$2,466-5,384
Participating Districts	20	422.70	138.61- 887.85	$3,053	$2,466-4,212
Non-Participating Districts	17	439.55	139.51- 1532.64	$3,157	$2,528-4,021

pertains directly to the research question, that information is presented in narrative rather than tabular form. Research question nine is not be addressed in this section, since it is a general question that focuses the perceptions from all three survey instruments. That question is addressed in the review and conclusions of Chapter V.

What Opportunities Did the A.S.T.S. Physics Program Provide That Would Not Have Been Provided?

This question addresses the opportunities provided by the A.S.T.S. physics class that would not have been provided by the local school. As noted in Table II, three items from the administrator questionnaire pertain to this question. The most positive response was to Item Number 2a. Of the participating district administrators, 96% responded that the ability to expand their districts' curricular offerings was the major opportunity provided, as did 91% of the nonparticipating district administrators. Similarly positive was the reported need to strengthen the science curriculum, Item Number 2b, with 89% of participating district administrators in agreement that A.S.T.S. would add such strength and 81% of the nonparticipating group responding affirmatively. A nonparticipating district administrator indicated that " A.S.T.S. is the best answer to the problem." His major concern was the threat of consolidation and, therefore, this approach seemed to be the "best answer."

TABLE II

ADMINISTRATOR PERCEPTION OF OPPORTUNITIES
PROVIDED BY A.S.T.S. PHYSICS

Administrator Instrument		Percent of Responses by Type of District					
		Participating			Non-Participating		
Item No.	Item Content	Yes	No	?	Yes	No	?
2a	Opportunities to expand curriculum	96	4	0	91	9	0
2b	Opportunities to strengthen science curriculum	89	11	0	82	18	0
2c	Opportunities to provide higher level science environment	50	50	0	64	36	0

* On this and subsequent tables, "Item Number" and "Item Content" refer to the items in the relevant survey instrument as contained in the appendixes.

Was There a Generally Stated Need to Expand Course Offerings?

Two items (2a and 4) on the administrator survey instrument focused on perceptions regarding the need for expansion of course offerings. Table III presents data on these factors that the administrators reported to have been important in the decisions made within the respondent school districts to participate in A.S.T.S. physics. The data indicate that the need to expand course offerings was the major need, with 96% of participating district administrators citing that factor as did 91% of the nonparticipating district administrators. In the interviews, building level administrators expressed that "this system has greatly improved our instructional approach in science, math and languages"; "as a principal, my biggest problem has been overcoming the lack of building space and the lack of course offerings"; and "it's not as good as having a teacher there, but it is working." Item Number 4 on Table III addresses the impact of financial problems on the range of course offerings in small districts. Administrators from participant districts indicated by a two-to-one margin that diminishing state funding had made it impossible to implement the college core curriculum, while 55% of nonparticipants believed this to be true. A typical response to queries regarding the feasibility of providing a full college core curriculum in small schools was "not impossible but very difficult."

TABLE III

NEEDS INFLUENCING THE DECISION TO USE
THE A.S.T.S. PHYSICS PROGRAM

Administrator Instrument		Percent of Responses by Type of District					
Item No.	Item Content	Participating			Non-Participating		
		Yes	No	?	Yes	No	?
2A	Need to expand curriculum	96	4		91	9	
		Agree	Disagree		Agree	Disagree	
4	Funding and the college core curriculum	67	33		55	45	

Has the Program Fulfilled the Stated Needs of the School?

This research question addressed the school district administrators' attitudes toward the fulfillment of school needs by the A.S.T.S. physics program (See Table IV). Administrators from participating schools indicated by an 84% affirmative response that the program had met the districts' needs, while 16% responded that it had not met the districts'needs. Administrators from nonparticipating schools responded, 64% affirmatively, that the program had met their districts' needs. Of the remaining nonparticipant administrators, 18% responded that A.S.T.S. physics had not met their districts' needs and 18 percent indicated that they were not sure.

Item Number 12b was asked only of those administrators who had indicated that their districts were not using the A.S.T.S. physics program that school year. Only 25% responded that they had dropped the program because the program had not fulfilled their schools' needs. Therefore, three fourths of all administrators indicated that even though the program was not being used in their districts, termination of such use was not done because of failure to meet districts' needs.

What Were the Reasons the Physics Program Was Implemented?

Table V shows that eight items from the administrator survey instrument were related to the reason A.S.T.S. physics was implemented. The alignment of participating and nonparticipating schools, on Item 7b, indicates that rural school administrators were

TABLE IV

FULFILLMENT OF DISTRICT NEEDS BY A.S.T.S. PHYSICS

Administrator Instrument		Percent of Responses by Type of District					
		Participating			Non-Participating		
Item No.	Item Content	Yes	No	?	Yes	No	?
8	Has the A.S.T.S. physics program fulfilled the needs of your school?	84	16	0	64	18	18
12b	Physics was dropped because it was not fulfilling the stated needs of our school.	NA	NA	NA	25	75	0

TABLE V

REASONS FOR IMPLEMENTATION OF A.S.T.S. PHYSICS

Administrator Instrument		Percent of Responses by Type of District					
		Participating			Non-Participating		
Item No.	Item Content	Yes	No	?	Yes	No	?
2C	Provided higher level science environment	50	50	0	64	36	0
3a	Lack of physics instructors	65	35	0	82	18	0
3b	Enrollment too small for physics class	69	31	0	82	18	0
3c	School too isolated to attract physics teacher	0	100	0	67	22	11
3d	School could not pay salary for physics teacher	36	64	0	67	33	0
7a	To improve ACT scores	72	22	6	73	0	27
7b	To enhance competitive ability in college	94	6	0	100	0	0
7c	To promote science majors in college	83	17	0	73	27	0

most concerned with the ability of their students to compete in college, citing that as a primary reason for implementing the A.S.T.S. physics program. While the promotion of college science majors and the improvement of ACT scores were also cited by a large proportion of administrators as major reasons for such implementation, neither had the high support that competitive ability showed.

Two areas reveal a discrepancy in responses of administrators from the two groups of school districts. Participating district administrators indicated, by a 100% response rate, that the geographic location of their school did not impact their ability to attract a physics teacher. Nonparticipating administrators indicated that their location indeed was a factor. Administrators from participating schools reported an inability to provide sufficient salaries to attract a physics instructor while 67% of the administrators from nonparticipating schools indicated that such pay was not a key factor. In fact, two responses to open-ended questions indicated that those nonparticipating schools have actually hired physics instructors since the districts first participated in A.S.T.S. physics programs.

What Impact Has the A.S.T.S. Physics Program Had on the Curriculum of Rural Schools?

Item Number 1 of the administrator survey concerned the enrollment of the A.S.T.S. physics class in each district. The enrollment of the 20 participating schools was 114 students which is an average of 5.7 students per class. The smallest class enrollment was 1 and the largest class enrollment was 17. The impact of this program could be demonstrated through the number of rural students who could not have taken a physics class because of the location, size, lack of a certified teacher, or insufficient financial support of their school district. An administrator from a nonparticipating district indicated during an interview that by alternating the A.S.T.S. physics program with an A.S.T.S. math class "this school can provide a well-rounded math and science program where otherwise I couldn't."

Do the Mechanics of the Program Need To Be Reviewed?

The mechanics of the physics computer and laboratory program have been well received. There is continuity between participating and nonparticipating schools in all areas. Participating school administrators indicated, by an affirmative response rate of 13%, that they were using a lab designed by their schools' instructors, and 20% of the nonparticipating had used a self-developed lab program. A response to the lab work indicated that special equipment was sometimes needed. "We go to a separate building for lab when the experiment calls for special equipment not included in a lab kit." Administrators responded that 78% of the districts were using the computer software provided with the program and 82% of the nonparticipating schools had used the suggested computer software for the physics program (See Table VI).

In responding to Item Number 10, 35% of participating district administrators cited the area of facilitator's certification as a possible hinderance to the program, a position agreed to by 57% from nonparticipating school districts. However, responses to Item Number 11 indicated a difference in attitudes toward the specific certification

TABLE VI

MECHANICS OF A.S.T.S. PHYSICS AS PERCEIVED BY ADMINISTRATORS

Administrator Instrument		Percent of Responses by Type of District					
		Participating			Non-Participating		
Item No.	Item Content	Yes	No	?	Yes	No	?
5	Using the suggested computer program?	78	22		82	18	
5a	Using the suggested Apple II with program?	94	6		88	12	
6	Using the sugggested laboratory kit?	78	22		70	30	
6a	Using the school-designed lab kit?	13	87		20	80	
10	Lack of certification as a hinderance to program	35	65		57	43	
11*	Certification most helpful:						
	Math	71	--		42	--	
	Science	29	--		50	--	
	Computer	0	--		8	--	
12a	Daily scheduling of the program did not fit into school schedule	NA	NA		19	81	

*For item 11, respondents indicated agreement with only one of the choices. There were no negative responses.

needs of the facilitator with 71% of participating district administrators indicating that math is the most important certification, while only 42% of the nonparticipating district administrators believed this to be true. While responses by most administrators listed math as the most desirable certification for success by the facilitators, one administrator stated the second most prevalent view, that, "science teachers have an edge with the lab experiments."

Item Number 12a was to be answered only by nonparticipating district administrators. There was an indication that the scheduling of this program was not a major conflict with most of the local schools' schedules. In the interviews with nonparticipating and participating district administrators, however, the broadcast schedule and its inflexible nature were seen as a hindrance to the success of the program in their districts.

What Impact Has the Facilitator Had on the Physics Program?

As noted in Table VII, the administrator survey instrument contains seven items that focus on the classroom facilitator. All of the facilitators were reported to be certified at the secondary level. Those in participating districts were less likely to be certified in science than had been those in nonparticipating districts, even though science was the predominant area of certification in both. A slight majority of all facilitators held certification in math. Participating district administrators were much more likely to see math certification as the area most helpful to a facilitator.

TABLE VII

IMPACT OF FACILITATORS ON A.S.T.S. PHYSICS AS PERCEIVED BY ADMINISTRATORS

Administrator Instrument		Percent of Responses by Type of District					
		Participating			Non-Participating		
Item No.	Item Content	Yes	No	?	Yes	No	?
9A	Facilitator certified in secondary?	100	0		100	0	
9b	Facilitator certified in math?	56	44		57	43	
9c	Facilitator certified in science?	67	33		91	9	
9d	Facilitator certified in computer science?	29	71		27	73	
10	Lack of certification a hindrance to program?	35	65		57	43	
11	Certification most helpful:						
	Math	71	--		42	--	
	Science	29	--		50	--	
	Computer	0	--		8	--	
12	Facilitator was not equipped to continue the television program into the lab setting or the computer setting	NA	NA		19	81	

Even though nonparticipating district administrators reported lack of proper certification as a hindrance to the program, they did not uniformly perceive that the program had been discontinued because of problems with the facilitator. In interviews with such administrators, it was found that a number of nonparticipating districts had, in fact, not permanently discontinued the core of the program. Survey responses indicated that four administrators planned to use the program in alternating years while three others had decided to hire physics teachers and reinstate the classroom program.

"Lack of a qualified class monitor led to students dropping the class the second semester" was one response from a nonparticipating administrator which presented the concern for a qualified facilitator and how the facilitator impacts the enrollment of the class. During interviews with administrators from nonparticipating schools, comments were made concerning the facilitators' role in the program. These comments included "the facilitator was not prepared to take up the slack left by the instructor," "I personally feel that, without the classroom setting, the desired result will be compromised," and "when money is available we will try to hire or train a physics teacher."

Could Rural Schools Implement the College Core Curriculum Without This Delivery System?

One part of the goal of distance learning is equal access to an educational opportunity which would not be offered due to geographic location or limited finances. Responses to Item Number 4 from administrators did indicate a need for the A.S.T.S. program. This was supported by a 67% affirmative response rate from participating schools and a 55% rate from nonparticipating schools. A typical response from an administrator indicated that it would be "very difficult but not impossible" to implement a college-oriented core curriculum without programs such as A.S.T.S. physics. As another administrator indicated, "A.S.T.S. is, from my understanding of the program, the best answer to the problem."

Survey Data From Facilitators

The information presented in this segment focuses on the perceptions of the classroom facilitators in regard to the A.S.T.S. physics program. Research questions 1, 2, 3, 7, and 8 are not addressed in this section because they were applied only to the perceptions of administrators and/or students. The following narratives and tables thus present responses from those facilitators who were participating during the school year 1988-89.

Do the Mechanics of the Program Need to be Reviewed?

In all readings reviewed on distance learning, the mechanics of the program were listed as an area to review closely. Table VIII presents data on software, laboratory kits, and differences of attitude toward the program by facilitators. Responses to Item Number 1b indicate that 68% of the facilitators perceived the software package to be helpful in understanding the lessons. However, 32% indicated that the software did not aid in understanding the lessons.

TABLE VIII

MECHANICS OF THE A.S.T.S. PHYSICS PROGRAM AS PERCEIVED BY FACILITATORS

Item No.	Item Content	Percent of Responses YES	NO
1a	Difficulty in using the computer software?	25	75
1b	Software helpful in understanding the lessons?	68	32
3	Attitude difference between these students and students of a regular classroom?	79	21
3a	Relationship between A.S.T.S. professor and student positive?	78	22

Facilitators responded often to the open-ended question number 3. Primarily, the reponses dealt with atttention span and motivation as student factors impacting upon the differences between a traditional classroom approach and the distance learning approach. "Students must be more motivated," or "the students must be more attentive" were typical of the remarks made concerning the students. Concern was also expressed in regard to the "inflexible schedule" and the rapid instructional "pace" of the class.

Item Number 3a focused on concerns for the relationship between the A.S.T.S. physics teacher and the students. Facilitators responded during interviews that "students felt rushed because of the inflexible schedule maintained by the teacher" and "there was a lack of attention between the student and the teacher because the instructor is unable to see the reactions of students." However, 78% of the facilitators also responded that the overall relationship was positive.

Has the A.S.T.S. Program Had An Impact on Rural School Education?

Facilitators give the impression that the A.S.T.S. physics program has had a quality impact on rural school education. In fact, 92% of the responding facilitators provided an affirmative response to Item Number 3b of their survey instrument.

What Impact Has the Facilitator Had On the Physics Program?

Table IX contains data regarding the impact the facilitator has had on the program itself. Responses to Item Number 4a indicated that 71%

TABLE IX

IMPACT OF FACILITATORS ON A.S.T.S. PHYSICS
AS PERCEIVED BY FACILITATORS

Item No.	Item Content	Percent of Responses YES	NO
4A	Prepared to deal with lesson topics?	71	29
4b	Prepared to deal with computer problems?	78	22
4c	Prepared to deal with homework assistance?	67	33
6	Serve as faciliator for another A.S.T.S. course?	67	33

of the facilitators perceived that they had the preparation necessary to deal with the topics of the program. However, the largest negative response was to Item Number 4c, which focused on the facilitator's preparation for homework assistance. Responses indicated that 33% were not prepared to assist students with the homework assignments.

Facilitators responded openly to the interview questions. While several facilitators indicated that they would serve again as a facilitator, two noted that they would serve only for the A.S.T.S. physics program. One responded that the school had told her that "this would not be possible." Another facilitator indicated that he was now certified in physics and would continue teaching the physics class but without the aid of the A.S.T.S. program.

Survey Data from Students

Students are the final group from which data were collected in regard to the A.S.T.S. physics program. Research questions 4 and 5 are not addressed in this part of the chapter because they applied only to the perceptions of administrators and/or facilitators. The following narratives and tables summarize the responses of those students who were participating during the school year 1988-89.

What Opportunities Did the A.S.T.S. Physics Program Provide That Would Not Have Been Provided?

Table X contains data in regard to students' perceptions of the impact A.S.T.S. physics has had on rural school education in Oklahoma.

TABLE X

OPPORTUNITIES PROVIDED BY A.S.T.S. PROGRAM
AS PERCEIVED BY STUDENTS

Item No.	Item Content	Percent of Responses YES	NO
3C	Could you have taken a physics class at your high school?	10	90
4a	Something different to do?	46	54
4b	Needed science credit for graduation?	36	64
4c	Considering a science major in college?	54	46
4d	Improve chances for scholarship?	62	38
4e	Improve A.C.T. score?	75	25

Students responded 90% of the time that without this program they would not have been able to take a physics class at their high school. Students were also asked if they perceived improvements in ACT scores, improved scholarship opportunities, and/or completion of general graduation requirements as opportunities that were made available by the provision of the A.S.T.S. physics program. The highest positive response was the opportunity to increase ACT scores while the lowest positive response was to the necessity to meet graduation requirements. In interviews with students, each expressed concern for college requirements as the primary stimulus to enroll in the physics class. Students also responded that "it was a challenge to take this class" and "it's harder, but it is not above my ability."

Was There a Generally Stated Need To Expand Course Offerings?

As stated by Barker (1986a), the quality of course offerings and the diversity of those course offerings is the most pressing issue for small and rural schools. Item Number 3c addressed this issue through the question: Could you have taken a physics class at your high school if A.S.T.S. had not been available? Students responded 90% of time the that they would not have had this exposure. Two students interviewed indicated that they needed a physics class to be prepared for the college majors they had chosen. "I need all the science and math I can get for college" and "physics makes a good beginning class for college because I want to go into pre-med" were the responses given by these students.

Has the Program Fulfilled the Stated Needs of the School?

Item 5 from the student's survey addressed their perceptions of the success of the A.S.T.S. program by asking them if they would consider enrollment in another distance learning class. Students responded that 75% would enroll in another satellite course, while 23% indicated they would not, and 2% were not sure.

Do the Mechanics of the Program Need to be Reviewed?

A concern indicated by students was the helpfulness of the software package. While Table XI indicates that 63% of the students regarded the software positively, 37% did not view the software as a help in understanding the lessons. A larger positive response focused on the lab kits as helpful support tools with only 20% indicating that they were not helpful.

Homework was seen as being harder than in a traditional class and the lack of teacher contact was frustrating to some students. Of the 50 responding students, 16 responses were directly related to the lack of direct contact between the teacher and the student. Comments included "you can learn more from a teacher than a T.V." and "it's nice to be able to ask for help right then." During interviews, students did not directly respond to the teacher contact issue. However, four referred to the homework as being more difficult because of the lack of teacher contact while nine referred to the motivation level, self-discipline, and/or fast pace as the main differences between the A.S.T.S. course and

TABLE XI

MECHANICS OF THE A.S.T.S. PHYSICS PROGRAM
AS PERCEIVED BY STUDENTS

Item No.	Item Content	Percent of Responses YES	NO
1a	Computer software helpful?	63	37
2b	Lab kits helpful?	80	20
3a	Major difference between learning by satellite and learning by a traditional approach?	64	36
3b	Homework different from a traditional class?	20	80

a regular classroom course. The students indicated that there were aspects of the homework assignments that were more positive than in the traditional classroom setting. Responses such as "specific problems are assigned instead of pages" and "you know what your homework will be in advance and have a chance to do it early" were typical. Other points made concerning the organization of the homework were that "we have homework every night and over the weekends but it isn't out of my abilities" and "you always have a set routine and always have homework."

What Impact Has the Facilitator Had On the Physics Program?

Table XII presents data regarding students' perceptions of the impact the facilitator has had on the program. Students reported that their facilitators were prepared to handle the computer assignments and the lab assignments using the lab kit. The positive response rates were 90% and 84% for these respective items.

Has the A.S.T.S. Program Had An Impact On Rural School Education?

As noted in Table XIII, for 85% of these students, this was the first course taken by a distance learning approach and, for 90% of the students surveyed, the A.S.T.S. program was the only way they could have taken a physics course prior to college enrollment.

TABLE XII

IMPACT OF FACILITATORS ON A.S.T.S. PHYSICS
AS PERCEIVED BY STUDENTS

Item No.	Item Content	Percent of Responses YES	NO
1b	Facilitators have expertise to use computer and programs?	90	10
2c	Facilitators have expertise to use lab kits?	84	16

TABLE XIII

A.S.T.S. IMPACT ON RURAL SCHOOL EDUCATION
AS PERCEIVED BY STUDENTS

Item No.	Item Content	Percent of Responses YES	NO
3	Is this the first course that you have taken by a distance learning approach?	85	15
3c	Could you have taken a physics class at your high school if A.S.T.S. had not been offered?	10	90

CHAPTER V

CONCLUSIONS, RECOMMENDATIONS, AND IMPLICATIONS

In the period from 1930-31 to 1982-83, the number of school districts in the United States decreased from 127,531 to less than 16,000 (Rios, 1987). While those remaining rural school districts have withstood the consolidation era, their leaders are faced with the key issues of school effectiveness and curriculum needs. In attempting to provide increasing state mandates in curriculum for declining student populations, these educators must consider technology-based distance learning as a method of maintaining local identity while improving educational effectiveness and curriculum stability.

The development of distance learning has closely paralleled the development of communications technology (Hosie, 1983). While early philosophers used handwritten text to convey ideas to their followers who were separated because of geographical barriers, the printing press and mail service allowed correspondence courses to develop in the 1700 and 1800s. Radio and television brought a new era of distance learning as information could be presented instantly to those connected to these new educational tools. Even the most remote schools of the Australian "outback" or in Alaskan Eskimo villages could be in touch with other learning centers. Lessons on audiocassette could reach students in every corner of the world, even the remote mountains of Ecuador. However, these involved one-way conveyance of learning.

A later generation of technology-based tools have allowed for two-way interaction between teacher and student (Hudson & Boyd, 1984). Barker (1987c) also noted that such tools as Cyclops, electronic mail, computers, satellites, and fiber optic transmission lines have all broadened the possibilities for educators.

The general problem of this study was to determine if the Oklahoma State University Arts and Sciences Teleconferencing Service (A.S.T.S.) physics course met the needs and expectations of students, facilitators, and administrators in rural schools of Oklahoma.

To accomplish this the following research questions were developed:

1. What opportunities did this method of instructional delivery provide that were not already provided through more conventional means?

2. Was there a generally stated need to expand course offerings through this type of distance learning system?

3. Has this program fulfilled the needs as proposed by the A.S.T.S. program in physics?

4. What were the reasons the physics program was implemented in the participating districts?

5. What impact has the physics program had on the curriculum in rural schools?

6. Do the mechanics (scheduling, delivery of the computer and lab experiences, etc.) of the physics program need to be reviewed?

7. What impact has the local classroom facilitator had on the program?

8. Could rural schools implement the suggested "college core curriculum" without this type of instructional delivery?

9. Is the distance learning approach, using A.S.T.S., an acceptable alternative method for offering the college core curriculum to students in rural schools of Oklahoma?

The population for this study consisted of those schools in Oklahoma which have utilized the Arts and Sciences Teleconferencing Service from Oklahoma State University to implement the study of physics (A.S.T.S. physics). Those 51 school districts were grouped according to whether their students were or were not using the A.S.T.S. physics program as of January 1, 1989. Responses were received from 37 school districts, a 72.5% return. Participating school districts accounted for 20 of this total, while there were 17 nonparticipating districts.

The three instruments used for this study were patterned after an instrument design used by the Oklahoma State Department of Education (See Appendix F). This approach, used earlier by Pease and Tinsley (1986), incorporates separate instruments for the decision maker (school administrator), facilitator, and user (student). The administrator instrument was completed by one individual from each of the 37 responding school districts while 20 facilitators and 50 students from the 20 participating districts completed their respective instruments.

Conclusions

As expressed in Chapter I there are critical theorists that have expressed concern over a growing use of technology-based learning. However, these conclusions are based on data presented in Chapter IV.

1. The majority of administrators reported, through responses and interviews, that the A.S.T.S. physics program had met the goals set by the home district.

This is equally true in both participating and nonparticipating districts. Thus, even the nonparticipating administrators agree that the program is meeting the needs of rural schools for expanding their curriculum. The facilitators agreed that this program is a quality effort to improve rural school educational opportunities. Many of the nonparticipating district administrators reported that their reason for nonparticipation was not the A.S.T.S. program itself, but that their district plans were to offer the physics course every other year, alternating with another science course.

2. Administrators and students would prefer to have local certified physics teachers present in their classrooms.

Those nonparticipating district administrators interviewed indicated that the facilitator's inability in the area of physics resulted in the lessons not being continued to their completion. A math certificate was seen as a possible correction to this area. Homework and problem solving was the major area cited where the facilitator could not aid the students properly. However, both administrators and students agreed that, without the A.S.T.S. program, it would be impossible to provide a physics class in the local school because of finances, lack of a certified physics teacher on staff, and/or small enrollment.

3. Administrators want to provide an expanded curriculum for their students and are concerned about the competitive ability of their graduates in college.

Administrators indicated that lack of financial support, as well as other problems already mentioned, has made offering the college core curriculum nearly impossible in small and rural schools of Oklahoma.

4. The most important attribute of the facilitator is that teacher's nature and personality in motivating students and maintaining an atmosphere of learning in the classroom.

The attitude of the facilitator was reported to have a large impact on the success or failure of the A.S.T.S. physics program.

5. Homework and problem solving assistance is the major concern of facilitators and students.

Students have mixed opinions concerning differences between homework from a traditional class and homework from the distance learning class. Students cited more homework than in a "normal" class as one difference but were also pleased with the organizational structure of A.S.T.S. physics homework. Students liked knowing about homework assignments in advance, focusing on special problems assigned by the A.S.T.S. teacher rather than entire pages as assigned by a traditional teacher, and having a set routine of homework which allowed them to schedule their homework around their private lives outside of class.

However, one third of the facilitators may be inadequately prepared to deal with the problem solving nature of physics. Administrators cited a math certificate as being helpful in this area. It has been previously indicated that the homework is a major difference between A.S.T.S. classes and the traditional class. The issue of lack of student/teacher contact is most critical when a problem arises which the facilitator cannot answer. The issue is complicated by the 11 or 12 years of immediate and direct teacher contact with which these students are accustomed. Eighty-five percent of these students are taking a distance learning class for the first time. In the Japanese studies, students participating for the second year produced informational gains. The reason given by the researcher was the maturing factor of a second exposure to distance learning by both the students and the facilitator.

6. Without A.S.T.S. physics a large majority of these students would not have been able to take a physics class in high school.

Students see the A.S.T.S. program as a means of taking college preparatory classes that would not be available otherwise. Students also see a relationship between college-prep classes and improvement their ACT scores. This, coupled with the competition for college scholarships, is well understood by rural school students.

7. Students cited the facilitators as doing a fine job of handling the computer and laboratory equipment and lab kits.

There were no negative written or verbal responses concerning the inability of the facilitator in this area. Students maintained that the facilitator could operate the computer software and the laboratory kits. However, facilitators indicated that the software usage, lesson topics, and homework assistance were among their weaknesses.

Recommendations

For Administrators

1. Building level administrators should be very aware of all courses offered by A.S.T.S. from Oklahoma State University as well as all other distance learning programs. They should review the research on each program, and the individual courses offered, to determine if the courses could fulfill needs expressed for their schools' curricula.

2. Building level administrators should spend as much time as possible in the A.S.T.S. class during the first few weeks. This will show support for the program as well as for the facilitator. Also, this contact will give administrators a better understanding of the format of the program that would be helpful in the evaluation of the facilitator.

3. Building level administrators should carefully examine their teacher evaluation forms to determine whether they are appropriate for the evaluation of classroom facilitators. A facilitator should be judged on the ability to maintain classroom organization and a proper learning environment. Since their responsibilities do not involve lesson planning and delivery, more general criteria should be used to determine if the facilitator is meeting the needs of the program and the needs of the students.

4. Administrators should allow the facilitators to attend distance learning workshops during the first year and the summer after the first year of experience. The contact with other facilitators will give encouragement and ideas for better programs in their home schools.

5. Administrators need to examine the criteria for selecting students for enrollment in a distance learning class. A self-disciplined and self-motivated student should be considered before GPA requirements. Facilitators indicate that these attributes are more important to the success of the student than previous grade point average.

6. Administrators need to provide a telephone for the A.S.T.S. classroom. Since so much of the program depends on the interaction of the student and the A.S.T.S. teacher, it is very important that the students and the facilitators have easy access to a telephone.

For Facilitators

1. Facilitators need to remember that they are the key ingredient in the success of the A.S.T.S. program at their local schools. They must maintain the student/teacher atmosphere that is lost because of the distance separating the student from the A.S.T.S. teacher.

2. Early in the summer, facilitators should attend seminars given by the State Department of Education and other distance learning programs. They should not hesitate to call for information from the Oklahoma State Department of Education and the Field Office of the Arts and Sciences Teleconferencing Services from Oklahoma State University.

3. Facilitators should build notebooks of difficult problems and homework questions. These would provide a focus for requests for assistance from the A.S.T.S. program office. Continued use of the notebook throughout the year will provide an easy reference for the next year, particularly if the facilitators use this same approach for noting computer software and lab kit difficulties.

4. Facilitators should make copies of each A.S.T.S. lesson in order to allow the physics students to review the lessons at their leisure. The VCR and television should be moved daily to the library or other location which would allow students to review demonstrations and lectures during and/or after school. This is important for those students who are not proficient in taking class notes and to also compensate for viewing conflicts created by changes in the local school schedule.

For Students

Students need to understand that the program is difficult and will require more dedication to classroom attention and homework concentration. Good notetaking and reviewing of taped lessons will aid in the task of understanding the problems and questions assigned as homework. The A.S.T.S. physics class will require more attention to homework than will a traditional physics class.

For the State Department of Education

1. The Oklahoma State Department of Education should re-examine the issue of facilitator certification. It has the task of governance for A.S.T.S. courses offered to rural schools. Administrators have reported the importance of a math background, because of the problem solving nature of physics, for facilitators. Serious consideration should be given to requiring a math and/or science background for certification of facilitators for the A.S.T.S. physics program.

2. The Oklahoma State Department of Education should provide workshops to facilitate communication between the field directors of the A.S.T.S. program and facilitators. Three main topics are recommended: computer software and how it is to be incorporated into the physics lessons, laboratory experiments at the home school and how the lab kits should fit into those experiments, and homework and problem solving. Each of these topics should incorporate hands-on activities and exercises.

3. The Oklahoma State Department of Education and the A.S.T.S. directors should cooperate with local administrators in developing a

teacher evaluation form that stresses the classroom management and student motivation components and duties of the facilitator.

For the A.S.T.S. Physics Director

1. The physics program is being received well by all concerned. Caution should be taken, however, to reinforce the understanding of the learning style of a high school student as opposed to a college student. Many administrators and facilitators indicated that the A.S.T.S. physics teacher may teach beyond the comprehension level of a high school student.

Recommendations for Further Studies

1. Using the same format as presented here, a survey should be done of students and facilitators that have had two years of distance learning experiences, back to back. This study could determine if the attitude toward the lack of student/teacher contact is still an issue, if the student still perceives that homework is too difficult and demanding, and if the pace and inflexible schedule is still addressed as a negative issue. In addition, the study could determine if a second year of experience results in a reduction in the pressure of homework and problem solving for the facilitator.

2. A study to determine the facilitators' attitudes toward problem solving and homework could involve the development of survey instruments for A.S.T.S. physics facilitators with a math and/or science certification as one group and for A.S.T.S. physics facilitators with some other certification as a second group. The study could focus on the question: Is certification a key factor in the success or failure of

the facilitator and the program?

3. General physics, biology, or chemistry are typical first-level college science courses for science majors. Using such courses in Oklahoma universities, a researcher could survey students in these classes to determine the number and performance of A.S.T.S. science students taking one of these classes. Professors could be surveyed to determine their perception regarding the competitive ability of these students as compared to those from a traditional high school science background.

4. Similar studies could also be used for the A.S.T.S. math or other programs and their impact on students and college success.

Implications

As a science major in an undergraduate program, this researcher became acquainted with many dedicated science students. However, dedication was not always enough. Several students with little or no math and science background came from small rural schools. Many of these students dropped the science program for another major or dropped out of college altogether, not that science is a harder discipline or would require a more intelligent student, but because of the lack of preparation in high school. The A.S.T.S. courses present an alternative for those science, math, and foreign language classes that could not be offered in rural schools of Oklahoma. This opportunity gives each student in Oklahoma a chance to succeed in college, in any chosen discipline. Desire, motivation, and hard work should be the only ingredients needed to succeed in college. These should not be affected by the size of the school district attended.

For students, like Dusty Rogers and James White, the limited course offerings in their high school could have altered their life goals. Each of these students wants to be a doctor of medicine. Each of them sees physics as a needed class in preparation for college and medical school. Rogers competed at the Connors College Scholastic Meet, placing first in the area of physics. White placed third in physics at that event and also competed at the Wilburton Eastern Oklahoma Scholastic Meet, placing sixth in physics. The only opportunity these students had to take a physics class was by the A.S.T.S. physics program.

After reviewing several live and taped A.S.T.S. lessons, this researcher became aware of the many demonstrations, laboratory visual aids, and special video taped segments used to build each day's lesson. The A.S.T.S. physics student receives a broader array of these aids than would be present in many high school physics laboratories. The data collected from administrators, facilitators, and students, as well as through on-site visits support the conclusion that A.S.T.S. physics has fulfilled the intent of offering an acceptable physics alternative for rural schools of Oklahoma and has maintained the high standard set by the National Rural Education Association (1986),

> To further the improvement of education opportunities for all children in rural areas with additional attention to those for whom opportunities have been severely limited (p. 3).

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APPENDIXES

APPENDIX A

COVER LETTERS

Hilldale High School

Steve Johns, Assistant Principal
Middle School
Attendance, Activities
(918) 683-0763

Clarence Chick Holland, Principal
Route 8, Box 141
Muskogee, Oklahoma 74401

DeWayne Pemberton, Assistant Principal
High School
Attendance, Activities
(918) 683-3253

Dear Principal:

Being a high school principal like yourself, I realize the day to day pace that is required. I am also accutely aware that answering a survey instrument is not a high priority item in that daily schedule. It is because of these things that I write and ask that you help me in this last obstacle in my doctoral program. My dissertation is only as complete as the information that is gained through these questionnaires.

Enclosed you will find :

a. an administrators form for the building principal
b. a facilitators form for the ASTS physics teacher
c. 3 student forms for any three students enrolled in the ASTS physics class.
d. a stamped, self addressed envelop for returning all forms to me.

PLEASE help me finish this task by filling out these forms and returning them to me. I will be most happy to aid you in educational projects that you are involved with, now or in the future.

Clarence Chick Holland, M.S.; M.Ed

Preparing For The Future ***NOW***

Hilldale High School

Steve Johns, Assistant Principal
Middle School
Attendance, Activities
(918) 683-0763

Clarence Chick Holland, Principal
Route 8, Box 141
Muskogee, Oklahoma 74401

DeWayne Pemberton, Assistant Principal
High School
Attendance, Activities
(918) 683-3253

2ND MAIL-OUT MARCH 1, 1989

Dear Principal:

Being a high school principal like yourself, I realize the day to day pace that is required. I am also accutely aware that answering a survey instrument is not a high priority item in that daily schedule. It is because of these things that I write and ask that you help me in this last obstacle in my doctoral program. My dissertation is only as complete as the information that is gained through these questionnaires.

Enclosed you will find :

a. an administrators form for the building principal
b. a facilitators form for the ASTS physics teacher
c. 3 student forms for any three students enrolled in the ASTS physics class.
d. a stamped, self addressed envelop for returning all forms to me.

PLEASE help me finish this task by filling out these forms and returning them to me. I will be most happy to aid you in educational projects that you are involved with, now or in the future.

Clarence Chick Holland, M.S.; M.Ed

Preparing For The Future ***NOW***

APPENDIX B

SURVEY FORM - ADMINISTRATORS

(Region 1-2-3-4-5-6-7)

Type A_____
Type B_____
Type C_____

Dear Fellow Educator:

The purpose of this survey is to gain input into a dissertation topic that I am researching. Your help will be extremely important in this process. My research includes the use of telecommunication systems in the teaching of Physics in rural schools in Oklahoma. Please complete the following questions and mail, using the self-addressed stamped envelope.

Administrators Form -- Questions denoted "A".

1. QUESTION -- What is the current enrollment in your A.S.T.S. Physics program? ________

2. QUESTION -- The factors that influenced our decision to use the Tele-conferencing System from O.S.U.:

   a. A need to expand our curriculum? NO YES ?
   b. A need to strengthen our Science curriculum? NO YES ?
   c. Provide the needed lab environment for a higher level Science course? NO YES ?

3. QUESTION -- Our school could not provide a regular Physics program because:

   a. We did not have a Physic instructor on staff. NO YES ?
   b. The size of our enrollment was too small for a Physics class. NO YES ?
   c. The geographic location of the school could not attract a Physics teacher. NO YES ?
   d. The salary and/or benefits could not attract a certified Physics teacher. NO YES ?

4. QUESTION -- Diminishing state funds has made it impossible to implement the suggested College Core Curriculum in rural Oklahoma. AGREE___DISAGREE___

5. QUESTION -- Is you school using the suggested computer program that is designed for this program? NO YES ?

   a. Apple IIe? NO YES ?

   If your answer is NO, what system are you using? ____________________________________

6. QUESTION -- Is your school using the suggested lab kit designed for this Physics program. NO YES ?

   a. Are you using a lab design of your own? NO YES ?

b. Is there a lab facility in the building? NO YES ?

RESPONSES: ______________________________

____

____

7. QUESTION -- The exposure to Physics provided by this program (A.S.T.S.) will:

a. Aid in improving the A.C.T. scores of your school's graduates? NO YES ?
b. Improve the competitive ability of your college bound students in the Science area? NO YES ?
c. Enhance the possibility that your graduates will enroll in higher level Science courses in college? NO YES ?

8. QUESTION -- Has the A.S.T.S. Physics program fulfilled the stated needs of your school? NO YES ?

a. If you answer NO the above question, would you indicate the reason(s) these stated needs have not been met:

____

____

9. QUESTION -- Was the teacher present in the classroom:

a. Certified by the state department to teach a secondary subject area? NO YES ?
b. Certified by the state department to teach Math? NO YES ?
c. Certified by the state department to teach Science? NO YES ?
d. Certified by the state department to teach Computers? NO YES ?

10. QUESTION -- If you answered NO to any of the above questions, did you see the lack of certification as a hinderance to performing the task of monitoring the over-all Physics program? NO YES ?

11. QUESTION -- From the questions b, c, and d which certification would be more helpful in performing the task of monitoring the over-all Physics program? (circle) MATH SCIENCE COMPUTERS

RESPONSES: ______________________________

____

____

FOR SCHOOLS THAT HAVE USED THE TELECONFERENCING SATELLITE PHYSICS PROGRAM BUT HAVE DROPPED THE PROGRAM AFTER ONE YEAR OF PARTICIPATION.

It is noted that your school was listed as participating in the A.S.T.S. Physics program, however, this school year your school was not listed.

12. QUESTION -- Would you indicate the reason(s) for discontinuing the Physics program? Was it because:

a. The daily scheduling of the program did not fit into your school schedule? NO YES ?
b. The Physics program was not fulfilling the stated needs of our school? NO YES ?
c. The monitor was not equipped to continue the televised program into the lab or the computer setting? NO YES ?
d. Students did not enroll in the program this year? NO YES ?

COMMENTS -- If you have other reasons that were not listed and would share those with this researcher, please write them below:

____

____

____

____

____

____

APPENDIX C

SURVEY FORM - FACILITATORS

SURVEY -QUESTIONNAIRE
(Facilitator Form)

Dear Facilitator:

The purpose of this questionnaire is to ask you about the teaching experience you have had be participating in the A.S.T.S. Physics Program from Oklahoma State University.

Would you answer the following questions concerning your contact with this program?

Facilitators Form -- Questions denoted "F".

COMPUTER CONTACT

1. QUESTION -- Was there a computer available for student to use in this program? NO YES ?

   a. Did you have difficulties in using the computer and/or the programs? NO YES ?
   b. Was the computer programs a helpful tool in understanding the lessons? NO YES ?

LAB CONTACT

2. QUESTION -- Did you use a laboratory setting at any time during the school year? NO YES ?

   a. Did you use the provided lab kit? NO YES ?
   b. If both the above answers are NO, do you feel this was a hinderance to the program? NO YES ?

SATELLITE LEARNING

3. QUESTION -- Could you detect a difference in attitudes in students in this type of program versus a regular classroom setting? NO YES ?

   List differences ________________________

   ____

   a. Was the relationship between the students and the satellite teacher positive? NO YES ?
   b. Would you regard this program as a quality effort to improve education in rural schools of Oklahoma? NO YES ?

4. QUESTION -- Do you feel you were prepared to deal with the:

   a. Topics of the course? NO YES ?
   b. Computer problem solving? NO YES ?
   c. Homework assistance? NO YES ?

5. QUESTION -- If you were asked to be a facilitator next year would you have any reason to say no? NO YES ?

6. QUESTION -- If other courses were offered by satellite would you volunteer to serve as the facilitator? NO YES ?

7. QUESTION -- Would you consider a personal interview concerning your experiences while acting as a facilitator of A.S.T.S. Physics program? NO YES ?

APPENDIX D

SURVEY FORM - STUDENTS

ASSESSMENT -QUESTIONNAIRE
(Student Form)

Dear Science Student:

The purpose of this questionnaire is to ask you about the learning experience you have received by participating in the A.S.T.S. Physics program from Oklahoma State University.

Would you answer the following questions concerning your contact with this program?

Student Form -- Questions denoted "S".

COMPUTER CONTACT

1. QUESTION -- Was there a computer available? NO YES ?

a. Were the programs helpful in understanding the physics problems? NO YES ?
b. Did the facilitator have the expertise to utilize the computer and programs? NO YES ?

LAB CONTACT

2. QUESTION -- Was there a laboratory available? NO YES ?

a. Were the lab kits and experiments provided with the program used? NO YES ?
b. If yes, were they helpful? NO YES ?
c. Did the facilitator have the expertise to utilize the lab kits and experiments? NO YES ?

SATELLITE LEARNING

3. QUESTION -- Is this the first course that you have taken by a long distance approach? NO YES ?

a. Is there major differences between learning by satellite and learning experienced in a regular classroom? NO YES ?

If yes, list them if you would.

____

____

b. Is homework in this type of program different from that of regular classroom homework? NO YES ?

If yes, list ways that it is different.

____

____

c. If this type of programing had not been available, could you have taken a Physics class at your High School? NO YES ?

4. QUESTION -- What were the primary opportunities that you considered before enrolling in this type of program?
   a. Something different to do? NO YES ?
   b. Needed a Science credit for graduation? NO YES ?
   c. Considering a Science major in college and thought that this would help? NO YES ?
   d. Thought this would improve the chances of a scholarship? NO YES ?
   e. Thought this would improve my A.C.T. composite for higher placement in college? NO YES ?

5. QUESTION -- If other satellite programs were offered at your school site, would you consider enrolling in the course? NO YES ?

6. QUESTION -- Would you consider an interview with this researcher concerning your contact with the Physics program? NO YES ?

APPENDIX E

INTERVIEW QUESTIONS FOR ON-SITE VISIT

INTERVIEW QUESTIONS USED DURING ON-SITE VISITATIONS WITH PARTICIPATING SCHOOLS AND TELEPHONE VISITATIONS WITH NON-PARTICIPATING SCHOOLS.

1. Could the physics course be offered if the A.S.T.S. program was not used? Why?

2. What do you consider the greatest strengths of this instructional program?

3. What do you consider the weaknesses or limitations of this instructional program?

4. How could this distance learning approach be improved?

5. What opportunities did this program offer that would not have been offered without the program?

6. What were your reasons for implementing this program at your school (admin.) or enrolling in this program at your school (student)?

7. To the best of your knowledge of the A.S.T.S. physics program, is it working to improve the educational opportunities in rural and small schools of Oklahoma?

APPENDIX F

OKLAHOMA STATE DEPARTMENT OF EDUCATION SURVEY

Oklahoma State Department of Education

LEARNING BY SATELLITE - 1987 ASSESSMENT

Interview Sheet for Administrators

Statistical Data:

1. Total High School enrollment _____

2. Total number of students receiving high school credit for courses by satellite _____

   German I _____

   German II _____

   Physics _____

3. Describe the academic level of students participating in satellite courses from OSU.

   a. mostly "A" and "B" students

   b. mostly "C" students

   c. any student that enrolls

   d. other special qualifications

4. Size and manufacturer of your satellite dish downlink (antenna)

   ____

5. Number and manufacturer of the microcomputers that are utilized in the satellite courses.

   ____

Open-ended Questions:

6. Would these courses be offered at your school if you were not participating in the satellite programs? Please explain.

Learning By Satellite
1987 Assessment
Page Two

7. What do you consider the greatest strength of this instructional program?

8. What do you consider the greatest weakness or limitation?

9. What suggestions do you have for improvement of this program?

OKLAHOMA STATE DEPARTMENT OF EDUCATION

LEARNING BY SATELLITE - 1987 ASSESSMENT

Interview Sheet for Classroom Coordinators

1. Is the satellite course viewed live or taped? _____

2. Did you participate in the inservice training provided by OSU? _____

   If so, how would you rate the training on the following scale?

   "Poor" "Excellent"

   1 2 3 4 5

3. Are materials and information sufficient for your class participation? ____________________

   ____

4. Please rate each of the following on the basis of "Poor" to "Excellent."

		Poor					Excellent
1.	Attitude of students toward satellite	0	1	2	3	4	5
2.	Attitude of pupils toward OSU satellite instructors.	0	1	2	3	4	5
3.	Quality of student learning of courses taught by satellite and computers.	0	1	2	3	4	5
4.	Overall attitude of teacher in your school regarding quality of courses taught via satellite.	0	1	2	3	4	5
5.	Use of audio visual aids in satellite courses (eg. pictures, graphics, films, etc.)	0	1	2	3	4	5
6.	Frequency of actual teacher/student interaction in satellite courses -- that is teacher directly addressing individual students and students verbally responding to teacher.	0	1	2	3	4	5
7.	Benefit of satellite courses to your school's instructional program.	0	1	2	3	4	5

Learning By Satellite
1987 Assessment/By Coo nator
Page Two

		Poor					Excellent
8.	Cost effectiveness of satellite courses -- that is, has the learning received by students been worth the money?	0	1	2	3	4	5
9.	Use of the instructional computer component in the courses.	0	1	2	3	4	5
10.	Use of the speech recognition system.	0	1	2	3	4	5
11.	Use of the electronic mail.	0	1	2	3	4	5
12.	Return of test results and other paperwork by mail from OSU.	0	1	2	3	4	5
13.	Use of the 1-800 number	0	1	2	3	4	5

Open-ended Questions:

5. What do you consider the greatest strength of the system of delivery for instructional purposes?

6. What do you consider the greatest weakness or limitation?

7. What suggestions do you have for improvement of this program?

OKLAHOMA STATE DEPARTMENT OF EDUCATION

LEARNING BY SATELLITE - 1987 ASSESSMENT

Evaluator: ______________________________

Title: ______________________________

Strengths of this delivery system:

Weaknesses of this delivery system:

Recommendations for improvement of this delivery system including satellite transmission and computer-assisted instruction:

OKLAHOMA STATE DEPARTMENT OF EDUCATION

LEARNING BY SATELLITE - 1987 ASSESSMENT

Interview Sheet for Students

The purpose of this questionnaire is to ask you about the learning experience you have received by participating in interactive satellite instruction. Please WRITE or CIRCLE the appropriate answer for each of the following questions.

PART I:

1. What year are you in school?
   a) 9th grade   c) 11th grade
   b) 10th grade   d) 12th grade

2. ESTIMATE your grade point average in high school.
   a) "A" student   c) "C" student
   b) "B" student   d) "D" student

3. If you had a choice between enrolling in a satellite/computer course or taking the same course in a regular classroom, which would you choose? a) regular class b) satellite class

4. ESTIMATE on an average the number of times per week that you called your satellite teacher on the telephone to ask a question during class ________

5. ESTIMATE on the average the number of times per week that your satellite teacher called you or your school to ask a question during class ________

PART II:

Consider each of the following statements as they relate to your experience with satellite instruction. On a scale of "1" to "5" where "1" represents "strongly disagree" and "5" represents "strongly agree," circle the number that best describes your attitude.

	Strongly Disagree				Strongly Agree
1. My TV teacher has outlined the lesson objectives in my satellite course.	1	2	3	4	5
2. Lessons given over satellite seem very organized	1	2	3	4	5
3. I find it easier to pay less attention in a satellite class than in a regular class	1	2	3	4	5
4. The TV picture in my class is usually clear and easy to see.	1	2	3	4	5

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		Strongly Disagree				Strongly Agree
5.	The sound of the teacher's voice on TV is usually easy to hear and understand.	1	2	3	4	5
6.	When students call on the telephone I can easily hear and understand their voices on the TV.	1	2	3	4	5
7.	Visual aids (overhead transparencies, written notes, pictures, etc.) used by my satellite teacher are usually very legible and easy to see.	1	2	3	4	5
8.	The drill and practice on the subject software is very helpful.	1	2	3	4	5
9.	The voice-recognition unit has been helpful.	1	2	3	4	5
10.	The computer is an important part of this course.	1	2	3	4	5
11.	My tests are returned rather quickly	1	2	3	4	5

PART III:

Answer each of the following questions by comparing satellite instruction with regular classroom instruction:

1. Studying by satellite is

   a) much harder b) somewhat harder c) the same

   d) somewhat easier e) much easier

2. Homework assignments given in my satellite class are

   a) much harder b) somewhat harder c) the same

   d) somewhat easier e) much easier

3. Satellite courses are a) much more interesting b) more interesting

   c) the same d) less interesting e) much less interesting

4. Exams and quizzes given in my satellite class are a) much harder

   b) somewhat harder c) the same d) somewhat easier

   e) much easier

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Provide brief answers to the following:

1. What do you like best about your satellite course?

2. Do you think the satellite course is presented at a faster rate than your regular courses?

3. How important do you feel the computer drill and practice is to your grades?

4. What recommendations would you make to improve instruction via satellite?

VITA

Clarence Chick Holland, Jr.

Candidate for the Degree of

Doctor of Education

Thesis: A DESCRIPTIVE STUDY OF THE PHYSICS BY SATELLITE PROGRAM AND ITS IMPACT ON RURAL OKLAHOMA SCHOOL DISTRICTS

Major Field: Educational Administration

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma, July 7, 1944, the son of Clarence C. and Nelda J. Holland. Married to Wanda F. Pamplin on July 6, 1963.

Education: Graduated from Escondido Union High School, Escondido, California in June, 1962; received the Bachelor of Science degree from Northeastern Oklahoma State University, Tahlequah, Oklahoma in January, 1970; received the Master of Science degree from Northeastern Oklahoma State University in July, 1984; received the Master of Education degree from Northeastern Oklahoma State University, Tahlequah, Oklahoma, July, 1986; completed requirements for the Doctor of Education degree at Oklahoma State University in December, 1989.

Professional Experience: Biology teacher, Muskogee High School, Muskogee, Oklahoma from August, 1970 to June, 1972; Science teacher (Biology, Chemistry, Physics), Hilldale High School/Middle School, Muskogee, Oklahoma, from August, 1972 to June, 1987; Principal, Hilldale Middle School, July, 1987 to July, 1988; Principal and Secondary Curriculum Director, Hilldale High School, July, 1988 to July, 1989; Chairperson, Education Department, Associate Professor, Oklahoma Baptist University, Shawnee, Oklahoma, July 1, 1989 to Present.