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FASTBACK

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Interactive Television: Progress and Potential

L. Neil Johnson, Samuel M. Tully

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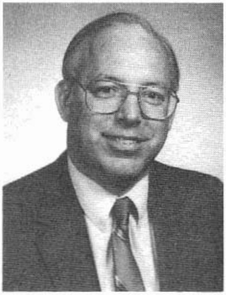

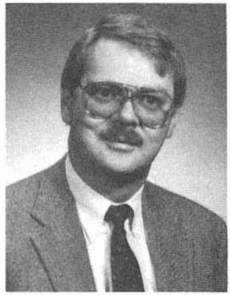

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Interactive Television: Progress and Potential

by
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Introduction

The year is 2009. The setting is a high school biology classroom. Twenty years ago in 1989, it was called the "classroom of the future." What is so different about this classroom?

First, each student in the class has a computer terminal, with printer, screen, and graphics capability. The terminal is connected to a mainframe computer from which students can access an entire library, including a complete biological specimen collection. By executing a few commands on the terminal, a student can bring up a picture of the Tasmanian Fuzzbug as well as text describing this specimen. The second thing that is different is that there is no teacher in the classroom. The teacher is located several miles away in a classroom. However, the students can see and hear her on a television monitor and can interact with her through a two-way audio and video hook-up. Furthermore, the teacher can see and hear these students as well as others in remote classrooms. This second feature of the "classroom of the future" is called *interactive television* (IATV).

The scenario described above will be commonplace in 2009, but the technology that makes IATV possible exists today. In fact, several IATV systems are in operation in selected locations around the country. In this fastback, we shall explore the potential of IATV, explain how it operates, and describe some of the programs currently in operation. The next 20 years should be exciting times, indeed.

The Potential of Interactive Television

The term "interactive" tends to be loosely defined. Some define it as a system where, for example, 300 students interact with a teacher via a two-way audio link over telephone lines. To a degree this is an interactive system. Actually, interactive instruction, whether in person or via television, can be viewed as a continuum. At one end is maximum interaction, which occurs with one student and one teacher; at the opposite end is an infinite number of students interacting with one teacher. Obviously, the larger the number of students, the less interaction can occur.

In the context of communication, interaction between student and teacher has two dimensions: audio and video. Some systems may be fully interactive while others may not be. For example, all classrooms may have television monitors to receive video transmissions but may not have the capability of two-way audio transmission. Or, the video may transmit from a central location in only one direction, but the audio has a two-way capability from all locations. Regardless of how the system works in terms of audio and video capability, interactive television should be viewed as a *communications system*.

A parallel might be made with a transportation system, where airplanes, trucks, trains, horses, or even humans can be used to carry items. These modes of transportation may be used alone or in any combination, but they all are part of a system, the purpose of which is to transport objects. So it is with interactive television, which is a system of communication having various combinations of audio and video capabilities. For example, a system might use satellite, coaxial cable, terrestrial microwave, or fiber optic transmissions; but regardless of the system used, communication is the purpose.

The interactive communication system familiar to most people is the evening news when the network anchor in New York talks with the foreign correspondent in London or Moscow. Because they can both see and talk with one another, this system could be considered totally interactive. However, the viewers watching the news at home are only passive observers of what transpires. They cannot discuss the news item with the anchor or correspondent, nor can the newspeople see or talk with the viewers at home.

This inability of the viewer to interact has been the major limiting factor in the use of instructional television. Because of this limitation, the potential of television as a primary mode of instruction has never been realized. Instead, it has come to be used principally as a supplement to daily instruction in the classroom. Actually, using a VCR with taped programs is a more effective instructional tool, because a teacher can stop the tape to discuss a point and get student reaction or re-run a section of the tape for review or elaboration. And with a VCR, the teacher has more flexibility by not being bound to the educational television station's broadcast schedule.

The interaction provided in one-to-one instruction, as in a tutoring situation, is ideal but impractical in a mass public education system. Yet some degree of interaction between students and teacher is essential for effective instruction. Teachers depend on both verbal and nonverbal cues from students to determine if the content they are presenting is getting across. A student's question or even a puzzled look may signal that further explanation or additional examples may be needed.

Because instructional television in the past could not provide student/teacher interaction, many educators became disenchanted with it. Now, as a result of new technology, interactive television is not only possible, it is being used in Wisconsin, Minnesota, and other locations. School systems have formed cooperatives that provide television with two-way audio and video capabilities from multiple locations. These capabilities permit all kinds of interaction essential for instruction at all levels as well as for staff inservice training and staff teleconferencing.

So far, instructional use of interactive television has been mostly for specialized or advanced subjects at the high school level, such as calculus, foreign languages, or advanced English and social studies courses. Students participating in these courses tend to be academically able and highly motivated. However, with the proper kind of programming, it certainly is feasible for interactive television to be used with average or even special education students. Possible uses at the elementary level include beginning foreign language instruction, cultural programming, and special offerings for the gifted.

At the college level, interactive television can be used for inservice programs in a network of school systems and for student teachers in these systems. The many excellent cultural programs colleges sponsor in the performing arts could be shared with elementary and high schools connected via IATV. Finally, colleges can offer adult education classes for communities in remote locations connected via IATV.

These same remote locations also could be used for vocational education courses ranging from automobile tune-ups to applied math. Courses could be designed to keep workers current with changing technology in many industries.

Finally, with the advent of fiber optic installations, schools can use the IATV system for data transfers/links using computers and for telephone communications. Using the system for these functions eliminates much paper handling, and telephone charges could be reduced by not using common carrier lines for local and even some long-distance calls. The uses of IATV and its associated technology is limited only by our imaginations.

School systems interested in cooperatively developing an IATV system need to know something about the technology involved and the costs. This is the subject of the next chapter.

The Technology of IATV

Several technologies currently exist for linking schools with both audio and video interactive capabilities. These include copper wire, fiber optics, and terrestrial or satellite microwave. One or more of these technologies are used in the following systems:

1. Instructional Television Fixed Service (ITFS)
2. Common-Carrier Telephone Lines
3. Terrestrial and Satellite Microwave
4. Community Antenna Television (CATV)
5. Fiber optic cable systems

Each of these five systems is discussed in this chapter.

Instructional Television Fixed Service. ITFS was authorized by the Federal Communications Commission in 1963. It is a licensed service operating under FCC regulations. The ITFS system consists of a central transmitting station designed to transmit up to four video and audio channels. An ITFS station typically consists of an omnidirectional antenna, which transmits line-of-sight to schools located at various bearings from the ITFS station. Each receiving school has a parabolic antenna, one to two meters in diameter on a rooftop or mounted on a tower. The broadcast signal is received by the parabolic antenna and transmitted into the school via copper cable, where it is displayed on a television receiver.

Remote locations receiving signals via ITFS generally use point-to-point microwave to broadcast their signals back to the ITFS, which in turn redistributes the signal to other remote locations. Thus, a bi-directional or interactive television system has been effected. There is no limit to the number of reception points, provided they are within line-of-sight of the ITFS transmitter. However, the interactive response is limited as more and more remote schools are added. This is because of the limited number of channels available on ITFS.

ITFS with terrestrial microwave (point-to-point) transmission is one of the cheapest forms of interactive linking. With an installation serving four to five locations in relatively flat terrain where tall towers would not be necessary, the costs would be in the $200,000 to $300,000 range.

Common Carrier Telephone Lines. A second way of connecting sites for interactive television is through telephone companies, also called common carriers. Telephone companies use copper wire in cables, microwave technology, and fiber optics in various combinations for purposes of communication and data transfer. When telephone lines are used for interactive television transmission, schools have to enter into an agreement with the telephone company as to what fees or tariffs will be paid.

The cost of using telephone company transmission links for interactive television is generally quite high. Local cost quotes are available from the Bell Operating Company in the area; and if interstate service is contemplated, AT&T will be involved. But uncommon services, such as those needed for the transmission of video signals that require more than a standard voice- or data-grade line, usually are non-tariffed items. In practice this means the Bell Operating Company quotes the customer a price based on the cost of providing the service plus a reasonable profit. If the requested services require equipment that is not already installed, the price includes purchase and installation costs. If a single customer must bear the cost of a unique service installation, the charges may be very high. However, there have been joint projects in which telephone companies and schools share the cost of installing a system that both can use.

As an example of costs (as quoted by a Bell Operating Company) for a broadcast quality video service from five different locations in a medium-size city using a fiber optic link less than 20 miles away, construction would be in excess of $800,000. And there would be a monthly service charge of $35,000. Such costs would be prohibitive for most school systems. Transmission by telephone trunk lines is less expensive, typically about $100 per mile per month. A typical school consortium with four locations might require 50 to 60 miles of telephone lines for an annual cost of $60,000 to $72,000. In addition, a signal processing device called a "codec" (code/decode) would be required for each of the four locations at a cost of about $50,000 each or a total of $200,000. Thus a three-year transmission cost would come to about $416,000. This does not include the cost of in-school terminal equipment for displaying the video image and receiving the audio signal.

Terrestrial and Satellite Microwave. This system of signal transmission was first used commercially by telephone companies for intracity connections. Soon railroad and public utility companies became heavy users of this technology. Because microwave signals are line-of-sight and are limited by the curvature of the earth and topography, a system of antenna towers was necessary to transmit signals over longer distances. This limitation was overcome with the advent of communication satellites, which orbit the earth and bounce back signals to local cable companies and to homes with satellite dishes. Today, communication satellites make it possible to have instantaneous worldwide television communication.

The uplink equipment to transmit to a satellite, which re-transmits to the earth's surface, costs from $280,000 to $600,000 per station. The downlink or home satellite dishes cost from $1,000 to $2,000. In addition, there is a charge of $300 to $500 per hour for using the satellite. Because of their costs, most satellite transmission systems are owned by large corporations and used for one-way programming over a wide area.

Community Antenna Television (CATV). In the late 1940s when the first television stations were being built, most of them were located in large urban areas. Rural and small town areas of the country had little or no reception from these off-air television stations. The solution to this problem was a community antenna distribution system. The earliest CATV systems used tall towers on hilltop locations with receiving antennas that could bring in the signal from distant stations. A single cable carrying three to five television channels ran down from the tower and connected to a network of cables going to homes in the community.

CATV has mushroomed as an industry. By 1983 there were 4,700 operating systems serving 23 million households. Today, cable systems with 30,000 to 50,000 subscribers are commonplace and bring in monthly revenues of as much as $40 per subscriber.

With the advent of satellite transmission, cable programming has proliferated to include as many as 35 to 50 different channels, often including a local community affairs channel. Already these local channels are being used for shop-at-home services and viewer response programming. They also have great potential for interactive television instruction if bi-directional audio amplifiers are connected to the cable.

Costs for installation of coaxial cable for a CATV distribution system in rural areas typically run about $7,500 per route mile. For a consortium of schools requiring 50 to 60 miles of cable, the cost would run from $375,000 to $450,000. This does not include the costs for in-school terminal equipment.

Fiber Optic Cable Systems. The next generation of technology in the CATV industry is fiber optic cabling. This glass fiber, along with equipment that converts electrical signals into light waves, is much more efficient than copper wire in terms of the number of channels it can transmit simultaneously and the long distances between amplifiers needed to maintain a quality picture. Furthermore, fiber optic cable is much lighter than copper and is not subject to electromagnetic interference.

Currently, fiber optic cable can transmit television, telephone, computer data – in fact, any signal that can be converted to light waves. Signals can be transmitted up to 40 kilometers without repeater stations to amplify the signal. Fiber optic cables can be buried or hung on telephone or power poles.

The space industry has been using fiber optic cable for some time. Telephone companies are using it in most new installations. It has become the method of choice in the cable industry for long distance "trunk" cabling. The possibilities for the use of fiber optics for interactive television and voice and data transmissions are tremendous. However, cost is a factor. Although costs are falling, fiber optic cable runs at least 25% higher than coaxial cable. However, given its high performance level and the fact that it does not need some of the equipment required for coaxial cable, in the long run it is probably worth the extra cost.

From this brief overview of the various technologies that can be used for interactive television systems, let us turn now to a description of some current IATV programs in school districts around the country.

IATV Programs in Action

A few school districts started their own IATV programs in the 1970s. Most, however, were started in the 1980s and involve a consortium of school districts. In this chapter we shall describe and comment on seven successfully operating systems. Readers seeking more information may want to visit or write these school districts. (For a more comprehensive description of IATV sites, see *Distance Learning: A Summary of Telecommunications Efforts* (1988), by Jerry K. Pinsel, published by the American Association of Educational Service Agencies, 1801 North Moore St., Arlington, VA 22209.)

Irvine Unified School District

The Irvine Unified School District in Irvine, California, has operated a cable-based interactive television program since 1974. The information about the program presented here is gleaned from an unpublished manuscript by M. Craig Ritter titled, "2-Way Cable Television in the School and Community of Irvine California."

The IATV system in Irvine uses inexpensive, consumer-quality hardware to link 24 schools in the school district, plus the public library, city hall, the University of California at Irvine, the Community Science Experience Center, Saddleback Community College, and the local art museum. Each site can originate programs.

The kinds of programming offered include: teacher inservice training, staff conferencing, administrator teleconferencing, student instructional services, showcasing student talent, parenting classes, student sharing and project work, presentations to multiple classes by an expert in some field, and broadcasting of school board meetings. The diversified programming in Irvine serves both the school and the community.

Some interesting examples of student use of IATV are high school students tutoring younger students in the skills of dissecting for a science class and students who have lived in foreign countries sharing their experiences with other students in the school district.

The type of IATV system in Irvine is quite feasible in urban areas with CATV systems. And it is relatively inexpensive if the schools are already connected to the system. If the CATV system will provide the channels, then all the school district must provide is the hardware and the in-line boosters providing bi-directional capabilities so that the system can be interactive.

Although inexpensive, this type of system is limited by the number of channels that are available to the school system from the CATV owner. Earlier, before the proliferation of alternative broadcasting, CATV companies might have been happy to provide the channels to school districts. But today with increasing competition, CATV companies feel they must offer 15 to 30 commercial channels. This leaves fewer community access channels for use by school and community agencies. Nevertheless, the Irvine model is worthy of consideration by a school district that wants to develop an IATV system.

Ti-In Network, Inc.

The Ti-In Network, based in Webster, Texas, began operations in August 1985. It is a proprietary instructional system using satellite transmission. It has been financed by venture capital and a federal STAR School grant of $5.6 million. The schools receive the signal on a satellite dish and the video is displayed on a television monitor. The system is not fully interactive since the video is only transmitted one-way via the GTE Spacenet II satellite. Although the audio is bi-directional, it has limitations because as many as 200 students from several states may be taking the same course at any given time.

Start-up costs for the program are approximately $10,000 for equipment and installation. In addition, there are annual subscriber fees of about $5,000, plus per student, per course, per semester fees of about $250. To participate in staff development activities, the participating school districts must pay fees of approximately $1.00 per student, based on average daily attendance. Thus a school district with 100 semesters of student courses the first year would have total expenses of about $800 per student per period. Assuming a seven-period day, this would be a per-pupil cost of $5,600 the first year. This is fairly expensive compared to per-pupil costs nationwide, but the cost has to be weighed against not having a course at all because of low enrollment or no qualified teacher – a common problem in smaller rural high schools. The second year would be more reasonable, about $4,900 per pupil.

Ti-In has a well-developed curriculum and its teaching staff are effective instructors. The courses and staff both are approved by the Texas Education Agency (the state education department). The courses are scheduled to begin on the hour and half-hour. A typical schedule might include computer math I, algebra II, trigonometry, physics II, research and technical writing, and creative imaginative writing. On another channel is a completely different schedule of courses, which might include calculus, advanced foreign languages, psychology, and sociology.

Ti-In's staff development program reflects timely topics of interest to practitioners. These programs are offered in the evening and on Saturdays. Some of the programs offered are:

- Teacher Evaluation: Pre-observation, Observation, and Scripting
- Thinking Styles/Teaching Strategies
- A Look at the Gifted and Talented Program
- Introduction to Models of Teaching
- Writing Across the Curriculum

- Gymnastics: Perfect Ten the Karolyi Way
- Cognitive Strategies
- Motivation/Stress

As one can see, Ti-In offers a rich menu for both high school students and for staff. Ti-In has led the way in the Southwest, but the State of Utah and Oklahoma State University also are involved in IATV distance learning using satellites. Without a doubt, Ti-In and similar operations will fill a void in curriculum and staff development in smaller school districts.

Ohio University

Ohio University has operated an IATV system since January 1983. The main studio is on the campus in Athens, and branches are located in the following Ohio communities: Lancaster, Ironton, Belmont County, and Zanesville. The system uses microwave broadcasting and can originate from any of the sites.

The system is used for instruction, telephone communications, data transfer, teleconferencing, student senate meetings, and career planning. According to Marvin Bowman (1986), the faculty like the system because they can teach extension classes from their home site without traveling to branch locations. He pointed out, however, that it took some time for the faculty to adapt to the new method of instruction.

A study showed that 80% of the students would take another class via IATV. Also, IATV students' test grades and final grades showed no significant difference from students who took the course in a conventional classroom. Based on the positive response from both faculty and students, the university plans to continue its IATV program.

Western Wisconsin Communications Cooperative

This cooperative was conceived in 1973 when eight small Wisconsin school districts in Trempealeau County began talking about connecting their schools through a CATV system, which also links homes to receive commercial broadcasts. In 1978 initial funding of $1.25 million was secured to build the cable system and an additional $500,000 was provided by the Kellogg Foundation for equipment. With these funds, a cable system was installed to serve the eight school districts as well as several thousand subscribers who used the commercial channels on the cable service. In 1984 an additional $4 million was invested by the Western Wisconsin Communications Cooperative for expansion purposes.

The instructional programming includes high school courses that could not be offered in small high schools because of low enrollment or inadequate staffing. Classes offered include: Spanish I, II, and III; French I; German I and II; digital computer logic; television production; and creative writing. In addition to these courses, the members of the cooperative use the system for Hi-Quiz Bowls, Math Counts, inservice training, staff meetings, and adult education.

Woodland Cooperative Center Communicating – Minnesota

A number of IATV consortiums or cooperatives have developed in Minnesota. The following program descriptions are based on information provided in a Minnesota State Department of Education publication titled, *Minnesota Technology Demonstration Sites* (1986).

The Woodland Cooperative was founded in 1980 and includes five school districts: Eagle Bend, Clarissa, Bertha-Hewitt, Parkers Prairie, and Staples. It uses an ITFS (instructional television fixed service) system that allows each school to broadcast to the head-in school in Eagle Bend. The head-in school receives the signal from the other schools and broadcasts out via a low power UHF transmission on channel 45. A unique feature of this system is that any home capable of receiving commercial UHF stations can pick up programming from the cooperative. Thus the general community can be served in many ways.

The districts in the Woodland Cooperative have small high schools with 100 to 200 students. The system was developed as an alternative to school consolidation and busing. The cooperative offers courses in shorthand, advanced math, physics, and foreign languages; the system also is used for staff inservice training. Programs can originate from sites in any of the five participating districts. During the 1986-87 school year 233 students in the five high schools took courses via IATV.

East Central Minnesota Educational Cable Cooperative

This cooperative, located north of Minneapolis, involves seven school districts serving the communities of Braham, Cambridge-Insanti, Milaca, Mora, Ogilvie, Pine City, and Princeton. The cooperative uses a combination coaxial cable-microwave system, which also is connected to a CATV system. The system has a 25-channel capability.

In 1985-86 the cooperative offered the following courses: advanced accounting, advanced shorthand, Advanced Placement English, astronomy/meteorology, calculus, college algebra, French, German, Latin, Spanish, World at War 1917-45, and speed reading and study skills. In addition, the cooperative is working on team teaching, community education courses, guest speaker presentations, regional meetings, college-level courses, student clubs and meetings, and vocational technical courses.

For further information about this IATV system, contact: Brad Windschill, Westview High School, Braham, MN 55006. Phone: (612) 396-3674

Mid-State (Minnesota) Educational Telecommunications Cooperative

This cooperative began operation in January 1986 and involves seven Minnesota school districts serving the communities of Holdingford, Little Falls, Long Prairie, Pierz, Royalton, Swanville, and Upsala. In 1987-88 more than 40 courses were offered at the high school level.

This system uses the latest fiber optic technology, which was financed through a joint venture involving the cooperative, Upsala Cooperative Telephone, Minnesota Power, Northwestern Bell, and the Pirelli Corporation. The fiber optic cable is buried underground and is thus protected from the harsh Minnesota winters. Fiber optic transmission provides a clear and sharp image and is not affected by weather and terrain, which sometimes plague microwave transmission.

In addition to using the latest technology, this IATV system is designed so that minimum electronic switching is required of the IATV instructor. The interactive classroom in each school has three video cameras and six color television monitors. One camera hangs from the ceiling and is focused on the instructor. A second camera is directly above the instructor's station and can be used to zoom in on the instructor's note pad or demonstration. A third camera is focused on students in the interactive classroom. The instructor can switch from camera to camera by simply pressing a button.

The six television monitors are placed so that the students in the studio classroom and the instructor can see and hear students from remote locations. A bank of three television monitors face the teacher and hang from the ceiling 5 to 10 feet away. The other three television monitors are placed on a platform in front of the studio but facing the students. In this manner students in the studio classroom can see and hear students at remote locations. Each remote location has the same setup, that is, a camera focused on the students and three television monitors in front of the room facing the students. Thus students in remote locations can see and hear the instructor and the students in two other remote classrooms.

This system is truly interactive and allows for up to three remote locations for each class. Because fiber optics allow for multiple channels, a number of classes can be offered at any given time. Any of the participating schools can broadcast on an interactive basis.

For further information about this IATV system, contact: Jerry Abraham, Little Falls High School, 1001 S.E. 5th Avenue, Little Falls, MN 56345. Phone: (612) 632-2921.

The seven IATV systems described in this chapter range from a single school district to consortiums involving several school districts. They use CATV, satellite, microwave, fiber optics, or some combination of these technologies. Many factors need to be considered to determine what system is best for a particular area of the country. These include terrain, weather, distance, number of sites, existing CATV systems, and most important of all — the purposes to be served with an IATV system. Every proposed IATV system must be evaluated closely in terms of the purposes it is intended to serve.

Implementing IATV: Some Potential Problems

The first consideration in establishing an IATV system is, of course, securing the funding, which could run from several hundred thousand to a million or more dollars. The consortium approach is one way of sharing the costs. However, there are many other issues or problems school districts must be aware of when undertaking an IATV program. This chapter will discuss a few of the issues under the general categories of staff considerations, student discipline, program evaluation, logistical considerations, and maintaining the system.

Staff Considerations. At the outset, teachers may feel threatened by the prospect of using bi-directional television for instructional purposes. Although a commonly stated purpose of an IATV system is to enhance the curriculum, it is also true that IATV is used to teach large numbers of students at remote sites and thus reduces the need for faculty in certain specialized subjects. For this reason the teacher union initially may be opposed to an IATV system. How does one deal with staff apprehension about using educational technology?

Obviously, there must be staff input on implementing an IATV system. Among the issues to be resolved are extra compensation for IATV teachers and inservice training. Many districts have paid teachers to come for training in August to learn to use the system. Generally, schools have asked for volunteers to teach via the IATV system. There usually are several teachers who are eager to teach "on the tube." And if they are not successful with IATV teaching, it should not reflect negatively on their overall evaluation.

The issue of teacher liability would be no different than the liability governing teachers in a traditional classroom. Matters regarding residual rights and rebroadcast rights are subject to negotiation with either individual teachers or their union representative.

Student Discipline. This is an issue of considerable concern to IATV teachers and to administrators. Schools participating in the IATV network must cooperate in developing a consistent discipline policy. In some of the newer IATV installations, the classrooms have a large glass partition, thus making it easier to supervise students without actually being in the room. In practice, discipline has not been a serious problem, because most of the courses offered are advanced and tend to attract highly motivated students with considerable self-discipline.

Program Evaluation. As more IATV systems are established, questions will arise about the effectiveness of IATV as a method of instruction. Although the authors are not aware of any definitive evaluation studies, the common response from IATV school districts is that there is no significant difference in achievement between IATV students and those students taking the same course in a traditional classroom. A similar finding was reported by Diane Morehouse (1986) in *Minnesota Technology Program Findings*, published by the Minnesota State Department of Education. She also reported that the level of student interaction in IATV classes does not differ significantly from traditional classes. Achievement seems to be more a reflection of the student group and/or the quality of the teaching than it does the medium of instruction.

Logistical Considerations. Getting tests and other materials distributed to students has posed a problem for IATV systems. Some cooperatives deliver materials by courier; others use electronic mail for delivering important items.

There also is concern about the lack of personal contact with the IATV teacher. Some districts arrange for the teacher to meet with the students at the remote sites one day a week. In addition, teachers have conferences with all parents, which provides another form of personal contact. Another way IATV consortiums have dealt with the depersonalization factor is by not allowing a course to be transmitted to more than three or four remote sites and by limiting student enrollment to 20 or 25 at each site.

Maintaining the System. Maintaining an IATV system requires technical expertise in electronics. In some systems a trained staff member is given this responsibility. In other systems with a vocational or technical high school, the electronics teacher and his students assume this responsibility. Regardless of how maintenance is accomplished, there needs to be a staff person who can troubleshoot and restore the system quickly when technical problems arise.

Another maintenance issue is what to do if the IATV teacher is ill or if teachers in one of the districts in the consortium go on strike. These kinds of issues must be anticipated and policy developed for dealing with them. Most IATV consortiums have a board composed of representatives from each of the participating districts. This body must deal with policy development and other governance issues.

No doubt, other issues and problems will arise when establishing an IATV system. Cooperation and open channels of communication are essential. Much can be learned from the experience of IATV systems currently in operation.

The Future of IATV in Education

The federal government's commitment to support telecommunications in education was established with the Star Schools Assistance Act in 1987. In October 1988 the U.S. Department of Education announced grants in the amount of $19 million to develop or expand high-technology networks to serve more than 1,000 schools in 39 states. The recipients of the four grants and the programs they will provide are described below.

The Midlands Consortium, a five-state partnership based at Oklahoma State University, Stillwater, received a $5.5 million grant. At least 140 of the neediest schools in a predominantly rural region will be equipped for full participation in satellite broadcasts and other telecommunications programming. Programs in math, science, and foreign languages will be produced; and teachers will be trained in using the technology.

The Ti-In Network, Inc., based in Webster, Texas, received a $5.6 million grant. Students and teachers in 244 Indian and Chapter I schools in 16 states will be equipped to receive instructional programming via two-way satellite broadcasts. Students will use electronic writing tablets to respond to teachers' questions.

The Technical Education Research Centers, Inc. (TERC), based in Cambridge, Massachusetts, received a $2.4 million grant. Secondary students in several North Central, Northeastern, and Mid-Atlantic states will work with professional scientists via computer, conducting cooperative hands-on experiments such as measuring acid rain levels, radon emissions, and weather changes. TERC will provide materials for the projects as well as the technology — computer and satellite hookups — so that students can share their findings with other students and scientists worldwide. Teachers will be trained in techniques to support the student projects.

The Satellite Educational Resources Consortium, based in Columbia, South Carolina, received a $5.6 million grant. Math, science, and foreign language courses will be offered via satellite three times a day to high school students in 14 participating states and in cities in two other states. All courses will provide for live audio interaction between students and the television teacher and tutors. Graduate courses and inservice training will be offered to teachers of these subjects, using the same two-way interaction. To reach students and teachers, nearly 700 downlink reception sites will be installed, ranging in size to serve a small, isolated school to a size that will feed an entire school system.

In addition to these federally sponsored programs using satellite transmission, several other technological developments will create dramatic changes in telecommunication education during the coming years. The regional telephone companies formed by the divestiture of AT&T, as well as other major companies such as GTE, have made and continue to make massive investments in fiber optic cable installations that crisscross most of the country. While currently used predominantly for voice and data communications, the capacity for fiber optics is so great that widespread video applications for educational purposes is not far in the future.

Using telephone lines for transmitting televised instruction is occurring in several areas, notably Hawaii Community Colleges served by GTE. Costs for this method of transmission are still high. But as the fiber optic cable network expands nationally, its increased transmission capacity should lead to lower costs. A second technological development in phone line transmission is called the Integrated System Digital Network (ISDN). When it becomes widely available (within five years in major cities, 10 years in smaller cities, and longer in rural areas) ISDN will allow limited but usable two-way instructional television using two phone lines rather than the minimum 24 equivalent lines currently required.

Costs will continue to be a major limitation for satellite transmission. It can cost as much as $100 million to put a satellite in orbit, and its life expectancy currently is about eight years. The satellite transmission system used by the Star Schools programs is economically feasible only because of the participation of a large number of school reception sites. However, having so many reception sites severely limits the amount of interaction between students and the television teacher.

For the short haul, say over the next 10 to 15 years, terrestrial microwave is probably the most cost-effective method for serving a small number of sites that are not separated by great distances. Typically, installations serve fewer than 12 remote locations within a 30-mile radius of some central site. Likewise, coaxial cable systems operating within a 20-mile radius may be the best option for compact districts and districts already cabled or that have public access channels available through the local cable operator.

Some things about the future can be only conjecture, but what is not conjecture is that telecommunications has changed and will continue to change education dramatically. Recent modifications of federal law may well result in telephone companies entering the cable television distribution market. This, coupled with some of the technological developments noted in this chapter, will make the coming two decades an exciting time to be in education.

References

Bowman, Marvin. "Televideo System Signals Opportunities for Students." *E-ITV* (November 1986).

Braun, Dick. "Video Classes Save Local Schools; At the Same Time They Can Improve Education and Cut Costs." *Farm Journal* (February 1987).

Brown, Francis C., III. "Televised Classes Help Rural High Schools Offer Fuller, More Demanding Curricula." *Wall Street Journal*, 12 November 1985.

Chion-Kenney, Linda. "New Satellite Network to Beam Instruction to Schools in Texas." *Education Week*, 11 September 1985.

Du Bois, John. "Linked by Fibers: New System Allows Schools to Communicate." *St. Cloud Times*, 24 January 1986.

Hall, Ginger. "Satellite-Link 'School' Opens." *San Antonio Express-News*, 5 September 1985.

Kitchen, Karen, and Kitchen, Will. "Two-Way Interactive Television for Distance Learning: A Primer." *Technology Leadership Network Special Report*. Alexandria, Va.: National School Boards Association, 1988.

"K 45AR: Tele-Ed Communicasting." Unpublished monograph. Staples, Minn.: Woodland Cooperative Center Communicating.

Levy, Paul. "Fiber Optics Will Link Seven School Districts in Central Minnesota." *Minneapolis Star and Tribune*, 24 December 1985.

Minnesota Technology Demonstration Sites. St. Paul: Minnesota State Department of Education, 1986.

Morehouse, Diane. *Minnesota Technology Program Findings*. St. Paul: Minnesota State Department of Education, 1986.

Pinsel, Jerry K. *Distance Learning: A Summary of Telecommunication Efforts Involving Education Service Agencies and Others*. Arlington, Va.: American Association of Educational Service Agencies, 1988.

Ritter, M. Craig. "Two-Way Cable Television in the Schools and Community of Irvine, California." Unpublished monograph. Irvine Unified School District, 5050 Barranca Parkway, Irvine, Calif.

Sharp, Deborah. "Need Teachers? Beam Them In." *USA Today*, 4 September 1985.

Technology in Education: Two-Way Interactive Television. Braham: ECMECC and the Minnesota Council on Quality Education, 1985.

"Two-Way Interactive Television." Unpublished report of the Mid-State Educational Telecommunications Cooperative, 1986. Available from Jerry Abraham, Little Falls High School, 1001 S.E. 5th Avenue, Little Falls, MN 56345.

Windschill, Brad, ed. "ECMECC." Unpublished monograph describing the East Central Minnesota Educational Cable Cooperative. Available from the author, Westview High School, Braham, MN 55006.

Windschill, Brad, ed. "Effective VIA Interactive Television: Suggestions of Experienced Teachers." Unpublished monograph of the East Central Minnesota Educational Cable Cooperative, 1985. Available from author, Westview High School, Braham, MN 55006.

Windschill, Brad, ed. "Technology: The Tool or the Fool?" *ECMECC Cablegram* (Winter 1968).

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