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Attitudes of high school students in small rural schools toward interactive satellite instruction

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CHAPTER I. INTRODUCTION

> A strong commitment must be made to assure that students attending small high schools are not unnecessarily disadvantaged in their opportunity to receive a quality education (Barker, 1985-86, p. 3).

Providing a varied and quality curriculum is one of the major concerns of small rural high schools. These school districts are struggling to overcome the obstacles of declining enrollments, teacher shortages, decreased state funding, high transportation costs, and economic and agricultural changes that are shrinking their tax base (Hobbs, 1985). Heightened public expectations for education, initiated by "A Nation at Risk" (National Commission on Excellence in Education, 1983), have brought about changes at all educational levels that have created further problems for small schools. More rigorous curriculum requirements brought about by recent legislation have forced high schools to increase their graduation requirements and offer more courses. Although these mandates have affected all schools, they have produced a crisis situation for many high schools with low enrollments. As a result of these factors, small rural school districts are unable to deliver the same range of courses that are offered by larger districts in urban areas.

The question is being asked, "How then can ´necessarily small´ rural school districts...best be freed from their most pressing handicaps--geographic isolation and size-limiting resources--without sacrificing their strengths in order to overcome their weaknesses?" (Educational Telecommunications in Small Rural Schools, 1984, p. 5). Administrators of small rural high schools are seeking to answer this question by looking beyond traditional methods of instruction and are pursuing new alternatives to deliver quality courses in a cost-effective way. Hobbs (1985) reported that these school districts are directing more attention towards technology to expand their curriculum offerings and are expected in the future to become leaders in the use of distance learning. Although there are various successful forms of distance learning and multiple uses of technology being employed, many educators are showing an increasing interest in the use of live, interactive televised instruction via satellite transmission. Interactive televised instruction is a new concept at the secondary level, but it has the potential to equalize educational opportunities and resources by overcoming barriers of size, distance, and geography (Barker & Beckner, 1986).

> Thus, rural school districts, once severely constrained by the limitations of isolation, time, distance, and resources, may well be on the threshold of exciting new capabilities to deliver instruction and remain competitive with more advantaged metropolitan regions. Education techniques now possible through modern telecommunications are so sweeping and revolutionary in potential scope they are limited only by the imagination of the user (Educational Tele-communications in Small Rural Schools, 1984, p. 6).

Background

Distance learning

Distance learning describes instruction in which the student and the instructor are separated. In the past, small rural schools have used distance learning to meet instructional needs by offering correspondence courses, one-way TV courses, and videotaped lessons (Barker, 1987a). Today educators have an opportunity to take advantage of an increasing variety of technologies. Thus, the term distance learning has taken on a broader meaning. Barker (1986a) defined distance learning as "transmission of a master teacher's lesson from a host site to previously identified receive sites simultaneously by means of telecommunications" (p. 4). Batey and Cowell (1986) included three elements in the definition of distance learning:

> (1) Communication between the teacher and the students is not face-to-face.
> (2) An organization plans, coordinates, and supervises the program.
> (3) A technology based delivery system is often used (but is not required) (p. 2).

Batey and Cowell (1986) observed that although just five years ago examples of distance learning were not easily found, there are a wide variety of programs in operation today. Wall (1985) noted that most successful distance learning projects involved a combination of delivery modes. An obvious weakness of methods in the past has been the lack of student/teacher communication, but today, by the incorporation of various technologies, instruction has interactive capabilities.

Interactive distance learning implies direct communication between students and instructor at the time of delivery. Barker (1987b) identified the most common types of distance learning today as audioconferencing in single or multiple combination with microcomputers, videotapes, or print materials; or interactive television transmitted by Instructional Television Fixed Service, cable, microwave, or satellite. Audio conferencing allows student/teacher contact through conference or two-way telephone calls. Interactive television delivers video lessons combined with audio interaction by telephone.

The focus of this study was interactive satellite instruction, a form of interactive television that delivers audio and video transmission of the instructor by satellite with immediate student response by telephone. Interactive satellite instruction includes both two-way audio and one-way video.

Interactive satellite instruction

Satellite transmission begins when a program is produced and sent by an earth station transmitter called an uplink to one of the man-made communication satellites located 22,300 miles above the equator (Connett, 1985). This satellite is in geosychronous orbit; that is, the forward momentum of the satellite is equal to the earth's rotation, and because of this, it appears to be motionless (Paritz, 1985). The satellite accepts the uplink signal, amplifies it, and converts it using an electronic receiver/ transmitter known as a transponder. Each transponder has the capacity of two TV programs and 980 telephone calls (Ruggles et al., 1982). Paritz (1985) reported that early satellites had 12-20 transponders; later satellites have up to 27. The satellite redirects the signal back to earth where it is received by a downlink earth station. The downlink receiving dish converts the signal into sound, video, and data. Paritz (1985) noted that this transmission process takes approximately half a second.

Benoit (1985) reported that the C-band and the Ku-band are the most common formats for satellite frequencies. The C-band has a frequency of 4-6 GHz. Most home earth stations utilize the C-band. The Ku-band has a higher frequency, usually 12-14 GHz. This set of frequencies is more powerful and is more often used by educational networks.

Characteristics of satellite communication that offer advantages over other forms of distance learning are:

(1) Satellite transmission covers a wide geographic area. A satellite's reception area, called a footprint, covers one third of the earth's surface (Grieve & Singer, 1984).

(2) The cost of transmission is not determined by distance. The distance between the sender and receiver on earth is insignificant when compared to the distance a signal travels in space (Paritz, 1985; Ruggles et al., 1982).

(3) Instantaneous delivery allows simultaneous communication between widespread locations (Grieve & Singer, 1984).

(4) The inaccessible location of a satellite requires that satellite technology is highly reliable (Ruggles et al., 1982).

Ruggles et al. (1982) observed that since the Soviet Union launched Sputnik in 1957, the continuing growth of the space program and satellite technology has created new opportunities for educators interested in distance learning. Although Grieve and Singer (1984) reported that adult continuing education has accounted for the primary use of satellites in education, Barker (1986a) indicated, due to advancements in technology and significantly reduced costs, satellite communication is now beginning to have an impact on secondary schools, especially the small rural high school. Barker and Beckner (1986) identified three separate vendors in the United States who have been responsible for the rapid growth of satellite courses for high school students. They are: German and Physics by Satellite from Oklahoma State University; Accelerated Learning of Spanish Project Via Satellite by Utah Board of Education, Bonneville International Corporation, and IBM Corporation; and TI-IN, a for-profit, private corporation, approved by the Texas Education Agency. During the school year 1985-86, these three networks beamed 16 high school credit courses to 13 states, reaching over 2,300 students in 200 different high schools. In 1986, Eastern Washington University and Education Service District 101 became the fourth vendor of high school courses (Barker, 1987b).

Statement of the Problem

Proponents of interactive satellite instruction believe it has tremendous potential for solving the educational problems of small rural schools. Rudolph and Gardner (1986-87) predicted that the popularity of instruction via telecommunications in rural schools will increase in the future. Simonson and Rasch (1987) surveyed superintendents in Iowa and found that 54% had positive attitudes toward satellite instruction. Twenty (5.9%) Iowa schools stated that they currently own a satellite dish and 78 (23%) indicated that they plan to install one in the future. Barker (1987b) stated,

> The application of satellite technology for interactive television instruction in public schools is still in its infancy. The future will undoubtedly see more program producers enter the airwaves. As existing networks grow and new networks begin beaming instruction, interest...is expected to mushroom (p. 3).

Learning by satellite is presently a reality or will be a reality in the future for many high school students. Student support is essential for the success of any new method of instruction; therefore, educators need to examine how this technology will be accepted by participating students. Unfortunately, little research is available that identifies the attitudes of students enrolled in interactive satellite courses.

Purpose of the Study

This study was designed to describe the attitudes of high school students toward interactive satellite instruction. The second purpose of this study was to identify, through students´ opinions, the unique qualities of interactive satellite instruction and suggest recommendations for improvement.

Research Questions

A 55-item questionnaire in two parts was mailed to 396 students who were enrolled in at least one high school course for credit from the TI-IN Network. The data collected from this survey were analyzed in order to provide answers to the following research questions:

(1) What are the characteristics of students enrolled in satellite courses?

(2) Why have students elected to enroll in satellite courses?

(3) What are the students´ perceptions of the strengths and weaknesses of interactive satellite instruction?

(4) How do students view the difficulty of satellite courses?

(5) In the students' perceptions, does satellite instruction offer other benefits beyond course content?

(6) In the students' perceptions, does satellite instruction provide a sufficient level of interaction between students and teachers?

(7) What new ideas do students have that would improve satellite instruction?

(8) To what degree do students support satellite instruction?

Definition of Terms

Instructional Television Fixed Service (ITFS) - Transmission of televised instruction by low power TV with a limited reception range.

Cable TV - Transmission of TV instruction by cable to which a subscription fee is required.

Microwave TV - Transmission of TV instruction through the air using a high frequency for closed communications. Used for short distances because it requires line-of-site transmission.

Gigahertz (GHz) - A radio frequency unit in billions of cycles per second (Communication Satellite Receiver Systems for Public Schools, 1984).

Summary

Small rural schools are facing critical problems providing a quality curriculum because of high per pupil costs, low enrollment, decreased funding, and increased graduation requirements. Distance learning is especially appropriate to meet the needs of these schools (Levinson, 1984). While distance learning is not a new concept, advancements in technology have made satellite communications a viable option for secondary schools struggling to offer courses in a cost-effective way. Satellites have made possible the transmission of quality courses by live television combined with telephone response. Barker (1986a) stated, "Interactive satellite teaching could well be the curriculum equalizer for small and rural schools in the 1980s and beyond" (p. 17).

The prevalence of the small rural school problem and the rapid growth of satellite vendors suggests that an increasing number of high school students may be receiving interactive instruction by satellite. Unfortunately, little research has focused on the attitudes of these students.

This study asked high school students enrolled in a TI-IN course to respond to a standardized questionnaire designed to describe their attitudes toward interactive satellite instruction. The data collected from this questionnaire were analyzed in order to provide answers to eight research questions. The data described significant attitudes of students and suggested additional implications for interactive satellite instruction.

CHAPTER II. LITERATURE REVIEW

This review of the literature addressed the major areas of concern in this study and investigated the previous research in each area. Therefore, the review of the literature was separated into four categories: (1) impact of educational reforms on the small rural school, (2) historical development of satellites in education, (3) student evaluation of courses and teacher effectiveness, and (4) student attitudes toward interactive satellite instruction including a study by Barker of the TI-IN Network.

Impact of Educational Reforms

In order to understand the impact of educational reforms on small rural high schools, knowledge of the social and economic problems of these districts is necessary. Small and rural schools vary enormously between states and within states. Sher (1983) observed that each school can be vastly different from any other, and "diversity is the norm" (p. 258). Because the definition of a small or rural school is relative to the speaker, the Iowa Department of Education (Stan Kerr, personal communication, October 1, 1987) does not set a guideline by which to define these schools. In New York state, a rural school is defined as one having 25 or less students per square mile; a small K-12 school has an enrollment of not over 1,500 students. More than half of the schools in New York fall in either of these categories ("Educational telecommunications," 1984). Barker (1985-86) reported that the 1983 census indicated there are 15,144 public high schools today. Of these, 7,329 (48.4%)

enroll less than 500 students. In the state of Texas, two-thirds of the high schools enroll fewer than 650 students and 19% enroll less than 275 (Barker, 1987a). Marshall (1986) stated that a definition of smallness applied to schools is difficult to identify because "small is not a particular number but a set of symptoms" (p. 4). Even though definition of smallness is not universally accepted, the number of "small" schools in the United States is significant. In this study the small rural school was not defined by a specific enrollment number but regarded as a high school that had a low enrollment and/or geographic location that was a major handicap to offering a varied and quality curriculum.

Small rural schools "often serve as a source of community pride and symbols of local autonomy" ("Educational telecommunications," 1984, p. 5). The school is commonly considered the center of community life, and the decline of the school can affect both the social and economic climate of the community. Many people hold the traditional view that schools are space bound; that is, they believe all resources and management should be located at the school site (Hobbs, 1985). Therefore, community support is frequently very high. Dunne´s (1983) survey of America´s smallest rural schools showed that 75% of the respondents expressed a high level of satisfaction with their schools.

In the past, the first solution to the problems of small districts was consolidation (Hobbs, 1985). Barker (1985-86) found school consolidation has reduced the number of the nation´s schools from 34,402 public schools in 1960 to 15,601 in 1980. Declining enrollment, additional travel for students, and lack of public support has made consolidation a questionable alternative for many schools today (Hobbs, 1985). McKinney (1985) reported that a 1984 national survey showed half the public was willing to support educational reforms, but not at the expense of closing local schools. Dunne (1983) observed the real issue of those in opposition to consolidation is that of local educational control, a philosophy dating back to the Jeffersonian populist belief of self-government by individual communities.

Reduced enrollment due to a decline in the birth rate has affected schools throughout the nation. The recent farm crisis has forced younger families with school age children out of rural occupations and has further reduced the number of K-12 students in many districts (Neilsen, 1986). The decline in school population has produced higher per pupil costs at a time when economic problems in agriculture were shrinking fiscal resources. Neilsen found most schools depended on local property tax revenues, yet the depressed farm economy has resulted in delinquent taxes, a drop in land values, and unemployment in agricultural-related businesses. Therefore, the rural economy has been less able to support the costs of educational services. Barker and Muse (1983) compared K-12 rural schools with an enrollment of 300 or less to rural schools with an enrollment of 301-900. Superintendents in both groups indicated securing adequate funding as the most important challenge they faced.

The survey by Barker and Muse (1983) further revealed that superintendents in the smaller districts ranked hiring teachers as one of their greatest problems, although both groups reported finding teachers in math and science as their most difficult recruitment problem. Three reasons that have made this problem more acute in small rural schools were (1) lower teacher salaries, (2) higher number of daily preparations required (Barker & Muse, 1983), and (3) reluctance of teachers to stay in isolated locations (Rudolph & Gardner, 1986-87). Barker and Muse (1983) found that a higher percentage of teachers in smaller secondary schools were teaching outside their area of certification and teachers in smaller high schools had four preparations per day as compared to three preparations in larger districts. Rudolph and Gardner (1986-87) noted that raised state certification requirements have contributed to this problem because teachers have been forced to gain additional certification. Almost 30 states have made changes in their policies for teacher certification (Goertz, 1986).

Dunne (1983) stated, "It may be more important to rural people to have their own school than to have what they and the experts would agree is ´better quality´ education" (p. 256). But what the "experts" are requiring of school districts is a reality that the small rural school cannot ignore, even though it creates additional problems. Barker (1987a) reported since "A Nation at Risk" (National Commission on Excellence in Education, 1983), every one of the 50 states has initiated efforts of educational reform. The National Commission on Excellence in Education (NCEE) recommended that all four-year colleges and universities should raise their entrance requirements. The minimum recommended state and local high school graduation requirements were (1) four years of English, (2) three years of mathematics, (3) three years of science, (4) three years of social studies, and (5) one-half year of computer science. For the college-bound, two years of foreign language in the high school was recommended.

There has been considerable public support throughout the nation for these recommended standards. McKinney (1985) observed that according to a national survey, the majority of the American public favors the NCEE recommendations for high school students. Barker (1985-86) surveyed principals in high schools with less than 500 enrollment. His data showed that high school principals realized additional courses were needed, especially in the area of computer skills.

Goertz (1986) identified secondary school graduation standards of the 50 states and reported that 43 states had raised their 1985 graduation requirements. The Iowa Department of Education (1987), for example, has proposed new standards that would require schools to offer and teach a minimum of 41 units in grades 9 through 12, as compared to the present 27 units. Additional criteria have been proposed to enrich specific curriculum areas. Similarly, state legislation in Texas mandated that schools provide 30 compulsory courses in their curriculum (Barker, 1985). Goertz (1986) reported the majority of states have increased requirements for numbers of mandatory courses by one or two units, establishing a general pattern of requirements of four years of English, two to three years of social studies, two years of mathematics and science, and one to two years of physical education. Goertz found that only five states required a one-semester computer science course. Goertz also found that an increasing number of states have defined extra requirements for the college-bound student. Five states mandated that these students complete additional units of foreign language, computer science, math, and science.

A study by the Center for Educational Statistics ("Public high school," 1986) revealed that even though school districts have increased their graduation standards and plan to further increase them by the 1987-88 school year, the requirements still would be lower than those recommended by the NCEE. The number of average credits has increased from 19.7 to 20.3, with an expected increase to 21. The number of courses required for graduation have been fairly similar regardless of size and location of schools. In 1985, schools with an enrollment of less than 2,500 required 20.4 credits for graduation; schools of 10,000 or more required 20.2 credits. Rural districts required students to complete 20.2 credits; urban districts required 20.5 credits. By 1988 the requirements in English and social studies are expected to come very close to NCEE recommendations, but math and science are expected to increase only to 2.3 and 2.0 credits. The report further indicated that only 11% of the districts will require foreign language courses in 1988 and only 22% will require a computer science course. It would appear that all secondary schools will need to significantly increase their curriculum offerings in order to meet public expectations for excellence in education.

The challenge to provide additional courses is especially difficult for the small rural schools already burdened by strong community pressures, limits of consolidation, declining enrollments, rising per pupil costs, reduced funding, and lack of qualified teachers. Despite their problems, a number of educators feel these schools have many strengths and it is important to preserve them. Dollar (1984) stated, "Smaller schools offering diversity and choice may be one of the most important strategies for educational improvement" (p. 2). He further noted,

> They offer, due to their smaller size, the best opportunity to create a school climate conducive to teaching and learning. They are, by definition, school-based innovations.... They accommodate diversity and choice both intrinsically as options and through internal flexibility of roles (p. 3).

Hobbs (1985) reported that small rural schools are expected to lead urban schools in adoption of creative educational innovations, especially in the application of technology. He offered these reasons: (1) Although all small rural schools are not creative, small schools because of their size, are more capable of being adaptive and flexible than larger districts, and (2) small rural schools have a unique and critical problem. They must find viable alternatives that will enhance the secondary curriculum in order to maintain their schools. Telecommunication technology has the potential to contribute to the solution of this problem by "delivering whole chunks of education over space in a cost effective way" (p. 11).

History of Satellites in Education

The early educational satellite experiments and demonstrations used the communications satellites built and launched by the National Aeronautics and Space Administration. During the 1970s the Applications Technology Satellites (ATS) provided the foundation for future educational projects (Polcyn, 1981). Norwood (1981) identified the first educational satellite system as Pan-Pacific Education and Communications Experiments by Satellite (Peacesat). This system used the ATS-1 satellite and in 1971 linked two campuses of the University of Hawaii. The following year Peacesat grew to include 12 Pacific Basin nations. This was the beginning of a wide range of international, regional, and domestic educational satellite projects. Schneller (1983) noted that most of these projects were short-lived; one only lasted a single day, but a few are still in existence.

Alaska and Hawaii used the ATS-1 for audio communications from 1971-74. Norwood (1981) reported that with the launching of the ATS-6 in 1974, color television signals became available. The Health/Education Telecommunications Experiments (HET) used the ATS-6 and demonstrated the value of satellites for providing educational programs to inhabitants of sparsely populated areas. The HET projects capitalized on the capability of offering two-way audio and one-way video. This capability made the ATS-6 experiments different from the one-way video mode of instructional television. The principal components of the HET experiments were the Appalachian Education Satellite Program, Experimental Satellite Communications Demonstration in Alaska, and Federation of the Rocky Mountain States - Satellite Technology Demonstration. These projects began operation in 1971 and concluded in 1974 (Polcyn, 1981).

The Appalachian Education Satellite Program (AESP) was initiated in 1975 by the Appalachian Regional Commission, the University of Kentucky, and eight state educational agencies. The purposes of the AESP were to provide in-service training for teachers and to investigate the effectiveness of satellite delivery of courses (Ruggles et al., 1982). The project offered two graduate courses in teaching elementary reading and two in career education at 15 different sites. Schneller (1983) reported that AESP was one of the few experiments successful enough to enable the programming to be transferred to commercial satellite. In 1979, AESP evolved into Appalachian Community Services Network: The Learning Channel. The Learning Channel transmitted educational programs for adults by satellite, including university courses and continuing education. These programs were available for retransmission by cable systems throughout the United States (Hudson & Boyd, 1984).

The Experimental Satellite Communications Demonstration in Alaska was primarily an experiment to gain experience required to plan and operate a satellite system (Polcyn, 1981). Ruggles et al. (1982) identified the four major programs offered as English language for primary-age children, health education for intermediate grade school children, public affairs for native Alaskan adults, and teacher training. These programs were received at 15 rural sites. Polcyn (1981) noted that this demonstration provided the knowledge and skills to develop the first state educational satellite system. Learn/Alaska, created by the Alaskan Legislature in 1980, offered a variety of instructional services throughout the state. Every Alaskan community of over 50 people had an earth station that included two telephone channels; in 100 villages television signals were received (Norwood, 1981). Barnhardt and Barnhardt (1983) related that students living in communities often accessible only by air and with only one village phone were able to interact with students in other parts of the state and other states through the Learn/Alaska audio and computer network. Six hours of instructional television were available for schools each day through Learn/Alaska.

The Federation of Rocky Mountain States - Satellite Technology Demonstration (STD) was the most extensive of the HET experiments. Hudson and Boyd (1984) reported that STD designed, produced, and broadcast three programs during 1974-75. These programs included a career development series for junior high students, an inservice on career development for teachers, and a community interest program for adults. Fifty-six of the 68 receiving sites were isolated rural schools located in eight Rocky Mountain States. Dale (1975) identified the goals of STD as: (1) to demonstrate the feasibility of delivering programs by satellite to isolated populations, (2) to evaluate user acceptance, and (3) to determine the costs of different delivery modes. The STD was not continued after this experiment, but it showed the feasibility of satellite delivery for rural audiences and identified positive components (Polcyn, 1981).

Since the existence of the early satellites, there have been dramatic advances in technology that have lowered the cost of satellite delivery to a level affordable for public education. Grieve and Singer (1984) found the cost of a satellite ground system has decreased from millions of dollars to thousands in just 25 years. Connett (1985) stated, "A downlink receiver which would have cost $70,000 10 years ago can be purchased today for $2,000 to $3,000...it will be possible for any school that can afford a microcomputer to purchase a downlink receiver" (p. 30). Norwood (1981) attributed the development of the geostationary satellite as a major factor in reducing the cost of satellite transmission. With geosychronous satellites earth stations do not need tracking mechanisms to send or receive signals; an antenna can be aimed in one position. The geostationary satellite can also broadcast to a much larger area than early satellites. Polcyn (1981) reported that increased use, life expectancy, power, and communications ability of today's satellites, as well as the decreased cost and size of earth receiving stations, has made satellite communication much less expensive. Polcyn identified eight trends of the 1980s which could influence the use of communication satellites in education in the 1990s:

(1) The life expectancy of a satellite has expanded from 7 to 10 years and is expected to advance to 15 years. A longer life expectancy will lower service costs.

(2) The number of communication channels per satellite is expected to increase, thus lowering user costs.

(3) Solar panel wattage has increased over six times since 1965, and improvements in solar cells will continue. The power of a satellite is provided by solar panels. Increased power is inversely related to the cost of an earth downlink; the more powerful the signal, the less expensive the earth receiver.

(4) The development of the extremely powerful and stable direct broadcast satellite (DBS), such as the ATS-6, has made usage more affordable. The DBS has the ability to focus signals so that a small earth station costing under $500 can be used. The

DBS also eliminated the use of local cable systems to redistribute the signal (Grieve & Singer, 1984).

(5) The use of intersatellite communication which transfers signals from satellite to satellite will enhance the satellite's efficiency, capacity, and number of programs available, therefore reducing costs.

(6) United States carriers are planning for future satellites to be capable of on-board data processing which will facilitate the movement of large quantities of data.

(7) Digital modulation, based on computer technology, may contribute to cost reduction through the ability to express data as bits.

(8) As lower frequencies are being saturated, the use of higher frequencies have reduced costs. The more powerful transponders operating in the Ku band require less expensive downlink installations. Benoit (1985) found that a typical business or institutional C-band system costs from $15,000 to $20,000; a similar Ku-band system costs from $6,000 to $8,000.

During the early 1980s, as educational satellite courses were increasing at the university level, advancements in telecommunications led to the creation of various distance learning projects in the secondary schools. Wall (1985) reported that a growing number of small rural school districts began to link their high schools by ITFS, cable, or two-way TV. Barker (1987b) noted that these regional networks were appealing to many small districts because they could maintain local control. However, expenses were very high, ranging from $400,000 to $2,000,000. Funding was often received from federal, state, and private grants. Three exemplary projects were (1) Two-Way Instructional Television (TWIT), Morning Sun, Iowa; (2) Eagle Bend, Minnesota, project; and (3) Curriculum Improvement Resulting from Creative Utilization of Instructional Two-Way Television (CURCUIT), Trempealeau County, Wisconsin. These projects all utilized two-way TV by microwave or cable and are still in operation today. Two-way television is interactive televised instruction in which cameras and monitors in each site allow students and instructor to see and hear each other.

The TWIT project linked four Iowa schools by microwave (Wall, 1985). Each school had the equipment to provide live, two-way audio and video transmission of psychology, sociology, pre-calculus, and Spanish courses. A disadvantage of this system was that microwave signals were limited to a distance of 30 miles. The TWIT model was used in the design of a similar system in New York (Educational Telecommunications in Small Rural Schools, 1984).

Hobbs (1985) described how five schools within a 70-mile range shared an interactive ITFS system with headquarters in Eagle Bend, Minnesota. Seven courses were transmitted, each originating at the school with the most qualified teacher. Batey and Cowell (1986) reported that Minnesota had developed a state network in which 50 school districts in seven clusters participated in instruction by two-way video and two-way audio.

Eight school districts in Trempealeau County, Wisconsin, shared Spanish, advanced math, shorthand, digital logic, German, and advanced computer courses via two-way TV (Hagon, 1986). Project CURCUIT used microwave and cable to link schools 50 miles apart. Hagon reported that CURCUIT served its purpose to enrich the curriculum by offering effective limited-demand courses.

As educators sought alternatives to provide courses for their high schools, and advancements in satellite technology lowered costs, four vendors in the United States pioneered the concept of interactive satellite instruction for high school students. Hobbs (1985) stated that these vendors used state-of-the art technology and "because of the combination of rural need and the marriage of several technologies have produced a method of providing entire courses to rural schools that are unable to offer them through traditional means" (p. 19). These four vendors are German and Physics by Satellite, Accelerated Learning of Spanish Project Via Satellite, Telecommunications Project, and TI-IN.

German and Physics by Satellite, administered by the Oklahoma State University College of Arts and Science, was the first vendor to appear and has grown to be the second largest (Barker, 1987b). Barker (1986a) reported that in 1983-84 science enrichment courses were offered to 21 Oklahoma high schools. By the 1986-87 school year, German, German II, and physics had been added and the program had expanded to include 101 high schools in six states (Barker, 1987b). Barker (1986a) observed that courses were broadcast three days a week to the school's downlink dish. Audio interaction between students and teacher was made possible by telephone. During the other two days, students worked on computer-assisted lessons with voice recognition software. The subscription fee was $1,750 for each course taken. This fee covered up to 10 students; if more than 10 were enrolled, an additional $50 per student was charged. Hardware costs ranged from $5,000 to $10,000.

The third largest satellite system, Accelerated Learning of Spanish Project sponsored by the Utah Board of Education, Bonneville International Corporation, and the IBM Corporation, began operation at the start of the 1985-86 school year in response to the foreign language entrance requirement at the state universities (Batey & Cowell, 1986). The Utah network transmitted Spanish I to over 800 junior and senior high school students in six states during 1986-87 (Barker, 1987b). Jordahl (1986) described how the satellite presented live 45-minute lessons two days per week. Each lesson was followed by a 15-minute interactive question and answer time by telephone. Three days each week the students worked on computer-assisted exercises that included voice input and speech synthesizers. Barker (1986b) found the most notable difference in this system was that previously recorded videotapes were used and no live audio interaction was included in the 1986-88 broadcasts. He stated, "In truth, this is not an interactive television project.... The strength of satellite is that it allows for live broadcasts and live teacher/student exchange" (pp. 7-8). Barker reported that costs were higher for the Utah program than for the Oklahoma system. The subscription fee was $1,600. Each student was charged $15 for materials or $100 for duplication rights for a class. Hardware costs were about $18,500 for 10 students. Jordahl (1986) noted "the initial investment for satellite reception equipment, computers, and software is roughly equivalent to a teacher's annual salary" (p. 15).

The Telecommunications Project, sponsored by Eastern Washington University and Educational Service District 101, was the most recent vendor in the interactive television satellite market (Barker, 1986b). Batey and Cowell (1986) related that in September 1986, Eastern Washington beamed Spanish, pre-calculus, advanced English, and Japanese to 18 school districts and over 200 students. Barker (1987b) noted that the project was very similar to TI-IN. It offered live, interactive lessons five days a week and teacher inservice sessions. The participation fee was $357 per student per course; hardware costs were about $15,000 (Barker, 1986b).

These three systems experienced rapid growth and all plan to add more courses in the future, but Barker and Beckner (1986) found that the fourth and largest system, TI-IN, has become the fastest growing of all the networks. TI-IN, originally named the Texas Interactive Instructional Network, began beaming courses to 53 sites in September 1985. By 1986-87, TI-IN had expanded considerably and was transmitting 17 courses to 145 high schools in 12 states, reaching approximately 1,500 students (Barker, 1987a). In the fall of 1987, TI-IN offered over 100 hours per week of live, interactive programming distributed to 15 states (School of the Air, 1987). Batey and Cowell (1986) found that although TI-IN was owned and operated by a private corporation, lessons were developed and teachers were selected by the Texas Region 20 Educational Service Center. Accreditation for TI-IN was received from the Texas Education Agency. Barker (1986a) reported that TI-IN emphasized interaction between the student and the teacher; four cordless telephones provided telephone communication to the instructor at any time during the live, televised lesson. TI-IN (TI-IN Network, 1986) listed an annual subscription fee of $5,050; course fees were $240 per student per semester. A one-time hardware cost was $4,550. Equipment installation ranged from $3,300 to $5,800. Richard Guenther (personal communication, April 3, 1987), Director of Educational Services, Iowa Green Valley Education Agency, estimated the average school district spent about $20,000 the first year of operation and approximately $11,000 in subsequent years.

Characteristics of the TI-IN Network that contributed to its success were:

(1) TI-IN provided live interactive instruction 55 minutes a day, five days a week.

(2) TI-IN did not use computer-assisted instruction or individualized learning modules.

(3) TI-IN leased and maintained all equipment.

(4) TI-IN offered a broad curriculum. The 1987-88 program included math magnet honors composed of linear algebra, linear programming, probability and statistics, and computer math II; physics I; computer science I; psychology; sociology; trigonometry; elementary analysis; French I and II; Spanish I and II; English IV honors composed of composition and British literature; art history and appreciation; and German I and II (TI-IN Network, 1987).

(5) TI-IN offered more than accredited high school courses. Offerings included student enrichment programs, staff

development and inservice, college credit courses, and a Scholastic Aptitude Test review (TI-IN Network, 1987).

The TI-IN Network, as well as the other three major vendors of interactive satellite courses for high school students, have provided an opportunity for small rural districts to offer additional courses to their students. Thus, the literature supported Connett's (1985) statement, "Satellite technology, appropriately used, can play an essential role in the secondary school improvement process" (p. 32).

Student Evaluation

This study used a student questionnaire designed to describe student attitudes toward interactive satellite instruction. A review of the literature on student evaluation of courses and teacher effectiveness revealed a great deal of controversy over the value of such instruments. Therefore, a description of the research on student rating instruments seemed appropriate.

A number of sources supported the wide use of student evaluation of courses and teacher effectiveness. Traugh and Duell (1980) reviewed the literature and found students played an important role in the evaluation of instruction and teachers. Traugh and Duell surveyed 474 junior and senior high school students and discovered the majority of the students felt their responses would make a difference in the way their teachers taught, and the time they were asked to spend in evaluation was worthwhile. Powell (1980) suggested that while other sources of information have only inferred how students feel, student evaluations have provided their exact feelings. He stated,

> The rationale for seeking student feedback is straightforward. Students are a primary source of information on student interactions, the effectiveness of resource materials, and the instructional process. Since these are the basic factors of classroom dynamics, it is important for every teacher to know how students perceive them (p. 79).

Masters (1977) reported that most teachers who have used student evaluation instruments agreed the information gathered was valuable. Hayes, Kiem, and Neiman (1966) found 90% of high school teachers believed the student evaluation form they had given their students was useful. Hayes et al. also found that students were reliable and honest raters of their teachers.

Masters (1977) tested the validity and reliability of the Student Observation of Teachers and Teaching Techniques (StOTT) instrument with 925 high school students. He found that students were capable of giving teacher ratings that were stable over time. His research showed students could make thoughtful decisions, a quality of instrument validity. Masters found his conclusion was consistent with previous studies that demonstrated the ability of students to provide reliable ratings. Powell (1980) stated, "Although not 100% reliable, student reactions are more reliable than many other sources of information" (p. 79).

However, Owen (1976) investigated research on student evaluations of classroom teachers and found an opposing conclusion. He proposed "a moratorium on student ratings as evaluative measures" (p. 11) because they were not valid, reliable, or meaningful, and invited misuse. Soar, Medley, and Coker (1983) provided further information and claimed that all methods of teacher evaluation used today were inadequate. They noted that rating scales of teacher performance were invalid because they (1) reflected "the beliefs of the raters about the nature of competent teacher performance, not the actual competence of teachers" (p. 245); (2) were subject to the halo effect, defined as the overall impression a teacher makes; and (3) did not reflect accurate measurements.

Validity of student evaluations of courses and teacher effectiveness has been a major concern of many researchers. Hanna, Hoyt, and Aubrecht (1983) conducted a study to identify extraneous, biasing variables in student evaluation forms. They enumerated variables that influenced a student's ratings and thus decreased the validity of the instrument: (1) class size, (2) course subject, (3) interest in school, (4) attitude toward teachers, (5) motivation, (6) prior achievement, (7) class meeting time, and (8) grade awarded or expected. These variables were also identified by Owen (1976) as the most common problems of student rating scales. Similarly, Smith and Brown (1976) found a strong relationship between teacher ratings and student attitudes toward school and teachers, course difficulty, enjoyment of the subject, and grades expected to be received. A study by Masters (1977) showed that students' characteristics affected how they rated teachers. He also reported that research has produced mixed results on the relationship between student characteristics and their evaluation responses.

The time of the evaluation was also found to affect validity. Powell (1980) noted that an evaluation should be given at least six weeks after the class is in session. Junior and senior high school students agreed they rated courses differently after they took them than they did when the course was in session (Traugh & Duell, 1980). Hanna et al. (1983) observed that students enrolled in classes during the late afternoon gave lower teacher ratings than students in classes that met during other periods of the day.

Although the research on student evaluation of courses and teacher effectiveness provided divergent results and opinions, most researchers agreed that student evaluation instruments could be beneficial when used together with other information in a total evaluation plan. Masters (1977) concluded that StOTT should not be used to compare or evaluate teachers, but could be used effectively in self-evaluation. Student evaluations, therefore, have not been proven to be the solution to the comprehensive formal evaluation process, but have been found to provide foundations upon which improvements can be built.

Student Attitudes toward Satellite Instruction

A review of the literature revealed a limited amount of research on interactive satellite instruction at the high school level. Barker and Beckner (1986) reported that no data on the quality of interactive satellite high school courses had been published. Whittington (1987) reviewed the literature on effectiveness of live, interactive instructional television and found that two evaluations have been made by the TI-IN Network, but was unable to locate any controlled research on interactive televised instruction by satellite. Information on evaluations conducted by TI-IN was requested on July 31, 1987, and August 3, 1987 (see Appendix A). No reply was received from TI-IN.

The Oklahoma State Department of Education surveyed 30 schools that participated in German by Satellite (Barker & Beckner, 1986). The total enrollment in the program was 244 students; the mean enrollment per school was eight students. Principals responded that the program's greatest strengths were (1) the opportunity to study a foreign language not offered by the school, (2) the cultural experience provided, (3) the exposure to technology, (4) the promotion of independent study and motivation, and (5) the high quality of the instruction and materials. The weaknesses identified were (1) the lack of synchronization with the school schedule; (2) the need to increase the number of broadcasts per week in order to maintain student interest, provide subject background, and increase interaction; (3) the need to shorten the time between testing and reporting grades; and (4) the absence of a real teacher in the classroom.

Barker and Beckner (1986) conducted an informal evaluation of the Accelerated Learning Spanish project in Utah and Nevada. They contacted principals by telephone and received survey data from 40 students enrolled in the project. Students felt the class was "fun, interesting, and a quality learning experience" (p. 9). Students indicated a need for more classes to be offered and for more interactive opportunities between the students and teacher. Positive comments were reported regarding the quality of the teacher, value of student/computer interaction, and the opportunity to take the course.

Hudson and Boyd (1984) and Dale (1975) investigated the STD program in the Rocky Mountain States. Hudson and Boyd found that teachers felt the forced viewing times, required by STD in order to include live interactive audio response, were too restrictive. Dale collected data from 24 junior high schools. Students in the interactive schools rated the program higher than those in schools that were noninteractive.

Whittington (1987) noted that experiences with ITFS and two-way TV can be generalized to satellite instruction, since they both use the interactive television mode. Hagon (1986) found Wisconsin high school students who participated in CURCUIT were comfortable with the media and did not regard their instruction as remote. Denton, Clark, Rossing, and O´Connor (1984-85) conducted a comparison study of two-way TV and conventional classroom instruction for medical students. They reported that attitudes toward two-way television were mixed, yet many qualities of television were well-received. Denton et al. found these data consistent with other findings on student attitudes, indicating that the media were perceived favorably, yet most students preferred to receive instruction in the traditional setting. Sanborn, Miller, and Naitove (1976) administered an attitude inventory designed to measure students´ attitudes toward instructional television to 30 medical students. Sanborn et al. reported that students displayed a significant positive shift in attitudes toward two-way TV after taking an interactive TV course.

Similarly, Oakes (1986) reported positive opinions were expressed by university students involved in the Washington Higher Education Telecommunication System (WHETS). Washington State University and the University of Washington were linked by WHETS, which delivered four engineering and computer science courses to off-campus sites. Student opinions included comments that (1) the system was generally effective,

(2) the audio and video signal was clear, (3) the feeling of being part of a class was mixed, (4) the lack of feeling at ease when asking a question was a problem, and (5) the video capabilities were an advantage.

A study by Barker (1987a) was the only research identified that described student attitudes toward interactive satellite instruction at the high school level. Barker sent a 25-item questionnaire to high school students in 30 Texas school districts who were taking courses through TI-IN. He reported a number of interesting findings on the level of interaction, perceived advantages and disadvantages of satellite instruction, and student recommendations for improvement of the system. He analyzed responses from 159 students and found the following data:

(1) Average daily attendance per high school was 239. All schools were small rural schools.

(2) Eighty percent of the schools limited enrollment to "A" or "B" students.

(3) Students were 44% seniors, 25% juniors, 22% sophomores, and 9% freshmen.

(4) Most students (85%) were enrolled in one class.

(5) More than half (65%) of the students felt satellite courses were more difficult than traditional courses.

(6) Students felt homework, exams, and quizzes were more difficult than in traditional courses.

(7) Students reported they initiated calls to their teacher two to three times per week.

(8) The teacher called students by name and asked for their response two to three times per week.

(9) Seventy percent of the students preferred the regular classroom.

Major advantages and disadvantages perceived by the students were reported. The major strength identified was the opportunity to take courses that were not otherwise available. Other highly rated qualities were personality of the teacher and interesting instruction. The least liked qualities were (1) homework was too lengthy and too hard, (2) telephone communication was difficult, (3) the classes were too impersonal, and (4) some instructors were not good TV teachers. Students recommended improving audio quality, getting a bigger TV, keeping the equipment operating, and getting better teachers. Although Barker's findings were favorable, he noted that more studies need to be conducted.

Summary

Iowa State University professor of economics Neil Harl "observed that only rarely has rural education in the United States faced the challenges inherent in today's rural environment" (Neilsen, 1986, p. 5). The literature has shown that the combination of decreasing enrollments and shrinking budgets with increased curriculum and teacher certification requirements has produced serious problems for the small rural school district. A 1986 national survey revealed that even though small rural school districts are keeping pace with larger urban districts in providing increased curriculum offerings, anticipated graduation requirements in the nation's schools as a whole still do not meet the recommendations of the National Council on Excellence in Education. Subsequently, the innovative nature of the small rural schools and the magnitude of the problem has created an increasing interest in the educational applications of satellite technology to provide mandated courses.

Experimental educational satellite projects have been in existence since the 1970s. Projects in Appalachia, Alaska, and the Rocky Mountain States demonstrated that satellites are a feasible method of providing instruction. Technological improvements and the rapid growth of four major vendors have made interactive satellite instruction accessible to secondary schools. Although each of these systems has shown success, Barker and Beckner (1986) found that the TI-IN Network has become the largest, fastest growing, and most widely used of the four systems. They attributed TI-IN's accelerated growth to its offering of a broad curriculum, broadcasting five days a week, and using a traditional instructional "model of teacher-present/student-recite" (p. 6), designed to emphasize live interaction between the student and the teacher.

Research studies of student evaluation of instruction identified diverse variables that affect the validity of student ratings. Researchers using student evaluations need to be aware of the influence of these factors. Support was shown for the use of student evaluations as an instrument to provide feedback for self-evaluation of teacher effectiveness and courses.

A review of the literature disclosed a limited amount of research on satellite instruction at the high school level. Because of this, related studies of ITFS and two-way TV at the high school and university level were reviewed. Barker's survey of attitudes of Texas students toward interactive satellite instruction through TI-IN was described. Major strengths and weaknesses of satellite instruction were identified and recommendations for improvement were proposed. The study presented in Chapter III attempted to further examine the attitudes of high school students toward interactive satellite instruction.

CHAPTER III. METHODOLOGY

A review of the literature found that a study by Barker (1987a) was the only directly relevant research available that addressed the attitudes of high school students toward interactive satellite instruction. Administrators of small rural schools have been looking at satellite instruction as a nontraditional alternative for providing secondary courses. Since students are a primary source of information about classroom dynamics (Powell, 1980), it is important for administrators to be able to access additional research in this area to aid them in their decision-making process. Evaluation is also needed in order to implement improvements in the system. Barker (1987a) stated, "more indepth evaluative studies need to be conducted to ascertain how to best use this new approach to delivering instruction" (p. 10). This research study was conducted to describe the attitudes of high school students toward interactive satellite instruction delivered by the TI-IN Network.

Sample

In order to conduct this study, a list of school districts subscribing to TI-IN was needed. On July 27, 1987, a list of subscribers to the TI-IN Network was requested by phone from Jo Babbic, TI-IN Network. On July 31, 1987, Babbic replied that TI-IN prohibited the release of a subscriber list. A letter to Patsy Tinsley, president of TI-IN, was sent on September 1, 1987, that again made this request. The letter was forwarded to TI-IN by Gil Noble, Iowa coordinator for the TI-IN Network (see Appendix B). The network again refused to release this information (see Appendix C). An alternative method of collecting school district names was then employed. A list of TI-IN subscribers was compiled from viewing two sections of Spanish I and one section of French I on September 1 and 2, 1987. As a result, the number and location of the school districts were limited to those districts which had students enrolled in Spanish I and French I classes. Through this method and a search of the literature, 79 districts in Iowa, Kansas, West Virginia, Michigan, Texas, and California were identified. Because school district names were stated orally or were handwritten by the TI-IN instructors, the correct spelling was sometimes uncertain. The list was checked for accurate spelling and location in the directory National Five Digit Zip Code and Post Office Directory (1986).

The subjects in this study were high school students who were enrolled in at least one high school course for credit from the TI-IN Network. Barker (1987a) reported that the average class in each school district consisted of eight to nine students. His data were used as a basis for the estimation of number of subjects.

Instrument Design

Instrument chosen

The questionnaire was selected as the type of instrument used in this study. The questionnaire was identified as the most direct method of attitude assessment for a large group of subjects (Henerson, Morris, & Fitz-Simmons, 1978). Henerson et al. described this instrument as one that: (1) permits anonymity, (2) provides time for the subjects to think about answers, (3) delivers uniform questions, (4) allows a variety of questions, and (5) permits mailing to simultaneously reach a large number of widely-dispersed subjects. No existing measures were available; therefore, an instrument was designed following the procedures outlined by Henerson et al. The questionnaire is included in Appendix E.

Design of Part One

The questionnaire was divided into two parts. The purpose of Part One was to obtain background information in order to establish a profile of characteristics of high school students enrolled in TI-IN courses. Part One consisted of closed response questions. The items were designed to answer research questions 1 and 2 identified in Chapter I:

(1) What are the characteristics of students enrolled in satellite courses?

(2) Why have students elected to enroll in satellite courses?

Design of Part Two

The purpose of Part Two was to describe the attitudes of high school students toward interactive satellite instruction through the TI-IN Network and provide an opportunity for students to suggest recommendations for improvement. The "agreement-type" of attitude rating scale was constructed following the procedures described by Henerson et al. (1978, pp. 86-88).

The first step in the construction of the attitude rating scale was to collect student opinions about interactive satellite instruction. United Community High School, Boone, Iowa, students who were enrolled in TI-IN courses were selected as a pilot group. The students were asked to list five favorable or unfavorable statements in response to each of the research questions 3 through 8 identified in Chapter I. The questions were rephrased to make them easier to be understood by the high school students.

One week later the students were asked to respond to 75 of the statements using the following Likert-like agreement scale:

SA = Strongly agree

A = Agree

U = Undecided

D = Disagree

SD = Strongly disagree.

Each statement was placed into an attitude category which reflected one of the research questions 3, 4, 5, 6, and 8. The responses were assigned in descending order from five points for the most favorable to one point for the least favorable. A score was computed for each respondent in each of the five individual categories. High scorers and low scorers were identified in each category. Each statement was analyzed. Items that provided good discrimination between high and low scorers were retained. Henerson et al. (1978) stated, "The purpose for doing an item analysis is to select from a pool of items the ones that most effectively obtain the information you want, and to eliminate the less effective items from your instrument" (p. 87). A 38-item questionnaire was constructed by listing the retained statements in random order. The following is a list of the research questions and related questionnaire items:

(3) What are the students' perceptions of the strengths and weaknesses of interactive satellite instruction?
(Items 2, 4, 6, 16, 21, 24, 26, 28, 30, 33, and 34.)

(4) How do the students view the difficulty of satellite courses?
(Items 5, 7, 11, 15, 17, 20, 22, and 25.)

(5) In the students' perceptions, does satellite instruction offer any other benefits beyond course content?
(Items 1, 12, 18, 35, and 37.)

(6) In the students' perception, does satellite instruction provide a sufficient level of interaction between students and instructor?
(Items 3, 8, 13, 19, 23, 27, 29, and 31.)

(8) To what degree do students support satellite instruction?
(Items 9, 10, 14, 32, 36, and 38.)

Three questions relating to research question 7 were included in the open response format to provide an opportunity for students to express their opinions:

(7) What new ideas do students have that would improve satellite instruction?

Henerson et al. (1978) stated that open-ended items are valuable "to permit some ventilation of feelings, to uncover unanticipated outcomes, and to obtain some unprompted responses" (p. 61).

Reliability and validity of the questionnaire

The questionnaire was pilot-tested on the same United Community students. Students responded to the statements using the identical

Likert-like agreement scale that was previously used. The reliability of the measure for each research question was computed to be (1) question 3, $r = .65$, (2) question 4, $r = .46$, (3) question 5, $r = .75$, (4) question 6, $r = .73$, and (5) question 8, $r = .37$. Two items from the original collection of student opinions were added to increase the size of the measure for the two constructs (questions 4 and 8) that had low reliability. Item 39 related to research question 4; item 40 related to research question 8. Since the pilot group of 16 students was small, the reliability estimates were considered acceptable.

The construct validity was tested following the procedure described in Henerson et al. (1978, pp. 135-36). The questions, grouped by constructs measured, were given to six professionals who had experience with satellite delivery of high school courses. These professionals included two high school TI-IN facilitators, one high school principal, and three area education specialists. They were asked to indicate what construct each group of questions measured. The panel of judges responded with similar conclusions. The construct validity was determined to be acceptable.

The instrument, A Study of Satellite Instruction Test (SSIT) was reviewed and certified by the Iowa State University Human Subject Review Committee (see Appendix D).

Distribution of the questionnaire

School districts were randomly selected from the subscriber list. Administrators of these districts were contacted by phone. The purpose of the study was explained and permission was requested for high school students in their district to be allowed to participate in this research. These administrators were asked to give the number of students enrolled in grades 9-12 in their district and to indicate the number of high school students who were enrolled in a TI-IN course. Calling continued, using the randomly ordered list of school districts, until a sufficiently large sample was obtained. Twenty-four school district administrators agreed to allow their district's students to participate. A total of 396 students were enrolled in a TI-IN course in these districts. An examination copy of the SSIT and a consent form were sent to each district administrator.

Later, copies of the SSIT and a cover letter were sent in a packet to each participating school district (see Appendix E). A self-addressed, postage-paid return envelope was included. Three weeks after this mailing, school districts that had not returned their questionnaires were contacted by phone and requested to complete and return them.

Treatment of the Data

The data collected were used to describe the attitudes of high school students toward interactive satellite instruction. The data were analyzed to include these descriptive statistics: (1) frequency of each response, (2) percentage of each response, (3) number of responses for each item, (4) mean scores, and (5) standard deviation of scores.

CHAPTER IV. RESULTS

The responses from the questionnaire, A Study of Satellite Instruction Test (SSIT), were used to describe the attitudes of high school students in small rural high schools toward interactive satellite instruction delivered through the TI-IN Network. The data reported in this chapter were collected from the SSIT and statistically analyzed. This chapter contains the results of the statistical procedures used to: (1) present a description of the participating high schools, (2) provide a descriptive profile of the respondents, (3) provide a summary of the attitudes of the respondents toward interactive satellite instruction, (4) provide an examination of relevant relationships and differences among variables used in the study, and (5) present a summary of opinions and suggested improvements.

Description of High Schools

The results reported in this chapter were based on the responses to the 290 questionnaires (SSIT) returned by high school students who were sampled. The sample group consisted of students from 24 high schools who were enrolled in at least one course for credit from the TI-IN Network. Fourteen of the high schools were located in the state of Texas, four high schools were located in Iowa, three high schools were located in Kansas, and one each was located in the states of California, Michigan, and West Virginia. The school districts were randomly selected from a TI-IN subscriber list of 79 districts compiled from viewing broadcasts of two sections of TI-IN's Spanish I and one section of French I.

A packet of SSIT questionnaires was sent to each of the 24 school districts that had agreed to participate. Permission was obtained from the administrator of the district by telephone and by a written consent form. Of the 24 school districts sampled, 20 promptly returned the student questionnaires. A follow-up telephone call was made to the four schools who had not responded within three weeks. Three of the four districts that were telephoned returned their questionnaires. The superintendent of the fourth district indicated that the questionnaires had been distributed and would be returned, but they were not received.

The response rate for the SSIT was very good. The return rate of the school districts was calculated using 24 as the number of districts sampled and 23 as the number of districts that returned the packet of questionnaires. The school district return rate was ninety-six percent. The return rate of the students was calculated using 396 (sample size) and 290 as the number of SSIT questionnaires completed and returned. The return rate of students was seventy-three percent.

Administrators were asked to provide the size of the total enrollment of grades 9-12 in their district and to indicate the number of high school students who were enrolled in a TI-IN course. The average enrollment in the high schools sampled was computed to be approximately 149 (148.7) students. The range from smallest to largest was 42 to 430 students. Although a universally accepted definition of small rural schools was not found in the literature, the enrollment and location of the participating districts indicated that they could be accurately classified as small and rural schools. The average number of students enrolled in TI-IN courses in the high schools sampled was found to be approximately 17 (16.5) students. The range from smallest to largest was 2 to 48 students.

Profile of Respondents

The purpose of Part One of SSIT was to provide a descriptive profile of the sample. The items in Part One were relevant to research questions 1 and 2 listed in Chapter I. Frequency distributions were computed for each item in Part One of the SSIT in order to accurately describe certain characteristics of the sample and identify why students had elected to enroll in a satellite course. These distributions are illustrated in Figures 1-12.

The characteristics of the sample are described and reported in the same order that the question relating to that characteristic appeared in Part One of the SSIT:

(1) Fifty-seven percent (57.09%) of the students responding were female. Approximately forty-three percent (42.91%) of the students responding were male (Fig. 1).

(2) The students enrolled in a TI-IN class were predominately 10th, 11th, and 12th grade students. Approximately thirty-one percent (30.8%) of the responding students were seniors in high school. Twenty-eight percent (28.37%) were juniors, twenty-seven percent (26.99%) were sophomores, and twelve percent (12.46%) were freshmen. The data revealed that four students (1.38%) were eighth grade students who were enrolled in English as a Second Language (Fig. 2).

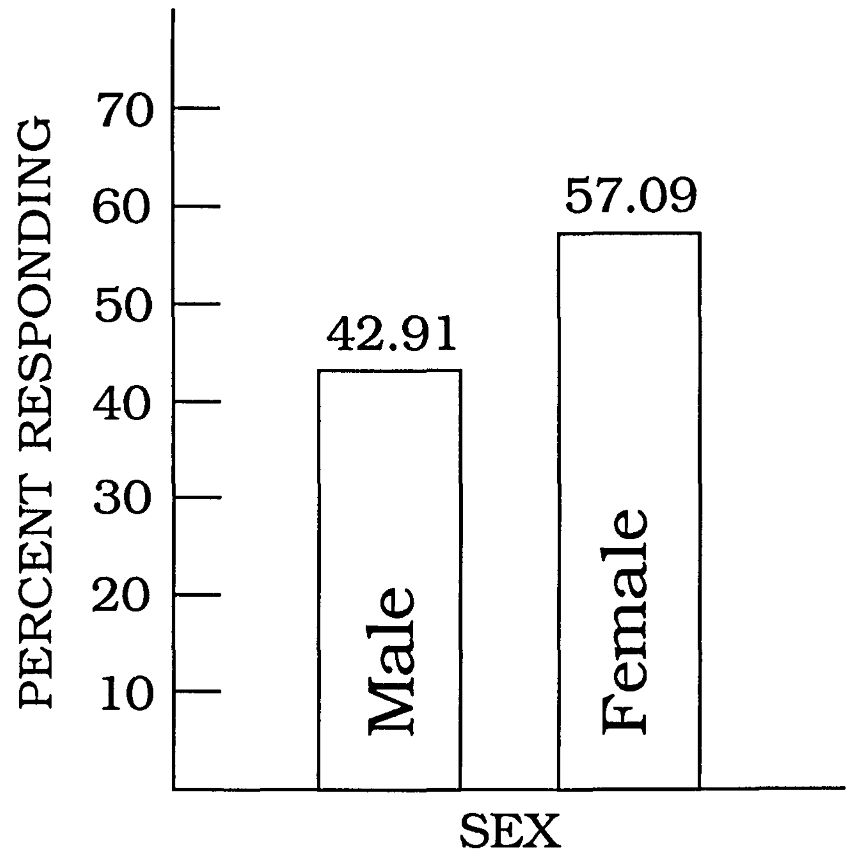

Figure 1. Sex of students

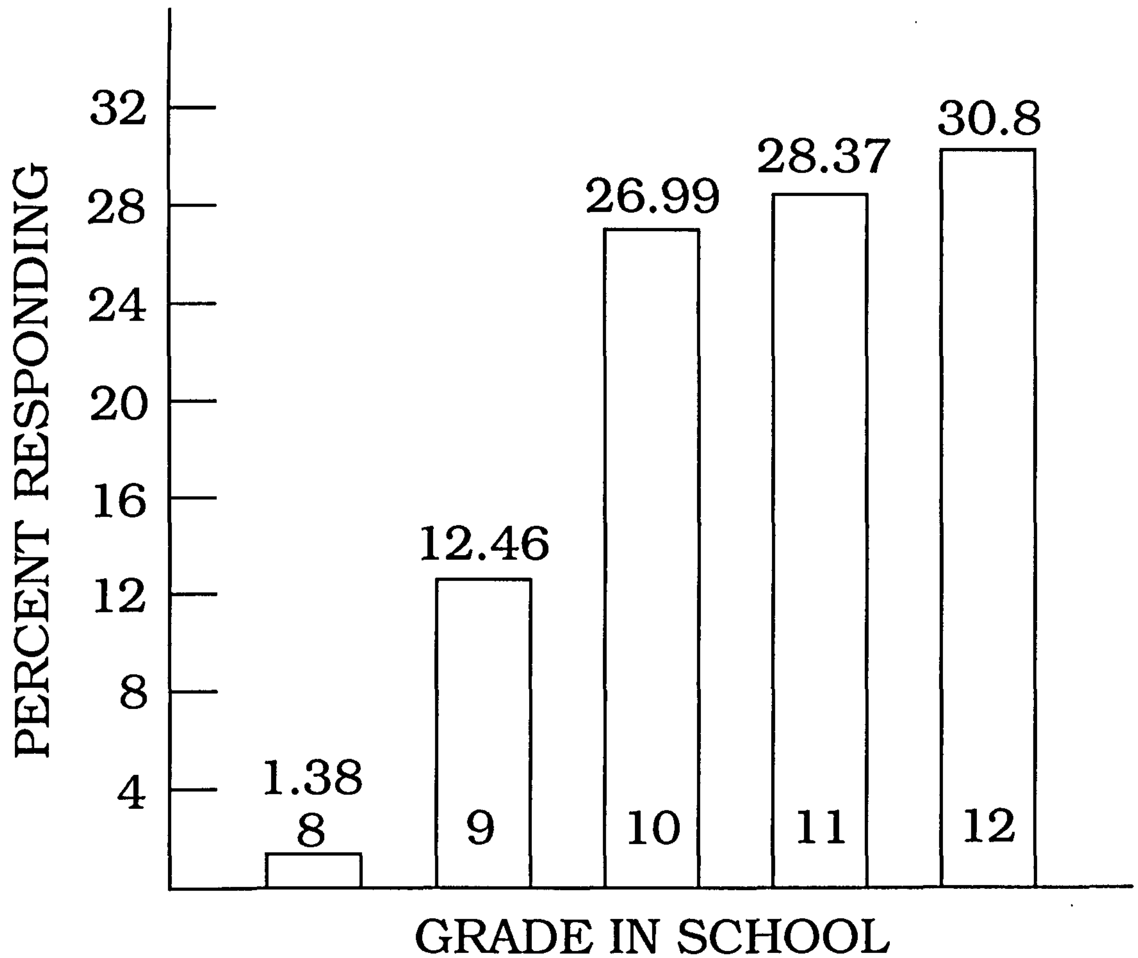

Figure 2. Students' grade in school

(3) Almost half (48.79%) of the students considered themselves to be "B" students, thirty-nine percent (39.1%) considered themselves to be "A" students, eleven percent (11.07%) felt they were "C" students, and one percent (1.04%) felt they were "D" students (Fig. 3).

(4) The majority (95.14%) of the students surveyed were enrolled in only one TI-IN course. Fourteen students (4.86%) were taking two courses by satellite. No student reported taking more than two courses (Fig. 4).

(5) The greatest percentage of the students (86.76%) were enrolled in their first satellite course. Approximately eleven percent (10.8%) of the students had previously taken one course by satellite, two percent (1.74%) had previously taken two courses, and only two of the responding students (0.7%) had taken three or more satellite courses before enrolling in their present course (Fig. 5).

(6) Figure 6 shows that the majority of the students were enrolled in a foreign language course. One hundred twenty-seven (44.1%) students were enrolled in Spanish I or II, approximately twenty-nine percent (28.82%) were enrolled in French I or II, and nine percent (9.38%) were enrolled in German I or II. The next largest enrollment, Art History and Appreciation, was reported by twenty (6.94%) of the high school students. Ten students (3.47%) were enrolled in English as a Second Language (ESL). Fourteen students were enrolled in more than one class.

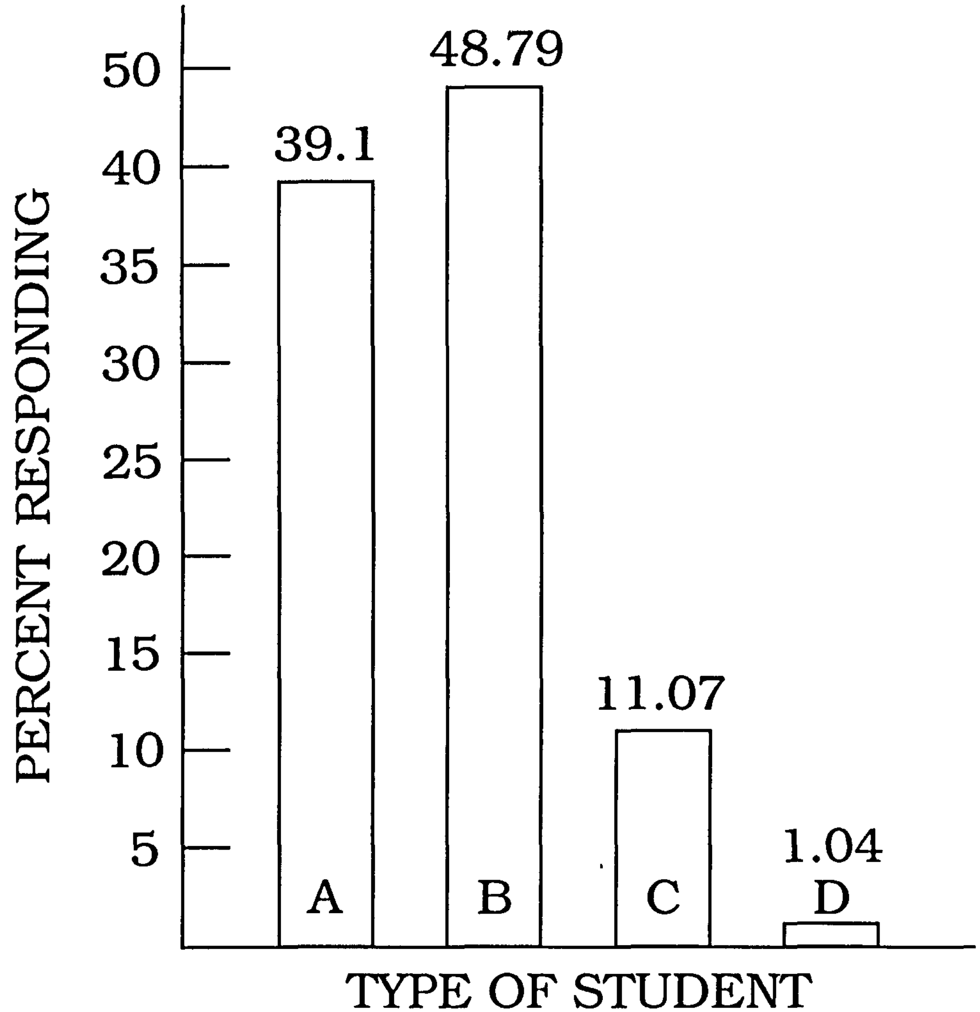

Figure 3. Academic ability of students

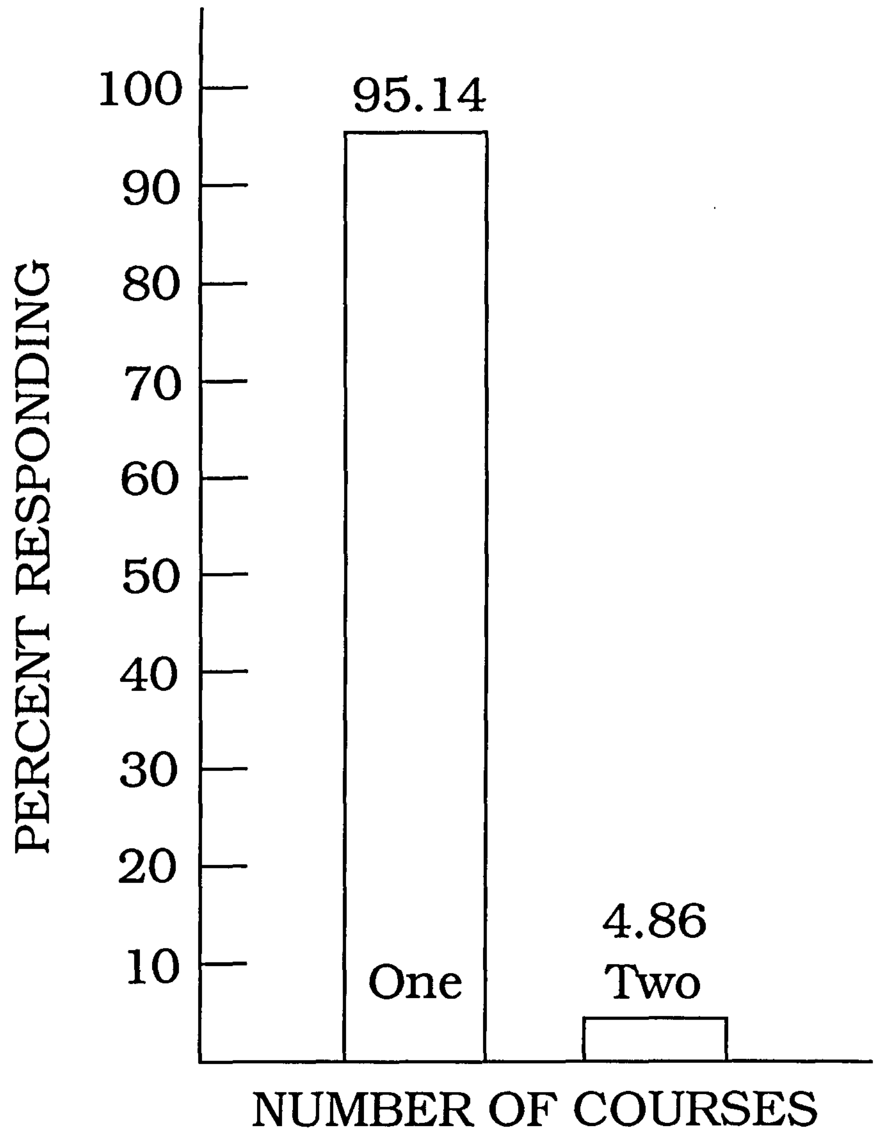

Figure 4. Courses presently taken by students

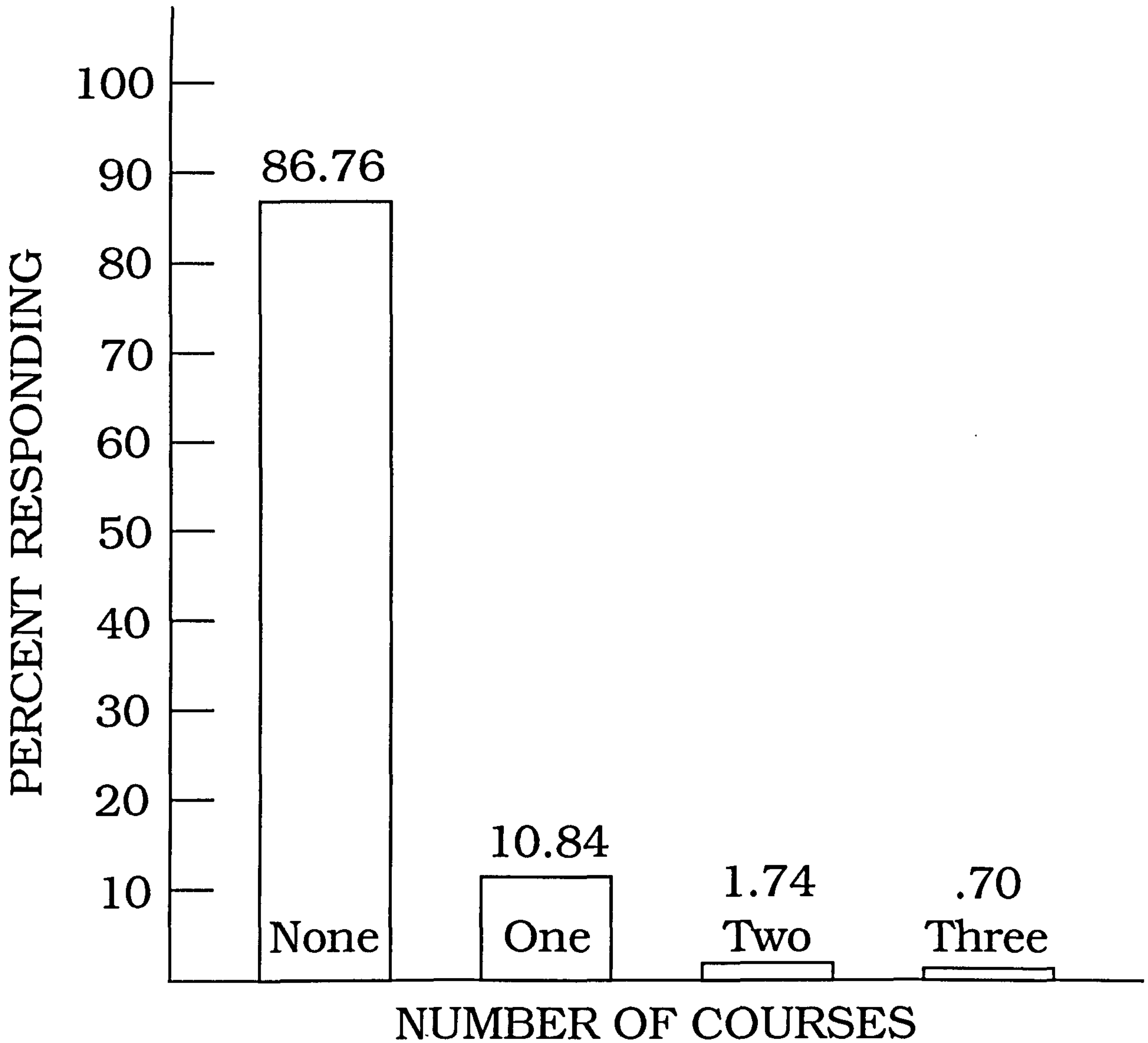

Figure 5. Courses taken in the past by students

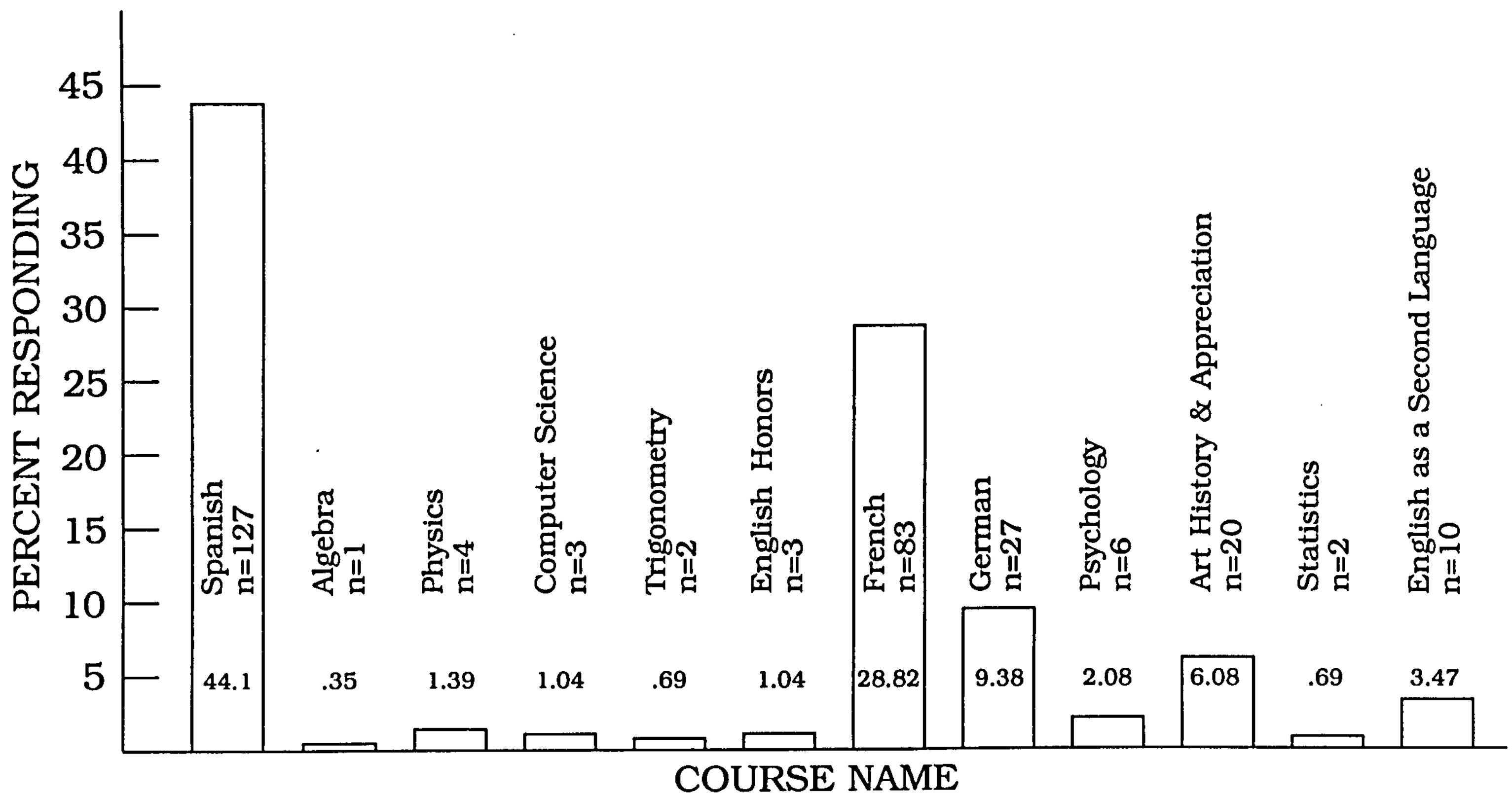

Figure 6. Student enrollment in satellite courses (total enrollment = 288)

Five (35.71%) students were taking computer science. Three (21.43%) additional students were enrolled in art, two (14.29) students each were enrolled in English Honors and German, and one student (7.14%) each was enrolled in Spanish and linear algebra/programming (Fig. 7).

(7) When describing the grade they expected to receive in their class, more than half the students indicated they expected to receive above a B. Slightly more than thirty-one percent (31.36%) expected an A, and thirty-one percent (31.01%) expected between an A and B. Approximately twelve percent (11.85%) of the students expected to receive a B, fifteen percent (14.98%) expected between a B and C, and five percent (4.88%) expected a C. Very few students expected to receive a grade lower than a C. Three percent (2.79%) of the students expected between a C and D, one percent (1.05%) expected a D, and two percent (2.09%) expected below a D (Fig. 8).

(8) The students were asked to indicate the number of students in their own school who were enrolled in their class. From their responses (n = 273), the average number of students in the local school enrolled in a single course was found to be approximately eight (7.84) students. The standard deviation was 4.3. The number enrolled ranged from 1-21 students.

(9) More than half of the students estimated the total size of their TI-IN class to be over 100 students. Thirty-six percent (36.3%) of the students responded that their class size was between

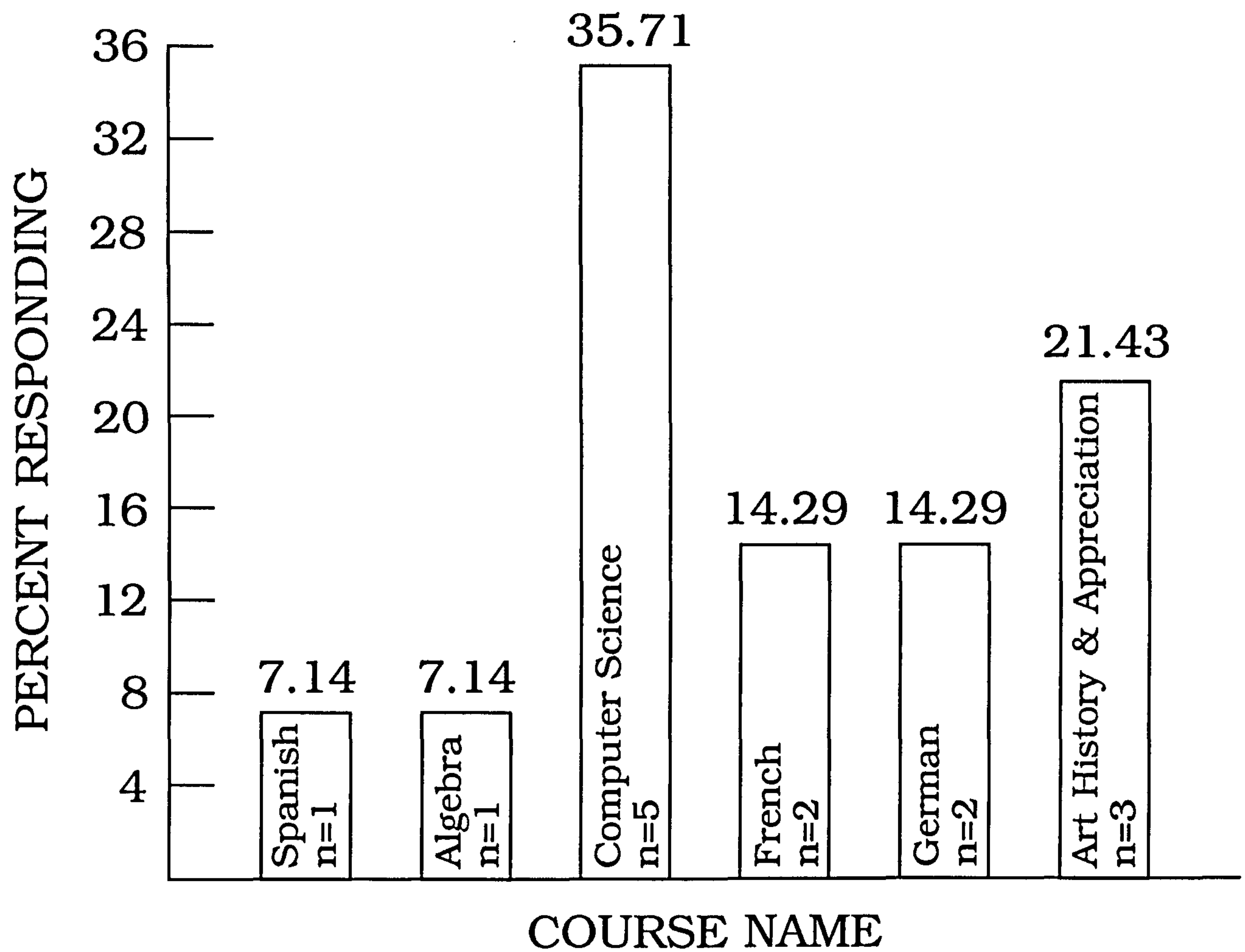

Figure 7. Student enrollment in second satellite course (total enrollment = 14)

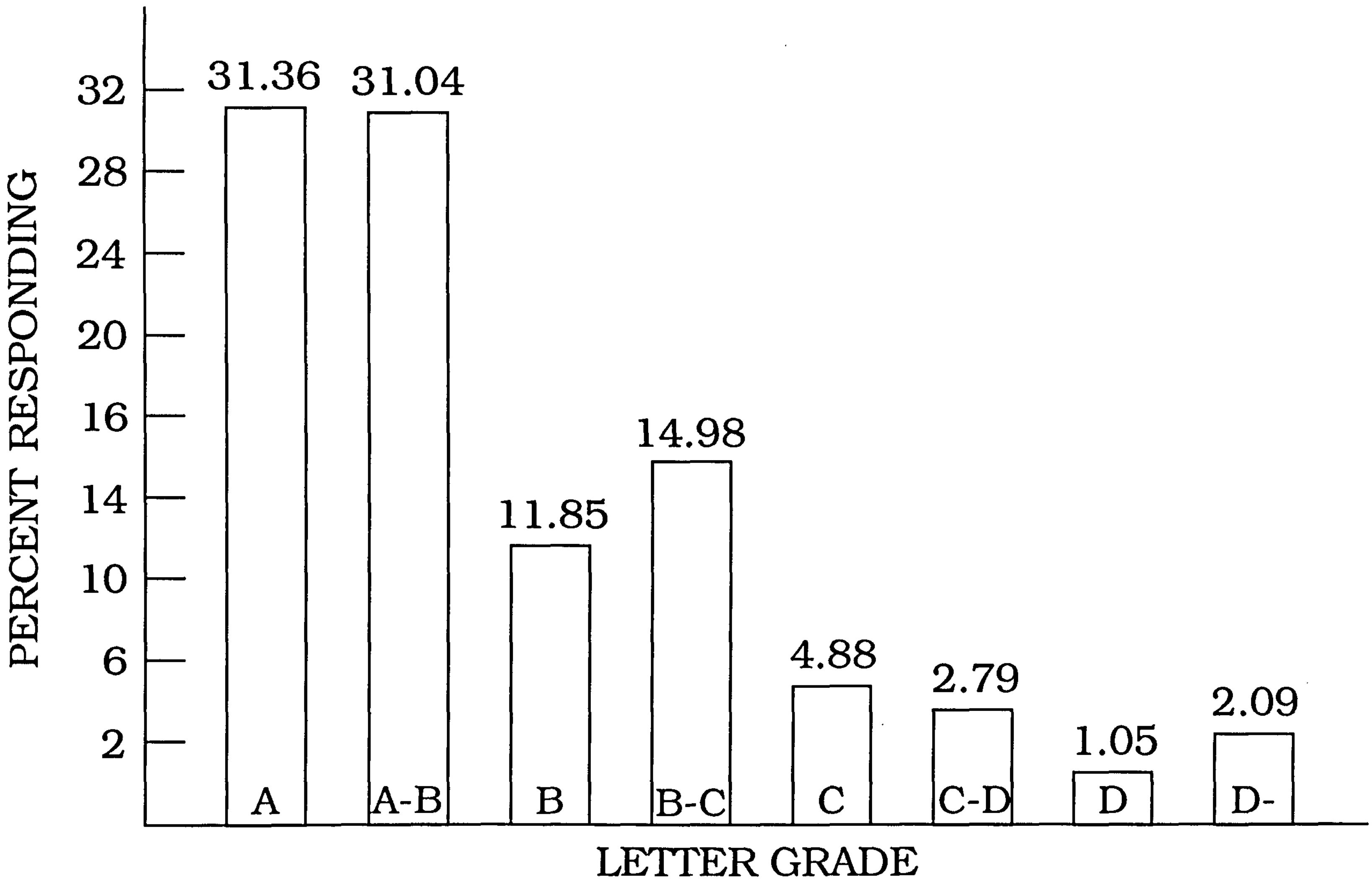

Figure 8. Course grade expected by students

101-150 students and approximately thirty-two percent (31.67%) estimated their class size to be between 151-200 students. A class size of below 50 students was reported by almost nineteen percent (18.51%) of the respondents and a class size of 51-100 was reported by slightly more than thirteen percent (13.52%) of the respondents (Fig. 9).

(10) Figure 10 shows that approximately twenty-eight percent (27.59%) of the students were enrolled in a TI-IN course that met at 12:30 PM. Twenty-six percent (26.21%) of the students met at 8:00 AM, fourteen percent (14.14%) met at 10:00 AM, and slightly less than fourteen percent (13.79) met at 1:30 PM. Meeting times of the other four courses comprised eight percent or less of the total enrollment. Only seven of the 14 students who indicated they were enrolled in two courses reported a second class meeting time; therefore, these data were not considered useful.

(11) Responses from the students indicated that over half (67.59%) of the TI-IN students expected their future to include a four-year college (Fig. 11). Thirteen percent (13.01%) of the students were undecided about their future plans. Percentages for the other options were low in comparison. All students (n = 290) responded with at least one choice. Students were allowed to choose more than one response. Responses were designated as a second response if they appeared second in the order of options in item 11. Therefore, a second response was not necessarily

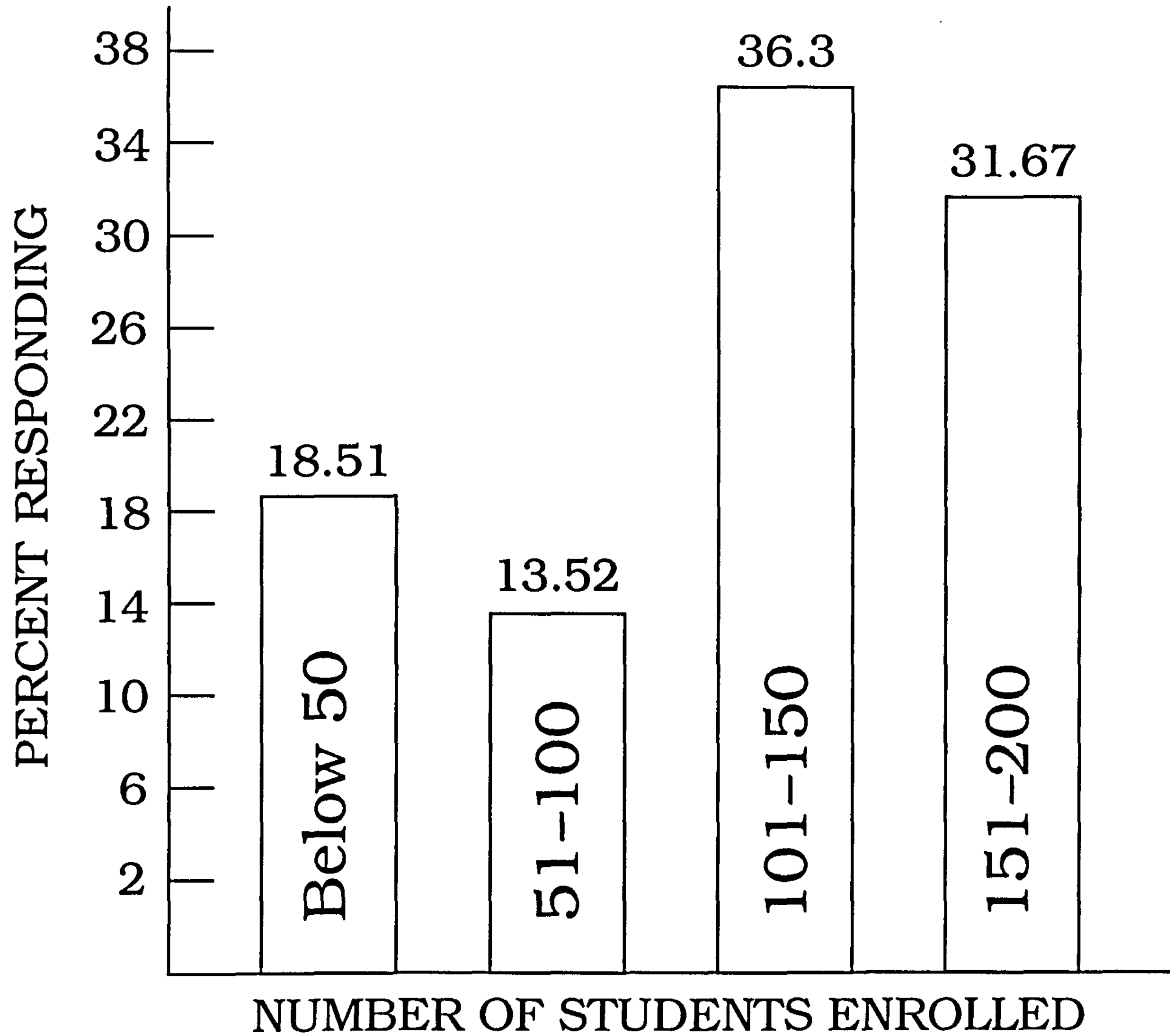

Figure 9. Estimated total enrollment in TI-IN class

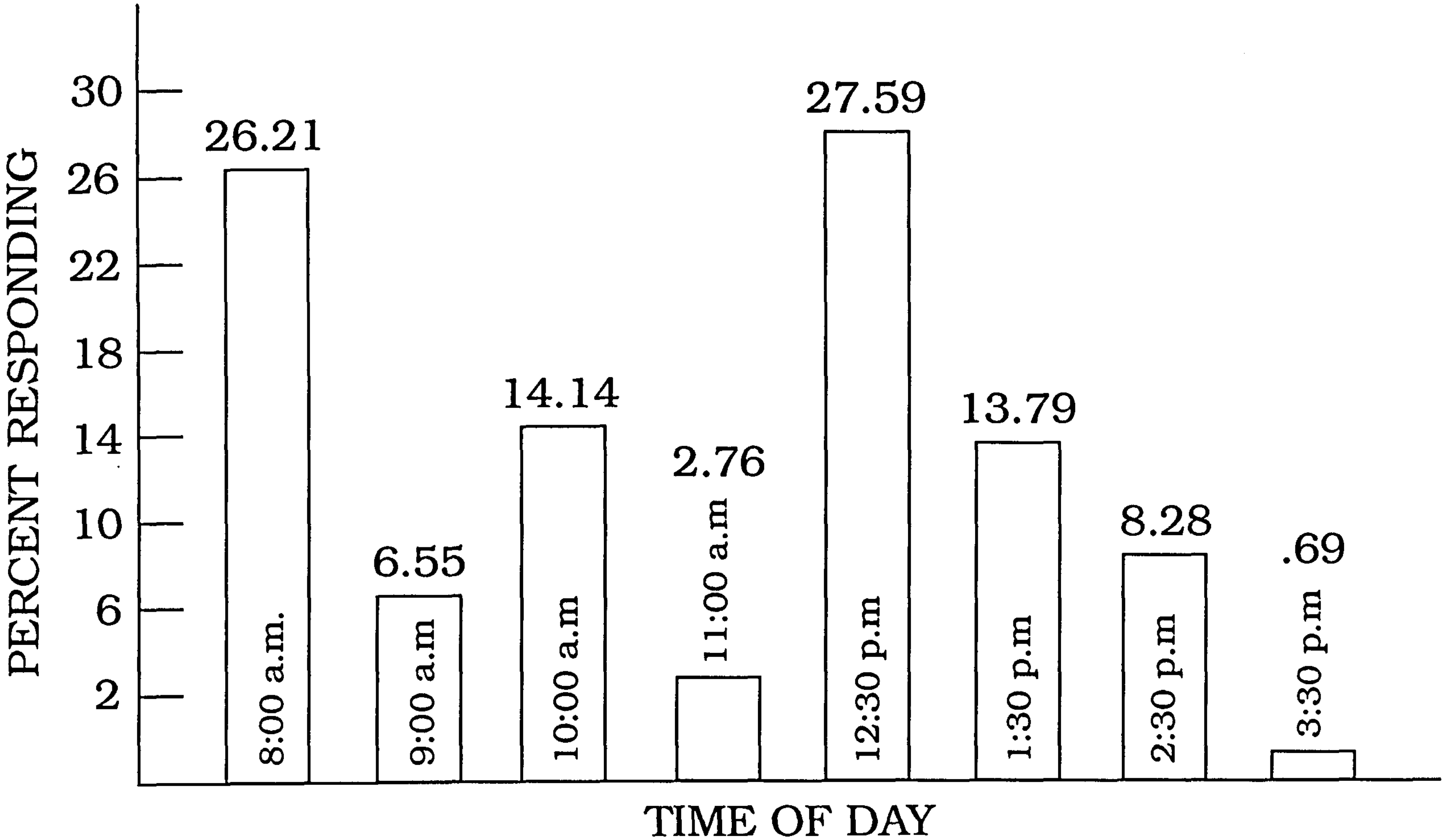

Figure 10. Student enrollment in satellite courses by class meeting time

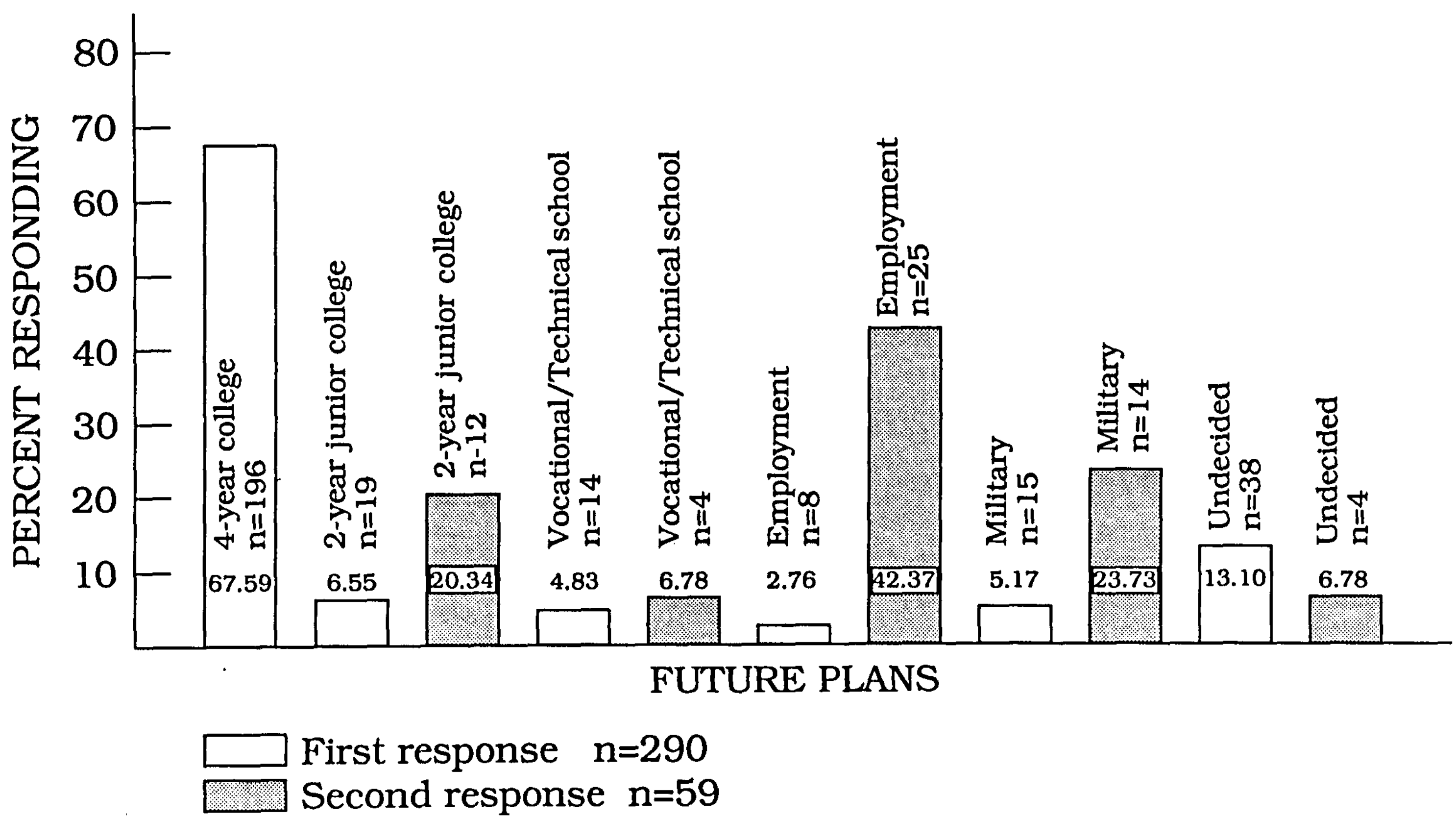

Figure 11. Students' future plans

the student's second choice. Of the 59 students who chose a second response, 25 (42.37%) also expected their future to include employment, 14 (23.73%) included military service, and 12 (20.34%) included a two-year junior college.

(12) Students had the option to choose more than one response to indicate what person or situation influenced them to take a TI-IN course. Responses were designated as influence one or two by the order in which they appeared in the answer to item 12. Students' choices were not ranked in a preference order. Figure 12 shows that "interest in the course topic" was the most frequent response in both lists (24.57% and 41.77%). College entrance requirement was found to be the second most frequent response (14.53% and 15.19%).

Attitudes of High School Students

The purpose of this study was to describe the attitudes of high school students in small rural schools toward interactive satellite instruction. This purpose was the basis for the item comprising Part Two, items 1-40, of the SSIT.

The students were asked to choose the response that best described how they felt about each of the 40 statements in Part II of the SSIT. Students used the following Likert-like agreement scale:

SA = Strongly Agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree

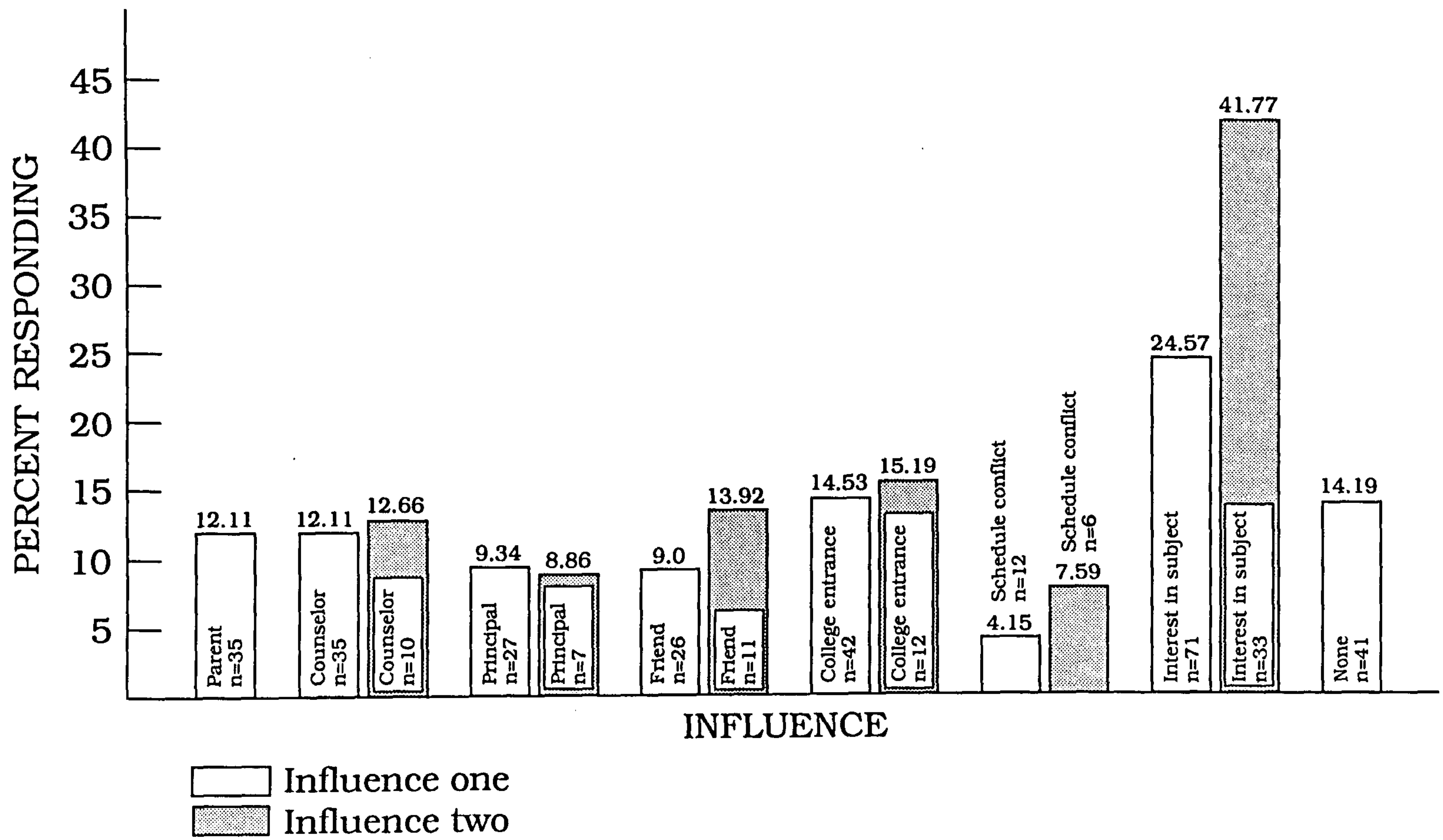

Figure 12. Influence upon students to enroll in satellite course

In order to answer research questions 3, 4, 5, 6, and 8 listed in Chapter I, each of the 40 statements in Part II of the SSIT was placed into five attitude categories or subtests. Each subtest was relevant to one of the research questions. The items in the SSIT and their relationship to each research question were described in Chapter III. Each subtest was considered an individual measure of an attitude construct and was examined separately.

The reliability of the measure for each subtest was computed (Table 1). A reliability coefficient of above .70 was reported for all subtests. It was determined that the subtests of the SSIT were acceptable and useful tests of student attitudes toward interactive satellite instruction.

An index of favorable or positive attitude and unfavorable or negative attitude was achieved by the following statistical procedures:

(1) The mean for each subtest was computed. A score at or above the midpoint of total possible points was considered a favorable attitude. A score below this midpoint was considered an unfavorable attitude (Table 1).

(2) The average score (mean) of all students was found for each item to allow the researcher to examine each item separately. A score of 2.50 or above was considered to indicate a favorable attitude for each item. A score of less than 2.50 was considered a negative attitude.

Table 1. Attitudes of students toward satellite instruction by subtests[a]

Subtest	Number responding	Range of scores	Mean score	SD	Highest possible score	Reliability of subtest
Strengths of satellite instruction	290	7-49	31.64 (2.88)	7.06 (.64)	55	.76
Adequacy of interaction level	290	3-40	25.75 (3.22)	5.33 (.67)	40	.72
Benefits beyond content of satellite courses	290	2-25	13.69 (2.74)	4.21 (.84)	25	.79
Satellite courses not too difficult	290	9-42	24.83 (2.76)	5.82 (.65)	45	.75
Support for use of satellite instruction	290	8-34	21.47 (3.07)	5.48 (.78)	35	.72

[a]Higher scores = more positive attitude.

Satellite instruction has many positive characteristics

Subtest: What are the students' perceptions of the strengths and weaknesses of interactive satellite instruction (Strengths of Satellite Instruction)?

Based on the results of Part Two, the mean of the subtest Strengths of Satellite Instruction (31.64) indicated that students held a positive attitude toward the strengths of satellite instruction (Table 1). The highest possible score was 55. A score of 28 or above indicated a positive attitude.

Level of interaction is adequate

Subtest: In the students' perception, does satellite instruction provide a sufficient level of interaction between students and instructor (Adequacy of Interaction Level)?

Table 1 indicates a positive attitude toward the level of interaction between students and teacher ($\bar{x}$ = 25.75). The subtest Adequacy of Interaction Level had a possible total score of 40. A positive score was 21 or above. An analysis of the items revealed that students talked to their teacher at least once a week ($\bar{x}$ = 3.20), yet the negative means of two items indicated that it was indeed difficult to ask questions ($\bar{x}$ = 2.92) and students would like to be able to ask more questions ($\bar{x}$ = 2.73).

Satellite instruction is beneficial beyond course content

Subtest: In the students' perception, does satellite instruction offer any other benefits beyond course content (Benefits Beyond Content of Satellite Courses)?

Table 1 shows the subtest Benefits Beyond Content of Satellite Courses had a possible total score of 25. A favorable attitude score was 13 or above. The mean was computed to be 13.69 and indicated that generally students had only a slightly positive opinion of the amount of additional benefits beyond course content.

Content of satellite courses is not difficult

Subtest: How do students view the difficulty of satellite courses (Satellite Courses Not Too Difficult)?

The mean of the subtest Satellite Courses Not Too Difficult (24.83) indicated that students did not think satellite courses were too difficult (Table 1). The highest possible score was 45. A score of 23 or above indicated a favorable attitude. An analysis of each item showed that students felt the TI-IN courses were easier than traditional courses ($\bar{x}$ = 3.34), yet they did not feel tests and homework were easy ($\bar{x}$ = 2.61, 2.81, and 2.79).

Students support the use of satellite instruction

Subtest: To what degree do students support satellite instruction (Support for Use of Satellite Instruction)?

The mean of the subtest Support for Use of Satellite Instruction (21.47) indicates that students favorably supported interactive satellite instruction (Table 1). The test had a possible score of 35. A positive score was 18 or more. Although an item analysis of the students' responses showed that students preferred traditional courses over satellite courses ($\bar{x}$ = 2.48), the responses also indicated students planned to take another satellite course in the future ($\bar{x}$ = 3.42) and students would like to take another course taught this way ($\bar{x}$ = 3.34) or take another TI-IN course ($\bar{x}$ = 3.28).

Post-hoc Analysis

Descriptive statistics of all student characteristics and subtest scores were examined to determine if further analyses were appropriate to explore the interrelationships and differences between variables. The data were analyzed using Pearson product moment correlation, t-test, and analysis of variance tests.

Correlation

The Pearson product moment correlation technique was used to determine the strength of the relationship between the characteristics of students and the score of each subtest. The characteristics examined were (1) type of student (ability), (2) grade expected to receive in the course (expected), (3) the number of students in the local, school-site class (local number), and (4) the number of students in the total TI-IN class (total number).

The correlation matrix (Table 2) showed the number of students in the local class most frequently correlated higher than the other student characteristics with all the subtest scores. The grade expected by the

Table 2. Correlation matrix: Degree of relationship between characteristics of students and score of subtests of attitude toward satellite instruction

	Ability of student	Grade expected	Local number in class	Total number in class
Ability of student	1.00	.50*	.04	-.06
Grade expected		1.00	.15	.04
Local number in class			1.00	.14
Total number in class				1.00
Strengths of satellite instruction				
Adequacy of interaction level				
Benefits beyond satellite course content				
Satellite courses not too difficult				
Support for use of satellite instruction				

*Significance level $p < .05$.

Strengths of satellite instruction	Adequacy of interaction level	Benefits beyond satellite course instruction	Satellite courses not too difficult	Support for use of satellite instruction
.13*	.04	.11	.12	.15*
.29*	.07	.26*	.37*	.35*
.36*	.22*	.46*	.14*	.44*
.04	-.06	.10	.09	.05
1.00	.55*	.66*	.47*	.76*
	1.00	.30*	.25*	.41*
		1.00	.38*	.74*
			1.00	.53*
				1.00

students correlated next highest with all the subtest scores. Although the relationship between the number in the local class and the Benefits Beyond Satellite Course Content (r = .46) was only a moderate positive relationship, it was the highest correlation between a single student characteristic and a single subtest score. Table 2 also shows a moderate positive relationship between the number of students in the local class and subtest Support for Use of Satellite Instruction (r = .44).

Table 2 shows a moderate positive relationship between two student characteristics. The correlation of .50 between the ability of the student and the grade they expected to receive indicated a moderate positive relationship.

Table 2 shows a positive degree of relationship between a number of subtest scores. A strong relationship existed between the subtest scores of Strengths of Satellite Instruction and Support for Use of Satellite Instruction (r = .76) and Benefits Beyond Satellite Course Content and Support for Use of Satellite Instruction (r = .74). A moderate positive relationship existed between the subtest Strengths of Satellite Instruction and (1) Benefits Beyond Satellite Course Content (r = .66), (2) Adequacy of Interaction Level (r = .55), and (3) Satellite Courses Not Too Difficult (r = .47). A moderate positive relationship was shown between the subtest scores of Adequacy of Interaction Level and Support for Use of Satellite Instruction (r = .41).

<u>The t-test</u>

The t-test was used to determine if there was a significant difference between males and females for their subtest scores.

Table 3 shows that the mean scores of male and female students were almost identical. The level of significance was set by the researcher at the .05 level. The level of significance (p) for all tests was higher than .05; therefore, there was no significant difference.

The t-test was used to determine if there was a significant difference between the time of day students were in class and their subtest scores. The most frequent class meeting times were grouped into morning (AM) and afternoon (PM) levels. The t-test indicated that students taking classes in the AM had more favorable attitude scores on all subtests than students taking classes in the PM (Table 4). The level of significance was set by the researcher at the .05 level. Table 4 shows a significant difference between the attitudes of AM and PM students in the subtests Strengths of Satellite Instruction ($p < .01$) and Support for Use of Satellite Instruction ($p < .03$).

Analysis of variance

The analysis of variance (ANOVA) was used to determine whether a significant difference existed between the students' grade level in high school and their attitude toward satellite instruction. The descriptive statistics in Table 5 showed that 9th grade students generally scored slightly lower on each subtest than students in the other grades. The ANOVA statistics showed there was not a significant difference between grade levels on the attitude subtest scores (Appendix F).

The analysis of variance test was used to determine if a significant difference existed between the persons or situations that influenced the student to enroll in a TI-IN course and their attitude toward satellite

Table 3. t-test: Sex of students by score of subtests of attitude toward satellite instruction[a]

Subtest	N	$\bar{x}$	SD	t-value	p
Strengths of satellite instruction:					
Male	124	31.19 (2.84)	7.11 (.65)	.99	.33
Female	165	32.00 (2.91)	7.02 (.64)		
Adequacy of interaction level:					
Male	124	25.81 (3.23)	4.90 (.61)	.11	.88
Female	165	25.74 (3.22)	5.63 (.70)		
Benefits beyond satellite course content:					
Male	124	13.56 (2.71)	4.18 (.84)	-.48	.64
Female	165	13.79 (2.76)	4.25 (.53)		
Satellite courses not too difficult:					
Male	124	24.43 (2.71)	5.56 (.62)	-1.00	.32
Female	165	25.12 (2.79)	6.02 (.69)		
Support for use of satellite instruction:					
Male	124	21.28 (3.04)	5.30 (.76)	-.51	.61
Female	165	21.62 (3.09)	5.63 (.80)		

[a]Higher score = more positive attitude.

Table 4. t-test: AM and PM classes by score of subtests of attitude toward satellite instruction[a]

Subtest	N	$\bar{x}$	SD	t-value	p
Strengths of satellite instruction:					
AM	136	33.15 (3.01)	7.02 (.64)	3.15	.01*
PM	145	30.55 (2.78)	6.81 (.62)		
Adequacy of interaction level:					
AM	136	26.40 (3.30)	5.53 (.69)	1.65	.097
PM	145	25.37 (3.17)	5.05 (.63)		
Benefits beyond satellite course content:					
AM	136	14.21 (2.84)	4.43 (.89)	1.80	.071
PM	145	13.31 (2.66)	4.02 (.80)		
Satellite courses not too difficult:					
AM	136	25.14 (2.79)	6.22 (.69)	.74	.468
PM	145	24.62 (2.74)	5.67 (.63)		
Support for use of satellite instruction:					
AM	136	22.32 (3.19)	5.25 (.75)	2.23	.03*
PM	145	20.87 (2.98)	5.65 (.81)		

[a]Higher score = more positive attitude.

*Significance level $p < .05$.

Table 5. Analysis of variance: Grade in school by score on subtests of attitude toward satellite instruction

Student grade level	Strengths of satellite instruction	Adequacy of interaction level	Benefits beyond satellite course content	Satellite courses not too difficult	Support for use of satellite instruction
Grade 9	30.58[a]	25.78	12.97	24.14	20.56
	(2.78)	(3.22)	(2.59)	(2.68)	(2.94)
	5.63[b]	4.86	3.50	5.44	8.13
	(.51)	(.61)	(.70)	(.60)	(1.16)
	36[c]	36	36	36	36
Grade 10	32.88	26.10	14.33	25.53	22.31
	(2.99)	(3.26)	(2.87)	(2.84)	(3.19)
	7.99	5.97	4.88	6.05	6.13
	(.73)	(.75)	(.98)	(.67)	(.88)
	78	78	78	78	78
Grade 11	32.20	26.59	14.00	24.72	21.41
	(2.93)	(3.32)	(2.80)	(2.75)	(3.06)
	6.42	4.71	4.14	5.94	5.60
	(.58)	(.59)	(.83)	(.66)	(.80)
	82	82	82	82	82
Grade 12	30.45	24.66	13.18	24.78	21.27
	(2.77)	(3.08)	(2.64)	(2.75)	(3.04)
	7.21	5.33	3.94	5.94	5.12
	(.66)	(.67)	(.79)	(.66)	(.73)
	89	89	89	82	89
Total	31.64	25.75	13.71	24.88	21.51
	(2.88)	(3.22)	(2.74)	(2.76)	(3.07)
	7.08	5.32	4.24	5.85	5.52
	(.64)	(.67)	(.85)	(.65)	(.79)
	285	285	285	285	285

[a]Equals $\bar{x}$.

[b]Equals SD.

[c]Equals N.

instruction. The descriptive statistics in Tables 6-10 showed that students who named their principal or superintendent as the person that influenced them to take a TI-IN course generally scored higher on the subtests than those students who named other influences. Students who named parents as their first influence scored lowest on all subtests except the Satellite Courses Not Too Difficult. Students who named interest in the subject as their first influence generally scored next lowest on all subtests. The analysis of variance statistics showed there was a significant difference ($p < .01$) between the type of influence and the scores of the subtests Strengths of Satellite Instruction (Table 6), Adequacy of Interaction Level (Table 7), Benefits Beyond Satellite Course content (Table 8), and Support for Use of Satellite Instruction (Table 10).

Suggested Improvements

The second purpose of this study was to identify by using students' opinions the unique qualities of interactive satellite instruction and suggest recommendations for improvements. This purpose was the basis for information summarized in Part Two, questions 41-43, of the SSIT.

The questions were stated in the open response format so that students could express their opinions and to give unprompted responses. The three questions were relevant to research question 7 listed in Chapter I. Similar student responses were grouped into like categories by the researcher. The responses were ranked from the most frequent response to the least frequent response.

Table 6. Analysis of variance: Influence on student to enroll in satellite course by score on subtest Strengths of Satellite Instruction

Influence by Strengths of Satellite Instruction	Analysis of variance SS	df	MS	F	p
	1,481.17	7	211.60	4.62	.01
Within	12,863.21	281	45.78		

Influence on student:	Descriptive statistics $\bar{x}$	SD	N
Parent	28.31 (2.57)	5.01 (.46)	35
School counselor	31.89 (2.90)	8.11 (.74)	35
Principal or superintendent	36.11 (3.28)	6.81 (.62)	27
Friend	31.27 (2.84)	5.94 (.54)	26
College entrance requirement	31.86 (2.90)	7.06 (.64)	42
Conflict in class scheduling	33.67 (3.06)	5.94 (.54)	12
Interest in subject	29.68 (2.70)	6.93 (.63)	71
None of above	33.98 (3.09)	6.88 (.63)	41
Total	31.62 (2.87)	7.06 (.64)	289

Table 7. Analysis of variance: Influence on student to enroll in satellite course by score on subtest Adequacy of Interaction Level

Influence by Adequacy of Interaction Level	Analysis of variance SS	df	MS	F	p
	600.19	7	85.74	3.17	.01
Within	7,594.88	281	27.03		

Influence on student:	Descriptive statistics $\bar{x}$	SD	N
Parent	23.71	4.54	35
	(2.96)	(.57)	
School counselor	25.37	5.66	35
	(3.17)	(.71)	
Principal or superintendent	27.74	5.62	27
	(3.47)	(.70)	
Friend	25.73	4.47	26
	(3.22)	(.59)	
College entrance requirement	26.76	5.58	42
	(3.35)	(.70)	
Conflict in class scheduling	25.25	5.24	12
	(3.16)	(.66)	
Interest in subject	24.45	5.62	71
	(3.06)	(.70)	
None of above	27.83	4.17	41
	(3.48)	(.52)	
Total	25.74	5.33	289
	(3.22)	(.67)	

Table 8. Analysis of variance: Influence on student to enroll in satellite course by score on subtest Benefits Beyond Content of Satellite Courses

Influence by Benefits Beyond Content of Satellite Courses	Analysis of variance				
	SS	df	MS	F	p
	477.67	7	68.24	4.14	.01
Within	4,629.40	281	16.47		

<u>Influence on student</u>:	Descriptive statistics		
	$\bar{x}$	SD	N
Parent	12.23 (2.45)	3.01 (.60)	35
School counselor	13.60 (2.72)	4.87 (.97)	35
Principal or superintendent	15.56 (3.11)	5.54 (1.11)	27
Friend	14.04 (2.81)	3.91 (.78)	26
College entrance requirement	12.48 (2.50)	3.60 (.72)	42
Conflict in class scheduling	15.42 (3.08)	3.55 (.71)	12
Interest in subject	12.86 (2.57)	3.85 (.77)	71
None of above	15.66 (3.13)	3.95 (.79)	41
Total	13.86 (2.77)	4.21 (.84)	289

Table 9. Analysis of variance: Influence on student to enroll in satellite course by score on subtest Satellite Courses Not Too Difficult

Influence by Satellite Courses Not Too Difficult	Analysis of variance SS	df	MS	F	p
	363.38	7	51.91	1.55	.15
Within	9,408.63	281	33.48		

Influence on student:	Descriptive statistics $\bar{x}$	SD	N
Parent	25.31 (2.81)	5.33 (.59)	35
School counselor	24.57 (2.73)	7.33 (.81)	35
Principal or superintendent	27.56 (3.06)	5.53 (.61)	27
Friend	24.19 (2.69)	5.45 (.61)	26
College entrance requirement	25.09 (2.79)	5.98 (.66)	42
Conflict in class scheduling	24.42 (2.71)	5.79 (.64)	12
Interest in subject	23.54 (2.62)	5.22 (.58)	71
None of above	25.51 (2.83)	5.78 (.64)	41
Total	24.84 (2.76)	5.83 (.65)	289

Table 10. Analysis of variance: Influence on student to enroll in satellite course by score on subtest Support for Use of Satellite Instruction

Influence by Support for Use of Satellite Instruction	Analysis of variance SS	df	MS	F	p
	1,042.59	7	148.94	5.55	.01
Within	7,542.34	281	26.84		

Influence on student:	Descriptive statistics $\bar{x}$	SD	N
Parent	19.11 (2.73)	3.92 (.56)	35
School counselor	20.80 (2.97)	7.35 (1.05)	35
Principal or superintendent	25.63 (3.66)	4.14 (.59)	27
Friend	20.81 (2.97)	5.00 (.71)	26
College entrance requirement	21.67 (3.10)	5.37 (.77)	42
Conflict in class scheduling	21.83 (3.12)	3.90 (.56)	12
Interest in subject	20.01 (2.86)	5.05 (.72)	71
None of above	23.68 (3.38)	4.94 (.71)	41
Total	21.43 (3.06)	5.46 (.78)	289

Question 41 asked the students to write a short answer to describe what they liked best about their satellite course (Table 11). The most frequent responses in descending order were:

(1) The subject was interesting (n = 64).

(2) The course had a good teacher with a good personality (n = 37).

(3) The course was easier than traditional courses (n = 34).

(4) The course let them meet and talk to students from other schools (n = 33).

(5) The course was different from other classes. It was a change in routine (n = 22).

Question 42 asked the students to describe what they liked least about their satellite course (Table 12). The most frequent responses in descending order were:

(1) The class was boring. The class was not interesting and had little variety. It was hard to keep their attention on the TV (n = 53).

(2) It was hard to understand and learn by TV. It moved too fast and was hard to keep up (n = 35).

(3) There was too much homework and too many labs. The homework assignments were not clear (n = 35).

(4) Calling was difficult because it was too hard to get in or it took too long (n = 27).

(5) The instructor was unorganized or hard to understand (n = 26).

Table 11. What students liked best about their satellite course

Response	Number of responses
Subject was interesting	64
Good teacher; good personality	37
Easier than traditional	34
Meet and talk to other students	33
Nothing	28
Different; change in routine	22
Relaxed, fun	20
Teacher not present	17
Opportunity to take course not offered; needed for college	17
Interesting specials	12
Challenging; learning more	11
Fosters independent learning	11
Chance to call in	9
Everything	5
Total	320

Table 12. What students liked least about their satellite course

Response	Number of responses
Boring; uninteresting	53
Hard to understand	35
Too much homework and labs	35
Calling is difficult	27
Instructor unorganized and hard to understand	26
Lack of communication	21
Scheduled at a poor time of day	20
Tests too difficult	14
Unable to ask questions; feel uncomfortable	11
Everything	10
Hard to make up work from vacations or absences	9
OK the way it is	9
Poor TV reception	8
Not challenging	6
Impersonal and not enough interaction with other students	5
Poor phone connections	4
Subject matter	3
Total	296

Question 43 asked the students to contribute ideas that would help improve satellite courses (Table 13). The responses, in descending order of frequency, were:

(1) Add more variety to increase interest. Suggestions included an activity time, music, a split screen with instructor and visual aids, a change of background, and using more videotapes (n = 33).

(2) Provide more student-teacher interaction. Suggestions included time for private calls outside of class and an opportunity to meet the instructor personally (n = 30).

(3) Improve the organization of the course and teacher. Students felt the need for better explanations and a slower pace of instruction (n = 25).

(4) Improve the phone system. Provide more out-of-state lines (n = 18).

(5) Reduce class size (n = 17).

Summary

The questionnaire SSIT was distributed to 396 students in 24 small rural high schools who were enrolled in at least one high school course for credit from the TI-IN Network. The size and location of the participating high schools were discussed. A composite profile of characteristics of 290 students was presented. Attitudes of students toward interactive satellite instruction were statistically computed from the responses in Part Two. The attitudes of the students were reported. The data identified areas of strengths and weaknesses of satellite

Table 13. Suggestions for improvement of satellite courses

Response	Number of responses
More variety	33
More student-teacher interaction	30
More organization	25
Improve phone system	18
Reduce class size	17
More involvement with other students	14
Schedule at a different time	14
Better TV reception	13
More courses and different course levels	12
Eliminate satellite courses	12
Improve tests and grading methods	8
Facilitators receive more training	7
More handouts and study guides	5
Total	208

instruction. Significant relationships and differences between variables were presented. A summary of students' suggestions for improvement was compiled.

CHAPTER V. CONCLUSIONS

An increasing number of small rural high schools have been using the distance learning method of interactive television broadcast via satellites used to deliver a varied and quality curriculum to their students. This new technology has provided an opportunity for many small high schools across the nation to offer more courses to their students in a cost-effective way. Barker (1988) reported the TI-IN Network is currently beaming instruction to 300 subscribing high schools in 27 states. Even though a rapidly growing number of high school students have been taught five days a week by interactive satellite instruction, little research has focused on how this instruction is perceived by those students. The purpose of this study was to describe the attitudes of high school students toward interactive satellite instruction, to identify, through students' opinions, the unique qualities of interactive satellite instruction, and to suggest recommendations for improvement.

Chapter V will review Chapters I through III. The eight research questions are restated. Based on the data from the questionnaire SSIT reported in Chapter IV, the research questions and results are discussed. Results are compared to Barker's (1987a) study of interactive satellite instruction in the high school. Conclusions and recommendations for further study of interactive satellite instruction are included.

Review of Chapters I, II, and III

Distance learning, instruction in which the student and instructor are separated, has proven to be especially appropriate for small rural schools in order to meet the challenge of providing a quality curriculum to their high school students. One of the most successful distance learning methods, interactive instruction by satellite, was the focus of this study. The advantages of satellite communication and the combination of television media and telephone have produced a technology that has tremendous potential for distance learning.

Research questions

In order to accomplish the purpose of this study, eight research questions were developed and presented. They were:

(1) What are the characteristics of students enrolled in satellite courses?

(2) Why have students elected to enroll in satellite courses?

(3) What are the students' perceptions of the strengths and weaknesses of interactive satellite instruction?

(4) How do students view the difficulty of satellite courses?

(5) In the students' perceptions, does satellite instruction offer other benefits beyond course content?

(6) In the students' perception, does satellite instruction provide a sufficient level of interaction between students and teachers?

(7) What new ideas do students have that would improve satellite instruction?

(8) To what degree do students support satellite instruction?

Review of the literature

The review of the literature addressed the four major areas of concern for this study: (1) impact of educational reforms on the small rural school, (2) historical development of satellites in education, (3) student evaluation of courses and teacher effectiveness, and (4) research on student attitudes toward interactive satellite instruction and related studies.

Even though local support is frequently high, the small rural school has found it very difficult to maintain the school district and expand the curriculum to meet new state standards. The National Commission on Excellence in Education (1983) recommendations have influenced the majority of the nation's states to increase high school graduation requirements and mandate districts to offer additional courses. Schools have been seeking alternatives to traditional instruction to overcome the obstacles of declining enrollments, teacher shortages, budget cutbacks, decreased state funding, and increased overhead costs, compounded with new curriculum requirements. The technology of interactive satellite instruction has been used to contribute to the solution of this problem in many school districts.

Educational satellite experiments began in the 1970s at the university level. Projects in Alaska, Appalachia, and the Rocky Mountain States demonstrated the feasibility of using satellites in education. Improvements in satellite technology and the efforts of four major vendors have made interactive satellite instruction a viable option for high schools. These vendors, Oklahoma State University German and Physics by

Satellite, Utah Accelerated Learning of Spanish Project, Eastern Washington University Telecommunications Project, and the TI-IN Network in Texas, have all experienced rapid growth. TI-IN was reported to be the largest and fastest-growing vendor in the high school instructional satellite market.

This study used a student evaluation instrument. The literature on student evaluation of courses and teacher effectiveness was reviewed in order to identify variables that affect the validity of student ratings. Support was shown for the use of student evaluations.

The amount of research on satellite instruction at the high school level was limited; therefore, related university-level, Instructional Television Fixed Service, and two-way TV studies were reviewed. A survey of German by Satellite, an informal evaluation of the Accelerated Learning Spanish Project, and Barker's study of attitudes of high school students in Texas identified strengths and weaknesses of satellite instruction in the high school.

Methodology

The questionnaire, called the SSIT, was developed and pilot-tested following the procedure outlined in Henerson, Morris, and Fitz-Simmons (1978). The validity and reliability of SSIT was determined to be acceptable. All items in the SSIT were directly related to a specific research question. The questionnaire was divided into two parts. Part One was designed to identify the characteristics of students enrolled in satellite courses and describes why students had enrolled in a TI-IN course. The purpose of Part Two was to describe the attitudes of students toward interactive satellite instruction. Part Two consisted of 40 questions that were answered using a Likert-type agreement scale and three open-ended questions. A list of 79 schools subscribing to the TI-IN Network was obtained by viewing two sections of Spanish I and one section of French I from the TI-IN Network. School districts were randomly selected from this subscriber's list. Administrators of 24 school districts were contacted by phone and asked to distribute the SSIT in their district. The SSIT was mailed to the participating high schools. The subjects of this study were high school students who were enrolled in at least one TI-IN course for credit.

Discussion of Results

Characteristics of the students

The purpose of Part One of SSIT was to provide a profile of the sample in order to answer research questions 1 and 2. Based on the frequency distributions computed for each question, the average high school student enrolled in a TI-IN course could generally be described as follows:

(1) The student is either male or female. No one sex predominated the enrollment.

(2) The student is a sophomore, junior, or senior.

(3) The student is a good ("B" or above) student.

(4) The student is taking one course, that course being his or her first satellite course.

(5) The student is taking a foreign language.

(6) The student´s class meets at 8:00 AM or 12:30 PM, the class meeting time of Spanish and French.

(7) The student expects to receive a grade of at least a "B" or above in the course.

(8) The student´s high school has an enrollment of 149 students.

(9) The student´s high school has 17 students enrolled in a TI-IN course.

(10) The student´s local TI-IN class has seven other class members.

(11) The average TI-IN class has a total enrollment of 101-200 students.

(12) The student plans to attend a four-year college.

(13) Interest in the subject influenced the student to take the TI-IN course.

Since a study by Barker (1987a) was the only research that identified attitudes toward interactive satellite instruction of high school students, results were compared to his study. Although all schools involved were small rural schools, the results from the SSIT indicated the high schools participating in the SSIT survey had a smaller enrollment (149) than those participating in Barker´s study (239). Barker´s study also showed that more seniors (44%) were enrolled than the 30.8% found in SSIT. The distribution of sophomores, juniors, and freshmen was similar in both studies. Although the questionnaire (SSIT) was to be given to grades 9-12, four eighth grade students enrolled in English as a Second Language (ESL) were included in the data. One superintendent of a Texas district commented that the majority of the 20 TI-IN students in his high school were taking ESL as well as other courses by satellite. Another superintendent indicated that ESL was being used extensively in the elementary school. The questionnaire (SSIT) was unable to isolate these data, but the remarks suggested another viable use of interactive satellite instruction.

The SSIT showed other data similar to that found by Barker (1987a). The average satellite class reported by Barker was about eight to nine students, compared to 7.84 found by SSIT. Barker reported that 85% of the students were enrolled in only one class, compared to 95.14% found by SSIT. However, Barker found that 14% were enrolled in two courses and 1% of the students were enrolled in three courses, while the SSIT found only 4.86% enrolled in two courses and none in three courses.

Both studies used "good" students as subjects; 80% of the schools in Barker's (1987a) Texas study limited TI-IN enrollment to "A" and "B" students. The SSIT data showed that 39.1% of the students considered themselves to be "A" students, 48.79% considered themselves to be "B" students, and only 12% of the students considered themselves to be a "C" or "D" student. The majority of the students (62%) expected to receive either an "A" or a "B" from their TI-IN course and only approximately 10% expected to receive less than a "C." Hanna, Hoyt, and Aubrecht (1983), Owen (1976), and Smith and Brown (1976) identified prior achievement and grade expected as factors influencing the validity of student evaluation forms. It should be noted that the majority of the students participating were of similar academic ability; therefore, this may have had an overall effect on students' attitudes.

Attitudes of students

The results from Part Two of the SSIT were used to describe the attitudes of high school students toward interactive satellite instruction and give suggestions for improvement of satellite instruction. Each of the 40 statements was placed into five individual subtests measuring a different attitude construct. Each construct related to a specific research question and was examined separately. The study revealed that on the whole students had positive attitudes toward satellite instruction.

The results showed that students held positive attitudes toward the strengths of satellite instruction ($\bar{x}$ = 31.64, possible score = 55). Positive ratings were found for the items related to the instructor. "Good teacher; good personality" was the second highest response (12%) to what students liked best about their satellite course. Students disagreed that "The teacher gets off the subject too often" ($\bar{x}$ = 3.61). Results indicated that the TI-IN teachers were a strength. Similar results were found by Barker (1987a). The personality of the teacher was rated by students as the second most important characteristic of satellite instruction in his study.

Students were positive ($\bar{x}$ = 25.75, possible score = 40) in their response about the level of interaction between student and instructor. An analysis of the test items revealed that students agreed that they talked to their TV teacher once a week, but would still like to be able to ask more questions. The comments "Calling is difficult," "Lack of communication," and "Unable to ask questions" totaled 20% of the responses of what students liked least. Students ranked the suggestion for more student-teacher interaction second in the suggestion list for improvements. This study concluded that students held a positive attitude about interaction, yet mixed responses indicated that interaction is an area that needs further examination.

The results showed that students had only a slightly positive attitude ($\bar{x}$ = 13.69, possible score = 25) toward the benefits of satellite instruction beyond course content. Students were asked to respond to statements about establishing relationships with other students and the development of independent learning. The results indicated students did not perceive these opportunities as major benefits of TI-IN.

The data showed that students did not feel satellite courses were too difficult ($\bar{x}$ = 24.83, possible score = 45). Students agreed with the statement that their TI-IN class was easier than a regular class ($\bar{x}$ = 3.34). These data contrasted with Barker's (1987a) results that indicated that 65% of the students said satellite courses were harder than regular classes and 24% said they were about the same. Although their general attitude was positive, students responded that homework and tests were not easy. "It was hard to understand and learn by TV" (13%) and "There was too much homework and labs" (13%) ranked high among the most frequent responses of what students liked least about their satellite course.

The results of the SSIT showed that students favorably supported the use of satellite instruction ($\bar{x}$ = 21.47, possible score = 35). It was interesting to note that SSIT item nine showed that students preferred traditional courses over satellite courses. Barker (1987a) also reported that 70% of the students preferred traditional classes. Despite the preference shown, students indicated that they would like to take another satellite course and planned to take another in the future. An explanation for this difference may be the fact that for the students in these small rural schools, satellite courses may be the only opportunity for them to take certain classes. This fact may influence why their support would tend to be favorable.

Relationships between variables

The relationships between variables were analyzed using the Pearson product moment correlation. Although no relationship between student characteristics and subtest scores was high enough to make accurate group predictions, more than half the relationships were significant above the .05 level, and some interesting observations could be made (Table 2). The number of students in the local class generally showed a higher positive relationship with subtest scores than any other student characteristic. The highest correlation ($r = .46$) was shown between the number of students in the local class and the subtest "Benefits Beyond Satellite Course Instruction." The second highest single correlation was a moderate positive relationship between the number of students in the local class and the subtest "Support for Use of Satellite Instruction" ($r = .44$). As the number of students in the local class increased, so did the positive attitude toward satellite instruction. These results were consistent with previous research that found class size influenced student ratings (Hanna et al., 1983; Owen, 1976). It was concluded that students wanted the traditional "live" contact with other students even though they had many TV classmates.

Although the relationship was very slight (r = .37), the second highest relationship between a student characteristic and the scores of the subtests was a logical relationship. The correlations showed that as the grades students expected to receive increased, their positive attitude toward satellite instruction increased. The results agreed with the strong relationship found by Smith and Brown (1976) between student attitudes toward school and teachers and the grades they expected to receive. A predictable positive correlation was also found between the two student characteristics of the ability of the student and the grade they expected to receive (r = .50).

The correlations between the majority of the subtests showed a moderate to strong positive relationship and emphasized the close association between the constructs represented by the subtests (Table 2). A moderate positive relationship, ranging from r = .41 to r = .66, was shown between four subtest scores. High positive correlations indicated a fairly accurate prediction could be made that as students increased in their positive attitude toward the strengths of satellite instruction, they also tended to increase in their positive attitude toward the use of satellite instruction (r = .76); and that as students' attitudes increased positively toward the benefits they received beyond course content, students increased in their support for the use of satellite instruction (r = .74).

Differences between variables

The differences between variables with two levels were analyzed using the t-test. The results from the t-test showed that there was no significant difference between male and female students´ subtest scores (Table 3), but there was a significant difference in the scores of students who were enrolled in a class that met in the morning and the scores of students who were enrolled in a class that met in the afternoon (Table 4). Students taking classes in the morning had a more positive attitude toward interactive satellite instruction than students who were taking classes in the afternoon. This conclusion was consistent with the observation of Hanna et al. (1983) that students enrolled in classes in the late afternoon gave lower teacher ratings than students enrolled in classes that met during the other periods of the day. Hanna et al. (1983) and Owen (1976) also identified class meeting time as a variable that influenced students´ ratings.

The differences between variables with three or more levels were analyzed by the ANOVA test. Although 9th grade students generally scored lower than other students in other grade levels on the attitude subtests, there was no significant difference between grade levels (Appendix F). It was concluded that grade level was not a significant factor in determining attitude toward interactive satellite instruction.

Figure 12 showed the most frequent response (n = 104) by the students that influenced them to take a satellite course was "interest in the subject," yet the results of the ANOVA showed that students who gave this reason for enrolling in a satellite course generally had a low positive attitude toward interactive satellite instruction (Tables 6-10). These results indicated that other factors besides their interest in the subject may have strongly affected their attitude once the course was in progress.

Although only 34 students named the principal or superintendent as the major influence for why they took a satellite course, those students generally showed a more positive attitude than the students who named other influences. Students who named parents (n = 35) as the major influence for taking a satellite course generally had the lowest attitude scores. It was concluded that student attitudes toward satellite instruction were affected more positively by the administration than by parents, and that the support by the administration was a major factor in the success of an interactive satellite program.

Student suggestions for improvement

When students were asked to give "free responses" about what they liked best and least about their satellite course, results were conflicting. Twenty percent of the students rated "Subject was interesting" as what they liked best about their satellite course, yet 18% of the students responding ranked "Boring; uninteresting" as what they liked least about their satellite course. The most frequent suggestion (16%) for improving satellite courses was "Add more variety to increase interest." This suggestion was similar to the response that classes were boring and uninteresting. It was concluded that because TV instruction was restricted by the inherent qualities of the medium, these comments may be well justified. Vendors of satellite courses may need to develop new activities and different ways to present course material. The reduction of total class size could help to provide more student-teacher interaction and to improve the congested telephone system.

Suggestions for Future Research

There is a need for additional research in all areas of interactive satellite instruction. The enthusiastic response and support received from the high school administrators contacted indicated that there was a great deal of interest in satellite instruction research. No administrator contacted refused to take part in this study. Several superintendents expressed their concern for the lack of research available in this area and requested the results of this study. Their interest and encouragement was exceptional; one administrator wrote a note of thanks for including their school in this study.

This study was limited by the lack of a complete list of all TI-IN subscribers, and by the lack of previous research at the high school level. Additional studies should use a more comprehensive list of subscribers. More data could be collected by repeated use of the SSIT, and additional studies may provide researchers with a broader basis for comparison to previous results.

An indepth investigation of the amount and type of interaction between teacher and students and between students from different schools should be conducted. A study that would monitor and record the actual interactions would provide much needed information concerning the quality and quantity of the interactions.

A study of the use of types of instruction other than high school courses for credit delivered by interactive satellite instruction would provide another aspect of the value of satellite instruction. TI-IN offers student enrichment programs for elementary students, ESL, staff development and inservice, and college credit courses. An accurate assessment of satellite instruction can not be made by school districts without considering these additional offerings.

Also, a study to determine what type of student and/or learning styles of students are more appropriate for satellite instruction would provide valuable information for educators. Research needs to be conducted to determine if there is a relationship between student learning styles and students' attitudes toward interactive satellite instruction.

Summary

The purpose of this study was to describe the attitudes of high school students toward interactive satellite instruction and to identify, through students' opinions, unique qualities of satellite instruction in order to suggest recommendations for improvement. Providing a varied and quality curriculum is a critical problem for small rural schools, and the use of interactive satellite instruction has presented an opportunity for these schools to offer needed courses in a cost-effective way. Eight research questions were formulated that addressed the purpose of this study. The questionnaire (SSIT) was developed to provide answers to these research questions. The SSIT was pilot-tested and distributed to 24 small rural schools subscribing to the TI-IN Network. Data were collected from 290 students who were enrolled in a high school course for credit delivered by the TI-IN Network. A profile of the average student was compiled from the SSIT results.

The data from the SSIT were analyzed to provide a description of the attitudes of high school students toward interactive satellite instruction. This study has determined that students generally have a positive attitude toward interactive satellite instruction. Students felt satellite instruction had many positive aspects, there was sufficient interaction between students and their teacher, and that satellite courses were not too difficult. Students held only a slightly positive opinion about the benefits beyond course content offered by satellite instruction. Students preferred traditional classes over satellite classes, but indicated positive support for the use of interactive satellite instruction. This study also found that students were more positive toward satellite instruction when other students were present in their local class, when the course was taken in the morning, and when their administrators influenced them to take satellite courses. A list of what students liked best and least about their satellite course and a list of student suggestions for improvements of interactive satellite instruction were presented. There is a great deal of interest in interactive satellite instruction among educators and many more evaluative studies need to be conducted in this area.

> Quality instruction by a certified teacher in the school is still the ideal way to educate students. Yet in remote and isolated schools where a certified teacher is not always available or in small schools where limited student enrollments make hiring teachers for low incident courses cost prohibitive, distance learning via satellite may be the next best thing to having a teacher in the classroom (Barker, 1988, p. 3).

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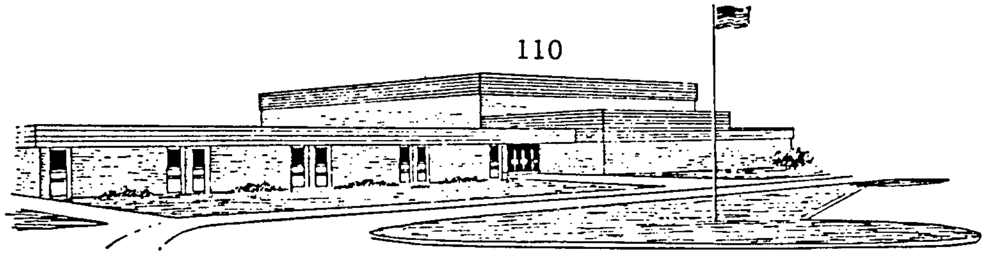
A very special thank you is given to my husband Bob and my three sons, Mark, Jeff, and Nick, for their continued understanding, patience, and support during the past years.

APPENDIX A. DOCUMENTATION OF INFORMATION REQUEST



UNITED COMMUNITY SCHOOL DISTRICT
R.R. 1, BOONE, IOWA 50036
515-432-5319

Ken Frazier
Superintendent

Ken Walter
Associate Principal

August 3, 1987

Jo Babbic
TI-IN Network, Inc.
100 East NASA Road One
Suite 201
Webster, Texas 77598

Dear Ms. Babbic:

Thank you for your prompt response and cooperation in regard to our phone conversation on July 31, 1987. I am very interested in obtaining additional information about interactive satellite instruction. It is certainly an exciting new alternative for providing quality instruction for high school students. I am interested in satellite instruction research both as a graduate student at Iowa State University and as a teacher at United Community High School, a new TI-IN subscriber.

I appreciate your offer to send me recent research completed by TI-IN. As discussed in our previous conversation, I would appreciate the following papers:

> Tinsley, P. (1985). Satellite delivered instruction: TI-IN to a classroom without walls. Presentation at the Technology-Based Curriculum Systems Conference, Dallas, Texas, October 21-23.
>
> Pease, P. (1986). The Evaluation of the TI-IN Network's satellite-based education network: The innovators (high school administrators) and the users (high school students).
>
> Pease, P. (1987). Evaluation of the TI-IN Network (when available)

Thank you again for your assistance.

Sincerely,

Janet K. Johnson
Route #2
Boone, Iowa 50036

cc: Patsy Tinsley, Pres.

APPENDIX B. DOCUMENTATION OF SUBSCRIBER LIST REQUEST

Route 2
Boone, IA 50036
September 1, 1987

Ms. Patsy Tinsley, President
TI-IN Network, Inc.
100 East NASA Road One
Suite 201
Webster, TX 77598

Dear Ms. Tinsley:

I am a graduate student in Professional Studies in Education at Iowa State University in Ames, Iowa. I am presently pursuing a Master of Science Degree in Curriculum and Instructional Technology. I have identified my thesis topic as "Attitudes of High School Students in Small Rural Schools Toward Interactive Satellite Instruction." My prospectus has been approved by my ISU Program of Study Committee; my work is under the direct supervision of Dr. Michael Simonson. Since TI-IN is a leader in this field, I am hopeful that you will provide me with information needed to continue my research.

On July 27, 1987, I requested a list of subscribers to the TI-IN Network for the purpose of distribution of a student attitude survey. On July 31, 1987, Jo Babbic informed me that TI-IN was unable to supply that list. In order to continue my research, I am resubmitting that initial request for a list of high schools subscribing to TI-IN.

This information will not be used for any purpose other than providing a contact with subscribing schools. Each individual school will then have the opportunity to decide whether or not they wish to have their students participate in the survey. Complete anonymity for all schools will be assured; no school names will be published.

I feel my research can make a significant contribution in the area of satellite instruction and the field of educational technology. Please give serious consideration to this request.

Sincerely

Janet K. Johnson

APPENDIX C. DOCUMENTATION OF SUBSCRIBER LIST DENIAL

Green Valley Area Education Agency 14

Dr. Patrick T. Kelly, Administrator

3 December 1987

To Whom It May Concern:

This letter is written at the request of the Iowa State University degree candidate, Janet Johnson, and her major professor, Dr. Michael Simonson. Please permit it to serve as verification that Ms. Johnson attempted to secure the names of schools/clients employing the TI-IN system emanating from San Antonio, Texas to facilitate her research on her thesis/dissertation. After being denied this information by the TI-IN staff, she was advised by Dr. Simonson to contact this agency. Dr. Simonson was aware of our unique relationship with TI-IN, and hoped that we could intercede and expedite this matter. After several attempts we, too, were denied a list of school names using the TI-IN system. The reason given us was the same Ms. Johnson has said was given her: in effect, "we do not want our clients inundated with surveys since we survey them quite a bit ourselves."

If the reader has any questions regarding this matter, please feel to contact me at the address given.

Sincerely,

Gilbert H. Noble
Educational Technology
Curriculum Specialist

Green Valley Rd / Creston, IA 50801 / (515) 782-8443

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APPENDIX D. HUMAN SUBJECTS APPROVAL

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

1. Title of project (please type): Attitudes of High School Students in Small Rural Schools Toward Interactive Satellite Instruction

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

Janet Kaye Johnson — Typed Named of Principal Investigator; Date; Signature of Principal Investigator

Route 2, Boone, IA 50036 — Campus Address; (515) 432-3698 — Campus Telephone

3. Sig... ...y) Date Relationship to Principal Investigator
12/7/87 Major Professor

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

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

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

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

6. Anticipated date on which subjects will be first contacted: Month 1 Day 18 Year 88

Anticipated date for last contact with subjects: 2 5 88

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

8. Signature of Head or Chairperson Date Department or Administrative Unit
Prof. Studies

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

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

George G. Karas — Name of Committee Chairperson; 1/14/88 — Date; Signature of Committee Chairperson

APPENDIX E. COVER LETTER AND SAMPLE QUESTIONNAIRE

Iowa State University of Science and Technology Ames, Iowa 50011

Instructional Resources Center
Quadrangle North

January 13, 1988

Dear

Thank you for permitting the students in your district to participate in this research study. A questionnaire for each student enrolled in a TI-IN course is enclosed. The purpose of this questionnaire is to identify the characteristics of high school students enrolled in a TI-IN course, to describe the attitudes of high school students toward interactive satellite instruction, and to provide students an opportunity to suggest recommendations for improvement.

Although the time of administration is entirely at your discretion, January 18, 1988, may be a convenient date for students to answer this questionnaire. On this date TI-IN observes a teacher work day. Your TI-IN facilitator will need to distribute and collect the students' questionnaires. They will take only about 15 minutes for students to complete. A self-addressed postage-paid envelope is enclosed for easy return of the questionnaires. Please return by February 1, 1988.

As previously stated, all student responses will be completely anonymous and confidential. The responses will be used only to produce group averages. The questionnaires will be destroyed after the data have been recorded.

Thank you again for your cooperation. A copy of the results of this study will be sent to you.

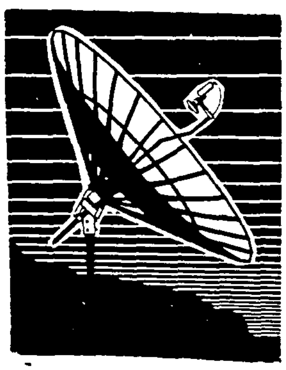
Sincerely,

Janet K. Johnson
Graduate Student

Michael R. Simonson
Professor

STUDENT SURVEY:

ATTITUDES OF HIGH SCHOOL STUDENTS TOWARD INTERACTIVE SATELLITE INSTRUCTION



Janet Johnson
RR#2
Boone, Iowa 50036

INSTRUCTIONAL RESOURCES CENTER
Lagomarcino Hall
Iowa State University
Ames, Iowa 50011
515-294-6840

A STUDY OF SATELLITE INSTRUCTION

The purpose of this questionnaire is to attempt to identify the attitudes of high school students toward interactive satellite instruction. You have been selected as a participant in this research study because you are enrolled in a TI-IN course. You have the opportunity to decide if you do not wish to participate in this research. If you choose not to participate, please return this questionnaire to your classroom facilitator. All answers will be confidential and will be used only for producing average responses of many TI-IN students. Your responses are anonymous, so answer the questions freely and honestly. Your opinion is important!

When you have finished the questionnaire, please return it to your classroom facilitator. Thank you for your cooperation.

PART I

I would like some information about you. Please circle the letter or fill in the blank that describes you or your situation.

1. I am
    a. Male
    b. Female

2. My grade in school is
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior

3. I consider myself an
    a. "A" student
    b. "B" student
    c. "C" student
    d. "D" student

4. The number of satellite courses I am presently taking is
    a. One
    b. Two
    c. Three
    d. Four

5. The number of satellite courses I have taken in the past is (Do not include your present course)
   a. None
   b. One
   c. Two
   d. Three or more

6. The TI-IN course (or courses) I am taking is
   a. Spanish I or Spanish II
   b. Linear Algebra/Linear Programming
   c. Physics I
   d. Computer Science I
   e. Trigonometry/Elementary Analysis
   f. English IV HONORS
   g. French I or French II
   h. German II
   i. Psychology
   j. Art History & Appreciation
   k. Probability & Statistics/Computer Math II
   l. English as a Second Language

7. The grade I expect to receive in this class is
   a. A
   b. Between A & B
   c. B
   d. Between B & C
   e. C
   f. Between C & D
   g. D
   h. Below D

8. The number of students in my school enrolled in my class is ____________

9. As far as I know, the total number of students enrolled in my TI-IN class is
   (Include students from all schools)
   a. Below 50
   b. 51-100
   c. 101-150
   d. 151-200

10. The time of day my class begins is approximately
    a. 8:00 AM
    b. 9:00 AM
    c. 10:00 AM
    d. 11:00 AM
    e. 12:30 AM
    f. 1:30 AM
    g. 2:30 AM
    h. 3:30 AM

11. My future will most likely include (You may choose more than one)
    a. Four-year college
    b. Two-year junior college
    c. Vocational/Technical school
    d. Employment
    e. Military service
    f. Undecided

12. The person or situation that influenced me to take this TI-IN course is (You may choose more than one)
    a. Parent
    b. School counselor
    c. Principal or superintendent
    d. Friend
    e. College entrance requirement
    f. Conflict in class scheduling
    g. Interest in subject
    h. None of the above

PART II

In this part of the questionnaire I would like your opinion about the satellite course you are presently taking. If you are taking more than one, answer these questions about your favorite course. There is no "right" or "wrong" answer. Please circle the response that best describes how you feel about the following statements. Choose only one response for each question.

SA Strongly Agree
A Agree
U Undecided
D Disagree
SD Strongly Disagree

1. This class makes me think for myself.	SA	A	U	D	SD
2. This class is scheduled at a poor time	SA	A	U	D	SD
3. I talk to my TV teacher once a week.	SA	A	U	D	SD
4. This class is boring.	SA	A	U	D	SD
5. Test questions are clearly written.	SA	A	U	D	SD
6. Watching TV makes this class interesting.	SA	A	U	D	SD
7. This class is easier than a regular class.	SA	A	U	D	SD
8. It takes a long time to call in.	SA	A	U	D	SD
9. If I had my choice, I would prefer a traditional class over a satellite course.	SA	A	U	D	SD
10. I am learning as much as I would in a regular class.	SA	A	U	D	SD
11. The multiple-choice tests are easy.	SA	A	U	D	SD

12. TI-IN lets me get to know kids from other states.	SA	A	U	D	SD
13. It is hard to ask questions.	SA	A	U	D	SD
14. I would like to take another TI-IN course.	SA	A	U	D	SD
15. The teacher assigns too much homework.	SA	A	U	D	SD
16. This class adds variety to my school day.	SA	A	U	D	SD
17. The teacher makes the assignments clear.	SA	A	U	D	SD
18. I like hearing about other schools in the U.S.	SA	A	U	D	SD
19. I would like to be able to ask more questions.	SA	A	U	D	SD
20. The teacher explains the subject matter well.	SA	A	U	D	SD
21. It would be easy to cheat in this type of class.	SA	A	U	D	SD
22. It is easy to keep up in this course.	SA	A	U	D	SD
23. Poor phone connections often make it hard to communicate.	SA	A	U	D	SD
24. This class is well organized.	SA	A	U	D	SD
25. The homework is easy.	SA	A	U	D	SD
26. There is enough involvement by the students.	SA	A	U	D	SD

27. It is difficult to get in when I want to talk to the teacher.	SA	A	U	D	SD
28. The teacher gets off the subject too often.	SA	A	U	D	SD
29. I can't talk to the teacher often enough.	SA	A	U	D	SD
30. There are too many students enrolled in this class.	SA	A	U	D	SD
31. It is hard to listen when the teacher talks to other schools.	SA	A	U	D	SD
32. I would recommend this course to my friends.	SA	A	U	D	SD
33. The TV reception is always good.	SA	A	U	D	SD
34. The teacher never knows how we are doing.	SA	A	U	D	SD
35. This class challenges me to do my best.	SA	A	U	D	SD
36. I would like to take another course taught this way.	SA	A	U	D	SD
37. This class has helped me develop independent study habits.	SA	A	U	D	SD
38. I plan to take another satellite course in the future.	SA	A	U	D	SD
39. The true-false tests are easy.	SA	A	U	D	SD
40. I look forward to coming to this class.	SA	A	U	D	SD

Please write a short answer to the following questions.

41. What did you like best about this course?

42. What did you like least about this course?

43. What ideas do you have that would help to improve satellite courses?

APPENDIX F. ANALYSIS OF VARIANCE: GRADE IN SCHOOL BY SCORE ON SUBTESTS OF ATTITUDE TOWARD SATELLITE INSTRUCTION

Table F.1. Analysis of variance: Grade in school by score on subtests of attitude toward satellite instruction

Subtest	SS	df	MS	F	P
Strengths of satellite instruction	312.44	3	104.15	2.10	.10
Within	13,939.62	281	49.61		
Adequacy of interaction level	172.12	3	57.37	2.05	.11
Within	7,877.21	281	28.03		
Benefits beyond satellite course content	81.81	3	27.27	1.53	.21
Within	5,021.43	281	17.87		
Difficulty level of satellite course	55.37	3	18.46	.54	.66
Within	9,647.82	281	34.33		
Support for use of satellite instruction	88.31	3	29.44	.97	.41
Within	8,554.94	281	30.44		