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ABSTRACT

The purpose of this hearing was to provide insight into the role of the Federal Government in supporting the development and implementation of the educational technology structure that is needed by elementary and secondary schools. It is argued that what is needed is a broad-based policy agreement about the role that educational technology can play in enhancing student achievement and curriculum development, changing the face of instruction in the classroom, and addressing the challenges of education in the 90s. A brief opening statement by Jeff Bingaman, Chairman of the Subcommittee on Technology and National Security, is followed by statements and, in some cases, submissions for the record, by the following witnesses: (1) Shelly Weinstein, President EDSAT Institute; (2) Jack D. Foster, Cabinet Secretary for Education and the Humanities, Kentucky (statement and report, "Analysis of a Proposal for an Education Satellite"); (3) Donald Ledwig, Corporation for Public Broadcasting (statement and report, "1991 Study of School Uses of Television Video"); (4) Henry J. Cauthen, America's Public Television Stations and South Carolina Educational Television Network; (5) Dennis D. Gooler, North Central Regional Educational Laboratory; (6) Daniel Schultz, Michigan Department of Education (statement and article, "An Inquiry-Centered Classroom of the Future"); (7) Cecilia Lenk, Massachusetts Corporation for Educational Telecommunications (statement and report "Reach for the Stars"); (8) Sally M. Johnstone, Western Cooperative for Educational Telecommunications (statement and article, "Research on Telecommunicated Learning: Past, Present and Future"); (9) Gregory J. Liptak, Mind Extension University; and (10) Gary N. Vance, Satellite Educational Resources Consortium (SERC) on Technology in the Classroom. An opening statement by Strom Thurmond, member of the Subcommittee on Education, Arts, and Humanities, is also included. (DB)

IR

S. HRG. 102—456

EDUCATIONAL TECHNOLOGY IN THE CLASSROOM

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HEARING

BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY AND NATIONAL SECURITY

OF THE

JOINT ECONOMIC COMMITTEE

AND

SUBCOMMITTEE ON EDUCATION, ARTS AND HUMANITIES

OF THE

SENATE COMMITTEE ON LABOR AND HUMAN RESOURCES

CONGRESS OF THE UNITED STATES

ONE HUNDRED SECOND CONGRESS
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OCTOBER 31, 1991

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EDUCATIONAL TECHNOLOGY IN THE CLASSROOM

THURSDAY, OCTOBER 31, 1991

CONGRESS OF THE UNITED STATES.
SUBCOMMITTEE ON TECHNOLOGY AND NATIONAL SECURITY
OF THE JOINT ECONOMIC COMMITTEE
AND
SUBCOMMITTEE ON EDUCATION, ARTS AND HUMANITIES
OF THE SENATE COMMITTEE ON LABOR AND HUMAN RESOURCES
Washington, DC.

The Subcommittees met, pursuant to notice, at 9:00 a.m., in room SD-430, Dirksen Senate Office Building, Honorable Jeff Bingaman (chairman of the Subcommittee on Technology and National Security) presiding.

Present: Senators Bingaman, Simon, and Thurmond; and Representative Fish.

Also present: Stephen Baldwin, Ray Ramirez, and Jason Hendler, professional staff member.

OPENING STATEMENT OF SENATOR BINGAMAN, CHAIRMAN

SENATOR BINGAMAN. Why don't we go ahead and get started. We have lots of witnesses and three excellent panels today. Let me go through a very short opening statement first.

We had a first hearing on this issue—the issue of education, technology in education, and the rapid developments that have occurred since the 60s. There exists now a vast array of educational courses, services, and programs for teachers in schools, the tools to profoundly change the classroom, interactive video, satellite links, telecommunications and hypertext. These have all been developed at a furious pace in recent years.

What we lack is a clear vision for how this is to be used in the classroom, the potential to change how teachers teach, how students learn, how courses are structured, and what is the best way to use the technology in our schools.

We need a broad-based policy agreement about the role that educational technology can play in enhancing student achievement and curriculum development, and changing the face of instruction in our classrooms, and in addressing the challenges of education in the 90s.

Our schools vary dramatically in their needs, and a national network of educational resources needs to be able to bring previously unavailable instruction to isolated rural schools and states, such as New Mexico where I hale from, and also it needs to be available to help teach basic skills in intercity schools, such as in New York City.

How will we balance the widely different needs of our students with the desire to have a unified national effort? One of the fundamental questions regarding educational technology in the classroom is what options are available to go this last mile between satellite and school room, to determine what the minimum hardware is that a class would need to take advantage of what is currently available in telecommunications.

Most distance education systems available to school districts today are satellite based. Cable and telephone companies, however, are now wiring schools with cable and fiber optic lines. In the near future, classrooms will be linked to each other by a wide range of telecommunications networks.

The purpose of this hearing is to provide some insight into the role of the Federal Government in supporting the development and implementation of the educational technology structure that the schools need and students deserve.

I think American educators today are using the technologies, but we need experts in the field, such as those who will testify today to describe the best way we can use that technology to reach the needs of our students.

I look forward to hearing from each of you. We have some excellent testimony that I have had a chance to look through briefly. We have three excellent panels.

Why don't we go ahead and start. If the first panel could come forward. The first panel is focused on satellite instruction primarily; Shelly Weinstein and Jack Foster with EDSAT; Donald Ledwig, President of the Corporation for Public Broadcasting; and Howard Miller with South Carolina Educational Television.

I have that wrong, Mr. Miller, tell me.

Mr. Miller. I'm Senior Vice President at PBS.

Senator Bingaman. Yes. That's what I thought. I don't know why we have that wrong here.

Why don't we start with the EDSAT discussion. Let me ask each of the witnesses if you would take say up to 10 minutes and summarize the basic points you want to make. Obviously, we will include the full statements in the record. You don't need to read through your statements. That will allow me some time to ask some questions. So, why don't we go ahead.

How do you wish to proceed? Ms. Weinstein.

Ms. Weinstein. I'll begin, Senator, and we would like to divide our presentation between Dr. Foster and me.

STATEMENT OF SHELLY WEINSTEIN, PRESIDENT, EDSAT INSTITUTE

Ms. WEINSTEIN. I would like to say good morning and thank you for the opportunity to discuss educational technology in the classroom. We also would like to be sure that our written testimony is submitted for the record.

As you have indicated, my name is Shelly Weinstein, and I'm President of the EDSAT Institute; Jack Foster is the Cabinet Secretary for Education and the Humanities for the Commonwealth of Kentucky, and as a representative for the Governor, is a member of our Advisory Board. Dr. Foster has been intimately involved from the beginning of this project and has worked closely in the leadership for it.

The EDSAT Institute is a nonprofit education and research organization that was formed in 1988 and is primarily concerned with what this Nation must do to encourage and improve access to and utilization of telecommunications for teaching and learning.

We would like to begin with what we think is an important element in your quest to improve American education through greater and better use of technology. Our vision is to build an integrated nationwide telecommunications system, a transparent highway that encompasses land and space over which teaching and educational resources can be delivered and shared with schools, colleges, universities, and libraries.

Our vision is to wire together our classrooms nationwide and ultimately, internationally through a single dedicated telecommunications system that can be accessed simultaneously through a telephone instrument, a computer, a fax, a video camera and/or a television set.

It would be wonderful if every school could simply pay a single monthly service fee and have unlimited access to a transportation system that carries information in all forms—video, voice and data—from almost anywhere in the nation or the world.

The crisis in American education is well documented. Moreover, the factors such as economic development and productivity are closely tied to telecommunications development. Technology has rapidly transformed every sector of our lives, except in education, and for the most part, our schools have remained relatively isolated enterprises. I don't think we need to make the case for why we must have telecommunications integrated at all levels, land and space, and throughout multiple technologies within our schools.

What we do know now is unquestionably the present situation must change. It must become an integrated satellite-based telecommunications system linked with existing cable and telephone lines as an important dimension of the solution to American education problems.

What are some of the obstacles in creating such a system?

In February of this year, the EDSAT Institute issued a report in response to Governor Wilkinson's suggestion to President Bush that the federal and state governments create a dedicated education satellite. We have submitted the report for your information.

We find that the obstacles to creating such a system are presently three major ones: One, the education telecommunications market is highly disorganized and fragmented; two, within existing commercial market practices, educational institutions are left without low-cost dependable and equitable access to telecommunications services; and, third, the absence of a national organization to represent educational and state agencies to create a total educational telecommunications system.

In July and August of this year, our institute and 17 co-sponsors held a series of regional outreach meetings. We met with over 300 representatives of educational and state agencies to discuss creating a national education telecommunication organization that would represent the education users of telecommunications.

These preliminary discussions yielded a high level of interest for more than 74 major educational and state agencies to join together and be affiliated with a nonprofit national organization to govern, purchase, and manage affordable and equitable satellite and other telecommunication services.

Pursuant to these meetings, the National Education Telecommunication Organization—likely to be called NETO—was incorporated in the State of Delaware on October 17, 1991.

What I would like to do now is to turn over to Mr. Foster the rest of the presentation to tell you what we see as the purposes and strategies for a National Education Telecommunication Organization to represent the users and buyers of telecommunication services.

Jack, please proceed.

STATEMENT OF JACK D. FOSTER, PH.D., CABINET SECRETARY FOR EDUCATION AND THE HUMANITIES, COMMONWEALTH OF KENTUCKY

MR. FOSTER. Good morning, Senator.

SENATOR BINGAMAN. Good morning.

MR. FOSTER. It's a pleasure to be here, and I see you have the sun in your eyes.

SENATOR BINGAMAN. You're right. It wasn't in my eyes when I sat down, but it seems to be moving.

MR. FOSTER. And it will probably move out in a matter of minutes.

It's indeed a pleasure to be invited here. If I could just make an opening statement about what I think my perspective on this will bring to this discussion.

I'm a Cabinet Official in State Government in Kentucky and have been involved in the Governor's initiative to improve education. We just recently enacted—as you all know—a major reform of our system.

One of the components of that was a commitment to technology. We created a trust fund that, if the economy holds up, we intend to put approximately $200 million into for expenditure on technology over the next five years.

We created a Council for Education Technology to draft a master plan for how that technology could be used, and I am a member of that Council.

As we have struggled over the last year to try to figure out how to integrate all of the possible technologies that we are talking about in a meaningful way in the classroom, it became apparent that we have two categories of problems. One of them obviously is the technology that resides in the classroom itself, how it's used, how it affects instruction and instructional practices, and so forth. But there is also a problem of connectivity with all of this.

SENATOR BINGAMAN. Congressman Fish is going to join us in the hearing.

So, go right ahead.

MR. FOSTER. We are pleased to have you here.

How all of this connects together in a compatible way has become an enormous problem. We are a state that has two major interconnect and regional operating companies, and they are committed to fiber optics to a certain extent, but not to the last mile.

We have school buildings that need to be retrofitted to accommodate the kind of communication that we want to bring about between the classrooms and school buildings.

Even though we have in Kentucky educational television one of the best resources in the Nation, along with South Carolina and some others, it is not a total solution until we resolve the problem of transporting information from one place to another in a way that is integrated.

So, the remarks that I bring to you this morning about the vision that we have come up with in conjunction with the EDSAT Institute is one that brings all of these communication technologies together in one seamless fashion.

The presentation that I'm going to make is going to address a space segment, an intersection between the space, and the terrestrial components, and then what has to done on the terrestrial side to make a satellite-based system even workable.

We have to have some policies that bring us all together to make this work, and it was after we had looked at this issue for a long time at the national level that it became apparent that while individual states could deal with the communication problems within their state, if we really wanted to share across state lines and nationally, it was going to take a lot more than just what we could do within our states.

So, the strategy that we envisioned the NETO being able to accomplish is to build an integrated telecommunications system built upon the existing telecommunications structures of this Nation, which use both space and terrestrial communication technologies in a seamless fashion for the end users so that they don't know whether it's coming across fiber, T-1 lines, satellites, satellite dishes, or whatever.

When the system is created, its users should be able to access any information resource—video, voice or data—through a common technical interface.

Now, let me talk about the space segment first, then the intersect, and then the terrestrial segment.

One major component of a national education telecommunications system, it seems to us, should be a space segment consisting of one or more satellites. Satellites presently are and probably will remain for the foreseeable future the most efficient method for the multi-point distribution of educational resources. However, the scattering of these resources over many satellites, as is now the case, has resulted in higher costs, technical confusion, and an inability to provide concurrent programming to school sites. You get the program that your dish faces, and that is the only program you can bring to your school house unless you put another dish on that looks in another direction.

Therefore, we envision the co-location of satellite programming as a benefit to increase access to all point to multi-point video, imaging, and data transmission.

Co-location on one or two satellites would enable schools, colleges, and universities to receive interactive and video-based instructional programs simultaneously—and that's a key point—and distribute them to their classrooms in much the same way as cable television now distributes entertainment programming. There are additional benefits that I can get into with you if you want to pursue them, but that's obviously a key point.

Now, it's like rain. If you send it up, it has got to come down somewhere and you have to collect it, and that's the way with a television signal that is transmitted by a satellite.

A land-based component has to go along with any satellite-based infrastructure, or any infrastructure, that intends to utilize satellites. So, a land-based component is critical to the efficient use of satellite-based communications at both the up-link and down-link points.

An integrated system like the one we envision would interconnect the satellite and terrestrial components so that video and computer-based instructional programs can be distributed concurrently or separately through satellite and terrestrial connections, depending upon which is the most efficient and effective.

A satellite system would include a network of down-link reception stations that feed directly and seamlessly into a land-based distribution system that takes satellite programming the last mile, that is, directly into the classroom.

For example, the system would support a one-on-one session that would be point-to-point. You and I communicating with each other as a student and teacher, using only perhaps terrestrial technology, or it would permit many students to simultaneously observe and interact in a national debate, for example, on television, which would be a point to multi-point.

There are other benefits of computer use and for educators and students trying to break out of the static instructional methodologies that we've all condemned, but we have to have a system that can allow that kind of flexibility. It seems to me that it is as important and maybe even more problematic than the satellite segment to complete the terrestrial segment.

Because of the land-based problems that we had in Kentucky, we made a decision in the mid-1980s to put a satellite dish on every school house, and we have now done that. That is 1,300 satellite dishes, and we have them on most of the university buildings in the state and on about a third of our libraries. And I'm not suggesting for a moment that that was an improper decision. It was a considerable multimillion dollar invesment, but each one of those dishes carries only one program at a time. So, you have the benefit of one program available in the school house at a concurrent moment.

It will cost us an enormous amount of money to retrofit all of those satellite dishes so that they can receive multiple signals, and then, even with compression technology, we have real problems of multiplexing at the school-site level.

It was obvious to us in Kentucky, and it's obvious to others in the states that are struggling with this, that we need a better solution than a satellite dish on every building.

What we are looking at here is something that can build on the kind of computer-based networks that we're also building along with the video. Each uses a different transport system at the present time and often incompatible communication protocols. Very simply put, they don't talk to each other. They carry a message down a highway, and suddenly, they get a fork in the road and are stalled, or the highway isn't built big enough or fast enough to keep up with the traffic that is on it.

Local area networks, or LANs, are being installed all over this Nation to tie together classrooms, but they don't talk to the common carrier communication network. They are built on a different methodology and on different technical protocols.

Now, these LANs are generally limited to digitized data formats that, of course, is inconsistent with analogue television, and while we talk about compression as perhaps a solution to that, we're now talking about considerable retrofitting of existing television equipment.

We find schools all over the Nation now installing separate communication lines for voice, video and data. You have three plugs in the wall, one for a telephone—if you have a telephone—if you want to do anything over a modem, then you have the video, and then you have the data stream. This is inefficient, costly, and complicated to use and discourages its expansion.

Not only is a terrestrial component necessary to improve communication among computers, we also need to integrate voice, video and data transmission, because now we have the capacity that all of these can operate from a single computer terminal.

Let me complete my testimony by pointing to the strategy for developing such a system. The general strategy that we have envisioned is to have an organization, like the NETO, that would function like a service organization acting on behalf of the educational community nationwide, that would develop the specifications for an integrated telecommunications system—emphasis on integrated—which meets the special needs of educational users and can be dedicated for their use, very similar to the kind of business networks that have been developed for corporate use.

Then, under NETO's leadership, the system would be developed by securing the desired communication services provided by different private-sector vendors. Some components of the system, such as the satellite and perhaps even the national terrestrial backbone segments, could be operated by subsidies of the NETO, becoming operating companies operating in the public interest.

The local and regional components then could be contracted out by the NETO through the RBOC's, or maybe the cable companies, or it might be operated under some kind of a state or regional franchise system.

Now, the last mile of the system should reach into the classroom offices and libraries of every educational institution and agency in the Nation.

Let me make the point, Senator, that is not going to be sufficient for this Nation to have lines dropped at the outside of the building. We have buildings that we're going to invest millions of dollars in Kentucky just to retrofit for the communications part of it before we ever connect a computer to it, a television monitor or a VCR. And until we can convince the TelCos and cable companies that they have to wire the building itself as part of the installation, we're going to have it dropped off at the street, and it still will not reach the classroom.

Therefore, our strategy is to come up with some kind of an approach that may involve state and federal assistance in some form or another that will encourage the TelCos and cable companies to, in fact, make the investment to not only bring the highway down the street to the front of the school house, but actually to the school wall where you plug in the computer—the modem and the telephone.

You asked us to discuss what might be a federal participation in this. We are not here to ask you for anything in particular, and particularly we know of the fiscal constraints that you operate under, and if you're reading the newspapers, we're under the same fiscal constraints at the state level.

It seems to me that any solution that says the Federal Government or the States have to pay for this highway for the investment to be made probably will doom its failure.

What we have to do is to come up with a joint strategy between the States and the Federal Government, using an organization like the NETO, to in fact incent the private sector to do what it should do and that is to take the system to the classroom.

We believe that can be done and that they will do it, but they will not do it without our participation and setting the right circumstances. Although the need is clear that a particular industry's competitive self-interest must be taken into consideration in what we do, we must recognize that it is not in the interest of any one aspect of the telecommunications industry, as it now exists to do this.

The satellite vendors have their particular interest, the TelCos are divided and are fighting the cable companies, and no one can step forward and build an integrated system for us.

Under the NETO, we think that we can do that, and maybe through some kind of franchising arrangement we can make it cost beneficial for the TelCos and cable companies to go ahead and make the investment, with our guaranteeing that they will not lose their shirt in the process.

How you can help with that is, I think, open for further discussion, and we welcome that kind of dialogue.

We appreciate this opportunity to make this case for some kind of solution to the enormous telecommunications problem we have. It's basically a transportation problem. No matter how well we do with the programming and no matter what we put in, in the way of equipment, if you can't transport it, you have a problem like you have in Russia today. You can grow it, but nobody can eat it if you can't get it to the people. That's basically the part of the problem we're trying to address.

Thank you very much.

SENATOR BINGAMAN. Thank you very much.

[The prepared statements of Ms. Weinstein and Mr. Foster, together with a report and attachments, follows:]

PREPARED STATEMENT OF SHELLY WEINSTEIN AND JACK FOSTER

Good morning Senator Bingaman, Senators.....

We would like to thank you for the opportunity to discuss "Educational Technology in the Classroom."

I'm Shelly Weinstein, President of the EDSAT Institute and this is Dr. Jack D. Foster, Cabinet Secretary for Education and the Humanities for the Commonwealth of Kentucky.

The EDSAT Institute is a non-profit education and research organization formed in 1988 primarily concerned with what this nation must do to encourage and improve access to and utilization of telecommunications for teaching and learning.

We'd like to begin with what we think is an important element in your quest to improve American education through greater and better use of technology.

Our vision is to build an integrated, nationwide telecommunications system, a "transparent highway" that encompasses land and space, over which teaching and educational resources can be delivered and shared with schools, colleges, universities, and libraries.

Our vision is to "wire" together our classrooms, nation-wide (and ultimately, internationally) through a single dedicated telecommunications system, which can be accessed simultaneously through a telephone instrument, a computer, a fax, a video camera and/or a television set.

It would be wonderful if every school could simply pay a single, monthly service fee and have unlimited access to a transportation system that carries information in all forms--video, voice, and data--from almost anywhere in the nation or world.

You might ask why a dedicated telecommunications highway is a "critical" element and what the obstacles are to making this vision a reality. There is a well-documented crisis in American education. The recently released National Goals Panel report hammers home the inadequacy of the present education system. Added to these outcome problems are those of state budget deficits, teacher shortages, retraining needs, mounting problems for youth-at-risk, and increasing costs for delivering programs and teachers for the underserved and the unserved. **In the face of this there can be no doubt that states must make the most cost-beneficial use of public resources and teachers if they are to succeed in improving the quality and productivity of America's schools.**

Technology has rapidly transformed every sector of our lives--except education. A nation's economic development and productivity are closely tied to telecommunications development, which constitute the electronic information transportation system. In our view, if this standard was applied to America's telecommunications infrastructure available to education, America's education sector would roughly compare to that of a developing nation. In testimony by the U.S. Chamber of Commerce before the Subcommittee on Technology and Competitiveness, U.S. House Committee on Science, Space, and Technology (June 18, 1991), it was pointed out that today the U.S. invests:

> only about $100 per student in education in computers and capital investment; this, compared to $50,000 per worker in private industry, and $100,000 per worker in high-tech firms. While the rest of America created a $20 billion -a-year industry by putting 45 million personal computers into use, during the last ten years, United States schools acquired a mere $2 billion of personal computers.

Although telecommunications has turned the world into a "global village", America's schools for the most part have remained relatively isolated enterprises. Access to information is critical to a knowledge-based enterprise like education. The educational resources available in this nation and around the globe are rich and growing exponentially, but the United States does not have a technologically integrated telecommunications system available to "transport" these educational and instructional resources from one place to another.

Unquestionably, an integrated, satellite-based telecommunications system linked with existing cable and telephone lines holds a piece of the promise to provide a quality educational opportunity which is equitable and affordable for all youth and adults, regardless of the wealth of their community, geographic location, or the density of their community's population.

What are the obstacles? They are systemic, widespread, and more policy than technical in nature:

1. The education telecommunications market is highly disorganized and fragmented;
2. Within existing commercial market practices, educational institutions are left without low-cost, dependable, and equitable access to telecommunications services;

3. The absence of a national organization to represent education and state agencies to create a total education telecommunications system using multiple communication technologies.

A major element within ' ıse problems was highlighted at the Education Summit in Charlottesville (1989) when Governor Wallace Wilkinson of the Commonwealth of Kentucky and other governors raised with President Bush the need for a dedicated education satellite to be built and launched as a partnership effort between the states and the federal government.

In response to this proposal, the EDSAT Institute issued a report entitled "Analysis of a Proposal for an Education Satellite" on February 26, 1991 (see TAB A).

The encouraging news is that the report finds that individual states and educational institutions are beginning to invest heavily in telecommunications tec^hnology. The communication technologies through which instruction is delivered at the local level includes optical fiber, co-axial cable, microwave, and fixed-based broadcast television as well as the receivers of satellite transmission. All land-based technologies are essential to a complete telecommunications infrastructure and satellites are the best means by which to distribute multiple education programs simultaneously to every part of a state and the nation at a relatively low unit cost.

The report found that the market to support an education satellite already exists. There are at least 111 program providers of satellite-based instructional programming. Of these, the 20 major education program providers purchased more than 75,000 hours of transponder time in the 1990-91 school year.

It is estimated that the same 20 major program providers spent at least $45.5 million during the school year for the purchase of transponders. Given that this represents only about 18% of the program providers, **it is plausible to assume that the states spent substantially more than $50 million the last school year for satellite time.**

Their problems are attributed to institutional purchasing practices, buying more time than is needed, rising costs, the inability to contract for large blocks over long periods of time, and little or no control over the system. There is no evidence that these buying constraints on educational and state agencies can be changed under current practices.

In response to the interest in the EDSAT report the Institute and 17 public and private sector cosponsors (see TAB B) conducted seven regional outreach meetings across the country to convene educational institutions, state agencies, educational T.V., satellite vendors, and other interested organizations and individuals to discuss creation of a voluntary organization--a National Education Telecommunications Organization (NETO)--for the purpose of providing affordable and equitable satellite and other telecommunications services.

We met with over 300 representatives of education and state agencies who use or are planning to use satellite and other telecommunications services to deliver instructional programming to students, teachers, state employees, and workers. The meetings confirmed the EDSAT findings that present commercial market practices for satellite services are incompatible with the needs and requirements for education users and buyers. Their issues are affordability, predictability, control, and equity.

More than 74 education and state agencies expressed an interest in being affiliated with a non-profit National Education Telecommunications Organization (NETO). Its purpose would be to govern, purchase, and manage affordable and equitable satellite and other telecommunications services. (see TAB C)

On the basis of this grassroots interest, NETO was incorporated on October 17, 1991 in the State of Delaware. NETO will be governed by a Board of Directors representing the range of public interests. Its membership will be comprised of former and current public officials, educators, state agencies, telecommunications experts, and private sector representatives. As a first step to building an integrated land and space highway dedicated to cost-effective and equitable policies for the distribution of instructional and educational programs, NETO has created an Education Satellite Corporation, a non-profit business subsidiary to operate and manage satellite services to affiliated education and state agencies.

NETO's strategy will be to build an integrated telecommunications system that uses both space and terrestrial communication technologies in a seamless fashion for the end user. When the system is completed its users should be able to access any information resource--video, voice, or data--through a common technical interface. In the following paragraphs we describe what we believe to be the benefits of an integrated national education telecommunications system.

The Space Segment of the System

One major component of a national education telecommunications system should be a space segment consisting of one or more satellites dedicated to communications among instructional resource providers and educational institutions and agencies. Satellites presently are the most efficient method for the multipoint distribution of educational resources. However the scattering of these resources over many satellites has resulted in higher costs, technical confusion for the users, and an inability to efficiently provide concurrent programming at the school site. Therefore, we envision a satellite-based component to the system which would enable collocation of all point-to-multipoint video, imaging, and data transmission.

Collocating point-to-multipoint educational communications on one or two satellites would enable schools, colleges, and universities to receive interactive and video-based instructional programs simultaneously and distribute them to their classrooms in much the same way as cable television distributes entertainment programming. Faculty and administrators can determine which video programs they want to use and participate in, and block out the others. Collocation also would (a) enhance the marketing of available interactive and video programs; (b) reduce the technical problems associated with locating the satellites which carry instructional programs; and (c) stabilize the pricing of satellite time.

Space and Terrestrial Intersection

Satellite communications are very efficient for distributing information over broad geographic areas and multipoint reception. However, a land-based component is critical to the efficient use of satellite-based communications at both the uplink and downlink elements. An integrated system like the one envisioned here would interconnect the satellite and terrestrial components so that video and computer-based instructional programs can be distributed concurrently or separately through satellite or terrestrial connections. The satellite system would include a network of downlink reception stations that feed directly into a land-based distribution system that takes the satellite programming the "last mile".

An integrated space and terrestrial system holds many benefits for the educational community. Our research indicates that educators are looking forward to using voice and video communications for point-to-point teleconferencing and interactive instruction over long distances. We also are finding that point-to-point interactive voice and video is being demanded as students and faculty move away from the static instructional methodologies of the past.

The system we envision can facilitate this form of communication through a combination of space and terrestrial technologies. For example, the system would support a "one-on-one" session (point-to-pont) between a student and teacher using only terrestrial technology or permit many students to simultaneously observe and interact in a national debate on television (point-to-multipoint). The former could use a terrestrial component, while the latter would likely utilize the more efficient space component. We also envision a communication system which would enable a student , using a "split screen" computer monitor, to simultaneously observe a speaker at a distant point in one "window" while typing notes on a word processor in another "window".

The Terrestrial Segment of the System

Education computer "networks" abound, and are growing in number. Each uses a different transport system and often incompatible communication protocols. Local area networks are being installed to link computers together within a school, but these LANs are generally limited to digitized data formats. We find schools all over the nation installing separate communication lines for voice, video, and data which is inefficient, costly, and complicated to use. Not only is a terrestrial component necessary to improve communication between computers, we also need to integrate voice, video, and data transmission.

A Strategy for Developing the System

The general strategy envisioned here is to have an organization like the NETO develop the specifications for an integrated telecommunications system which meets the special needs of education users. Then, under the NETO's leadership, the system would be developed by securing the desired communication services from private sector providers in a fashion that would result in one virtual system using services provided by different vendors. Some components of the system such as the satellite and national terrestrial "backbone" segments could be operated by subsidiaries of the NETO. The local and regional components could be contracted out by the NETO or they can be developed and operated under state or regional franchises.

The "last mile" of the system should reach into the classrooms, offices, and libraries of every educational institution and agency in the nation. This means that we need to find a way to encourage the investment of the telecommunications industry in taking the system all the way to the telephone, T.V., computer,and video terminal. We mentioned the idea of a state or regional franchise. This is an idea which needs further research, but it seems that the use of a state-issued franchise which guarantees the capital investment in return for installation and maintenance of the local segment of the national system might have some potential.

What is the role of the federal government? We can move information at a far lower cost and with greater ease than we can move people. And there is no doubt that when there is fragmentation and disorganization in a market sector, the costs rise and benefits decline.

If for no other reason, the economics of the communications revolution and the needs and requirements of the education sector make it imperative that the National Education Telecommunications Organization along with the states, the Congress, and the private sector assume a role in building an integrated telecommunications highway.

Although the need is clear that a particular industry's competitive self-interest must be taken into consideration, and in some cases, even altered, these considerations are more likely to occur in a timely fashion with the federal government as a partner in a public-private co-venture.

For example, NETO must develop pricing structures for the land and space technology segments that will guarantee the small and large education users and buyers affordable and stable pricing. Congress can share in the costs or "subsidize" a portion of these costs during the start-up of this system. The benefit of this would be to encourage more and more educational institutions to use the highway.

Congress can also provide tax incentives and/or loan guarantees for the private sector that takes the risk out of helping to build this system.

As NETO develops the space and land segments, in instances where it is appropriate, it will research and propose industry-wide standards in order to meet the diverse needs and requirements of educational and state institutions and to insure technical integration of the system. Regulatory policies will also come into consideration and will need review.

Finally, Congress can provide general operating support for the National Education Telecommunications Organization in its start-up and organizing period.

Thank you for this opportunity to tell you about this exciting effort. We welcome your questions.

ANALYSIS OF A PROPOSAL
FOR AN
EDUCATION SATELLITE

The Edsat Institute

1025 Connecticut Avenue, N W Suite 506
Washington, D C 20036

1991

The EDSAT Institute is a non-profit tax exempt educational and research organization founded in 1988 to encourage the access and utilization of telecommunications in all forms throughout America's schools, colleges, universities and libraries. The Institute is supported through private gifts, grants, and contracts. The work of the Institute is conducted under the policy guidance of a 20 member Advisory Board.

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In an endeavor such as this, there are many who deserve recognition and appreciation for their contributions. It is safe to say in this case, without the help of the following people this report would not have been written. A special recognition goes to the EDSAT Institute Advisory Board for its leadership, commitment and courage to address telecommunications and education issues which are essential as we prepare for the twenty-first century.

Our gratitude and thanks go to the Chairs of the Working Groups which provided valuable insight and information that shaped many aspects of this report. These outstanding leaders found time to Chair meetings of their respective groups in spite of very full calendars: Dr. Peter Likins, President of Lehigh University and a Director of COMSAT, Inc. who chaired the Technical Issues Group; and the Honorable Joseph Duffey, President of the University of Massachusetts System and the Honorable John H. Buchanan, Jr., Chairman of People for the American Way, who co-chaired the Policy and Governance Working Group. These three individuals made a great contribution to the productivity and success of the Working Groups.

Special thanks also go to the members of the Working Groups whose names appear in the Appendix to this Report. All of the participants in the Working Groups gave freely of their time. Their information, research, insights and contacts made an invaluable contribution to the analysis of issues addressed in this report.

We also are indebted to the expertise provided by the researchers: Philip Malet and Jerry Howe, partners with Steptoe and Johnson; Kevin DiLallo, attorney, and Grier Raclin, partner, Gardner, Carton and Douglas; and Frank Weaver, President and CEO of UNET, Inc.. They always were prepared and worked conscientiously under the pressure of very short time lines.

Jack Hannon, Vice President for Corporate Issues Management at COMSAT, Inc., must be placed in the category of "unsung hero." His institutional memory of the creation of COMSAT/INTELSAT was invaluable to our work. Through Mr. Hannon's good offices, COMSAT generously provided facilities and in-kind support to make the long, arduous working group meetings pleasant and comfortable. The EDSAT Institute is indebted and grateful.

Special thanks and gratitude are extended to Governor Wallace G. Wilkinson of Kentucky for the confidence he placed in the EDSAT Institute when he requested that this study be done in response to his call for the creation of a satellite dedicated to education. We trust that this report will provide the basis on which he and other state and federal policymakers can move forward to implement a satellite-based telecommunications system for education.

Special recognition is due the Honorable Jack D. Foster, Secretary of the Education and Humanities Cabinet in Kentucky, for his keen understanding of the issues and state policy. We express deep appreciation to Governor Wilkinson and the people of Kentucky for the generous contribution of time and effort put forth by Secretary Foster. His insights on public policy and personal commitment to the reform of American education can be found throughout our work and this report.

Last but not least, we extend great appreciation to Harlan Rosenzweig, President of Westinghouse Communications, Inc., for the sustained personal and financial support of the EDSAT Institute over several years which made this project possible.

ABOUT THIS REPORT

Telecommunications is transforming almost every sector of American society -- small business, manufacturing, commerce, communications, religion, transportation, banking, tourism, entertainment, health and defense. But not education. Our schools must undergo a transformation to meet the global challenges of the Information Age.

Standing in our way to this transformation are significant disparities in access to quality educational opportunities. Major differences exist in availability of qualified teachers in both urban inner city schools and remote rural schools. Telecommunications has the potential to make cost-effective, equitable access to quality education a reality for all American students without regard to their personal wealth or the wealth of their community or state.

Governor Wallace G. Wilkinson of Kentucky, along with other Governors of the states and territories, has raised the issue of a need for a public domain satellite dedicated to education. At the request of Governor Wilkinson, the EDSAT Institute undertook this analysis of the governance, management, technical and fiscal issues associated with creation and maintenance of an education satellite telecommunications system.

We embarked on this challenge with a view that the numerous stakeholders with different interests could be brought together to use their expertise and experience to develop realistic policies and options. The cooperation and participation of a large number of people from government, education, and the telecommunications industry, working with experts in telecommunications gave substance and direction to the analysis contained in this report. All of them shared a common desire to improve American education.

It was apparent throughout the project that the problems associated with an education satellite were not technical in nature. The central issues were how to finance and govern this resource in an equitable and efficient manner. The analysis presented in this report provides Governors, the Congress, federal and state officials, educators and the telecommunications industry feasible, equitable and cost-beneficial options for creating and maintaining an education satellite system.

Issues were raised during the project which deserve serious attention but were considered outside the scope of the present analysis. Among these are issues of program quality, teacher certification and training, improving interaction between students and teachers, and research on the effectiveness of various distance learning methodologies. It is hoped that the EDSAT Institute can address these issues in a similar manner in the near future.

I am pleased to submit this report as a resource for moving forward with the proposal to create an education satellite system for all levels of American education. Surely such a system can make a significant contribution toward our goal of equal opportunity to a quality education for everyone.

Shelly Weinstein, President
The EDSAT Institute

ANALYSIS OF A PROPOSAL FOR AN EDUCATION SATELLITE SYSTEM

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ANALYSIS OF A PROPOSAL FOR AN EDUCATION SATELLITE SYSTEM

1. INTRODUCTION

The crisis in American education is well documented. Although public education is a constitutional responsibility of the states, the consequences of a failed educational system affect the nation as a whole. America is moving rapidly from an industrial to an information and technology based economy in which only the educated will thrive. There is a great need to reach, educate, train and retrain an ever larger number of people of all ages with limited time and resources.

Not only is the quality of American education generally substandard, there also are significant differences from one community to another in the quality of the educational opportunity available. Disparity in wealth within and among the states has become a very troublesome problem as we pursue the national goal of providing equal access to a quality education in America. Ways must be found to provide high quality education and training to all Americans without regard to their personal wealth or the wealth of their locale or state.

Universal access to the rich educational resources of this great nation is possible in part through telecommunications. Although telecommunications has turned the world into a "global village," our schools for the most part remain relatively isolated enterprises. The encouraging news is that this situation is rapidly changing. Individual states are beginning to invest heavily in telecommunications technology as one approach to sharing educational resources.

The communication technologies through which these programs are delivered at the local level include optical fiber, coaxial cable, microwave and fixed-base broadcast television as well as receivers of satellite transmissions. Although all land-based technologies are essential to a complete telecommunications network, at the present time satellites are the best means by which to distribute multiple educational programs simultaneously to every part of a state or the nation at a relatively low unit cost.

Problems Which Impede Greater Use of Satellites

Schools and colleges find it difficult and costly to secure appropriate and predictable transponder time because of their inability to negotiate individual long-term commitments with satellite communication vendors. Likewise the satellite industry regards schools and colleges as "occasional users" which precludes their securing transponder time at the lower rates available for long-term contracts.

Purchasing an entire transponder by education agencies to ensure reliable time can triple or quadruple the effective transmission cost because this practice requires them to purchase substantial amounts of less desirable time. The effective cost of "prime" time under such circumstances turns out to be even more expensive than the high cost transient rates. Schools and colleges are forced to compete with business users even for the available transient time. Commercial buyers generally purchase transient time for business teleconferencing and major news agencies often purchase it to cover unexpected major news events. Both are willing to pay whatever is required under the circumstances, often driving the cost beyond the reach of education.

Another problem related to the availability of satellites is a projected shortage of transponder time. Industry experts indicate that new satellites are being launched with full or nearly full contract commitments. Some experts view the problem of limited transient transponder time as likely to become even tighter over the next decade. Contributing to this uncertainty is the impact of digital compressed video technology will have on satellite capacity. This dilemma underscores the unpredictability education purchasers of satellite time will face in the future.

It should be obvious that some education agencies are at a distinct disadvantage in such a competitive marketplace. The inability of education agencies to aggregate purchasing power means they end up paying unnecessarily high rates for satellite transmission. On the other hand, vendors must deal with multiple purchasers few of which by themselves are major consumers of their commodity. In the larger marketplace, education agencies do not represent at the present time a major market for satellite vendors. The bottom line problem is that states are expending as much as 40% more for transponder time than they would have to spend if there was a more efficient marketplace. Presently, there is no mechanism through which education agencies can aggregate their purchasing of transponder. Sound public policy dictates that we search for an alternative to competing for transponder time with commercial buyers.

The use of transient satellite time also means that our education broadcast stations have to find a vendor with available time. Satellite transmission requires precise telemetry. A change in vendor requires a reorientation of the uplink transmission facilities which in turn requires a corresponding reorientation of the downlink facilities. The effect is similar to having to place telephone calls through 20 or 30 different telephone companies each requiring a different telephone receiver. Existence of a single satellite source would eliminate most of the need for such technical adjustments at the school district or school site.

When commercial vendors market their programming to schools, some offer receivers oriented to their own satellite transmissions. This is tantamount to having different telephone companies selling unconnected telephone services to schools. As teachers decide to move from one program to another, they must reorient their satellite receivers. The problem could be greatly increased if commercial vendors were to shift their programs to the Broadcast Satellite Service (BSS) band which requires circular rather than linear polarization. The ground station equipment now in place in American public schools is based on C and Ku Band technology which is incompatible with BSS transmission polarization.

A Proposed Solution

The various technical, operational and fiscal problems described here are directly related to the nature of the satellite marketplace. Under the present system, the need for satellite vendors to ensure financial viability leaves schools, colleges and universities without predictable, low-cost and equitable access to satellite services. Creation of an educational satellite infrastructure is a tangible step toward mitigation of the equity and quality of education problems facing America's public schools. Such a telecommunications system could make possible extensive distribution of high quality educational programming to every school, college, university and library in the nation.

It is impractical for states, individually or collectively, to undertake the development of such a system without creative partnerships among the federal government, the private sector and themselves. The cost of the construction and launch of a Ku-C band satellite is estimated to be somewhere between $150 and $200 million. Additionally, annual operating costs for maintenance of the satellite can be several million dollars each year. Our analysis indicates that American taxpayers will pay at least $45.5 million this year alone to commercial vendors for satellite services. A similar investment in a dedicated satellite would return its initial cost in three to four years. Improved access to satellites would eliminate some of the problems that inhibit greater use of this technology for educational purposes and thereby stimulate further demand.

In response to these issues, the EDSAT Institute is reviewing the policy, governance, fiscal, operational and technical issues and options associated with development of a satellite-based telecommunications system dedicated to education.

2. THE STUDY PROCESS

The EDSAT Institute is a non-profit tax exempt educational and research organization founded in 1988 to encourage the access and utilization of telecommunications in all forms throughout America's schools, colleges, universities and libraries. The Institute is supported through private gifts, grants, and contracts. The work of the Institute is conducted under the policy guidance of a 20 member Advisory Board.

Governor Wallace Wilkinson (Kentucky) proposed to President George Bush at the Charlottesville Education Summit in 1989 that a public domain satellite dedicated to education be built and launched as a partnership effort between the states and the federal government. The EDSAT Institute agreed to review the relevant legal, fiscal, operational and policy issues and to recommend options for organizational structures to govern, manage and utilize a dedicated public education satellite system in a manner that would ensure its appropriate and equitable use.

The workplan described here was designed to directly involve representatives of the various stakeholders in this project such as the education community, various federal agencies, the Congress, the satellite and communications industry and other interested parties. Over the course of the study substantial interest in the concept was found among these groups. The EDSAT Institute is indebted to these groups and is grateful for the extensive amount of important information and assistance they provided. Their continued interest in the proposal remains high.

The Working Groups

The Institute sought to broaden the base of participation in the study by establishing two working groups made up of representatives of these stakeholders. A Technical Issues Working Group focused on the technical aspects of the proposal and was chaired by Dr. Peter Likins, President of Lehigh University and member of the Board of Directors of the COMSAT Corporation. The mission of this group was to respond to information prepared by the EDSAT Institute researchers regarding the technical attributes, orbital configuration and estimated cost to design, construct and launch a public domain satellite dedicated to education. Mr. Frank Weaver, CEO of UNET, Inc., an engineer and former satellite industry representative, coordinated research for the technical issues working group.

A Policy and Governance Working Group focused on the legal, fiscal and governance aspects of the proposal and was co-chaired by Dr. Joseph Duffey, President of the University of Massachusetts System, and Mr. John H. Buchanan, Jr., Chairman of People for the American Way and former Congressman from Alabama. The mission of this group was to respond to alternative approaches to the governance and management of one or more public domain satellites dedicated to instructional functions or activities to be used by educational institutions (preschool through graduate school) and adult learning programs. The research for this aspect of the project was provided by Grier Raclin, Partner, and Kevin DiLallo, attorneys with Gardner, Carton and Douglas and by Philip Malet and Jerry Howe, partners with Steptoe and Johnson. Both law firms are Washington-based with strong practices in telecommunications law.

The primary role of the working groups was to ensure that the researchers were responsive to the concerns of those entities which have a direct stake in the existence of a public domain satellite dedicated to education. The working groups met twice between October and December of 1990 to review and comment on the draft documents prepared by the consultants and offered valuable insights that guided the contents of this final report. Revisions and further research followed each session. The working group members gave a final review of this report in draft form in January 1991. The EDSAT Institute Advisory Board reviewed the draft report at a December 1990 meeting and provided editorial comment on the final report in February 1991.

The Conceptual Approach

There were several guiding principles followed in the conduct of the study. A public domain satellite system design had to satisfactorily meet these criteria:

Accessible	Reliable
Equitable	Timely
High Quality	Predictable
Acceptable to Users	Sufficient
Affordable	Compatible
Fundable	Fully Utilized
Effective	Flexible

The consultants were asked to advance only those proposals which would optimize attainment of these attributes.

The Report and Conclusions

This report is offered to policymakers and the public as an analysis of the various options available for the governance, management and acquisition of one or more satellites dedicated to education. The conclusions of fact and the recommendations based upon them are those of the EDSAT Institute and do not necessarily represent the official position of any of the organizations, businesses or governmental agencies who served as participants in the working groups.

3. TECHNICAL ISSUES

Several considerations were discussed in determining whether or not satellites should be used for the delivery of educational programming. A brief review of some of the available delivery systems was made to give a comparable assessment of their relative strengths and weaknesses.

Alternative Delivery Systems

A satellite has the capability to deliver a signal that can be received anywhere in its footprint which can cover all 50 states. That signal can be received by anyone with a satellite dish. Currently, there are several satellites in orbit with the capability to transmit educational programming and there will be no delay in waiting for a system to be built in order to begin transmission. In addition, satellites have a tremendous capacity to transmit several programs simultaneously. With the advent of digital video compression technology, up to 20 video programs may be transmitted over a single transponder at one time thereby enhancing the throughput of a satellite without having to spend one cent in redesigning or retrofitting the existing base of satellites in orbit. Through the use of very small aperture terminals (VSATS), it is possible to combine video, audio, and data with interactivity.

Of the 92 million U.S. television households (TVHH), 53 million or 57% subscribe to basic cable service. Not all households are passed by cable, because it is either not cost-efficient to lay the cable or areas are too sparsely populated to justify the investment. Oddly enough, satellites are being used to reach those homes inaccessible to cable. For example, K Prime Partners, which includes major cable programmers and operators, has just initiated a service to deliver cable type programming to those homes unserved by a ground cable. Hence, the obvious advantage of a satellite's ability to reach every household is demonstrated.

It should also be noted that satellites are used by cable programmers to deliver their programs to cable headends for distribution to an installed base of over 50 million TVHH. This fact should not be ignored in considering the importance of satellites in the delivery of educational programs provided there is available channel space on a particular cable system. Cable is limited in its throughput capacity. The average channel capacity of cable systems is 35 channels. This is scarcely enough to satisfy the voracious demand for entertainment and to offer capacity for educational programming.

Fiber optic cable has some advantages in that it has greater bandwidth capacity than coaxial cable, suffers lower losses of signal strength over distance, and is capable of interactivity. However, fiber is not available everywhere and it would be very costly to wire the nation with fiber. It is estimated that if the telephone companies were to wire the nation with fiber optic cable, it would cost between $500 and $900 billion and would take many years to complete.

Microwave and terrestrial broadcast television are the oldest technology and presently are the primary vehicle for instructional television. Although both are effective means of video distribution, they each have coverage and capacity limitations and they cannot compete with satellites for nationwide or even regional program coverage. No one delivery system is without any shortcoming, but satellite transmission is the most effective for satisfying the criteria stipulated in the preceding section. Satellites are also compatible with other delivery systems and can utilize the inherent advantage of each.

The Education Satellite Market

At least nine C-band satellites with 30 or more full time or occasional use transponders offer educational services. They are GE Satcom 3R and F1R, Hughes Westar 4 and 5, Hughes Galaxy 2 and 3, GTE Spacenet 1 and 2, and Telstar 301. At Ku-band, eight satellites providing 22 or more full time or occasional use transponders are used. They are GTE GSTAR 1 and 2, GTE Spacenet 1, 2, and 3, GE Satcom K1 and 2, and Hughes SBS 4.

As of October 31, 122 Ku-band transponders were operational on U.S. satellites. Of that amount, 111 are in use. The Ku-band transponder figures do not include 19 on SBS 6, launched on October 12, 1990, but already 16 of these have been leased for video entertainment services. GSTAR 4's 16 transponders, launched on November 20, 1990 are also not included. There were 384 C-band transponders operational for the same period. Of that total, 331 were in use. Not reflected in either of these numbers are the 24 transponders on each of Galaxy 6 and GE Satcom C1, launched October 12 and November 20, 1990 respectively. All of these satellites will become operational some time in 1991.

Some difference of opinion exists within the industry as to how much surplus capacity is going to be available to education in the 1990s. Industry estimates, based on planned launches in the early years of the decade, indicate that most vendors will have prelaunch contracts for most of the transponders available on new satellites. However, emerging technologies such as digital video compression technology could radically change the utilization of existing and future transponders and dramatically increase their capacity.

Present satellite providers probably will continue to have space for their current education clients. However, the EDSAT Institute could not determine how prepared the private marketplace will be to accommodate a rapid expansion in educational use. Our best estimate is that consolidation of educational programming on one or more satellites will result in some migration of present users from existing satellites to other inflight or new satellites in order to accommodate the present market. Presumably, lower cost reliable transponder time also would result in greater availability and utilization of satellite-based instruction.

Program Providers

At least 111 providers of educational programming delivered by satellite have been identified. A study compiled by Kentucky Educational Television of 20 of the larger providers revealed that they expect to purchase more than 75,000 hours of transponder time during the 1990-91 school year. If the prime broadcast time is 12 hours, taking into consideration time zone differences, for five days a week over 36 weeks which is the typical school year, these 20 agencies would *average* 2,160 hours per year utilization of at least 35 transponders *during the designated time frames*.

The KET study did not indicate the hours, days or weeks during which these transponder hours would be used so the exact utilization of a dedicated satellite by these 20 education agencies could not be determined. However, if one assumes a satellite has 24 transponders, then just these 20 program providers conceivably could utilize nearly 73 percent of the capacity of two satellites during the prime 12 hour, 5 day, 36 week broadcast period. Obviously, there could be considerable underutilization of these same transponders during the remaining hours, days and weeks by some users. A cost efficient use of a dedicated satellite system obviously will require the development of imaginative educational programming targeted to nontraditional students, other educational uses of excess time, or the sale of unused time to non-education users.

Given that the 20 agencies identified in the KET study only represent about eighteen percent of the 111 purchasers identified by the EDSAT Institute, one can see that the probable demand for transponder time will be much greater than pictured in the KET study. Many other agencies also will seek time on an education satellite, although we could not document how much it might be. The point being made here is that education represents a significant market right now. The problem does not seem to be demand as much as the lack of coordination in purchasing satellite time so as to gain maximum economic benefit from such a large expenditure.

Assessment of Existing Earth Stations

A minimum of 55,000 receive sites of educational telecommunications have been identified. This figure does not include business television for training. There are about 125,000 school buildings, grades K-12 in the country. There are also 3,000 colleges and universities and 6,000 libraries. Little data are available about the installed based of receivers of satellite signals by schools, colleges and libraries. What is knows probably represents only a portion of the actual installed based. Here is what we found.

In a Fall 1990 Quality of Education study, it is reported that 2,336 (16%) of the nation's 15,000 school districts have satellite dishes. Seen another way, 19,201 (23%) of the schools in these districts have satellite dishes. One earlier study of school districts with satellite dishes identified that 68% are C-band, 40% are Ku-band, 7% are C and Ku-band, and 84% are steerable. In addition, there are over 3 million home satellite dish owners, mostly at C-band. Due to the mix of earth stations operating at both C and Ku-bands, any satellite servicing them should offer dual frequency capability.

The size of these earth stations varies from about 2.5m to 10m (or about 8 to 30 feet) in diameter. There is a strong desire by program providers to offer broadcast quality reception, hence a somewhat larger dish is required to receive the weaker signal from some of the older C-band satellites. The use of higher power Ku-band transponders brings down the size of the earth station to about 1.2m (or 4 feet). Most dishes are mounted on the ground so as to minimize problems of having to reinforce roof structures to withstand the weight and wind loading conditions imposed by these dishes.

Although no actual cost figures are available from educational telecommunications users, it is known that earth station equipment costs, including installation, can range from about $2,500 to $30,000 or more. This figure is exclusive of the costs of peripherals such as monitors, phone lines, video cassette recorders, personal computers, or linking the dish to several locations around a site. A more complete survey of the universe of ground stations used to receive educational programming is in progress.

Space Segment Configuration and Deployment

When one looks at the universe of satellites being used for educational telecommunications, both C and Ku-band satellites are being utilized. Hence, any satellite(s) providing service must offer capability at both frequency bands. If one were to aggregate the users on one satellite, it should be a hybrid. It may also be desirable to provide cross-strapping of C and Ku-band transponders on-board the satellite. In other words, one could uplink at C-band and the satellite would convert the frequency to downlink at Ku-band in addition to being able to receive an uplink at Ku and downlink at C-band. This capability would make it possible to access the large number of C-band dishes at cable headends and at private households plus the growing number of Ku-band dishes. It should be noted that the FCC will require full frequency reuse of both bands on a single satellite in order to maximize the use of limited orbital slots.

Hybrid satellites such as GTE Spacenet 1, 2, 3 and Contel ASC offer full frequency reuse at C-band but not at Ku-band. Because of the increased demand for satellite capacity and the limit of spectrum, the FCC has determined that these designs are no longer an efficient use of an orbital slot. Because instructional programs originate from and are received in all 50 states, it is necessary for the satellite to have CONUS uplink capability so that the location of any program provider or receiver is not restricted.

A few comments on the relationship of satellite power to dish size are necessary. Generally speaking, the higher the power on the satellite, the smaller the dish and that implies lower cost of earth station equipment and installation. The current on-orbit C-band satellites operate between 5 and 16 watts, and the Ku-band satellites between 20 and 45 watts. Future trends are towards putting even more power on the satellite at both frequency bands.

The highest power satellites being proposed (from 100 to 200 watts) are the direct broadcast satellites operating in the Broadcast Satellite Service (BSS) band with an uplink at 17 Ghz and a downlink at 12 Ghz. It is anticipated that reception of a high quality signal can be achieved with a 13 inch flat plate antenna or a similar size parabolic dish. It should be noted that the circular polarization scheme in the BSS band differs from the linear polarization in the Fixed Satellite Service (FSS) band of existing satellites and earth stations. To achieve compatibility, the existing universe of dishes must be retrofitted or replaced to receive signals in the BSS band. In any event, none of these new BSS birds will be launched and operational before 1994.

Ironically, new satellite systems in the FSS band are offering higher power at Ku-band at 60 watts and at 120 watts by combining the output of two 60 watt travelling wave tubes. AT&T's Telstar 4, due for launch between late 1993 to early 1994, will provide this capability. Other replacement satellite systems may also offer similar power levels. Since they will operate at the same frequencies and polarizations that are currently in use, there will be no compatibility issue. Satellites that service the educational telecommunications market today and for the near future should operate at both C and Ku-bands in the Fixed Satellite Service. BSS could be used to augment program offerings when it comes into existence but not to replace the systems currently in orbit.

Technologies for Transmission and Reception

Digital video compression can help to increase the use of transponders by allowing more than one video program to be transmitted simultaneously over a single transponder. Some estimates range as high as up to 20 video signals per transponder. At present, no compression service of more than eight signals per transponder has been announced for commercial operation. Also, compression techniques do not affect the satellite design. Instead they reduce the amount of transponder capacity required and thereby lower the cost of transmission.

Subcarriers along with the video signal offer the potential for simultaneous foreign language translation as well as special services such as data, audio, and closed-captioning for the hearing impaired. Technology should and can make educational programming available to all regardless of their handicap.

VSATS (very small aperture terminals) are one of the fastest growing applications of satellite technology. Hundreds of business networks employ VSAT systems to handle data, audio and video transmission with two-way capability among several sites within an organization. Most of these services are provided on Ku-band satellites. This being the case, there will continue to be increased competition between the business and education sectors for access to the already limited supply of Ku-band transponders.

Financial Considerations

Depending upon the design configuration, a communication satellite can cost between $50 and $75 million. The launch vehicle required to place the satellite into orbit is also priced in the $50 to $75 million range. Insurance to replace both the satellite and the rocket in the event of a launch failure or some other anomaly would cost as much as 20% of the combined cost of the satellite and launch vehicle. Total space segment costs are estimated to be:

1 Satellite @ $75M	$75 million
1 Launches @ 75M	75
Subtotal	150
Insurance @ 20%	30
Total	$180 million

Some experts believe it is prudent to purchase two satellites and launch services in the event of a catastrophic failure of one, thus reducing the time to replace the lost satellite to only a few months. Such a plan obviously would double the cost.

Total system cost must also consider the cost of the ground segment, that is the size and cost of the thousands of earth stations to be used for satellite reception. It was noted earlier that to put more power on the satellite would reduce the antenna size and consequently its cost. When several thousands of earth stations are involved, this is always a beneficial trade-off even if the space segment costs rise. They will always be offset by the reduction in ground segment costs.

The KET study identified 20 program providers which will purchase more than 75,000 hours of transponder time in the 1990-91 school year. These agencies represent only about eighteen percent of the purchasers of satellite time. Although we could not confirm their total expenditures, it is plausible to assume that the total market is in excess of $50 million annually which is more than enough to pay for a satellite in about seven years including the annual cost of maintaining it.

Summary of Technical Findings

1. The universe of users of satellites to receive educational programming is rather large, at over 55,000 receive sites and growing.
2. Both C and Ku-band frequencies are employed.
3. There is a shortage of available transponder capacity at the times required. This is especially true in the Ku-band.
4. Educational institutions cannot effectively compete with private business for transponder time.
5. There is a trend to put more power on the satellite at both C and Ku-bands.
6. Digital video compression techniques are an effective way to deliver multiple programs on a single transponder.
7. To service the existing universe of earth stations, a satellite should operate in the Fixed Satellite Service. Broadcast Satellite Service should not be ruled out, but should only be considered to augment service delivery in the foreseeable future.
8. Some measures should be taken to aggregate educational program providers to more effectively obtain satellite capacity.

4. GOVERNANCE AND MANAGEMENT ISSUES

Ownership of the Satellite

Ownership of an education satellite is a matter of great importance to both federal and state policymakers. There are three options for securing a satellite for education purposes:

1. acquire a Federal Communications Commission (FCC) license to an orbital slot and purchase a satellite to fill it;
2. acquire a license to an orbital slot and contract with a vendor to provide a satellite on a lease basis; or
3. let a vendor acquire the license to an orbital slot and provide the satellite on a lease arrangement.

The first option is ideal from a control standpoint, but it may not be the most feasible initially. The design, construction and launch of a satellite is costly and requires at least three years to complete. It is a capital intensive venture that requires considerable up front investment before the satellite is in orbit and useable. Financing a project like this from design to launch would be difficult. Since the need for an education satellite is immediate and growing, one of the other options may be more viable for the near term.

Under the second option one could acquire an orbital slot and then contract with another party to build, launch *and privately finance* a satellite. The advantage to this approach is that it provides more flexibility in financing the project. However, there still remains the long application process required by the FCC. This option will take some time to pursue, but it could avoid even longer delays associated with financing or construction. It also ensures celestial space will be available even if there is a change in satellite vendor.

The third option presents the quickest route to securing access to a satellite for education. The rights to an existing inflight satellite can be secured either by outright purchase or by leasing all or a portion of its transponders. An existing owner of the satellite already has an FCC license for an orbital slot and an operational spacecraft. Such an approach avoids the lengthy process of securing rights to an orbital slot and the time required to design, construct and launch a new satellite. Also there is no risk of losing the satellite at launch.

The third option does have some problems. One reason for having an education satellite is to eliminate the need for repeated reorientation of ground antennae. The licensee is in the best position to maintain its orbital slot. Also, finding an existing satellite that is properly configured could be a problem.

Given the time required to secure a new satellite it might be prudent to get started with the "best fit" available now and design a better replacement to come on-line three to five years down the road. However, since an orbital slot belongs to the owner of a satellite, a later change in satellite vendor could require every uplink and downlink to change orientation to a different orbit. It is conceivable that a satellite owner might be willing to transfer one of its orbital slots as part of a contract to provide the satellite hardware, but this option probably is not a long term solution. At the very least policymakers should seek to have several hybrid orbital slots reserved by the FCC for educational purposes. The option of direct or second party ownership of the satellites then remains open but long term stability is gained for the ground segment of the system.

Governance of the System

The education satellite system is to be a telecommunications "pipeline" available to educational institutions for instructional purposes. The primary mission of the organization governing the satellite system is to ensure effective, equitable and efficient use of this public resource at a reasonable cost to its users. Designing an appropriate structure for governing the system is a matter of determining who should control what decisons. The decisions to be controlled in this instance would seem to be these:

1. The price of satellite time;
2. Schedules and priorities for satellite time;
3. Equitable access to the satellite;
4. Budget, contracts and debt;
5. Ownership of assets;
6. Acquisition and design (configuration, capacity, band, etc.) of satellites;
7. Expansion, dissolution or sale of the system; and
8. Operational policies and procedures of the organization.

Other matters such as encouraging greater use of the satellites, monitoring changes in technology, and anticipating future needs are more appropriate for the organization's management rather than a governance body to deal with.

Governance of an organization generally falls to those who make up its membership or have the most financial interest in it. Many of the users of satellites to distribute instructional programming are educational television stations which operate under a state charter or under the auspices of an educational institution. There also are several nonprofit organizations which broker satellite-based instructional programs such as the Black College Satellite Network and the National Technological University. These agencies have a financial interest in the organization since the purchase of satellite time is a major program expense. More importantly, these are the agencies that will be expected to use an education satellite if it is developed.

Models for Governance

The EDSAT Institute examined many organizational models but this report addresses only those models which are considered feasible to implement. Central in the analysis was identifying an organizational structure which could both serve the interests of those who will use the system and those who will invest in it. Four possible models are discussed here:

1. a national, non-federal agency responsible for all governance functions;
2. a new or existing interstate compact organization;
3. a multistate education telecommunications

"cooperative;" or

4. a "COMSAT/INTELSAT" type structure with membership under the control of user governments and/or educational agencies.

Each model is first discussed in general terms followed by a discussion of issues related to control, membership, and funding. Of course, it is possible to modify any of these models to meet specific concerns the organizing parties may have.

(1.) A National Non-federal Agency

One model is to create by Congressional action a national nonprofit organization dedicated to providing satellite communication services to educational agencies nationwide. The chartered organization is public but not governmental in nature. Although operating under a federal charter, it would not be a federal agency. The National Red Cross and the Boy Scouts of America are examples of federally chartered national organizations. The charter would provide for the creation, structure, governance and mission of the organization. It would operate much like a business entity except it has no stockholders and pays no dividends.

Control: An organization of this type is a public corporation that operates at the national level. It is self-governed by a board of directors appointed in the manner specified in its charter. Neither the states nor the federal government have direct control of the agency unless they are given responsiblity for the appointment of its directorate. The agency management controls its assets and has the same fiduciary responsibility as any public agency. The amount of control users of the system have depends on whether they are represented on the board of directors.

Membership: The agency is an operating entity, not a membership organization. There are no dues or other membership type requirements. The agency functions as a service organization. Any educational institution or agency fitting the service definition in its charter can purchase transponder time on its satellites.

Funding: Initial financial support could come from federal or state appropriation, but the agency is expected to be self-supporting. Revenues for the agency are generated from the sale of transponder time on the satellites under its ownership or control. The charter grants the organization authority to enter into contracts, acquire debt, establish fees for services, and conduct any other business necessary to its efficient operation. Financing for its satellites and related land facilities can be secured through loans, gifts, grants and revenues from transponder sales.

(2.) A New or Existing Interstate Compact Organization

A second model is an interstate compact organization. The interstate compact is a legal instrument for the conduct of multistate intergovernmental activity of mutual interest and benefit. Organizations formed in this manner function as agencies of the participating states and, therefore, can be supported through direct appropriation of state funds. The compact must be ratified by the participating state legislatures and is codified in the state statutes. The terms of the compact are considered binding on each state. However, a compact organization does not have the "good faith and credit" of the member states so it must be responsible for its own instruments of debt.

A compact organization can operate in a manner similiar to a federally chartered agency except it is chartered by the states rather than the federal government. (See discussion below about federal approval of interstate compacts.) Therefore, all of the *functions* described for the previous model can also be performed by an interstate compact organization. A compact would have to be drafted and adopted by the states which desire to participate in the satellite system. There are several regional education compacts (Southern Regional Education Board and Western Interstate Commission on Higher Education) and one national compact forming the Education Commission of the States. These three interstate compacts can serve as precedents for creating an interstate compact to acquire and manage an educational satellite system.

The U.S. Constitution prohibits interstate compacts that tend to increase the political power in the states and to encroach on or interfere with the just supremacy of the United States. [See the U.S. Const. art. 1, 10, cl. 1; Northeast Bancorp., Inc. v. Board of Governors of Federal Reserve, 472 U.S. 159 (1985); U.S. Steel Corp. v. Multistate Tax Commission, 434 U.S. 452 (1978).] However, states wishing to form such a compact may petition Congress for permission to do so. [See Texas v. New Mexico, 462 U.S. 554 (1983); New Hampshire v. Maine, 426 U.S. 363 (1976).] An express agreement among states is not a prerequisite to a finding that a constitutionally prohibited interstate compact exists; such a finding could be based on reciprocal legislation by two or more states effectuating the same purposes as a formal agreement. [See U.S. Steel Corp. v. Multistate Tax Commission, supra.]

Control: An interstate compact organization is under the direct control of the states which enter into it. Various methods have been used to govern a compact organization although some compacts are administered directly by officials of the member states. In this case, a governing board of some type would be needed to maintain oversight of the satellite system. In most instances the governing board of a compact agency is made up of gubernatorial appointees representing each member state although this can vary depending on the nature of the compact. Representation of various educational interests could be required if desired. Often state policymakers or officials are specifically named to the governing board of a compact organization, generally on a rotational basis if the compact involves more than several states. There is no federal government involvement other than initial congressional approval of the compact.

Membership: The members of a compact are governments. An act of the legislature is required for participation in an interstate compact. Eligible membership is defined in the compact which can be enlarged only by consent of the member states. In this instance, the membership could be all states and territories or it could be limited to those states which utilize the satellite system. In the latter case, "utilize" means uplink access to the satellite. The downlink signal is in the public domain and freely available to anyone with a receiving antenna.

Funding: An interstate organization is funded at least in part by appropriations from the member states. Appropriation requests often take the form of "dues" assessed against the member states according to some formula designed to allocate organizational costs in an equitable manner. Member states voluntarily contribute their dues but the compacts usually have some provision for withholding compact services or benefits from nonpaying members. The organization also may secure outside funding from gifts and grants. In certain instances it may charge for certain services, especially those provided to entities outside the membership states.

In this model the organization could function without a large dues structure by charging for use of the satellite. The rates for transponder time can be uniform for educational institutions in the member states but set at a level sufficient to cover all organizational expenses. The organization underwrites the cost of securing and maintaining the satellite system from these and other revenues. Transponder time not used by the member states could be sold at appropriate rates to educational institutions in nonmember states as "occasional users" and at commercial rates to all other buyers. The organization should be financially self-sufficient.

(3.) A Multistate Telecommunications "Cooperative"

The formation of a multistate telecommunications "cooperative" is a less cumbersome model than the interstate compact organization. All education agencies which purchase satellite time can form a cooperative organization to acquire and manage a satellite system on their behalf. The cooperative is a not-for-profit business organization which provides goods and services to its members at below market rates. In the model here, the cooperative provides satellite communication services to its members. The cooperative is created to acquire, finance and manage one or more satellites for exclusive use of the members.

Control: A cooperative is under the direct control of the members. In this model the users of satellites would control the organization rather than political officials. The cooperative is a business organization and is structured as such. Management is selected and supervised by an elected board of directors. Policies of the cooperative are established by the directors and approved by the membership. Many of the cooperatives have strict operating procedures implemented by bylaw provisions that: (1) define membership eligibility standards; (2) establish democratic procedures for selecting and electing directors to ensure control by active members; and (3) prohibit conflicts of interest. This model probably provides the best opportunity for direct control over the system by its users.

Membership: Membership in the cooperative probably would consist of educational agencies which originate satellite-based instructional programming. Membership would be voluntary and could include organizations which are not governmental in nature such as private nonprofit educational institutions and television networks. However, membership in the cooperative could be a prerequisite to uplink access to the satellites in the system.

Funding: A cooperative is created to provide specific goods or services for the benefit of its members. The members support the cooperative by purchasing the goods and services it provides. In this case the members can underwrite the cost of acquiring, financing and managing the satellite system through payments for satellite time purchased from the cooperative. Cooperatives are expected to be self-sustaining.

(4.) The COMSAT/INTELSAT Model

In many ways states behave like sovereign political bodies and find it difficult to enter into cooperative ventures. We examined the interstate compact as one model for interstate cooperation. The COMSAT/INTELSAT structure might be another model. It combines some of the features in the interstate compact and cooperative models already discussed.

INTELSAT is a multi-national cooperative created in 1964 when 12 nations signed an Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System. Presently some 119 nations are signatories to the agreements establishing and governing INTELSAT. INTELSAT's purpose is to own and operate a global system of communications satellites to serve the entire world. One of the main reasons for forming the international cooperative was the recognition that it would be difficult to persuade other nations to yield some of their sovereignty to an international organization. The best way to do so would be to allow each nation to price the services purchased from INTELSAT as it sees fit.

Control: INTELSAT is governed by a Board of Governors having between 25 and 30 members. Presently there are 27 members of the Board of Governors. Most of the Governors are appointed by nations with the largest annual usage of INTELSAT's services; however, some Governors are selected by groups of nations. For example, all of the Caribbean nations are jointly represented on the Board and three groups of sub-Saharan African countries are represented on the Board. Each nation or group of nations designates its own representative to the Board. Governors serve one-year terms and the Board meets four times per year. The Board elects a chairman and vice chairman annually.

In addition to the Board, there are two governing "chambers": the "Meeting of Signatories," and the "Assembly of Parties." Each of these chambers meets once every two years to set policy for INTELSAT and provide guidance to the Board. The Signatories represent the commercial interests in INTELSAT. For example, the United States representative to the Signatories is COMSAT. The Parties represent the governmental aspect of INTELSAT. In the case of the United States the representative to the Assembly of Parties is the Department of State. COMSAT is advised by the State Department, Commerce Department, and Federal Communications Commission concerning matters of foreign policy and international trade coming before the Meeting of Signatories.

INTELSAT policies, programs, and plans are established primarily by consensus and coalition building. If a member nation seeks to increase its use significantly, it must negotiate the increase privately with other nations that might be willing to give up some of their allotted capacity. Daily operations of INTELSAT are controlled by an executive organ headed by a Director General.

Membership: The only requirements for membership in INTELSAT are that a nation be a member of the International Telecommunications Union and that it make its payments in a timely manner. Although each member nation's investment interest in INTELSAT is proportional to its use of the space segment, the minimum unit of ownership is a fraction of one per cent, worth approximately $750,000 U.S. A nation's use is calculated by the number of uplinks or downlinks that occur in that country during the last quarter of one year and the first quarter of the next year; in other words, satellite transmissions are viewed as having two components which are counted separately in determining a nation's use of the system.

Funding: INTELSAT funding derives from three sources: (1) periodic capital contributions by member nations for capital expenditures, e.g., procuring a new satellite; (2) periodic assessments made against members for operations and maintenance expenses; and (3) payment by members and non-member customers for use of services. The first two categories of assessments are determined in proportion to each member nation's annual usage of INTELSAT's services. Members that do not pay their assessments in a timely manner are placed on a list distributed to the Board; the ultimate sanction for nonpayment is expulsion from INTELSAT. Members generally are conscientious about making their payments in a timely fashion.

Should such a model be employed by the states, some modification in the INTELSAT structure and operations is probably necessary. The states and territories could create a multi-layered structure in which there is a Board of Governors representing the political and policy interests of the member states and territories which sets the major policies governing the system. An "intelsat" organization, with its own Board of Directors, could manage the system according to the policies established by the Board of Governors. The Board of Governors would be a kind of "holding company" and the "intelsat" would be one of its "operating companies." Under this model the Board of Governors could have a broader mission with other operations associated with satellite-based instruction under its control.

The Technical Management of Satellites

Creating and managing a public domain satellite system requires a capacity to own and operate the technical infrastructure associated with space technology. The design, construction, launch and daily maintenance of the spacecraft are highly technical responsibilities b· nd anything states or educational agencies have attempted up to now. These responsibilities can be performed by an existing governmental agency at the federal level, a private sector space and communications company, or a new multistate agency created for this purpose. Ideally the organization responsible for the business and technical management of the satellite system should have long experience in this business. The only federal agencies qualified to perform these functions are the National Aeronautical and Space Administration (NASA) and the Department of Defense.

Although the Department of Defense has an extensive satellite system worldwide, the space segment is dedicated to specific military missions and is not readily available for civilian use. The military might be able to donate one or more of its launched or unlaunched satellites for this purpose, but it is inappropriate for a military agency to manage the technical and business affairs of a civilian educational system. Therefore, the only other viable federal agency is NASA.

NASA has been given the mission to develop civilian utilization of space for "peaceful and scientific purposes." The Congress could give NASA responsibility for managing the technical aspects of an education satellite system. NASA has all the tracking stations and expertise required. In fact the satellites could be designed, constructed and launched by NASA contractors. However, NASA would be operating a telecommunications business in competition with the private sector, something the President and Congress might find politically undesirable.

If the states collectively create and finance the satellite system, with or without some federal financial assistance, they would no doubt wish to secure and retain to themselves ownership of the orbital slots and frequencies for the system. A multistate agency could contract with NASA or any private sector satellite telecommunications company for the provision and technical management of the satellites.

Direct contracting with a private sector space and communications company probably would be preferable, since NASA would rely on private contractors in any event. Such a course of action would permit participation in the project by the private sector on a competitive basis and probably result in lower cost to the states. If the states were to lease or purchase transponders, presumably the satellite owner would be responsible for operational aspects of the system.

5. FISCAL ISSUES

Financing the Organization

The education satellite system must become self-sufficient as soon as possible. The system provides a service which education agencies currently are purchasing on the commercial market. These expenditures, if aggregated, could be sufficient to underwrite the cost of the satellites, their technical management and ·e governing organization. The market forces that will play upon it are the same as found in the private sector. The organization must expect to respond in a similar manner.

The EDSAT Institute believes the system should not assume it would be subsidized beyond its initial years. Furthermore, it must be able to provide its services at a rate competitive with what is available in the commercial market. In order to do this, the organization may need to be structured in a way that permits it to sell excess capacity at commercial rates to non-educational purchasers. Obviously, this can have significant impact on its tax status as an organization and the tax status of any financing it may seek.

Financing the Satellite with Tax-Exempt Bonds

The cost of procuring and launching a satellite for educational purposes may be financeable on either a tax-exempt or taxable basis. Because tax-exempt interest rates are significantly lower than taxable interest rates for comparable rated securities of comparable maturities, it would be beneficial if the satellite could be financed in whole or in part on a tax-exempt basis. If tax exempt financing is available to the governing body, then direct financing (and probably ownership) of a satellite might be a feasible approach. Federal and state laws regarding tax exemption are diverse and complex.

Generally, tax-exempt financing for a satellite can be accomplished if it is owned and used by state or local governmental bodies, by entities which are exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Code of 1986, or by a combination thereof. Any ownership and interest in more than a *de minimis* amount of use of the satellite by for-profit entities or the federal government (or an agency or instrumentality thereof) will eliminate the tax-exempt bond option.

It is expected that significant use of the satellite will be made by 501(c)(3) educational institutions. Therefore, issues related to having these bonds treated as "qualified 501(c)(3) bonds" is important. With respect to qualified 501(c)(3) bonds, Section 147 of the Code provides that the average maturity of bonds can be no more than 120% of the average useful life of the assets being financed. Thus, if it is anticipated that the satellite will remain in orbit and be useful for ten years, the average life of the bonds should not exceed twelve years. This limitation does not apply if the bonds are governmental bonds.

A practical concern with respect to the issuance of these bonds is that state enabling legislation which authorizes the issuance of bonds for 501(c)(3) organizations typically requires bond proceeds to be used in the state in which the facility is located. Thus, any special launching facilities could be financed in the state in which those facilities were located. It may also be possible, given specific language in state enabling legislation, that although the satellite would not be located within the state of the financing, the financing could be done because it would benefit institutions located in the state.

Where the number of institutions using the satellite are located in a number of different states, it may be necessary to complete the financing through a number of composite offerings of separate bond issues. Furthermore, if the entity which owns the satellite is a 501(c)(3) organization, it may be possible to do the financing all in the state in which the 501(c)(3) entity is located, regardless of the fact that educational institutions around the country would also be taking advantage of the satellite, thus avoiding the need to do multiple composite transactions. Finally, if a new governmental entity is created, the enabling legislation could be drafted to solve these issues.

Whether bonds are issued on a taxable or tax-exempt basis, the key determination of their marketability is the credit behind the debt. In all likelihood, either the participating educational institutions will have to guaranty debt service or contracts analogous to take or pay contracts will need to be entered into and pledged to the bond trustee covering revenues from the use of the satellite.

Another issue which could arise in the context of marketing of the bonds is the coverage of interest payments until the satellite is operational and generating revenues. Typically, bond proceeds have to be expended within three years from the date of issue of the bonds, and the bonds can be sized to include the amount of interest owed on the bonds during the construction or payment period. It needs to be determined in connection with the feasibility of the economics of issuing the bonds as to how long it will be until the satellite generates sufficient revenues to cover its debt service.

The entity owning the satellite will need to be either a 501(c)(3) organization or a state or local governmental entity to take advantage of tax-exempt financing. Furthermore, to the extent there would be more than a *de minimus* amount of usage by for-profit entities, the financing could not be done on a tax-exempt basis. To the extent that use of the satellite was limited to public schools and universities, then more liberal tax-exempt bond rules would apply.

There are no specific limitations on the amount of loans that a 501(c)(3) organization may have outstanding. However, under Code 514, an exempt organization is required to include a fraction of income received from any debt-financed property in its unrelated business taxable income. However, the term "debt-financed property" does not include property acquired with borrowed funds if "substantially all the use of ... [the property] is substantially related ... to the exercise or performance by such organization of its charitable, educational, or other purpose or function constituting the basis for its exemption." IRC 514(b)(1)(A)(i).

Other Methods of Financing a Satellite

There may be an important role for the federal government in financing an education satellite. The Congress could make an appropriation for the cost of design, construction and launch of the satellite and then turn it over to the governing body. Such a scenario might be more likely if the states were to pick up a major portion of the cost. However, present fiscal and military circumstances would indicate that such direct financial support is unlikely in the near term. The federal government could underwrite the bonds issued by the governing body which would give them marketability similar to other federally guaranteed financial paper. However, such securities are not tax exempt. Finally, the federal government could donate an existing inflight or replacement NASA or military satellite to the governing body. This would require no new appropriation or delay in implementing the project.

On the private sector side, the organization could seek a satellite vendor willing to finance, build and launch the satellite on a guaranteed lease-back basis. A relatively stable revenue stream must be established first, but this might be a feasible approach in the outlying years.

6. GENERAL OBSERVATIONS

Some working group participants expressed concerns about various aspects of televised instruction such as program quality, teacher certification problems and improvement in the ability of teachers and students to interact. Although these are important issues, the proposal presented to President Bush by Governor Wilkinson focused only on problems associated with the space segment of distance learning. Therefore, the EDSAT Institute has confined this analysis to issues associated with the satellite system itself and not with the programming which it might carry.

Another concern of the participants was the amount of control, if any, the body which controls the satellite should have over the agencies which use it. The EDSAT Institute has taken the position that it is *inappropriate* for the organization which controls the satellite to control programming content or the terrestrial transmission and reception facilities of the educational agencies which use the satellite. Therefore, the governance discussion focused only on the kind of structure which can best ensure the equitable, efficient and effective management of the space segment of a satellite-based telecommunications system dedicated to instruction.

The analysis did not include using either the Corporation for Public Broadcasting CPB) or the Public Broadcasting Service (PBS) as candidates for governing or managing the satellite system. The Corporation for Public Broadcasting is a D.C. nonprofit corporation, the creation of which was authorized by Congress in the Public Broadcasting Act of 1967. CPB was intended by Congress to foster the development of public radio and television. CPB's active participation in the pursuit of these goals is checked, however, by the reluctance of Congress to allow it any control over broadcast operations or program content.

Specifically, CPB is prohibited from owning or operating, among other things, "any TV or radio broadcast station, system or network ... interconnection system ... public telecommunications entity, system, or network," and from producing programs. Its function is thus largely limited to extending grants to entities not constrained by these prohibitions. It apportions these grants to public television and radio stations and producers of noncommercial programs through an elaborate process prescribed by Congress.

CPB is endowed by Congress with a "Public Broadcasting Fund" administered by the Secretary of the Treasury. Congress enacts authorizing legislation for the Fund several years in advance. The amount available to CPB is also linked to the amount of funds raised by the entities CPB supports. A "Satellite Interconnection Fund" has also been established. The amount of $200 million has been authorized to the Satellite Interconnection Fund for 1991. Presently, CPB is using these funds to purchase transponders for use by the Public Broadcasting Service.

The Public Broadcasting Service (PBS) is one beneficiary of CPB grants. It, too, is a D.C. nonprofit corporation, incorporated in 1969. As such, it has 338 public television stations as "members." PBS is substantially supported by funds from these station members and receives only a small percent of its funds directly from CPB. These member stations, however, are financed by CPB for approximately 20% of their funds; the rest is provided mostly by private sources and state and local governments.

The statutory mission and constraints placed upon these two federal agencies do not provide the structure for the governance and technical management of a satellite system. However, if the federal government were to assume full responsibility for the system, including purchase of the satellites, then it would be reasonable for the Congress to consider granting either CPB or PBS responsibility for managing a federal satellite system. All information available to the EDSAT Institute at the time of this analysis indicated little likelihood that either the Congress or the President were inclined to support a federally funded system at the present time. Therefore, this approach was not considered feasible at this time.

The matter of PBS using a satellite system developed by the states was considered and discussed with the participants of the working groups. It was the consensus that such a decision was PBS's to make, but there was no reason for not making its participation part of any organizational structure that is created. In fact it is probably highly desirable. Present contractual relationships with AT&T for transponders on its new satellite might delay such co-location unless AT&T were to win the contract to provide a satellite for the state consortium. The AT&T contract with PBS might be renegotiable under such circumstances.

The National Telecommunications and Information Administration (NTIA) can serve an important role in channelling federal grant funds to a satellite system. Congress could use NTIA as the vehicle for financing part of the cost of a satellite procurement negotiated by the governing body of the system. It can assist with planning for future developments and provide matching funds to educational institutions which utilize the system. However, it was not considered an appropriate agency for the governance or technical management of the satellite system.

The U.S. Department of Education, like NTIA, can be an important player by providing research and information on the use of satellite technology for instructional purposes. However, it is not an appropriate agency, either by mission or experience, to operate a satellite system even though the system is dedicated to educational purposes.

A final word is addressed to the importance of the private sector in this project. Many of the satellite telecommunications companies had representatives at various meetings of the working groups. Their knowledge and the information they provided were very helpful. The satellite industry has shown a strong interest in forging a partnership in this project. The idea of a for-profit organization created to develop this system was given thoughtful consideration but ultimate was rejected because of concerns from educators who wanted control of the system to be in public hands.

The EDSAT Institute is very cognizant of the concerns that are raised by the private sector when government seeks to compete with business and commerce for goods and services. However, we believe that the proposals offered here provide ample opportunity for private participation. Under every scenario, the private sector will at the very least be called upon to build and launch the satellites that make up the system. Most likely the private sector will provide the technical maintenance of the satellites once in orbit. Even private financing may be possible. It is expected that every element will be open to competitive procurement. The only aspect of the project which will be kept public is the governance of the system. A public investment in the system almost dictates public ownership and governance.

APPENDIX

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DRAFT

SCHEDULE FOR EDSAT OUTREACH ACTIVITIES

HOST CITY*	WEEK OF 6/24 - 28	7/22 - 28	7/29 - 8/2	8/5 - 9	8/12 - 16	8/26 - 8/30
St. Louis, Missouri	27th & 28th					
Dallas, Texas		25th & 26th				
San Francisco, California			29th & 30th			
Salt Lake City, Utah			8/1 & 2			
Boston, Massachusetts				8th & 9th		
Atlanta, Georgia					14th & 15 th	
Baltimore, Maryland						26th & 27th

* Host City includes:

Baltimore, Maryland
Virginia
West Virginia
Maryland
Pennsylvania

New Jersey
Delaware
District of Columbia

St. Louis, Missouri
Missouri
Kansas
Nebraska
Minnesota
Wisconsin
Michigan
Indiana
Ohio
Kentucky
Iowa
Illinois

Dallas, Texas
Texas
Arizona
New Mexico
Oklahoma
Arkansas
Louisiana

San Francisco, California
California
Hawaii
Pacific Rim Islands

Salt Lake City, Utah
Utah
Idaho
Washington
Nevada
Wyoming
Montana
North Dakota
South Dakota
Colorado
Alaska
Oregon
British Columbia

Boston, Massachusetts
Maine
New Hampshire
Vermont
Connecticut
Massachusetts
Rhode Island
Canada
Nova Scotia
New York

Atlanta, Georgia
Mississippi
Alabama
Georgia
Florida
Tennessee
South Carolina
North Carolina

U.S. House of Representatives
Committee on Energy and Commerce

SUBCOMMITTEE ON TELECOMMUNICATIONS AND FINANCE

Washington, DC 20515

August 8, 1991

Dear Ms. Weinstein:

I would like to take this opportunity to extend a warm welcome to the attendees of today's EDSAT Conference at the Museum of Science. As most of you know, the EDSAT Institute is a Washington-based, non-profit educational and research organization, that was founded to encourage the access and utilization of telecommunications and related technologies in all forms throughout America's schools.

I feel strongly that we should actively encourage all efforts aimed at ensuring that the telecommunications revolution benefits every sector of American society -- including America's schools. In his recently published book, Powershift, Alvin Toffler articulated the important link between education and the emerging information-based economy. To ignore this connection, Toffler said, would h[illegible] ast the learners" who will be formed by this nexus. Amer[illegible] nomic vitality into the next century will be predicated on [illegible] undamental realization that education is, in Toffler's words, "no longer merely a priority for parents, teachers, and a handful of education reformers, but for the advanced sectors of business as well, since its leaders increasingly recognize the connection between education and global competitiveness."

It is imperative to begin to examine the host of policy, governance, fiscal, and managerial issues involved in establishing a satellite-based telecommunications system dedicated to education. The EDSAT Institute's proposals and the important meeting today will avail all of us of the opportunity to explore these issues in greater detail.

Again, I would like to extend a warm welcome and look forward to hearing the results of today's meeting.

Best wishes,

Sincerely,

Ed Markey

Edward J. Markey
Member of Congress

CONSTANCE A. MORELLA
[illegible]
POST OFFICE AND CIVIL SERVICE
SCIENCE, SPACE AND TECHNOLOGY
SELECT COMMITTEE ON AGING

Congress of the United States
House of Representatives

August 23, 1991

Ms. Shelly Weinstein
President
The EDSAT Institute
403 North Capitol Street
Suite 550
Washington, DC 20001

Dear Shelly:

Thank you for the invitation to participate in the Baltimore meeting to discuss options for establishing an education satellite. I will be attending a U.S. - Soviet Conference in Budapest in my capacity as Chair of the Congressional Arms Control and Foreign Policy Caucus, and regret that I will be unable to join you.

I commend you and the other cosponsors of the Baltimore gathering for your continued diligence in exploring possibilities for establishing an organization to govern and manage an education satellite.

Congress is deeply concerned with finding ways to improve educational opportunities for all Americans, regardless of their geographical location. A satellite-based infrastructure dedicated to education is an obvious way to provide quality education and economic benefits to the nation.

I am confident that we are only a short time away from having a dedicated education satellite. Meetings such as the one you are holding in Baltimore will help ensure that such a satellite becomes a reality in time to improve the quality of education for today's children, and for generations to come.

I look forward to learning the results of the meetings and extend my best wishes and appreciation to the participants for their interest in this important work.

Sincerely,

Connie Morella

Constance A. Morella
Member of Congress

CAM:cb/sx

PATSY T. MINK
SECOND DISTRICT, [illegible]
[illegible]

Congress of the United States
House of Representatives
Washington, DC 20515-1102

COMMITTEE ON EDUCATION AND LABOR
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COMMITTEE ON GOVERNMENT OPERATIONS
[illegible]

July 16, 1991

Shelly Weinstein
President
EDSAT
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Washington, D.C. 20036

Dear Shelly:

Thank you for your letter of July 11th, inviting me to the San Francisco meeting of the EDSAT Institute to determine the level of interest and support for an education satellite. As much as I would love to attend this meeting, I will be required to remain in Washington D.C. as Congress will be in session.

Please keep me informed on this situation, which is of vital importance to me, and extend my best to your participants.

Very truly yours,

Patsy T. Mink

PATSY T. MINK
Member of Congress

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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July 29, 1991

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Dear Shelly:

Thank you for the invitation to participate in the San Francisco meeting to discuss options for establishing an education satellite. Due to the congressional schedule, I am unable to attend.

I commend you and the other cosponsors of the San Francisco gathering for your continued diligence in exploring possibilities for establishing a national organization to govern and manage an education satellite.

Congress is deeply concerned with finding ways to improve educational opportunities for all Americans, regardless of their geographic location. A satellite-based infrastructure dedicated to education is an obvious way to provide quality education and economic benefits to the nation.

I am confident that a dedicated education satellite will some day come into being. Meetings such as the one that you are holding in San Francisco will help make sure that such a satellite becomes a reality in time to affect the quality of education for today's children, and for the children of generations to come.

I look forward to learning of the results of the meetings and extend my best wishes to the participants for their interest in this project.

Sincerely,

George E. Brown, Jr.
Chairman

TAB C

National Education Telecommunications Organization

The following have expressed an interest in affiliating with a National Education Telecommunications Organization (NETO) to purchase and manage affordable and equitable satellite and other related telecommunications services.

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Ruth Truman, Director of Program Services
University Extended Education Services
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Peggy Falkenstein, Director
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Sinclair Community College
Dayton, Ohio

Ralph F. Meuter, Dean
Regional and Continuing Education
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Las Vegas, Nevada

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Homer Dyess, Director Education Services
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Gladys Penner, Teleconferencing Coordinator
David Barney, Dean of Telecommunications
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Irwin Hipsman, Executive Director
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Kern County Office of Education
Bakersfield, California

Frank Bugg, Deputy Director
Georgia Public Television
Atlanta, Georgia

Virginia Gaines Fox, Chief Operating Officer
Kentucky Educational Television, Lexington

Ina C. Brownridge, Director
Multimedia Resources
State University of New York-Binghamton

Ben Hambelton, Assistant Executive Vice President
Boise State University, Idaho

Glenn Kessler, Director of Media
Judy Garcia, Coordinator of Program Development
Fairfax County Public Schools
Annandale, Virginia

Howard Jones, Associate Executive Director
Missouri School Boards Association
Columbia, Missouri

David Hutto, Director
University Television Center
Mississippi State University

Brian Raymond, President
Michigan Information Technology Network
East Lansing, Michigan

Fred Rex, Interim Director
Georgia Institute of Technology
Continuing Education
Atlanta, Georgia

Leon W. Hevly, Director of
Instructional Media
University of Washington
Instructional Media Services
Seattle, Washington

Stan Plewe, Dean
Continuing Education
Dixie College
St. George, Utah

M. Winston Egan, Director
Educational Telecommunications
Department of Special Education
University of Utah, Salt Lake City

Stephen H. Hess, Director
Utah Education Network
University of Utah, Salt Lake City

Ida Hill, Deputy Superintendent
Student Services
Virginia Department of Education

Lee Wing, Executive Director
North Carolina Agency for
Public Telecommunications, Raleigh

Ivy Hoffman, Program Director
North Carolina Department of Administration, Raleigh

Elizabeth Craft, Director
Distance Learning Technology
Arizona State University

Sharon Hoshida, Producer/Director
Instructional Development
University of California, Santa Barbara

T.L. Russell, Director
Instructional Telecommunications
North Carolina State University

Scott V. Fedale, Director
Cooperative Extension Service
Washington State University

TAB D

EDSAT Institute

[illegible]

STATEMENTS FROM GOVERNORS AND CONGRESSIONAL OFFICIALS

ABOUT A PUBLIC DOMAIN SATELLITE DEDICATED TO EDUCATION

The Honorable Gaston Caperton
Governor, State of West Virginia

"...colleges, universities and public school systems must compete for scarce satellite time and pay high user fees. The creation of a 'celestial highway' over which our education systems can communicate is a dream of mine."

The Honorable Wendell H. Ford
U.S. Senate, State of Kentucky

"The primary responsibility for good education must remain at the state and local levels. Yet our federal government still has a vital supporting role to play in our drive to meet the critical educational goals of this nation. We must make prompt and prudent investments in the future."

The Honorable Evan Bayh
Governor, State of Indiana

"...The opportunities associated with such educational technology can be important to states in their attempts to substantially improve education. ...A satellite designed to provide greater access to global knowledge can only ensure that more of our children will be prepared for the many challenges the future holds."

The Honorable Edward J. Markey
U.S.House of Representatives, State of Massachusetts

"Telecommunications will be as important to the infrastructure of the 21st Century as highways were to the 20th Century. We need to prepare now to ensure that we have an education system that takes full advantage of the information age."

The Honorable John Ashcroft
Governor, State of Missouri

"...I hope the concept of a public domain education satellite can be fully explored and discussed as a means to link our public schools to the vast array of instructional resources available through telecommunications technology."

- more -

The Honorable James G. Martin
Governor, State of North Carolina

"...We are taking steps in North Carolina to re-dedicate our efforts to improve education. It is a mammoth task, and an operative satellite system could fill many gaps in making educational resources available to all learners through the medium of telecommunications. Without federal assistance, it would be very costly and virtually impossible to reach those most in need."

The Honorable Claudine Schneider

"As Thomas Jefferson said, 'I like the dreams of the future better than the history of the past.' We can build a future of our dreams where our children can blaze a successful path in the global economy clear minded and hard working, without distinctions based on gender or race or other meaningless categories."

The Honorable Ned McWherter
Governor, State of Tennessee

"I am excited about the new doors that modern technology can open for the citizens of Tennessee. A public domain education satellite such as has been proposed would be a great asset and an important resource...I support the ongoing research to develop answers to the legal, operational and technical questions that have been raised about the proposal. I look forward to continuing to monitor the progress of your work and hope that we will see the public domain education satellite become a reality in the very near future."

The Honorable William Donald Schaefer
Governor, State of Maryland

"The federal government, with our help, is in a unique position to pursue a meaningful program on a national scale, one which would be an enormous technological asset to education at all levels in every State... I know that Maryland would benefit highly from an 'education satellite.'"

The Honorable Jim Florio
Governor, State of New Jersey

"There is no limit to the value of this satellite. It is clearly the cutting edge of education and also is on the forefront of providing new opportunities for children everywhere. I offer my full support of this program and I commend you for your dedication to ensure that this program is cornerstone of our children's future."

EDSAT Institute

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Council of Chief State School Officers
Washington, District of Columbia

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U.S. House of Representatives
Washington, District of Columbia

Honorable John H. Buchanan, Jr. *
People for the American Way
Washington, District of Columbia

Sarah Carey *
Steptoe and Johnson
Washington, District of Columbia

Peggy Charen
Action for Children's T.V.
Cambridge, Massachusetts

Joseph Duffey
The American University
Washington, District of Columbia

Susan Eisenhower
Eisenhower Group
Washington, District of Columbia

Dielle Fleischmann
Over the Grass
The Plains, Virginia

Keith Geiger
National Education Association
Washington, District of Columbia

LaDonna Harris *
Americans for Indian Opportunity
Washington, District of Columbia

Honorable F. David Mathews
Kettering Foundation
Dayton, Ohio

Honorable Constance A. Morella
U.S. House of Representatives
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Gardner, Carton, and Douglas
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Pittsburgh, Pennsylvania

Albert Shanker
American Federation of Teachers/AFL-CIO
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H. Brian Thompson
LiTel Communications, Inc.
Columbus, Ohio

Shelly Weinstein *
EDSAT Institute
Washington, District of Columbia

Honorable Wallace G. Wilkinson
Governor
Commonwealth of Kentucky

Arthur Wise
National Council for Accreditation of Teacher Education
Washington, District of Columbia

* Director

A DISCUSSION PAPER ON:

A PLAN TO CREATE A NATIONAL EDUCATION TELECOMMUNICATIONS ORGANIZATION

An Education Satellite System is Feasible

The EDSAT Institute analyzed the proposal for a public domain education satellite system and confirmed its technical and financial feasibility.[1] A market for an education satellite already exists, but it is highly fragmented at the present time. The study found there are at least 111 providers of satellite-based educational programming. Of this number, twenty of the major ones will purchase more than 75,000 hours of satellite time in the 1990-91 school year.

While it was difficult to determine the distribution of programming at specific hours of the day, days of the week and months of the year, it is highly likely that at some point all twenty of these agencies will want to transmit programming at the same time. Concurrent programming by just these twenty agencies would create a peak demand for twenty transponders—nearly 84 percent of the capacity of a 24 transponder satellite.

The EDSAT Institute examined the financing alternatives for a public domain satellite. Public financing of an education satellite requires either a direct appropriation from the Congress, the contribution of an existing federal satellite, or appropriations by state legislatures. Private financing is feasible if the entity which takes ownership of the satellite, or guarantees a long term lease for its use, has a cash flow sufficient to assure payment or there is a governmental guarantee of such payment in the event of default.

Although the actual size of the education market is unknown, the EDSAT Institute analysis indicates that it is substantial. It is estimated that twenty major education program providers will spend about $45.5 million during the 1990-91 school year for satellite time. It is plausible to assume that the expenditure by all educational agencies is substantially more than $50 million per year, since these twenty agencies represent only eighteen percent of the 111 purchasers.

A cash flow of this magnitude should be sufficient to support a single satellite if it can meet the peak time demand of the agencies using it. While federal funding for an education satellite might be available at some future time, the project need not be contingent upon it. The project could be self-financing if the buyers had an appropriate vehicle for securing, governing and managing the use of the satellite.

The inability to confirm the number of purchasers and how much time they would use constitutes a major obstacle to the immediate acquisition

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of a satellite for education regardless of how it is financed. Neither the actual amount of transponder time needed nor the technical configuration (C-Band and Ku-Band) of the satellite could be determined. Obviously, decisions about the design, construction and launch of an education satellite cannot be made until these questions are answered. The documented usage of satellites for instructional programming indicates that there presently exists a market large enough to justify at least some form of cooperative management and purchase of transponder time. For the longer term, it sets the stage for the eventual acquisition of a satellite dedicated to education.

The Need for Action Now

There is legitimate concern among the stakeholders that something be done now to lower costs and provide predictable access for those education agencies which presently are using satellites or have a strong interest in doing so. The governors, the president and the congress are seeking innovative ways to achieve national education goals. Satellite technology can play an important role in such a strategy because it can provide access to multiple education programs of an interactive nature simultaneously to every part of the nation at a relatively low unit-cost.

In the present commercial marketplace, the rising and unpredictable costs of transponder time are at best limiting the use of televised instruction in rural and often poor school districts; at worst, some school districts are beginning to reduce availability of these instructional resources. A strategy is needed that will enable education agencies to secure many of the benefits of a dedicated satellite now while planning continues for the building and launch of such a satellite in the future.

A STRATEGY FOR SECURING AN EDUCATION SATELLITE

A feasible strategy for development of a dedicated satellite system is to first aggregate the present education expenditures for transponder time through an organization made up of purchasers. Such a step would enable users to migrate to a single satellite and obtain low, uniform rates regardless of the amount of usage--all of which are important reasons for having a satellite dedicated to education. This strategy is a first step toward achieving the goal of securing a dedicated satellite for education. It will give the participating agencies valuable experience in managing the use of a satellite while documenting the cash flow available to underwrite private financing of a dedicated satellite if this should be necessary. Both are necessary to proving the long term viability of the project regardless of how it is ultimately financed.

Two steps need to be taken concurrently. One step in implementing this plan is to form an organization of buyers of satellite time.

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Such an organization, which might be called the National Education Telecommunications Organization (NETO), can be incorporated in a member state or the District of Columbia as a non-profit public purpose corporation. Alternatively, the Congress can be asked to charter it as a national organization. A national charter gives the organization national standing and the backing of the Congress of the United States. In either case, NETO would be under the direction of a representative Board of Governors which would set policy for the satellite system.

A second step in the plan is to create a non-profit subsidiary operating company to manage the satellite system. The Corporation would become a legal subsidiary wholly owned by NETO and function as a telecommunications vendor on behalf of the membership. The NETO Governing Board can name the Corporation's Board of Directors which in turn would hire a professional management team for the Corporation.

The rationale for proceeding in this manner is based on the following concepts and assumptions. The most immediate stakeholders are the buyers of satellite time. These agencies will directly benefit from participation in the system and represent the most logical basis for organizational membership. Presumably any non-profit educational agency could be a member of NETO. Membership dues might be required initially to provide working capital for NETO and the Corporation. Thereafter, an "initiation" fee might be required of new members similar to what the charter members invested in the organization.

The rationale for two organizations -- NETO and the Corporation -- rests on the premise that policy for the use of the satellite(s) should rest with a body representative of the membership. However, the business management should rest with an organization which can function like any private telecommunications vendor. A similar model exists in INTELSAT where each participating country has its own satellite operating company but the system is governed by a Board of Governors representative of the political jurisdictions which have ownership in the system.

Although this strategy doesn't lead directly to the launch of a "dedicated public domain satellite," the major benefits of such a satellite can be secured now. By pursuing this course of action, five objectives of an education satellite system can be met almost immediately: (1) an equitable pricing structure for all users; (2) priority access to a satellite; (3) the cost advantage of bulk purchase even for occasional users; (4) assessment of the kind of satellite that is needed and the time and nature of its use; and (5) a documented cashflow to support a dedicated satellite in the future.

CREATION OF A GOVERNING STRUCTURE

Policies regarding utilization of the system, its financing and future development need to be established by a body representative of the "stakeholders" who in this case are the elected state officials and heads of

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education agencies which have a direct stake in the success of the system. A governing board should be created to ensure that the operating company serves the public purposes intended for the education satellite system. Designing an appropriate structure for governing the system is a matter of determining who should control what decisions. The decisions to be controlled in this instance would seem to be these:

1. The price of satellite time;
2. Schedules and priorities for satellite time;
3. Equitable access to the satellite;
4. Budget, contracts and debt;
5. Ownership of assets;
6. Acquisition and design (configuration, capacity, band, etc.) of satellites;
7. Expansion, dissolution or sale of the system; and
8. Operational policies and procedures of the organization.

Other matters such as encouraging greater use of the satellites, monitoring changes in technology, and anticipating future needs are more appropriate for the organization's management rather than governance body to deal with. The cost of the NETO Secretariat can be financed by the Corporation from revenues it generates from the sale of transponder time.

CREATION OF A MANAGEMENT COMPANY

The Board of Directors for the Corporation should be elected or appointed by the NETO Board of Governors, but the operating company should be managed by people with experience in the satellite communications industry. The company will have to be capitalized and operate on the basis of revenues it generates from the sale of time on the transponders it acquires.

The initial task of the operating company is to secure from a satellite communications vendor transponder leases on an inflight satellite for the use of members of NETO. The Corporation then contracts with members for use of the transponders according to policies established by the NETO Board of Governors. The Corporation management would ensure that sufficient transponder time is available to meet the needs of all members, but any conflicts in scheduling would be resolved according to policies set by the Board of Governors.

It is envisioned that members would only pay for actual time used but at a uniform rate thus ensuring equitable access. However, rates would need to be sufficient to ensure the lease payments. Management could sell unused time to nonmembers at commercial rates which would accrue to the benefit of NETO members. Receipts in excess of expenses can be held in reserve to protect against future shortfalls or to offset future increases in operational costs. Over the next several years the Corporation can establish

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the cashflow record necessary to assure sound financing of a dedicated satellite. In the interim, the Corporation can determine the size and technical features of a dedicated satellite desired by the participating agencies.

THE EDSAT IMPLEMENTATION PLAN

The EDSAT Institute is prepared to orchestrate the creation of the National Education Telecommunications Organization and the operating Corporation. The Institute will conduct seven regional meetings of potential membership organization and agencies to secure their support for the creation of the NETO. A consensus organizational charter and by-laws will be developed with participation of key charter member organizations. A national effort will then be undertaken to secure members and launch the new organization before the end of 1991.

Parallel to these organizational activities, the EDSAT Institute also will work to create the Corporation. An interim Board of Directors can develop a business plan for consideration by prospective members of NETO. The Corporation also can begin negotiations with prospective satellite vendors and satellite-based communication companies to secure transponders that can be used by NETO members. As rapidly as feasible, member organizations will migrate to the Corporation satellite and begin enjoying the benefits of collective buying power and access to a satellite dedicated to their use.

NOTES

1. EDSAT Institute. Analysis of a Proposal for an Education Satellite. Washington, D.C., 1991

SENATOR BINGAMAN. Let's go ahead and hear from Mr. Donald Ledwig, who is President of the Corporation for Public Broadcasting.

STATEMENT OF DONALD LEDWIG, PRESIDENT AND CHIEF EXECUTIVE OFFICER, CORPORATION FOR PUBLIC BROADCASTING

MR. LEDWIG. Thank you, Mr. Chairman.

The Corporation for Public Broadcasting was created by the Congress in 1967 as a private, not-for-profit corporation that would develop public telecommunications.

SENATOR BINGAMAN. Let me just interrupt you just a minute here. Senator Thurmond wanted to make a statement. He has another meeting he has to go to, but let me call on him to make a statement here, and then we'll go ahead with your testimony.

[Mr. Ledwig' statement interrupted.]

OPENING STATEMENT OF SENATOR THURMOND

SENATOR THURMOND. Thank you very much, Mr. Chairman. It's very courteous of you to allow me to do this. I do have to go in about three minutes.

Mr. Chairman, it's a pleasure to be here this morning, and I'm going to read this testimony on "Technology in the Classroom: The Last Mile."

The hearing today will provide us with valuable information to build upon some of the innovative learning technologies already being used by many schools, public television stations, and others around the country.

Just a few years ago, it was a privilege for me to support the establishment of Star Schools, which allows students in kindergarten through grade 12 to take courses by way of satellite, which they otherwise would not be able to take. For example, some high school students in rural areas are now able to take courses in Russian I and II, Japanese I and II, physics, advanced placement economics, pre-calculus, and several other courses. Thanks to satellite technology, many students can now participate.

Earlier this year, I was pleased to strongly support legislation reauthorizing the Star Schools program, and also to participate in a live, interactive hook-up with several Star Schools at a hearing in this room. We have come a long way in just a few short years.

Much of the success of distance learning can be attributed to the fine work of people across the country who have made a commitment to this cause. My good friend, Henry Cauthen, is here today, and is one of these people, and I particularly am pleased that he is one of our panelists. Henry is the President of the South Carolina Educational Television Network and the Chairman of the Board of Trustees of America's Public Television Stations. He is a long-time leader in the whole field of public television and all that it encompasses. He continues to make substantial contributions to public television and the advancement of distance learning technologies.

I'm also pleased that another South Carolinian, Mr. Gary Vance, will be testifying today. Mr. Vance is the Executive Director of the Satellite Educational Resources Consortium, a leading national provider of distance learning courses to high schools across the country.

Mr. Chairman, again, it's a pleasure for me to be here. I have another meeting, and I'm sorry that I have to go now. Thank you for your courtesy in calling on me at this time.

SENATOR BINGAMAN. Thank you for that statement, Senator Thurmond.

SENATOR BINGAMAN. Mr. Ledwig, why don't you go right ahead with your statement.

MR. LEDWIG. Thank you.

Mr. Chairman, I was just mentioning that the Corporation was formed in 1967 to facilitate the development of public broadcasting in the United States and public telecommunications, and conditions in our industry at that time were very similar to the conditions that Dr. Foster just described.

The stations were not interconnected. We were bicycling tapes and mailing them back and forth, because there was no integrated national system. So, the Congress at that time created a private, not-for-profit corporation—our organization—to receive federal funds. The CPB Board is appointed by the President and is confirmed by the Senate. The first thing CPB we did was to create a satellite system to interconnect public broadcasting stations nationwide.

We were the first broadcasting network by satellite in the United States. We were there before the major networks—NBC, ABC, and CBS—in being connecting by satellite. At the time, some were connected by coaxial cable.

We then moved to facilitate the development of this system around the country over the years. We particularly helped those states where there were state systems—KET in Kentucky, as was mentioned—and South Carolina's educational television with our grants.

When the SERC project came along, we were pleased to be there with our discretionary dollars to help fund the development there and, as we saw, the increased uses of educational telecommunications in schools. In 1988 we moved to ask the Congress for funds to provide us with a new satellite to replace the old one that was expiring, and we specifically asked for funding to purchase a state-of-the-art satellite that would have additional capabilities, so we could expand our direct access for educational purposes. That satellite has been authorized, appropriated, and funded in the full amount that we requested and will be in place in 1993.

The United States demonstrated that we are the premier technological power in the world during Operation Desert Storm, and I believe that the time has come to use our superb technology in a major part of our economy where it has not yet been fully applied, and that's education. The Corporation for Public Broadcasting has demonstrated our ability to move as an entity into these areas to the extent that we've had the resources to do so.

I really don't think that there is time or need for further study. The time to act is now. Thousands of young people are being poorly educated and turned out onto the streets of America each day. They are ill prepared for employment, and we know that. Consequently, America finds itself increasingly unable to compete in a world economy that is becoming more competitive every year.

When American industry is faced with a need to increase productivity, it looks to technology, and it trains its existing work force to make the best use of technology. That, Mr. Chairman, is what we propose we do for our schools.

My colleagues today will describe for you with far more detail, the capabilities of the public telecommunications system that is now in place, and the capabilities of the new public broadcasting satellite that will be launched in 1993. They will also describe for you some of the creative uses that teachers are making of the limited resources that are available to them in the classrooms today.

The picture that emerges is one of a public broadcasting system that is serving education at all levels, with excellent educational resources derived through a variety of technologies, including broadcast, instructional television fixed service, satellite, fiber optics, cable, and computers.

As promising as our involvement in education has been, however, public broadcasting has only scratched the surface of the potential uses of these technologies in education. This structure, which has benefited from over 25 years of federal support, has created the foundation that places within our Nation's reach a comprehensive telecommunications infrastructure for all of the Nation's schools.

As part of its commitment to providing quality educational programs and services, the Corporation for Public Broadcasting has just completed a nationwide study of the availability of instructional television, video facilities, and programming in elementary and secondary schools. The results of our school utilization study show that, while the use of television and video in the classroom has increased since 1982, access to television resources is still limited. It is limited not because the highways for delivering those resources are inadequate, but because local facilities are limited and teachers do not have the training and support needed to make appropriate use of the technical resources that are available.

For example, the results of our study show that the average school has one television set for every four classrooms, one video cassette for every seven classrooms, and virtually no classrooms with telephone jacks—a vital necessity for computer communication or audio feedback for two-way interactive television. Regrettably, computer equipment is even less available in the Nation's classrooms than television and video equipment.

However, a disturbing factor indicated in the study is that, while technology in the schools is gaining greater acceptability and use, funding sources for those technologies in many cases are decreasing.

We know from other information that the current economic situation has forced many states, such as Michigan, Maryland, Virginia, and Tennessee, and individual school districts and other areas, to delay or even reduce the acquisition of technologies or services for education. It seems to be the first item that is cut when budgets are reduced, to cut out the new television ano the new VCRs.

Our study has also indicated that many schools have a budget of less than $600 per year for instructional television or ITV and video. School districts did not fare much better with the majority having a budget of less tha $5,000 per year for the entire district to meet individual teachers' needs for ITV and video.

These budgets must cover the entire range of costs. As a result, many teachers in order to utilize the potential of telecommunications in their lessons plans are spending their own funds. Teachers who themselves are often seriously underpaid have very limited resources at their disposal. School districts and schools just do not have the funds, especially given the current economic climate, to invest heavily in ITV and video.

In 1988 Congress authorized an appropriation of $200 million to CPB to replace the public broadcasting satellite interconnection system. This new satellite interconnection system provides public broadcasting with new opportunities to move forward by integrating many of the existing and developing technologies into the system. As a result, public broadcasting has the Nation's largest television and radio network, with established ties to the educational community. It is a unique position to become the major provider and distributor and repository of educational programming and services to the Nation.

Indeed, Congress has already begun to link technologies to the classroom by funding this satellite. Yet, without a concerted effort and assured funds for utilizing the satellite's capabilities, Congress will miss an existing opportunity to bring technology into every classroom very economically.

We know that using technology in education works. The highways are in place. What is needed is the equipment at the local level. For the infrastructure and end-user equipment to be utilized fully, we believe that the federal role should include assisting in the development of quality programming.

Funding through CPB for programming and through the Department of Education for Star Schools are two examples of the ways Congress can make a significant impact on the availability of quality programming. However, these existing programs have just begun to meet the needs and tap into the potential of technology in schools. In addition, our study shows a need to demonstrate to classroom teachers how they might use the technologies to improve on what they are currently doing in the classroom. Only one in four teachers has received training in the use of television in the classroom. Even fewer have learned how to match the characteristics of programming to the needs of their individual students.

Finally, underlying these components is the need for adequate and sustained funding. Without adequate funding for technological advancements, schools that are most in need of improved educational resources will be doomed to lag behind wealthier schools in our Nation.

Thus, the establishment of an effective educational telecommunications infrastructure must include at least three components: delivery systems and end-user equipment; software or programming; and teacher training. Only then can we effectively address our Nation's educational needs. Such an infrastructure will be expensive, but it is an investment that we cannot afford not to make.

CPB believes that an effective and efficient telecommunications infrastructure is critical to the educational well-being of America. The public telecommunications system in the United States could serve as a model for such a national telecommunications infrastructure.

We urge you to consider the effective role that public telecommunications can play in providing a comprehensive delivery system and the accompanying programming and services.

In summary, public telecommunications already has the reach and experience of working effectively with schools and colleges. It has accomplished much to support education at all levels, and it has the capacity to do much more in the future.

We stand ready to help improve our Nation's educational system by bringing effective educational technology into the classroom.

Thank you, Mr. Chairman.

SENATOR BINGAMAN. Thank you very much.

[The prepared statement of Mr. Ledwig follows:]

PREPARED STATEMENT OF DONALD LEDWIG

I. INTRODUCTION

Mr. Chairman, and members of the committees, we all are familiar with the education crisis our nation faces. One need only pick up a copy of any report issued over the past ten years to appreciate the enormity of the problem. While the reasons given for this dilemma are many, the plain fact is that we are not graduating students who are competent in even the most basic skills of reading, writing, and simple mathematics.

The United States demonstrated that it is the premier technological power in the world during Operation Desert Storm. I believe it is time to use our technology in a major part of our economy where it has not yet been applied -- education. We need to forge a new public-private partnership to bring advanced technology into classrooms nationwide. There is neither the time nor the need for further study. *The time to act is now.* Thousands of young people are being educated poorly and then turned out onto the streets of America each day, ill-prepared for employment.

Recent studies indicate that as much as a quarter of the American labor force lacks the basic reading, writing, and math skills necessary to perform in today's increasingly complex job market. One out of every four teenagers drops out of high school and, of those who graduate, one of every four has the equivalent of an eighth-grade education. Employers are facing a proficiency gap in the workforce so great that it threatens the well-being of hundreds of U.S. companies which are now forced to pour millions into education and training programs in order to meet basic levels of competency.

Consequently, America finds itself increasingly unable to compete in a world economy that is becoming more global every year. When industry is faced with a decrease in productivity, it looks to technology to improve productivity, and it trains its existing workforce to make the best use of technology. That, Mr. Chairman, is what I purpose that this committee can enable our schools to do.

As part of its commitment to providing quality educational programs and services, the Corporation for Public Broadcasting (CPB) has just completed a nationwide study of the availability of instructional television and video facilities and programming in elementary and secondary schools. The results of the School Utilization Study show that while the use of television and video in the classroom has increased since 1982, access to television and video resources is limited. It is limited, not because the highways for delivering those resources are inadequate but because local facilities are limited and teachers do not have the training and support needed to make appropriate use of the resources that are available. In general, the study also concludes that there is a clear need for federal involvement in at least three areas: 1) funding for the acquisition and replacement of instructional video and computer end-user equipment; 2) instructional video and computer programming and resource development in core subject areas; and, 3) teacher training in the effective use of technology.

For example, the results of our study show that the average school has one television set for every four classrooms; one videocassette recorder, or VCR, for every seven classrooms; and virtually no classrooms with telephone jacks, a vital necessity for computer communication or audio feedback for two-way interactive television. While our study focused on instructional television and video, I must point out that, as technology develops, the line used to clearly divide these technologies from computer technologies is quickly disappearing. Regrettably, computer equipment is even less available in the nation's classrooms than television and video equipment.

My colleagues on this panel will describe for you with far more detail the capabilities of the public telecommunications system now in place and the capabilities of the new public broadcasting satellite that will be launched in 1993. They will also describe for you some of the creative uses that teachers are making of the limited resources that are available to them in their classrooms today. The picture that emerges is one of a public broadcasting system that is serving education at all levels with excellent educational resources delivered through a variety of technologies, including broadcast, instructional television fixed service (ITFS), satellite, fiber optics, cable, and computers. As promising as our involvement in education has been, however, public broadcasting has been able merely to scratch the surface of the potential uses of these technologies in education.

This structure, which has benefitted from over 25 years of federal support, has created the foundation that places within our nation's reach a comprehensive telecommunications infrastructure for all of the nation's schools. The public telecommunications system today offers a proven, effective foundation upon which local, state, and federal leadership can build a better education system.

II. THE ROLE OF CPB IN PUBLIC TELECOMMUNICATIONS

CPB and public broadcasting has long played a successful role in the development of public telecommunications programs and services. Public broadcasting has given Americans the opportunity to see or hear educational, cultural, and public affairs programs of the highest quality.

When Congress established the Corporation in 1967, it directed CPB to find, initiate, and finance the production of high-quality educational, informational, instructional, and cultural programs. For nearly 25 years, programs supported by CPB have been produced by a variety of entities, including public broadcasting stations, minority-based production companies, independent producers, and educational institutions. Through their educational content, innovative qualities, and diversity, these programs have enhanced the knowledge and imagination of all Americans.

In addition, CPB has always strongly encouraged the use of public television as a supplement to textbook education. Currently, approximately 65 percent of the public broadcasting schedule is devoted to delivering educational programming during the school day. In conjunction with this, CPB-funded programming delivers a wide range of programming and services addressing educational problems both at home and in the classroom.

Since 1978, Congress has found that it is "in the public interest to encourage the growth and development of *nonbroadcast* telecommunications technologies for the delivery of public telecommunications services" (47 U.S.C. 396(a)(2), emphasis added) including, but not limited to, coaxial cable, optical fiber, broadcast translators, cassettes, discs, microwave, or laser transmission through the atmosphere.

Accordingly, CPB has directed its efforts toward beyond broadcast activities. CPB funds the interconnection of public broadcast stations via satellite and provides financial support for the development of various specialized broadcast-related services and devices, such as closed captioning and decoder chips. CPB has also taken the lead in development of interactive video with the series, *The Civil War*, and distance learning by supporting the creation of the Satellite Educational Resources Consortium (SERC). The Corporation also researches public telecommunications industry and audience needs and trends, and helps to develop industry policy, including methods to expand the reach of public telecommunications.

III. PUBLIC TELECOMMUNICATIONS EDUCATIONAL INFRASTRUCTURE

Public broadcasting plays a major and increasingly valuable role in the nation's education system. Through on-site use in schools and the utilization of various combinations of satellite dishes, television monitors, computer networks, printers, VCRs, and telephones, the infrastructure allows educators to reach students in other geographic locations. In addition, this infrastructure can free teachers to work with students in need of extra assistance, access teacher training materials, and allow teachers to exchange ideas among themselves.

CPB does not believe that any one technology can be designated as the best delivery technology for education. Each one has its advantages and disadvantages, is suited for a particular need or situation, and may be used alone or in conjunction with one or more technologies. Economic, geographic, regulatory, and educational standards (certification for teachers, curriculum requirements, and electronic barriers) are determining factors when choosing one telecommunications delivery system over another.

Recognizing these differences, the public telecommunications infrastructure in the United States has evolved into a multifaceted and diverse endeavor consisting of many elements, including more than 700 public radio and television stations. The broadcasting component of this infrastructure, both radio and television, has a combined access to more than 96 percent of the population.

Many of these new public broadcasting telecommunications networks already are hybrid mixes of transmission technologies such as the Satellite Education Resources Consortium and the South Carolina ETV Commission, which are represented here today. These are two excellent examples of the public broadcasting's infrastructure in action. Additional examples include:

- **Wisconsin Educational Communications Board (ECB).** The ECB is responsible for ensuring that public radio and television programs and services are made available throughout the state of Wisconsin. Further, the ECB facilitates the cooperative acquisition, development, and use of instructional programs, technologies and services by the educational institutions within Wisconsin. In addition to using broadcast technologies, the ECB increasingly is carrying out its educational mission through such new technologies as narrowcast services transmitted over instructional television fixed signal (ITFS) frequencies, program transmission and reception via satellite, fiber optics, the radio sideband Subsidiary Communications Authorization (SCA) signals that "piggyback" with the regular FM broadcast signal, and the vertical blanking interval.

- **Iowa statewide education network.** When the first stages are completed in 1993, the Iowa Educational Telecommunications Network will have a foundation of fiber optic lines that will bring voice, computer, and video transmissions to 15 hubs at community colleges and then to the state's 99 counties. With microwave and satellite transmission, the network will extend inward to smaller communities and outward to the world. Iowa Public Television is the planner and coordinator of the network's educational uses.

- Nebraska ETV. In 1990, Nebraska Educational Telecommunications leased a full-time satellite transponder (NEB*SAT) for educational and public service programming. In 1991, the continuation of educational telecommunications services into the next century was assured through the purchase of a transponder. Nebraska is the first state to purchase a dedicated multiple channel transponder for statewide educational use involving all sectors of education. NEB*SAT is establishing a comprehensive and coordinated network of originating and receiving sites across Nebraska. NEB*SAT is designed to provide four distinct and concurrent services: 1) a broadcast quality channel which interconnects via special receiving antennas Nebraska's nine ETV Network transmitters and nine Nebraska Public Radio transmitters; 2) a second broadcast quality channel which provides statewide distribution of distance learning and continuing education programming for all sectors of formal education, as well as in-service and continuing education; 3) new compressed video technology which enables additional transmission of video and audio singals between origination and reception sites, allowing for 12 simultaneous one-way or six two-way interconnections; and 4) working with telephone companies that service Nebraska, NEB*SAT will develop regional fiber optic networks linking groups of elementary, secondary, and postsecondary schools to share two-way instruction.

The development of new networks is linked closely to the extended use of existing networks, interactive capability, and shared usage. For example, state education departments and other state agencies own the license for more than two-thirds of all public television stations. In the past few years, more than 23 states have added new communications technologies such as satellite, microwave, and cable to their existing broadcast facilities. These technologies increase the capacity of the existing network and can serve more specialized interest groups such as education more effectively.

Currently, not all of these delivery systems reach the home. However, with the continued development of these systems, the possibilities for the home learner expand greatly.

IV. PUBLIC BROADCASTING SATELLITE

In widely varying degrees, each of the following technologies is used today in American education: satellites, broadcasting, instructional television fixed signal (ITFS), coaxial cable, the public switched telephone network, and optical fiber. The costs of the different delivery systems and technologies vary widely for both the public and the service provider based on their complexity, capacity, range, and purchase options. The costs, especially for the end user, must be carefully considered in determining which delivery technology or system will be employed.

In 1988, Congress authorized an appropriation of $200 million to CPB to replace the public broadcasting satellite interconnection system. This new satellite interconnection system provides public broadcasting with new opportunities to move forward by integrating many of the existing and developing technologies into the system.

As a result, public broadcasting, as the nation's largest television and radio network with established ties to the educational community, is uniquely positioned to become the major provider, distributor, and repository of educational programming and services to the nation. Indeed, Congress already has begun to link technologies to the classroom by funding this satellite. Yet, without a concerted effort and assured funds for utilizing this satellite's capabilities, Congress will miss an existing economical opportunity to bring technology into every classroom.

A. Expanded Ku-band Capacity

The Congressional appropriations funding for the replacement of the satellite interconnection system have enabled public broadcasting, primarily public television, to purchase five wideband Ku-band satellite transponders on the TELSTAR 401 satellite. These transponders are the foundation of the public telecommunications system, and will allow the integration of existing and new telecommunications technologies such as live interactive VSAT (Very Small Aperture Terminal) systems, digital television technologies, high definition television, and video compression technologies. The use of these technologies will be critical to public telecommunication's ability to provide educational programs and services during the 1990s and into the next century.

The predominant advantage of expanded Ku-band capacity is its ability to incorporate new technologies such as:

- **Interactivity.** This technology can take many forms: live interaction with a teacher through an audio or video channel; game-type simulations in computer software; and written exchanges through electronic mail or a computer conferencing system. It enables the student to be an active participant in the learning process, and not just a passive receiver of information and knowledge.

- **Digital technology and compression techniques.** Public broadcasting plans to incorporate digital television technologies into its new satellite interconnection system. The change from analog to digital transmissions has enormous potential for increasing the quality of transmissions and effectively expanding available channel capacity. Digital compression techniques allow more information (video, data, audio) to be compressed into a single transponder. Recent experiments indicate that four or more full-motion video channels could be transmitted on a single transponder and *that by the launch date of the new satellite, as many as eight to 10 channels could be transmitted on a single transponder.*

For example, there could be a dedicated channel for basic mathematics, another for science or literacy instruction, still another for music or art instruction, and one for teacher training. However, to utilize fully the educational capabilities of the new satellite will require substantial resources on behalf of public broadcasting.

B. **VSAT capability.**

This device allows a small satellite receiving dish to serve as a satellite transmission dish beaming its signal nationwide via satellite. In addition, the VSAT system could provide the following databases to educational users, which could be delivered on a real-time, live basis, or transmitted onto cassettes or discs for later use: central information repository for educational programs and supplementary educational materials; electronic bookmobile; bibliographic database; professional development for teachers, including in-service training, teacher workshops, and an electronic bulletin board for networking; interconnection with already existing databases, such as those maintained by the nation's library system and the state and federal government; fax systems; print materials and indexing to public television programs; and homework and reading assignments.

For example, by using a portion of public television's satellite transponders, the VSAT system will be able to provide public television with a nationwide, interconnected, interactive system that will link remote sites (educational programmers, schools, homes, business, libraries, etc.) through the local public television stations so that they may communicate directly with each other on a live, interactive basis. Through such a multi-point network, it will be possible to transmit and receive data, graphics and texts, audio, and low-grade video among interconnected users.

C. Educational Use of Satellites

The educational community has already begun its transition from C-band satellite receive dishes to the much smaller Ku-band dishes, which are easier and less costly to install. The new public broadcasting satellite's expanded use of the Ku-band will make the public broadcasting signal less susceptible to ground interference and, therefore, accessible to a greater number of users. For example, many inner-city schools that might have difficulty installing a C-band receive dish because of its size and interference problems could have access to educational programming delivered by Ku-band. *This Ku-band delivery system will facilitate the development of a nationwide, two-way digital data response system that will enable public broadcasting to further develop the use of interactive distance learning educational activities and technologies that help to improve access to education.*

One facet of distance learning is the distribution of televised classroom courses to a student body that, due either to logistics or economics, would otherwise be unable to participate. Televised courses are transmitted via satellite (or among more geographically close areas using Instructional Television Fixed Signal (ITVS) microwave links) from a central studio complex to remote classrooms. During live presentations, students respond to questions and solve problems interactively, using a cordless classroom telephone or using a keypad device for return data transmission to the central studio complex. Students may speak directly to the instructor during the broadcast, or to course tutors either during the broadcast or at other times for help and added instruction. Some distance-learning providers utilize a portion of the broadcast signal to download course material directly to a classroom computer. The telephone connection is utilized for the same purpose, downloading the computer over land lines through the classroom modem. Additionally, the telephone link provides the central studio complex with the ability to collect student tracking data from each remote site.

V. ROLE OF TELECOMMUNICATIONS TECHNOLOGIES IN EDUCATION

Providing learners with the skills and tools necessary to function productively in a rapidly competitive economic, political, and cultural climate has become a common goal for many Americans. Achieving such goals hinges upon the nation's commitment to provide teachers with the resources and training needed to utilize technological advances to improve teaching.

Educators increasingly are looking to technology as a method to expand teaching and provide learning opportunities during a time of severe budget cuts at the local and state level, when skilled teachers are increasingly in short supply, and when curriculum development struggles to keep pace with a changing environment.

A. School Utilization Study

As part of the Corporation's mandate to conduct research on matters relating to the use of public television and radio broadcasting as well as other communications technologies. CPB recently undertook a major study focusing on the use of television in schools. This study was designed to be a census of what is available to teachers in instructional television (ITV) and video and provides the only current comprehensive national statistics. The study did not focus on the availability of such technologies as telephone lines and computers in the classroom, as this information is available from other sources.

Three patterns clearly emerged: 1) use of instructional television and video by teachers has grown markedly; 2) teachers have positive attitudes about television and video's value and use in the classroom; and, 3) despite the growing enthusiasm by teachers for instructional television and video in the classroom, the availability of equipment and resources is severely limited and funding is decreasing.

1. Initial Results Indicate Increased Use

Results show that the use of television in the classroom has grown markedly in recent years. Today, television is used by more than 23 million students or 61 percent of all children in public schools, up from 46 percent in the school year beginning in 1982. Approximately three out of every four teachers used ITV and video to teach in the last school year, and nearly nine out of 10 teachers agree that ITV can make a positive contribution to education. Other findings of the study include:

- Ninety-six percent of teachers have some sort of access to ITV and video as compared to 70 percent in 1982;
- Seventy-seven percent of teachers used ITV and video during the school year as compared to 54 percent in 1982; and,
- 23.8 million students were exposed to ITV and video during the 1990 school year, as compared to 18.5 million students who received some portion of curriculum from ITV in 1982.

Results also indicate that teacher's perceptions of ITV and video are positive. For example, 65 percent reported that ITV and video generate new interest in a topic. In response to the question as to whether ITV and video help teachers teach more effectively, 79 percent of teachers surveyed responded positively, while 77 percent agreed that ITV and video enable teachers to be more creative in their instruction, and 87 percent agreed that ITV and video can have a positive impact on the quality of American education.

2. Types of Delivery Systems Used

In addition to being concerned with the use of instructional programs in the schools, the study focused on the availability of telecommunications technologies in schools and classrooms and the types of technologies being used.

- The study revealed that 96 percent of all schools have access to ITV and video. In addition, over 88 percent of teachers have access to a VCR in the school.
- On average, schools have approximately one television set for every four classrooms.
- On average, schools have fewer than four VCRs. For the average school with 25 classrooms, approximately 84 percent of the classrooms are without VCRs on a permanent basis.
- Not surprisingly, given teachers limited access to equipment, more than one-third of all teachers are reporting that they regularly experience problems having access to equipment on a timely basis. In addition, more than 13 percent of teachers report that in order to use ITV and video, they must bring their own personal equipment to use in the classroom.
- The one promising statistic revealed by the study is that when teachers are able to gain access to equipment, less than 20 percent report that they have a problem with the equipment being in good condition.

Apparently, when teachers do have access to television sets and VCRs, they will incorporate them into their lesson plans. A number of teachers even go so far as to bring equipment from their home. Unfortunately, while these results indicate that the use of ITV and video is on the increase, schools still are lacking in having adequate equipment on hand for teachers to use readily with any regularity.

3. Funding Trends

The survey also focused on school districts' plans for incorporating technology during the next three years. Of the school districts responding to the survey, 45.1 percent reported that they plan to add or acquire videodisc equipment; 35.5 percent plan to add or acquire satellite equipment; 27.3 percent plan to add or acquire cable television connection; 42.2 percent plan to add or acquire interactive video capability, and 21.6 percent plan to add or acquire fiber optic link systems.

However, a disturbing factor indicated in the study is that while technology in the schools is gaining greater acceptability and use, *funding sources for those technologies are decreasing*. We know from other information that the current economic situation has forced many states, such as Michigan, Maryland, Virginia, and Tennessee, and individual school districts in other states to delay or even reduce the acquisition of technologies or services for education.

Our survey also indicated that many schools have a budget of less than $600 per year for ITV and video. School districts did not fare much better, with the majority having a budget of less than $5,000 per year for the entire district to meet individual teacher's needs for ITV and video. These budgets must cover the entire range of costs for ITV and video: purchase and repair of equipment; purchase or rental of videocassette tapes; satellite hook-ups; and antennas. As a result, many teachers, in order to utilize the potential of ITV and video in their lesson plans, are spending their own funds. Teachers, who themselves are in many cases seriously underpaid, have very limited resources at their disposal. School districts and schools just do not have the funds, especially given the current economic climate, to invest heavily in ITV and video.

Clearly, any long-term initiative to equip our schools and classrooms with adequate ITV and video equipment and resources support must come from the federal level. Our schools are not able to do so at the local level.

B. Higher Education Utilization Statistics

The most recent national study of the availability and use of technology by institutions of higher education in the United States was published in 1986 by CPB and the National Center for Education Statistics. CPB plans to replicate that study in 1993.

1. The 1986 Study

The 1986 study results showed that 90 percent of the nation's colleges and universities have some of each of the three major types of technology (computers, audio, and video) available for use by faculty and students. The extent of availability varied greatly from college to college. Larger and more sophisticated equipment was substantially more available at public institutions than at private institutions. For example, computers were much less available at private institutions and, when they were available, they were more likely to be stand-alone microcomputers rather than the mainframes and minicomputers found at [illegible] institutions. Student access to the equipment was often limited by the number [illegible] ts available on campus. In the intervening years since that study, we know from contact with colleges and universities that there has been substantial growth in the availability of both video and computer technology on campus.

Perhaps more important than the growth in equipment availability is how faculty and students have been using the available equipment. In 1986, approximately one in three institutions used video to deliver college courses to off-campus students. Data from the Public Broadcasting Service's (PBS) Adult Learning Service and our own experience with the Annenberg/CPB Project suggest that the number has increased substantially during the past five years. *In fact, we estimate that telecourse enrollment has grown by almost 20 percent per year for those five years.*

One very promising trend is that faculty and institutions are beginning to integrate the technologies, drawing on the appropriate strengths of each technology to provide the best possible educational opportunities. A new initiative from the Annenberg/CPB Project best illustrates this trend. Through the New Pathways to a Degree program, some 30 colleges at seven sites around the country (in Maine, Oregon, West Virginia, Indiana, Virginia, and New York) are using a variety of technologies to provide complete degree programs to persons who cannot attend campus regularly. Some are using broadcast video for class lectures, telephone conferencing for seminar discussions, and telephone calls for tutoring. Others are using electronic mail for class lectures, computer conferencing for seminar discussions, and telephones for private tutoring. Several provide students with electronic access to library resources.

2. The 1993 Study

What will our 1993 study reveal about the availability and use of technologies by institutions of higher education? If the informal feedback we are receiving from those institutions is an accurate barometer, it will show that most institutions (especially public institutions) have made a formidable investment in video and computer equipment, that those available technologies have enabled faculty to provide different types of instruction, that students also have invested heavily in the technologies (by purchasing their own VCRs and computers), and that the lines that once separated video and computer technologies on our campuses have blurred.

However, we also believe that the data will show that, having whetted the appetites of faculty and students for the possibilities that result from the use of the technologies, colleges and universities will be expected to make even greater investments in more powerful technologies as they become available in the second half of this decade.

VI. KEY ISSUES TO BE CONSIDERED

As discussed above, public telecommunications services and other noncommercial public service communications already are available to the American public in a host of forms and through a variety of electronic delivery systems and technologies.

CPB and public broadcasting are currently in the process of evaluating how public telecommunications can best serve the educational needs of this country and use technology in meeting those needs. Research from the fields of education, government policy, and the leading edge of technology, as well as public broadcasting's studies, indicate a number of key issues:

A. Comprehensive Planning

Planning is needed to ensure that the electronic highways being put in place today meet the needs of education and are cost effective. States are recognizing that comprehensive planning is essential. They are developing specific long-range plans for statewide and regional telecommunications systems. Some considerations include:

- The inclusion of daycare centers, households, state and local office buildings, the private sector, and other establishments is not complete;
- There have to exist clear education policies at the local, state, and federal level that incorporate existing technology components;
- Planning efforts have to include educators at the local level since that is where education policy is normally established; and,
- Political support must be generated at the federal level and accompanied by a commitment of new funds, or the reallocation of funds, *specifically* toward full implementation of the infrastructure and the service it provides.

B. Copyright Constraints

Copyright constraints pose a significant barrier to education in using technologies effectively. The electronic technologies make it possible to take excerpts from original works and recombine them in many different formats. In short, how can innovators have the flexibility to create new works while the creators of the original works are adequately rewarded?

C. Accessible and Affordable Technologies

Which technologies must be accessible and affordable if the majority of students and adults will be able to take advantage of them for learning? Technologies will play a major role in making learning more accessible and effective. To which technologies will people have regular access? What kind of support services will people need? Can the system easily respond to students' and workers' needs for training and retraining based on changes in the economy? Schools must have in place the technological tools that students will be expected to use in the workplace. For example

- **Interactive Video.** WGBH-TV, Boston, Massachusetts, produces interactive videodiscs of the series, *NOVA*, that give secondary-school science students highly flexible access to information and images. With the videodisc player hooked to a school computer, students can follow their curriculum or their curiosity, learning through introductory minidocumentaries, databases of video-illustrated text, and hands-on activities, using both the television and the computer. Students also have the ability to tailor the video to make their own reports and presentations.

- **3-2-1 Classroom Contact.** CTW has edited this successful series into 30 programs to teach core scientific concepts in the classroom. Schools will receive teacher guides with step-by-step activities and reproducible handouts. The new programs will be aired on public television stations for in-school use.

D. **Bringing Teachers into Age of Technology**

How do we bring the current population of teachers and future teachers into the age of technology? Teachers need training, opportunity, and incentives to incorporate technologies into their curricula. Policies on status and salaries must reflect these issues. Schools of education must build the policy of using technology into their degree requirements, states must make it a part of teacher certification. For example:

- **Annenberg/CPB Math and Science Project.** The goal of this project is to increase scientific and mathematical understanding of the nation's elementary and high school students. The Annenberg Foundation and CPB are collaborating for the purpose of helping teachers in kindergarten through the 12th grade better convey the concepts and principles of science and the ways in which science, mathematics, and technology depend upon one another. The project will use communications and educational technologies -- including computers, two-way video, laser discs, and electronic networks and data services -- as means of achieving its objectives.

- **PBS Videoconferences.** One of the most effective, low-cost ways of reaching large numbers of teachers, administrators, educational institutions, and community groups simultaneously is through live, interactive videoconferences. These videoconferences let participants talk directly to experts, converse with other educators across the country, and transmit and receive additional information.

- **WNET Summer Institute.** The Thirteen•WNET/Texaco Training Institute was launched in the summer of 1990 through a partnership between Texaco Inc. and Thirteen•WNET, New York, New York. The Institute was founded as a pilot program, on the premise that educational television could have enormous potential in the classroom, but that teachers need training to use it effectively. The Institute brings together elementary and secondary school teachers to develop creative approaches to teaching with instructional television, curriculum-based programming designed and produced specifically for the classroom and approved by educators. It also shows that teachers embrace the opportunity to master the technology and to integrate video into their science lessons. So far, in the New York area alone, the Institute has reached 2,500 teachers and 13,000 students from diverse geographic and socioeconomic schools. On August 1, 1991, both CPB and Texaco announced additional grants to the Institute for the expansion of the Teacher Training Institute to additional public television sites and for the training of additional science teachers.

E. **Building Awareness of Resources**

As the delivery systems are put into place and the curriculum materials are acquired, systems that disseminate information about the availability of resources, background on existing models and implementation, and how to access that information need to be developed. The VSAT capability of the new public broadcasting satellite will provide educators with a network to share teaching resources, strategies and curricula with other teachers outside their own schools. In addition, the VSAT system could provide a variety of databases to educational users. Currently, there are systems that provide this service:

- Learning Link. Developed by WNET/New York, this is an interactive, on-line computer link between public television stations and their member schools and agencies, used to notify schools about educational and informational services available as well as program summaries, lesson plans, and curriculum tie-ins.

- EDISON (Education Information Services Online). The EDISON service of the Central Educational Network provides a computer information network for instructional television professionals. There are now more than 450 EDISON accounts at 200 stations and state and regional education agencies. Use has climbed to 1,800 calls a month.

VII. THE FEDERAL ROLE

We know that using technology in education works. However, the technological aspects should not overcome the service provided. The highways are in place. What is needed is the equipment at the local level, for the end users. As I stated earlier, CPB believes that at least four major issues must be addressed: funding, end-user equipment, programming and resource development, and teacher training.

One scenario that illustrates these issues is that each classroom be equipped with several multimedia learning stations that would integrate television/video, computer, and voice technologies. While there is still much to be discussed regarding the appropriate number of computers in a classroom, or the number of television monitors and VCRs, one could argue -- for the sake of today's discussion -- that one such learning station in every classroom is a starting point. In addition, any equipment funding formula must consider the need to replace equipment as needed, and we would encourage the inclusion of replacement provisions in such a formula.

Equally important is the availability of quality programming that is easily and affordably obtainable by every teacher and student in the country. There currently exists an excellent pool of educators and producers that are capable of creating the resources that meet the needs of individual teachers and students, regardless of age or background. What is lacking is sufficient funding to guarantee a steady stream of such programming.

1. Funding

The key component of the federal role in the development of a national educational telecommunications infrastructure is to ensure adequate funding for its development. Without adequate funding for technological advancements, schools that are most in need of improved education resources will be doomed to lag behind wealthier schools in our nation. The ability of these schools to produce graduates who are able to compete in the world economy will be severely undermined without a federal financial commitment. Individual students will be denied the opportunity to live up to their potential, and the nation will not keep pace with a world economy that is gaining speed rapidly.

2. End-user Equipment

Another important component of the federal role includes the recognition of the need for end-user equipment for students and teachers. Over 70 percent of classrooms do not have their own television monitors, and fewer have telephone or satellite reception antennas. In addition, computer access for students and teachers is still far too rare.

3. Programming and Resource Development

For the infrastructure and end-user equipment to be utilized fully, the federal role must include assisting in the development of "software," or quality programming. Funding through CPB for programming, and through the Department of Education for Star Schools, are two examples of the ways Congress can make a significant impact on the availability of quality programming. However, these programs have just begun to meet the needs and tap the potential of technology in schools.

4. Teacher Training

And finally, our study shows a need to demonstrate to classroom teachers how they might use the technologies to improve on what they are currently doing in the classroom. Only one in four teachers has received the training in the use of television in the classroom. Even fewer have learned how to match the characteristics of programming to the needs of their individual students.

None of these components is separate from the other and we believe that each is needed to make the entire equation work. Thus, the establishment of an effective educational telecommunications infrastructure must include at least these four components: funding; delivery systems and end-user equipment; software or programming; and teacher training. Only then can we effectively address our nation's education needs. Such an infrastructure will be very expensive, but it is an investment that we cannot afford *not* to make.

VIII. CONCLUSION

CPB's main concern is not the delivery technology or system employed, but with the public's access to the broadest possible range of public telecommunications services delivered by any and all available means. It is only through such access that public telecommunications can continue to play a vital role in improving the lives of our citizens through the provision of diverse, innovative, noncommercial educational and cultural programming of the highest quality, no matter which delivery technology or system becomes preeminent.

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CPB believes firmly that an effective and efficient telecommunications infrastructure is critical to the educational well-being of America. The public telecommunications system in the United States could well serve as a model for such a national telecommunications infrastructure. We urge you to consider the effective role that public telecommunications can play in providing a comprehensive delivery system and the accompanying programming and services.

Public telecommunications already has the reach and experience of working effectively with schools and colleges. It has accomplished much to support education at all levels and it has the capacity to do more in the future. Finally, all the key elements of such an infrastructure already are encompassed in varying degrees by public telecommunications: high quality programs that inform and instruct; the wide use of differing delivery systems; and, national leadership, planning, and coordination of efforts combined with local control of stations.

CPB and all of public broadcasting stand ready to help you in the important job ahead. Thank you.

Senator Bingaman. Our final witness on this panel, Mr. Howard Miller, is with the Public Broadcasting Service.

Why don't you go right ahead, Mr. Miller.

STATEMENT OF HOWARD N. MILLER, SENIOR VICE PRESIDENT, BROADCAST OPERATIONS, ENGINEERING AND COMPUTER SERVICES FOR THE PUBLIC BROADCASTING SERVICE

Mr. Miller. Thank you, Senator.

I'm the technologist and chief engineer for Public Broadcasting. My responsibilities are to deal with and solve some of the many problems that Mr. Foster has described.

You will be hearing today about our existing infrastructure and the many uses that are being made of it, and also what we believe will be accomplished in the future.

I have just two brief points that I would like to make this morning, and then I'll be able to answer any questions you might have on the technical side; issues such as digital compression or very small aperture terminals, cable, ITFS channels, other distribution media, and so forth. In combination, however, these technologies will make the public television satellite interconnection system an even more powerful tool for the Nation's educators.

First, I would like to emphasize that PBS is firmly committed to aggregating a large number of educational users aboard its new satellite, Telstar 401. This satellite is scheduled to be in service by July 1993. Digital compression technology will allow public television to increase the channel capacity of each of our transponders by a factor of 2 to 8 times for video and perhaps even more. In addition, VSAT technology will make it possible to interconnect many multiple combinations of user groups with two-way interactive voice, computer data, facsimile, or even slow-scan video services. The combination of these two new technologies will make it possible for public television to deliver a very wide array of educational services to every school in the United States.

The PBS staff has been instructed to develop a plan to make Telstar 401 the public television education satellite for the United States. I would add that PBS's plan to aggregate educational users, that is, to offer capacity to users who are presently paying commercial rates for services on many other satellites onto a single satellite can produce tremendous advantages, especially for rural schools, as you have heard before. Once this has been accomplished, each school can have access to many educational services at the same time from a single satellite dish.

My second point—as you have heard before—is that the last mile that is needed is to get from outside of the school building into the classroom itself. Public television will have the ability to deliver educational services to literally every school in the United States by wire, by fiber optic link, over the air, by microwave, or by space link.

Each school can be configured like a cable headend or a telephone switchboard with multiple services, and each classroom could then become a potential user. Ideally, each classroom should be equipped with access to video, voice and data services, but each school will need to decide for itself which of the voice, data and video services it will use in each classroom.

The equipment that is needed to deliver these services to schools and classrooms will, in each case, depend upon what is already available in the community and upon the needs of local educators and students. In some cases, this may be a satellite or microwave dish; in others, cable, fiber or telephone lines; and in others, an ITFS or broadcast antenna.

Many schools will require installation of fiber or cables into the individual classrooms. Once a signal is delivered, equipment that could be used in each classroom, of course, will include computers, facsimile machines, video cassette recorders, video disk players, television receivers, and on and on. But there is no standard set of equipment for each class, in part because there are various classroom uses for the new technologies.

Because of public television's broad experience in providing many different educational services through telecommunications, including satellites, it is uniquely qualified to advise and assist educators in an application of these various technologies for educational uses.

I would be pleased to answer any questions that you may have about this testimony or about technologies.

Thank you.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF HOWARD N. MILLER

You have heard today about the public television communications infrastructure that is already in place and how, by building on this existing network, the Federal Government can extend technology into every classroom

I would like to make just two points briefly. I will then be available to answer any questions you may have about technological advances, such as digital compression and VSAT (Very Small Aperture Terminals), that are bringing telecommunications to the classroom. These technologies will make the public television satellite interconnection system an even more powerful tool for the Nation's educators than it already is.

First, I would like to emphasize that PBS if firmly committed to aggregating a large number of education users aboard its new satellite, Telsar 401, which is scheduled to be in service by July 1993. Digital compression technology will allow public television to increase transponder capacity by a factor of two to eight—or possibly more. VSAT will make it possible to interconnect multiple combinations of user groups with interactive voice, data, facsimile or slow scan services. In combination, these technologies will make it possible for public television to deliver a wide array of educational services directly to our schools.

PBS staff has been instructed to develop a plan to make Telstar 401 the public television education satellite for the United States. I would add that PBS's plan to aggregate educational users, that is to place users that are presently on many satellites on a single satellite, will produce tremendous advantages, especially for rural schools. Once this has been accomplished, each of these schools will have access to many educational services at the same time.

My second point is that the "last mile" needed is really to go from outside the school building into the classroom itself. Public television already has the ability to deliver educational services to literally every school in the United States, either by wire, over-the-air or via space link. Each school can be compared to a cable headend or telephone switchboard, with each classroom a potential user. Ideally, each classroom should be equipped to offer access to video, voice and data services. Each school will need to decide for itself which of the voice, data and video services it will use in each classroom.

The equipment that is needed to deliver these services to classrooms will in each case depend upon what is already available in the community and upon the needs of local educators and students. In some cases it may be a satellite or microwave dish, in others, cable, fiber or telephone lines, and in others, ITFS or broadcast antenna. Once a signal is delivered, equipment that would be used by schools would include computers, facsimile machines, videocassette recorders, videodisc players, television receivers, etc. There is no standard set of equipment needed by the schools in part because there are various classroom uses for the new technologies. Because of public television's experience in providing educational services through telecommunications, including satellites, it is uniquely qualified to assist educators in the application of new technologies to educational uses.

I would be pleased to answer any questions you may have about my testimony and about the technical advances that are bringing telecommunications to the classroom.

Senator Bingaman. Thank you very much.

I have some questions, but before I start, let me ask if Senator Simon had any opening statement he wanted to make.

Senator Simon. I do not. I regret that I'm running between meetings, as I guess we all are these days, but I appreciate that this is an area where there is no question that we can enrich the education curriculum.

It is not a substitute—and I think this has to be stressed—it is not a substitute for good teachers, but it is a supplement. If we have the right teachers, then there can be an enriching factor here, and we want to enrich our education all we can.

Thank you, Mr. Chairman. I appreciate your holding hearings on this.

Senator Bingaman. Thank you for being here.

Let me start with some questions, and then I'll defer to Senator Simon for any questions that he might have.

Dr. Foster, I'm getting some mixed signals here from the panel. As I understand your position, it is that we don't have an transportation system in place or plans to really provide the integration of this system that is necessary to really help the schools and classrooms.

I guess I'm hearing from the other two witnesses—Mr. Ledwig and Mr. Miller—that they believe that this new satellite that is going up will essentially be a lot of the solution to this problem, and that the plans are in place to have a nationwide system that can reach each classroom. At least that is what I picked up from the testimony.

Maybe you could explain to me why you think the plans that are in place are not adequate.

Mr. Foster. It seems to me, Senator, that it's easy for us to get into a problem of overstatement of what's possible. I'll speak for Kentucky in response to the PBS scenario.

What has not been told to you yet is where the money will come from for the VSATs on 1,300 school sites. Kentucky may or may not elect to use VSATs for instructional programming and other methodologies that originate in Kentucky and stay in Kentucky. We're talking about a transportation system that we want to use for staff development, for conferences between universities, for university presidents and so forth. We're not talking about just taking down programming from PBS or any other source. We have a major decision to make about how we are going to transmit data from one school to another and to the State Capitol and back again on a single system that we can pay a single bill to. So, that's point number two. We need a terrestrial system that is very efficient for quite different purposes than educational programming. It involves sharing software and so forth.

You know, we use the technology in our own in-state Star Schools program that we fund ourselves in Kentucky, along with what we do with SERC. It costs us $500,000 a year just for the telephone line to connect the computers with those little key pads that the students use to make it interactive—$500,000. We pay $1.6 million for the transponder time.

So, the full communication system is costing us $2 million, and we haven't invested anything in programming. It's also on a metered basis. You know, you pay so much for this mile, a different rate for that mile, and another rate for another mile. It takes a great deal of coordination of the switching of the system on the terrestrial side in order to make sure that those computer signals and key pad signals reach the computer at KET.

So, it seems to me that a system that we need has to be put together in a fashion where whoever is putting the system together is in a position to negotiate with the local TelCos, the regional TelCos, and the national interconnect companies, so we can get some dedicated telephone lines that have the band-width capacity that we need to transport all forms of media concurrently, so you don't have to separate your signals.

We have used compression technology in several sites in Kentucky on multi-point distribution. We have a demonstration site in western Kentucky that does that. We believe that we have to experiment with all of these. I've watched it; I've participated in it and have been on the camera, and you have certain voice-lag problems between the terrestrial connection of the voice and the video.

Yes, VSATs may be able to do that, but VSATs are only two way on the data and voice side. You still have to have some kind of split signal.

So, can PBS and the Telstar satellite solve the problem? I don't believe it can. Can it contribute to it? It obviously can. I mean, you've made the investment in Telstar, and we're not here to suggest that that's a bad investment or that it won't interconnect. Clearly, if people are going to use PBS originated programming and it's going to come down on Telstar, we need some kind of system to do that.

The co-location of the programming is really dealing with a whole segment of people that PBS does not deal with. When we held our hearings around the Nation—I can tell you, Senator—that the overwhelming majority of people who came were not PBS connected. They were people who are using university-based uplinks or other commercial uplinks and do not use the PBS system at all, and furthermore, indicated to us that they do not intend to? So, we have to have some kind of a system that we think will be responsive to them.

Senator Bingaman. Why do they not intend to? I don't understand that last point.

Ms. Weinstein. Senator, I wonder if I might answer a piece of that from the EDSAT point of view, and if I might also take a moment and say to Senator Simon that I'm very pleased to see that he is here. The Western Illinois State University, the School of Education, the Dean of the School of Education has been very actively involved in the steering group on behalf of these efforts to develop the National Education Telecommunications Organization.

Senator Simon. If I could just add that they have had the cooperation of a great many schools in that. I've met with the group on a couple of occasions out there.

Ms. WEINSTEIN. Senator Bingaman, they are a small university in the center of Illinois that is delivering probably more public school—K through 12—education to schools who would otherwise not have the advantage of teachers in language, science and math than anyone of the outstanding universities that has been doing it for many years.

As they discussed in our very first outreach meeting in St. Louis—what we heard all over the country from colleges and universities that are delivering to public school districts and those public school districts that are also getting into it—their problem is that, one, there is no highway and that, two, the costs of the transportation of the delivery system were absolutely—to use their language—"blowing their budgets out of the water."

I might add to the "costs" issues that—which we heard throughout the outreach meetings—the control of the delivery system is paramount and important to the schools, colleges, and universities, as well as the dependable low costs. Whether it was Kansas State University saying, if I do not have dependability, than how can I make plans for the next two or three years to deliver to the schools, the public schools in the State of Kansas; or the Dean of the School of Ed at Western Illinois University saying that I am delivering to schools who would otherwise not have this programming. We need to have control of the delivery system.

Could I take one second, Senator, and go back. I really am very pleased that Mr. Ledwig went back to 1967 when PBS was started in the country, because I'm very pleased to tell you that our first chairman of the EDSAT Advisory Board was Dr. Norman Cousins—the late Dr. Norman Cousins—and when we first started with the notion, we asked what were the problems and why had America's schools remained isolated.

Dr. Cousins pointed out that he was the Chair for President Eisenhower of the Educational Television Board, which was the precursor to public broadcasting. He said that over the years—the 25 years—while we have built a good commercial system through the Communications Satellite Act, while we have built an excellent public broadcasting system through the public broadcasting stations, which the government has supported, what we clearly have left out is education. We are at a point in time with technology, the size of the education market, and the diverse and unique needs of the education sector that we must build a telecommunications highway dedicated, controlled, and managed by that education sector.

Dr. Norman Cousins served as our first Chair. So, I'm very pleased to remind Mr. Ledwig of this, because over the 25 years, it is the education sector that has been left out.

Then, if I might just add that when Governor Wilkenson went to President Bush, it was not a technical question with the education satellite. It was not a question of whose system do we use. It was a governance issue, and that was why the EDSAT Institute did the study. What we found—the key issues in that study from the national working groups as they were reconfirmed in our outreach meetings—was that control, governance, and equity were the questions that were important to the education establishment.

I am sure that PBS has a dedicated system that you have helped to support and indeed helped to grow in terms of delivering services to public broadcasting stations. There are now 337 stations. The National Education Telecommunications Organization is dedicated to its education users, which are 110,000 schools, 3,000 colleges and universities, and 6,000 libraries.

Educators have told us in seven major regional outreach meetings and in their surveys that they would like to begin services by the end of 1991 through 1992 and the beginning of 1993. They want control of this system that gives them dedicated telecommunication services on land and space, so they can get on with the business of modernizing American education.

SENATOR BINGAMAN. Let me ask Mr. Ledwig if he would just comment. It sounds as though, in Mr. Foster's and Ms. Weinstein 's point of view, there are things that they believe are needed to get instructional technology and use technology to get instruction into our schools that the Corporation for Public Broadcasting is not going to or is not able to provide through the satellite, which you folks are planning to do in 1993.

I guess my initial reaction is that there is a big jump between 300-and-some-odd public broadcasting stations and 110,000 schools, and I wonder how much of that leap you folks are going to be able to take, and how much of the services that Dr. Foster described you folks are going to be able to provide, or is there a vacuum here that needs to be filled that you folks don't have plans to fill?

MR. LEDWIG. Thank you, Senator. First of all, I would say we're not proposing any competition for control. Ms. Weinstein talked about control, governance, and all of those issues for another system that is not yet there.

My purpose in coming to this Committee is to tell you what the Congress has already paid for, what is already up there, and how we think we can exploit it further. The costs that were mentioned, the costs in various systems around the country—as I understood it—are typically analogue costs—phone lines and all of that.

We have moved forward. We took a quantum leap to digital technology for the new satellite. In selling this satellite to our Authorizing Committee, I had trouble until the minority side—which happened to be a very forward-looking group of technology-minded individuals led by Congressman Ritter—said, if you make this an educational satellite and you put in digital technology and make this available, you can get a bigger bang for the buck, so to speak. America can benefit from this, and there can be quantum leaps in what PBS can do for the Nation in education. And I said that's what we're proposing, and Congressman Ritter said, "fine, we'll authorize the full amount." They authorized $200 million and the Congress appropriated $198 million, with strong support on both sides of the aisle.

I'm here simply to say that that has been paid for, authorized and appropriated; it's goirg up, and we ought to exploit it because the problem is the down-links down to the schools and equipment, and training the teachers need to use technology.

At the Corporation, we have worked with Texaco using their funds and ours to train teachers to use technology, and there is a great lack of that training. There are just some basic things that don't exist. We're saying, let's take what we have, let's exploit what we have, let's add a few more dollars and make the leap, because we're dealing with digital technology that gives us the capability and a reduction in cost.

If other people want to propose other systems for reasons of control and governance and educational establishment and all those words that we heard, that's their business. We're saying, why not take advantage of what the Congress has already paid for.

SENATOR BINGAMAN. Let me just ask a follow-up now. We have this $200 million digital satellite going up that will have all these great capabilities. Do you folks have a plan that you could give to us or have given to the Authorizing Committee or something as to how we actually get that into the classroom?

Out in my state, for example, the only thing anybody sees is Channel One, and most of them don't see that yet, but they would love to be able to just because they don't have access to anything. So, how are we going to get from here to actually getting some of this in the classroom?

MR. LEDWIG. Well, you see, we are doing it in certain states. Education, of course, is a decentralized system. Kentucky has a wonderful system and so does South Carolina. The President of South Carolina ETV will be here to answer your question more fully.

We're exploiting what we have. I'm proposing following the Japanese model. If you have a great Toyota, you make it into a Lexus. That's how they are beating us competitively as a nation worldwide.

SENATOR BINGAMAN. They are also beating us because they have a strong national educational system where we don't, in my opinion.

MR. LEDWIG. That's right, and that's because we're designed to be a locally controlled system. But we can provide programming at the national level, and that's what I'm proposing we do, better programming.

We have thousands of students that get college credits from Annanberg/CPB project, college-level telecommunications courses that are shown throughout the United States. Students at home can take the course and go down to the University and take the test. We're doing educational television for the kindergarten through the twelfth grade. We're doing these things, and we just want to be given the funds so that we can compound the effectiveness of what we're already doing.

SENATOR BINGAMAN. But is there a plan? I think, Mr. Miller, didn't you refer to a plan that has been developed, or is being developed, to actually get this instruction into the schools to a greater extent than we have been able to in the past?

Mr. Miller. Yes, Senator. Let me explain, first, that our existing capacity is slightly over three channels.

Senator Bingaman. And by that you mean that a——

Mr. Miller. On the satellite, I'm referring to.

Senator Bingaman. —given school can take in three courses at once, if they have the right set-up?

Mr. Miller. No. We have to deliver all of our services at the present time on slightly over three channels. Therefore, many of the services that people would like to have on the satellite are obviously not possible. There is a priority sequence of services that have been offered.

The governance of that particular allocation process is not PBS. It is an interconnection committee that is representative of all the users, a number of which have nothing to do with PBS programs. As we move more toward educational services, there will be a greater group of people representing the educational community.

But the key issue here is that because of digital technology, our new satellite, although it has six transponders, those six transponders will enable us to deliver probably in the range of 20 to 30 channels of video. This technology is moving very rapidly, and you can't say for sure exactly what you're going to have. We have another 20 months, and we're working with a number of vendors, but we will obviously maximize the number of channels possible.

In addition, since this is a federally funded asset, one of the proposals that we will be submitting to the Interconnection Committee and the Board is to offer lease costs well below the commercial cost, but to use that money to acquire additional transponders. In other words, offer a low-cost alternative, but nonetheless use the federally funded portion to enable us to expand capacity even further if the need is there. We have an option on an additional four transponders as a part of our contract. So, that is really our plan.

Now, with regard to how do you get it into the schools, in digital technology, there are at the present time five totally inconsistent and incompatible approaches that are available, or will soon be available, in the marketplace.

Senator Bingaman. These are the ones that Dr. Foster was referring to?

Mr. Miller. Yes, and that of course could clearly lead to disaster if you are not careful.

We have made a decision to join the largest buyers of this kind of technology, which happens to be the cable industry in conjunction with the DBS industry. By doing this, we are hoping to set, if not a standard, at least a common set of objectives for the manufacturers, so we can buy from multiple sources and buy products that are consistent, so that no matter where you go you'll be able to receive the programming appropriately. In other words, what we are trying to do is to avoid having multiple, inconsistent, digital compression technologies.

As I say, we have joined very recently this initiative on the part of the cable industry. We will add our buying power to theirs to achieve commonality on the video side.

SENATOR BINGAMAN. Isn't there some governmental involvement in trying to set a common standard?

MR. MILLER. There is no standards' effort in this area. A lot of this is a result of work that is being sponsored in the high-definition television area. A lot of the technology actually applies specifically to our current television system, but there is no effort at the present time for a national standard.

I would certainly agree with having at least some guidelines. We do have standard gauges on our railroads. We do have standards, so you can talk from this part of the country to other parts of the country, and the telephone system still works and so forth, that would be very helpful.

SENATOR BINGAMAN. Who would be the natural agency to do that?

MR. MILLER. Well, we typically work with the FCC. So, I suppose they would be appropriate.

SENATOR BINGAMAN. And they made a decision not to for some reason?

MR. MILLER. Yes, that's correct. It's a very difficult area, as you can imagine. What we're trying to do, as I said, within the realities of the world as it is today, to make sure that we're buying a technology that is the most common we can get, and, as I say, the best way to do that is by joining the large buyers.

SENATOR BINGAMAN. Let me defer to Senator Simon. I've been asking too many questions here. Go ahead.

SENATOR SIMON. Not at all. I'm the nontechnician in this whole crowd, let me tell you.

First, since you're here, Mr. Ledwig, let me just say, and this is a comment to the members of the Senate more than to you, but I have to say that I am a little discouraged, but it has nothing to do with this hearing right now, that the Corporation for Public Broadcasting has to lean increasingly on commercial advertisings or sponsors. I think that means that inevitably you have to look for programs that get ratings. If you have a program that wants to cover the conditions of hospitals in Ethiopia, which will get 1/10th of 1 percent of the viewing audience, that may be a special contribution that you ought to be making. Anyway, that's more a comment for us, because I know your financial constraints.

Two questions, and then I have to get to a Judiciary Committee markup. Does the FCC have the authority to impose standards?

MR. MILLER. The FCC does control satellite spacing and a number of other issues. So, I would assume they could were they to choose to do so, yes.

SENATOR SIMON. And if they have the authority, your strong feeling is that they should impose the standards?

MR. MILLER. We need a set of common approaches in the educational community, or it will be chaos. So, whether they create a standard or whether we find a way of doing it on a voluntary basis, it must be done. As I say, at the present time, we're doing what we have to do to get there. We have 20 months left. So, the timing is now.

SENATOR BINGAMAN. You have 20 months until you make the decision?

MR. MILLER. We have 20 months to have the system in place and operational.

SENATOR BINGAMAN. When do you need to make the decision on the standard you're going to use?

MR. MILLER. Our plan calls for a standards decision in June 1992.

SENATOR BINGAMAN. So, they really need to make whatever input they're going to by then?

MR. MILLER. Yes. The first hardware of these various vendors will be provided to us in January. We have some very large names in the United States providing this equipment. AT&T, General Instrument, Scientific Atlanta, and Compression Labs, for examples. But, unfortunately, they are all different.

We are trying to create some commonality among these various approaches so that we can maximize the communications capability and minimize the cost.

SENATOR SIMON. When you buy the equipment, you don't need to know at that point the standards, or do you?

MR. MILLER. Well, if it were a standard, then obviously everyone from then on would follow it. It's a free market today, and not everybody necessarily will buy the equipment that we specify.

SENATOR SIMON. I'm trying to determine, and I think that's what my colleague is also trying to determine, do you have just three months until January, or do you have eight months until June?

MR. MILLER. We have eight months until June in order to make our decision, and hopefully have an agreement on what technology we all intend to use in common.

SENATOR SIMON. I would be interested in any comments Mr. Ledwig or Dr. Foster or Dr. Weinstein might have. Is this something where we ought to adopt the sense of the Senate resolution, saying to the FCC, you ought to do this?

MR. FOSTER. I can give you a partial answer to that from our research in a state where we are using several compression technologies at the moment. This is still an evolving technology, and there are those who are arguing that setting a standard too early may lock us into a less than sufficient solution.

There is an international standard that is to be issued from the international body that sets those standards, and I believe it's in the spring of 1992. However, this is already falling under criticism that it's going to be a very minimal standard and probably won't solve the competition issue.

In a sense, it is a side issue to hinge the whole thing on whether compression goes or doesn't go. Most of the people who have been trying to sell us compression in Kentucky are not satellite vendors. They are the TelCos who want to use their T-1 lines for television communication, and they can only do that because of the band-width constraints if compression is available.

SENATOR SIMON. You're losing me.

MR. FOSTER. My point is that the standards that are there are not set yet, and whether or not we ought to set a national standard, apart from an international standard, I think, may be unwise for us as a nation, but I'm not an expert in that area.

SENATOR SIMON. Let me phrase the question this way. If the Chairman of the FCC were to call each one of you and say should we or should we not adopt standards before next June, what do you tell him?

MS. WEINSTEIN. I would answer it a little bit differently, Senator, because I am speaking here coming from the grass-roots colleges, universities and schools. What we learned in our surveys in the answer to that is, one, the education sector is hanging back with this. Those that are experienced in the field know that they do not want to spend dollars on first-generation equipment, which within a year is going to be either outdated or unusable and will not connect them.

So, our surveys indicate that largely the education institutions are waiting to see what happens, and that feeds into the larger question.

SENATOR SIMON. What do you tell the Chairman of the FCC?

MS. WEINSTEIN. I don't think the FCC is going to set standards for this, Mr. Simon.

SENATOR SIMON. I'm not asking whether they are going to. I'm asking what do you advise the Chairman to do?

MS. WEINSTEIN. I couldn't advise them because the commercial industry right now is in such chaos. There are two tracks going. One is the PBS stations and the other is the commercial stations, and that is what is critical of why in the schools no one is looking at the diverse needs and requirements of the schools.

SENATOR SIMON. So, your answer to the Chairman of the FCC is no?

MS. WEINSTEIN. My answer to the Chairman of the FCC is that I do not have enough information now about the schools to see what impact the decision that you make will have on the schools, colleges, and universities.

SENATOR SIMON. Mr. Foster.

MR. FOSTER. I would say it's too early to set a standard. We need more experimentation.

SENATOR SIMON. Mr. Ledwig.

MR. LEDWIG. I think that at some point we certainly need a software standard so that all of the programming that is out there that is being converted to digital will be on a common basis, so anybody anywhere can access it nationwide. At some point that is going to come.

As far as hardware and those other standards, I will defer to my technical expert.

SENATOR SIMON. Mr. Miller.

MR. MILLER. Senator, there is a thing in the digital parlance called hierarchy, and to the extent that high-definition system selections will be made in 1993, I would strongly urge that there be a commonality of hierarchy between our current television system and high definition. That way, it goes all the way from a very slow speed or slow-scan video, up through high definition using common kinds of equipment. It doesn't have to be identical, but it needs to be similar. That way it's cost effective and universally available.

SENATOR SIMON. Thank you. Thank you, Mr. Chairman.

SENATOR BINGAMAN. Thank you very much.

SENATOR SIMON. I just noticed that in the next panel there is a distinguished witness from Illinois, and I'm sure he will be the outstanding witness for the day. [Laughter.]

But I regret that I can't be here to listen to that.

MR. FOSTER. Senator, may I have a matter of personal privilege just to make one final statement?

SENATOR BINGAMAN. Certainly, go ahead.

MR. FOSTER. I think that it would be unfortunate if you came away from this discussion this morning feeling, at least on my part, that we have any sentiment of unhappiness with CPB or PBS. Kentucky has been a beneficiary of the largess of the Federal Government, as it has come down through those two agencies.

What we're really talking about here is a fundamental difference in strategy on how to build a system, and I don't want to have missed the point that we intend to build it as a public/private partnership with the financing not coming from the Federal Government, but coming from the revenues of the users, and that we use the private sector to come up with the capitalization for the system. Someone has to put the system together, but that's a fundamental difference.

Thank you for that opportunity.

SENATOR BINGAMAN. All right. Well, thank you all very much.

We do have two additional panels. Before we start the second panel, let's take about a five-minute break.

[Brief recess.]

SENATOR BINGAMAN. Why don't we go ahead and start up again here.

Let me just ask, if there is still someone here from the Corporation for Public Broadcasting, if you folks could give us a copy of that survey that you referred to, where you surveyed the extent of the technology available in the schools today. If we could have that, we would like to include that in our record.

MR. LEDWIG. We would be pleased to do that.

SENATOR BINGAMAN. All right. Thank you very much.

[The following survey was subsequently supplied for the record:]

1991 STUDY OF SCHOOL USES OF TELEVISION AND VIDEO

A Summary of the Results of the Corporation for Public Broadcasting 1991 Study of School Uses of Television and Video to the Senate Subcommittee on Education, Arts and Humanites and the Joint Economic Committee.

November 22, 1991

INTRODUCTION

This report summarizes the results of the 1991 Study of School Uses of Television and Video. This study is the third in a series of comprehensive national surveys of the use of television as a teaching resource in America's classrooms, sponsored by the Corporation for Public Broadcasting (CPB).

The first School TV Utilization Study, cosponsored with the National Center for Educational Statistics, was conducted during the 1976-77 school year, and provided widely-accepted national data regarding the educational use of television. It was followed by the 1982-83 School Utilization Study, which tracked the role of instructional television as new technologies emerged (such as videocassette recorders, or VCRs) and expanded the information available for effective planning, implementation, and evaluation of policies and programs to further the effectiveness of instructional technologies and educational achievement.

The nine years since the completion of the 1982-83 study have seen important changes in classroom television and the technologies that accompany it. VCRs have become far more plentiful, giving teachers greater flexibility in presentation and scheduling; the growth of program delivery systems, including videocassettes, satellite, cable, and broadcast services have given educators more sources for programming; and newer technologies such as interactive videodiscs have begun to enter the nation's classrooms.

CPB has sponsored the present study to provide current data that reflect the impact of these important developments, to document almost a decade's worth of on-going experience in the use of classroom television by literally hundreds of thousands of educators, and to expand and update the existing base of information.

This Summary Report provides key measures of the use of instructional television, availability of equipment and programming, and support and resources devoted to instructional television. It summarizes teachers' attitudes toward the use of television in the classroom, notes the growth of several new television-based technologies, and suggests what trends will develop during the next few years.

It is CPB's hope that this information will assist professionals in education, broadcasting, and government to make more effective use of classroom television and related teaching resources, and ultimately help improve teaching and learning in our nation's schools.

A number of national education and broadcasting organizations provided important support by endorsing this study. These organizations include: American Association of School Administrators, American Federation of Teachers, Association for Educational Communications and Technology, Council of Chief State School Officers, National Association of Elementary School Principals, National Association of Secondary School Principals, National Education Association, National PTA, and Public Broadcasting Service.

In addition, this report reflects the cooperation and support of the thousands of teachers, principals, and superintendents who agreed to participate in this study, and who took the time to respond to lengthy questionnaires. Without their generous assistance and cooperation, the success of this study would not have been possible.

METHODOLOGY

In early 1991, over 6,000 educators throughout the United States completed detailed questionnaires regarding the availability, use, and support of school television. Their responses are the basis for the 1991 Study of School Uses of Television and Video, a comprehensive national study sponsored by CPB.

The design of the 1991 Study of School Uses of Television and Video called for a national random sample of classroom teachers, school principals, and district superintendents. The sampling procedure was designed to ensure to the extent possible that every public school teacher in the nation had an equal chance of being selected for participation in the study.

The sampling technique involved 1) the selection of school districts with the probability proportional to size, using number of teachers as the measure of size; 2) the selection of a sample of schools within selected districts, to reach the desired number of elementary, junior high, and senior high schools, and to reach a desired number of urban, suburban, and rural schools; and 3) the selection of a sample of two teachers in each selected school. The final number of selected participants was:

716 school superintendents
2,032 school principals
4,112 school teachers

The survey was conducted by mail questionnaire, with separate questionnaires developed for superintendents, principals, and teachers. Data were collected during the period from February through June 1991, and the mailing procedure included up to three questionnaire mailings, two follow-up mailings, and telephone follow-up. Final participation rates were:

87 percent of superintendents
90 percent of principals
75 percent of teachers

Questionnaires were all returned to a single, central location, with bar-coded identification numbers used to record receipt through an automated survey control system. Keying of the data from the questionnaires was controlled by data entry programs designed for each of the three questionnaires; all keyed data were 100 percent key verified.

A sampling weight was assigned to each member in the original sample to account for unequal selection probabilities; these weights were adjusted further for nonresponse in an attempt to reduce, to the extent possible, potential bias resulting from such nonresponse. These adjusted weights then were used for estimating results for the total population of superintendents, principals, and teachers in the nation.

Despite efforts to reduce error to the extent possible, the estimates in this study are subject to both sampling and nonsampling error. Error for survey responses is no greater than two percent; in many cases, the error is less than five-tenths of one percent. For several more detailed cross-tabulation or sub-population analyses, the standard error may be higher. The cases are noted in this report.

SURVEY RESULTS

The results of the Study on School Uses of Television and Video are best presented in the tables and graphic presentations of this Summary Report. The following text highlights particular dimensions of these tables and charts, and where appropriate, provides additional explanation and trend data for particular findings.

TELEVISION AND VIDEO EQUIPMENT IN SCHOOLS

The study collected information on the number of television sets and videocassette recorders (VCR) available at a school, as reported by the school principal. Figures 1-2, 3-4, and 5-6 present these data in per classroom, per teacher, and per 100 student ratios.

The results indicate that relatively few schools, approximately 5 percent of all schools, report having a TV set for every classroom or for every teacher (Figures 1-2 and 3-4). The median ratios for TV sets is roughly one TV set for every four classrooms, and one TV set for every four teachers. The median per student ratio is roughly 2 TV sets for every 100 students.

There are fewer VCRs in schools than there are TV sets, and this is reflected in lower ratios for VCRs (Figures 1-2, 3-4, 5-6). Approximately 1 percent of schools report having a VCR for every classroom or for every teacher.

Equipment is made available in a number of different ways for use by teachers (Table 7). Most schools, 78.4 percent, have some TV sets that can be rotated among classrooms on request. Many schools also have equipment that is kept in one location for use, either in specific classrooms or in a media center or library.

A range of other equipment and video resources are reported as available at schools (Table 8). Most schools, 82.9 percent, report having at least one video camera, and most schools, 78.2 percent, maintain a videocassette library. Newer technologies, such as videodisc players and interactive video systems, are available in only a limited number of schools, reflecting their more recent development and introduction into schools.

SOURCES OF PROGRAMMING

Each of the respondent groups (superintendents, principals, and teachers) were asked how instructional television and/or video are available. The responses from each group reflects generally on which delivery systems are most widely available (Table 9).

The responses from each group with regard to broadcast, both public television and commercial, are somewhat difficult to explain. Actual signal availability of public and commercial broadcasters is much higher, on the order of 95 percent or higher. In addition, teachers report that the programs they used in classes include many general broadcast programs that are made available by broadcast signal to over 90 percent of schools. It is therefore difficult to make any conclusions from the responses regarding availability from broadcast.

Responses regarding availability of instructional television and video from cable are more consistent, at least among superintendents and principals. Teachers may be less likely to know if cable delivers programming to their school. A clearer picture of availability of specific program services over cable or satellite systems is described in Table 10. Principals report that 71.9 percent of schools have some access to cable or satellite programming. Listed are the total school coverage of the various cable and satellite programming services to schools. It should be noted that the broadcast network figures (i.e. for ABC-TV, CBS-TV, PBS) reflect availability only through cable systems, and do not include availability by terrestrial broadcast signal.

Availability of programming by videocassette is the largest category and is consistent among all three groups, with 89.1 percent of all schools reporting availability by videocassette.

Satellite delivery of instructional programming is available in 17.3 percent of all schools. Many districts, 49.5 percent, report having satellite systems, but for most districts, such availability is limited to only a portion of the school buildings within the district.

Availability by videodisc is reported in 13.6 percent of schools, and availability by instructional television fixed service (ITFS) is reported in 13.5 percent of all schools.

Sources of instructional programming on videocassette is reported by teachers in Table 11. Many teachers report using videocassette libraries maintained within their school (69.5 percent), by their school district (50.5 percent), or by a state or regional agency. Teachers also report a significant amount of use of other sources, including commercial video stores and public libraries, as well as recording at home or borrowing from another teacher or friend.

When teachers were asked about how they record programs off-air (Table 12), the leading method was recording by the teacher, either at home (65.2 percent) or at school (16.2 percent). Forty-seven point five percent of teachers use other school personnel to do the off-air recording.

Leading categories of original programming produced by schools for school use included videotapes made in school for student and teacher feedback of performance, videotaping sports and extracurricular activities, and video productions for instructional use (Table 13).

The survey examined for the first time the category of use of "live televised instruction," which was defined as instructional television and video involving distance learning, teleconferencing and/or "camera in the classroom." It included interactive services with hookup through satellite, micro-wave, or fiber optic and phone lines. As reported in Tables 14A and 14B, 21.3 percent of district report that they had some use in this category, with the vast majority of the services delivered by satellite with some interactivity. While only 8.9 percent of teachers responded that they had ever used live televised instruction, typical users may include teaching aides which were not surveyed. Therefore, this count may not reflect the full level of use.

RESOURCES AND SUPPORT FOR INSTRUCTIONAL TELEVISION AND VIDEO

Most schools and many districts have some personnel providing support for instructional television and video (Table 15). In schools, almost all of these people share other responsibilities in addition to coordinating instructional television and video (Table 16), with most sharing library and other media functions.

The services provided by these personnel are wide-ranging (Table 17) and include distributing teachers guides, providing assistance with equipment, calling attention to special programs, and recording programs.

Perceptions of the level of encouragement for use of instructional television were surveyed (Table 18). Most principals report that their superintendents "strongly encouraged" (15.9 percent) or "encouraged" use (62.8 percent). Only 1.1 percent of principals report that they felt their superintendents discouraged use.

Roughly half of teachers felt their principals encouraged use, with 47.1 percent reporting that their principals neither encouraged nor discouraged use. Only 2.4 percent of teachers report that principals discouraged use.

Financial support for instructional television and video has remained steady, or has increased in the last three years (Table 19) at both the district and schoc' levels. For most schools and districts, this level of support is expected to remain constant in the next year. The study shows that 31.1 percent of districts and 22.2 percent of schools report that they expected support to increase in the 1991-92 school year, while 13.0 percent of districts and 18.6 percent of schools expected support to decline.

Levels of financial support for all media and instructional television and video are reported for districts (Figure 20A), and for schools (Figure 20B). For most school districts, overall expenditures on all media are less than $25,000, and are $5000 or less for instructional television and video only. For most schools, the average expenditures on all media are $5000 or less, and for instructional television and video are $1000 or less.

Sources of funds for instructional television and video equipment include federal grants, state grants, district funds, PTA and community groups, and corporate sponsors (Table 21). The leading source of funds is district revenues (62.4 percent of funds at the district level, and 56.8 percent of funds at the school level). It should be noted that the data in this table were particularly difficult to collect, and thus the standard error for these figures is higher than for other tables.

Districts reported considerable interest in expanding their efforts and resources for instructional television and video over the next three years (Table 22). Most plan to increase their number of television sets and VCRs. Most plan to expand their videocassette libraries. Many express interest in adding satellite equipment, interactive video capability, production equipment, and fiber optic link systems.

Many schools report that in-service training is available to teachers on the use of instructional television and video (Table 23). Most districts and teachers report that television and/or video also is used to deliver in-service training on other topics (Table 24).

But relatively few teachers (25.0 percent) report that they have ever had any training in instructional television and video, and fewer (11.3 percent) report they have received training in the last three years (Table 25).

AVAILABILITY AND USE OF INSTRUCTIONAL TELEVISION AND VIDEO

Today, there is virtually universal access to television and/or video for instructional use (Table 26), with 97.1 percent of teachers reporting some access. This reflects a significant increase since the 1982-83 survey, when only 70 percent of teachers reported access.

Teachers report using a variety of arrangements for viewing instructional television and video (Table 27). The leading uses include viewing by the entire class and viewing a program with another class. Viewing by small groups or by individual students is used considerably less.

In the last year, 79.4 percent of teachers report that they used instructional television and video (Table 28). This reflects a considerable increase since the 1982-83 study, when only 54 percent of teachers reported use in the last year.

The leading subjects in which teachers used instructional television and video include science, reading, social sciences, history, English, health/nutrition, and math (Table 29). The ranking of subjects has not changed appreciably since 1982-83, and in part reflects the number of teachers that teach these various subjects.

When asked whether they had used instructional television and video in the last month, 52.4 percent of teachers report such use (Table 30).

Most teachers report that their use of instructional television and video in the last three years has remained about the same or has increased (Table 31).

The survey polled teachers about difficulties they might encounter in using instructional television and video (Table 32-33). Many teachers cited some problems with finding out about programs in advance, having programs available when needed, and sampling and assessing the quality and appropriateness of programs before their use. Fewer cited problems with having equipment available when needed and having equipment in good condition.

When asked about what student outcomes teachers had *personally seen* in their classes (Table 34), most teachers report observing that instructional television and video generated new interest in topics, and that students comprehended and discussed content and ideas presented in programming. Many teachers reported observing that students learn more, that student motivation increases, and that students follow up ideas mentioned in the programming. Very few teachers report observing an increase in discipline problems or a decline in attention span of students as a result of use.

The survey asked about teacher perceptions of instructional television and video (Table 35). Most teachers agree that instructional television and video helps teachers teach more effectively, enables teachers to be more creative in instruction, and can have a positive impact on the quality of American education.

When teachers use instructional television and video in class, a considerable amount of time is spent discussing the subject of a program both before and after a program is shown (Table 36). The median amount of time for discussion is about 10 minutes before the program is shown, and about 15 minutes after the program is shown.

Teachers guides are made available both to schools and districts, as well as directly to teachers (Table 37A). Of teachers surveyed, 34.4 percent report that they do not have teacher guide available. When asked about whether they use teachers guides, most teachers responded that they use them some of the time or most of the time (Table 37B).

Teachers report that they also use a variety of other classroom activities in conjunction with instructional television and video (Table 38). Leading activities include classroom discussion, lectures and presentations, written assignments, and examinations and quizzes.

Teachers were asked about the effectiveness of instructional television and video with various student characteristic groups (Table 39). While many teachers reported no experience with some of the groups, teachers reported that instructional television and video was effective with gifted and talented students, with learning disabled and other mild handicapped students, and with economically disadvantaged students.

PERSONAL USE OF TELEVISION AND VIDEO BY TEACHERS

Finally, teachers were surveyed about their media use at home. Virtually all teachers (99.8 percent) report having a television set at home (Table 40), almost all report having a VCR (93.2 percent), and 25.1 percent report having a video camera.

Teachers report that they use their home media equipment for both personal and school uses (Table 41). On average, teachers used their VCR to record for personal use 4.0 times a month, and for school use 1.4 times a month. Teachers report that they also used their video camera for personal use 3.3 times a month, and for school purposes 1.1 times a month.

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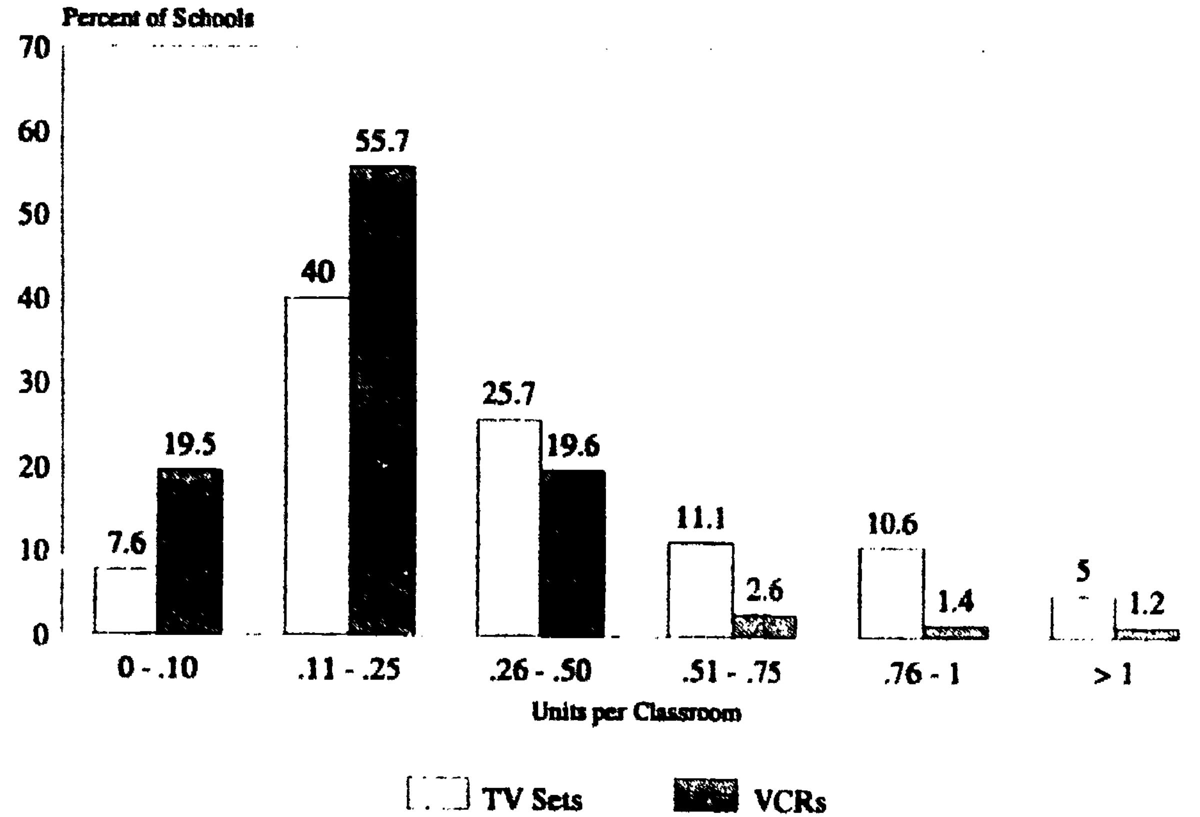
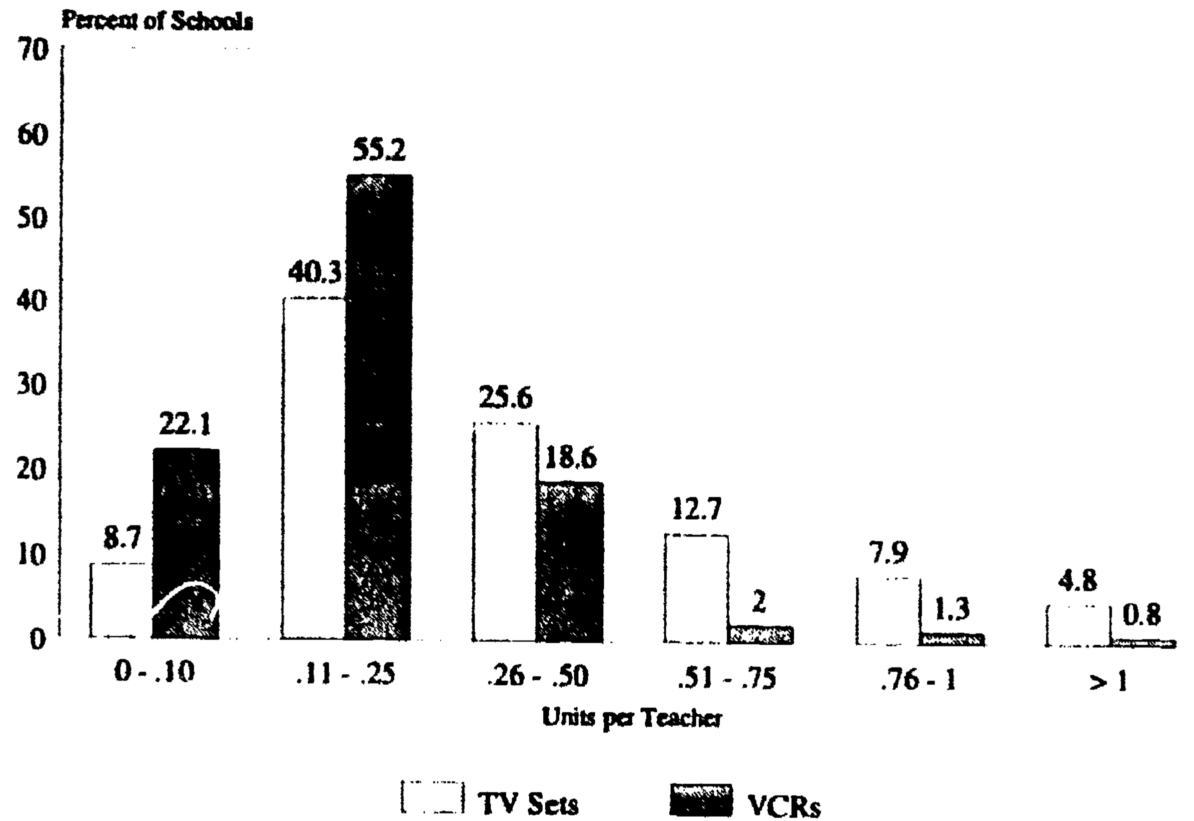
Figure 1-2
Television Sets and Videocassette Recorders per Classroom, as Reported by Principals



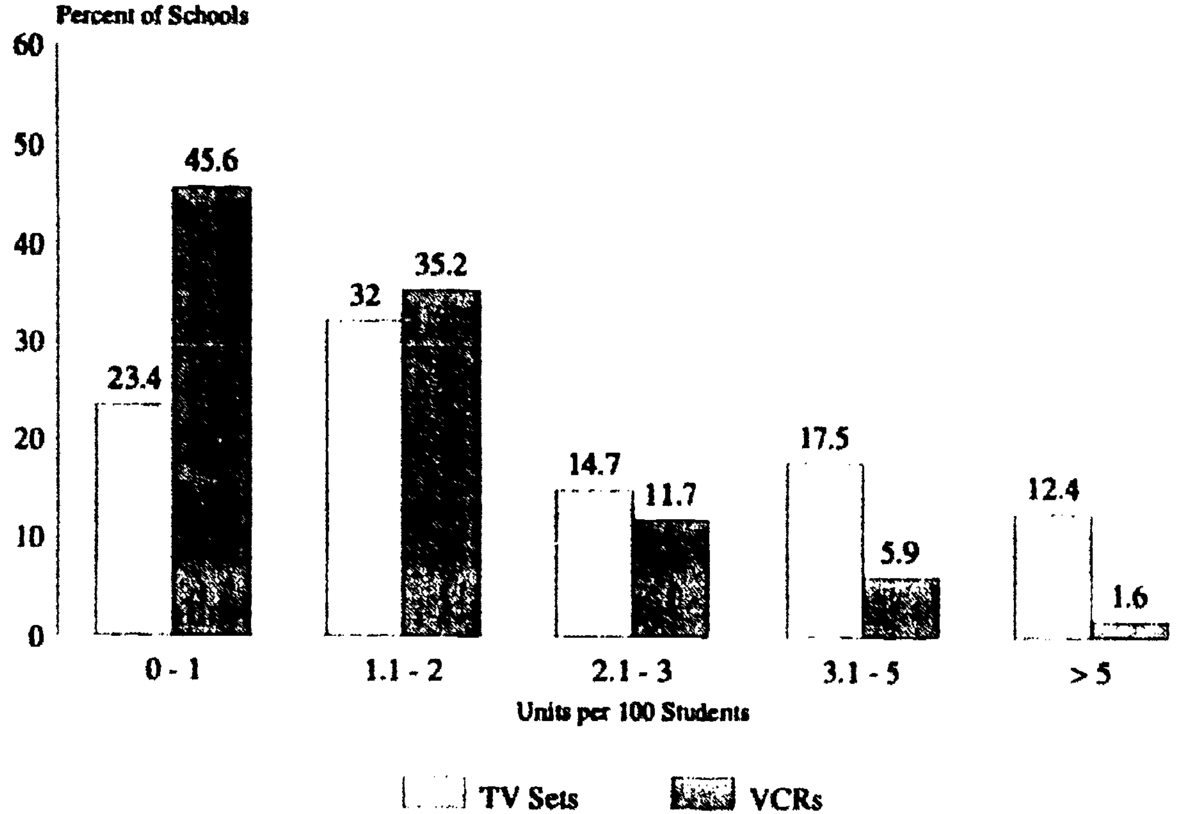
Source: Principal Questionnaire items 10, 12, and 15

Figure 3-4
Television Sets and Videocassette Recorders per Teacher, as Reported by Principals



Source: Principal Questionnaire items 9, 12, and 15

Figure 5-6
Televisi   Sets and Videocassette Recorders per Student, as Reported by Principals



Source: Principal Questionnaire items 5, 12, and 15

Table 7

Location of Television Sets in Schools, as Reported by Principals

Location of Equipment	Percent of Principals
Kept and used in specific classrooms, except for maintenance and repair	46.8
Kept and used in the media center or library	64.6
Rotated among classrooms on request	78.4
Kept and used in large rooms or auditorium	11.8
Other	0.8

Source: Principal Questionnaire item 13

Note: Multiple responses by principals were possible.

Table 8

Availability of Other Instructional Television and Video Equipment and Materials in Schools, as Reported by Principals

Available Equipment/Materials	Percent of Principals
Video camera	82.9
TV studio in school	7.9
Videocassette library in school	78.2
Videocassette library maintained by district	54.2
Videocassette library maintained by state or region	53.0
Videodisc player	19.5
Interactive video system	7.2
None of the above	2.0

Source: Principal Questionnaire item 14

Note: Multiple responses by principals were possible.

Table 9

Sources of Instructional Television and Video, as Reported by Superintendents, Principals, and Teachers

Source of ITV	Percent of Superintendents	Percent of Principals	Percent of Teachers
Direct off-air broadcast from public television	64.2	66.6	49.3
Direct off-air broadcast from commercial television	34.5	52.8	33.1
Cable or fiber system	64.1	64.5	40.4
Videocassette	84.1	89.1	85.8
Satellite system	49.5	17.3	12.5
Videodisc	25.9	13.6	7.9
Instructional television fixed service	18.9	13.5	7.3
Unknown	0.2	0.5	5.3

Source: Superintendent Questionnaire item 6, Principal Questionnaire item 11, Teacher Questionnaire item 9

Note: Multiple responses by sample members were possible.

Table 10

School Access to Cable and Satellite Channels, as Reported by Principals

Cable/Satellite Channel	Percent of Principals
No access to cable or satellite channel	28.1
ABC-TV (ABC)	66.3
Arts and Entertainment (A&E)	29.3
American Movie Classics (AMC)	13.4
Black Entertainment Television (BET)	10.6
Bravo (BRV)	2.6
CBS-TV (CBS)	65.0
Channel 1/Whittle	13.2
Cinemax (MAX)	4.9
Consumer News and Business Channel (CNBC)	9.8
Cable News Network (CNN)	51.9
CNN Headline News	42.3
C-SPAN (CSPAN)	30.2
Disney Channel (DIS)	7.1
Discovery Channel (TDC)	34.5
ESPN (ESPN)	44.5
Family Channel (FAM)	22.9
Fox Broadcasting (FOX)	33.3
Galavision (GALA)	1.5
Home Box Office (HBO)	5.5
Lifetime (LIFE)	26.4
Mind Extension University (MEU)	3.9
NBC-TV (NBC)	60.7
Nickelodeon (NICK)	33.0
Public Broadcasting (PBS)	60.8
Showtime (SHOW)	5.6
TBS Superstation (TBS)	32.1
The Learning Channel (TLC)	16.0
The Movie Channel (TMC)	4.2
Turner Network Television (TNT)	33.3
The Weather Channel (TWC)	37.0
Univision (UNI)	2.5
USA Network (USA)	29.7
Internal school district channels	9.0
Other	8.6

Source: Principal Questionnaire items 18 and 19

Note: Multiple responses by principals were possible.

Table 11

Sources for Instructional Programming on Videocassette, as Reported by Teachers

Source of Programming on Videocassette	Percent of Teachers
No access to VCR	4.4
Requested from collection maintained by state department of education or regional education agency	37.5
Requested from collection maintained by school district	50.5
Requested from collection maintained by library, department, or other office in school	69.5
Purchased from commercial vendor by school or district	31.3
Rented for use from video store	48.8
Recorded at home/from collection maintained home	57.6
Checked-out from public library	30.5
Borrowed from another teacher or friend	55.3
Other	2.7

Source: Teacher Questionnaire items 11 and 12

Note: Multiple responses by teachers were possible.

Table 12

Means by Which Teachers Record Instructional Programming, as Reported by Teachers

Method of Recording Programming	Percent of Teachers
No access to VCR	8.7
Record it at home	65.2
Record it at school	16.2
Request recording be done by other school personnel	47.5
Never wanted to record "off-air"	7.5

Source: Teacher Questionnaire item 13

Note: Multiple responses by teachers were possible.

Table 13

Reasons for Producing Original Television or Video Programs for School Use, as Reported by Principals

Reason for Original Programming	Percent of Principals
Instructional use	45.1
Administrative use	22.6
In-service training	24.8
Production experience for students	56.0
Teacher feedback of own performance	41.7
Student feedback of own performance	63.1
Sports/Extracurricular activities	62.9
School does not produce original programming	51.9

Source: Principal Questionnaire item 17

Note: Multiple responses by principals were possible.

Table 14A

Utilization of Live Televised Instruction (e.g., Teleconferences, Distance Education) in Districts and Classrooms, as Reported by Superintendents and Teachers

	Percent of Superintendents	Percent of Teachers
Use of live televised instruction	21.3	8.9

Source: Superintendent Questionnaire item 14, Teacher Questionnaire item 20

Table 14B

Delivery Systems and Interactive Capabilities for Districts Using Live Televised Instruction, as Reported by Superintendents

Live Televised Instruction Domain	Percent of Superintendents
Delivery System	
Satellite	72.8
Fiber or cable	31.0
Terrestrial microwave	5.1
Unknown	1.0
Interactive Capability	
Voice or Sound	70.9
Video	18.7
Keypad/Keyboard	20.1
None	23.2

Source: Superintendent Questionnaire items 15 and 16

Note: Multiple responses by superintendents were possible.

Table 15

Availability of Persons Responsible for Coordinating
Instructional Television and Video in Districts and Schools,
as Reported by Superintendents and Principals

	Percent of Superintendents	Percent of Principals
ITV Coordinator available	46.6	68.2

Source: Superintendent Questionnaire item 30, Principal Questionnaire item 20

Table 16

Other Responsibilities of Instructional Television and Video Coordinators in Schools with Such Positions, as Reported by Principals

Other Responsibilities	Percent of Principals
No other responsibilities	1.5
Administration	13.2
Teaching	32.5
Library	76.8
Other media	30.7
Other	2.9

Source: Principal Questionnaire item 22

Note: Multiple responses by principals were possible.

Table 17

Services provided by Instruction Television and Video Coordinators in Districts and Schools with Such Positions, as Reported by Superintendents and Principals

Activity of ITV Coordinator	Percent of Superintendents	Percent of Principals
Distributes teachers guides	81.4	81.3
Provides newsletters or other information	59.2	61.5
Calls attention to special program	81.8	84.5
Provides assistance with equipment	89.8	89.9
Provides utilization training/consultation	59.7	55.4
Works with subgroups of students	47.1	63.0
Records programs for teachers	81.4	80.6
Repairs and maintains equipment	50.9	54.4
Maintains videocassette/videodisc libraries	66.0	75.0
Selects ITV programs for purchase	56.7	62.8
Produces ITV materials	37.4	35.0
Distributes surveys on utilization/needs	--	54.3
Coordinates previous/screenings	--	52.2
Other	2.3	1.9

Source: Superintendent Questionnaire item 33, Principal Questionnaire item 23

Note: Multiple responses by superintendents were possible. The two questions not asked of superintendents are represented with dashes.

Table 18

Encouragement of Instructional Television in Districts and Schools, as Reported by Principals and Teachers

Level of Encouragement	Percent of Principals	Percent of Teachers
Strongly encourage use	15.9	6.4
Encourage use but leave to discretion of individual teacher	62.8	44.1
Neither encourage nor discourage use	20.2	47.1
Discourage use but leave to discretion of individual teacher	1.0	2.0
Strongly discourage use	0.1	0.4

Source: Principal Questionnaire item 24, Teacher Questionnaire item 39

Table 19

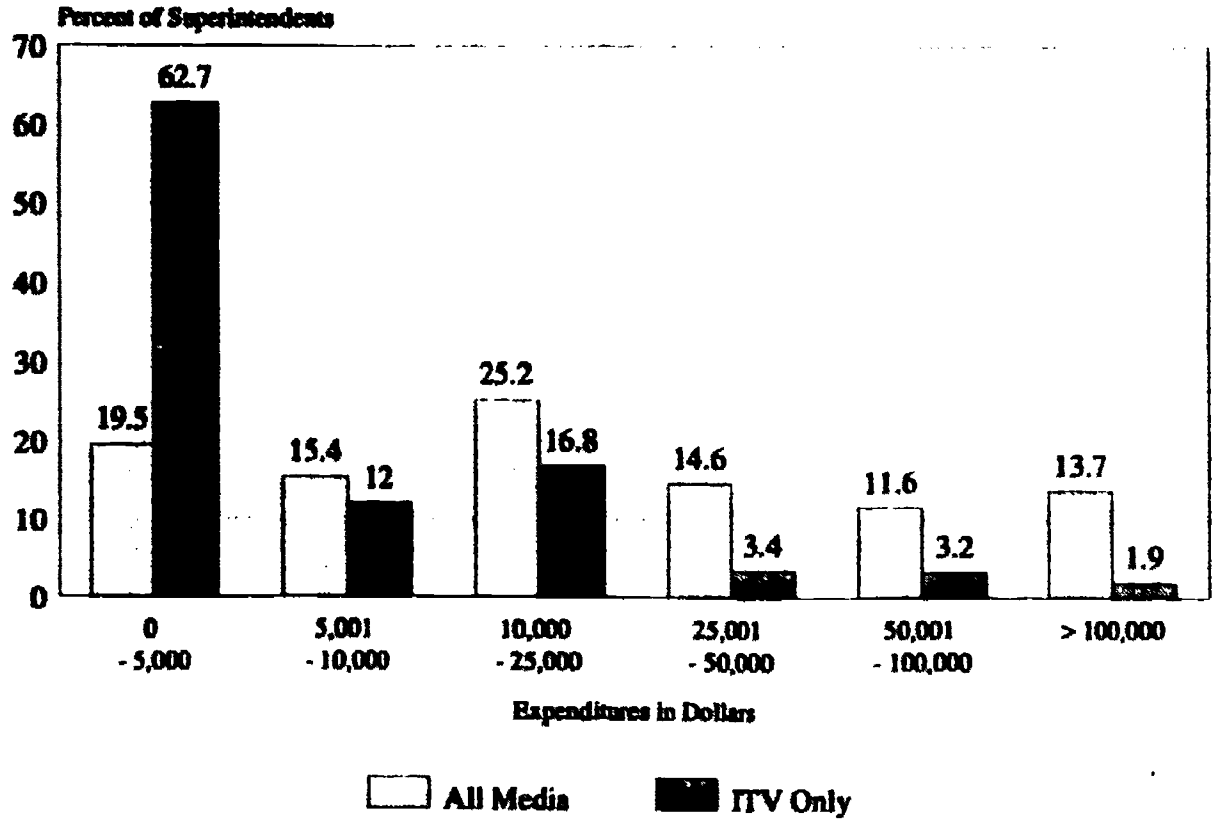
Changes in Financial Support for Instructional Television and Video, as Reported by Superintendents and Principals

Period of Change	Percent of Superintendents	Percent of Principals
Previous Three Years		
Support has increased	47.5	41.0
Support has remained about the same	42.3	42.7
Support has decreased	5.5	10.6
Don't know	4.7	5.6
Next School Year (1991-1992)		
Support will increase	31.1	22.2
Support will remain about the same	45.1	46.9
Support will decrease	13.0	18.6
Don't know	10.8	12.3

Source: Superintendent Questionnaire items 22 and 23, Principal Questionnaire items 32 and 33

Figure 20A

School Year 1990-91 Expenditures for All Instructional Media and for ITV Only, in Districts, as Reported by Superintendents



Source: Principal Questionnaire items 21A and 21B

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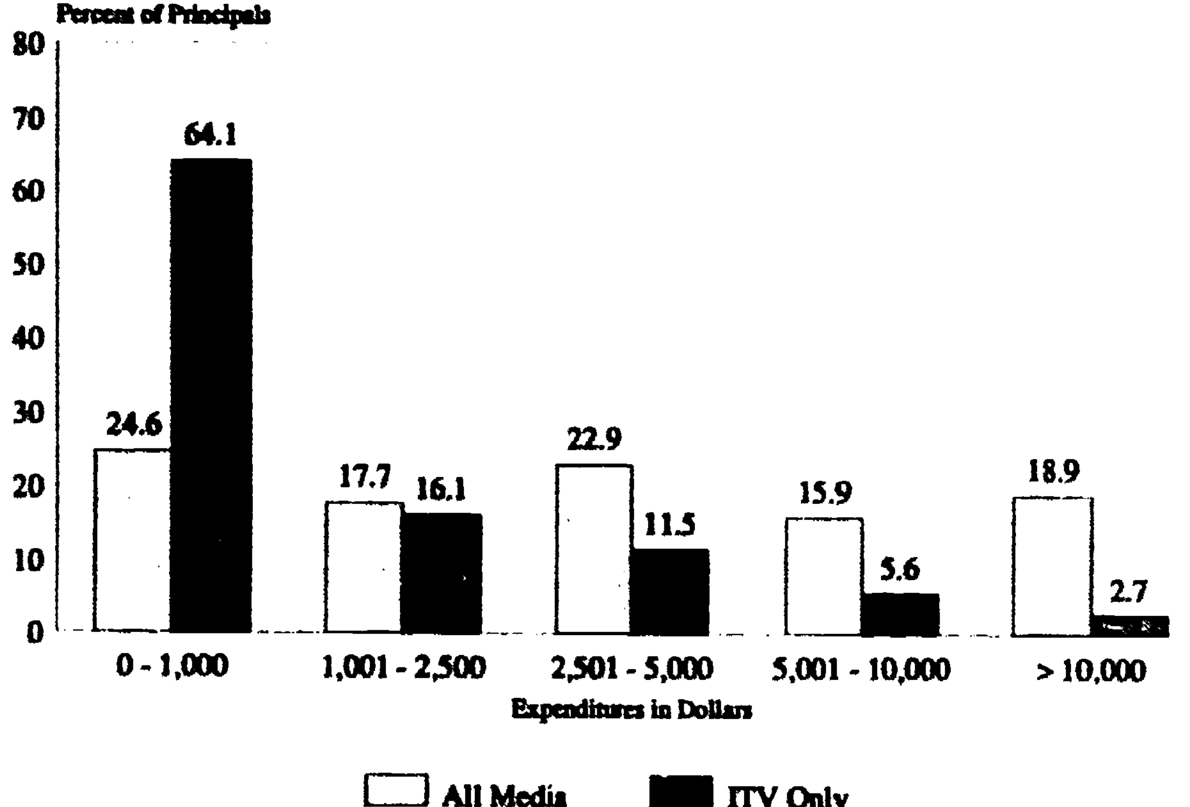
Figure 20B
School Year 1990-91 Expenditures for All Instructional Media and for ITV Only, in Schools, as Reported by Principals



Source: Principal Questionnaire items 21A and 21B

Table 21

Total and Percent Expenditures Nationwide for ITV Equipment for Districts and Schools in School Year 1990-91 by Funding Source, as Reported by Superintendents and Principals

Source of Funds	District: Dollars Nationally	District: Percent of ITV Dollars	School: Dollars Nationally	School: Percent of ITV Dollars
Federal grants funds	10,815,935	7.2	10,414,687	10.4
State grants funds	32,303,884	21.6	20,867,100	20.8
Other district revenues	93,329,282	62.4	57,056,069	56.8
PTA or other community group	4,413,525	3.0	5,607,453	5.6
Corporate Sponsors	4,050,534	2.7	1,601,206	1.6
Other	4,693,405	3.1	4,831,050	4.8
TOTAL	149,606,565	100.0	100,377,566	100.0

Source: Superintendent Questionnaire items 21, 24A-24F, Principal Questionnaire items 31, 34A-34F

Note: Estimates are based on valid responses from 399 districts (64.3% of sample) and 920 schools (50.3% of sample). Thus, the dollars allotted nationally to ITV represent only those districts.

Table 22

Districts Planning to Increase or Expand Instructional Television and Video Equipment or Programming Over the Next Three Years, as Reported by Superintendents

Area of Increase	Percent of Superintendents
Increase the number of TV sets	62.9
Acquire/increase videocassette equipment	69.4
Start videocassette library	35.3
Expand videocassette library	67.9
Acquire/increase videodisc equipment	50.1
Start videodisc library	42.0
Expand videodisc library	31.7
Acquire/increase satellite equipment	39.5
Add connection to Cable TV system	30.4
Add interactive video capability	47.0
Acquire/increase production equipment	38.0
Develop a fiber optic link system	24.1
Acquire/increase large screen projection equipment	34.1

Source: Superintendent Questionnaire item 13

Note: Multiple responses by superintendents were possible.

Table 23

Percentage of Districts in Which In-Service Training on the Use of Instructional Television and Video is Available for Teachers, as Reported by Principals

	Percent of Principals
In-Service training available	46.9

Source: Principal Questionnaire item 25

Table 24

Districts Using Television and/or Video to Deliver In-Service Training or Development, as Reported by Superintendents and Teachers

	Percent of Superintendents	Percent of Teachers
District uses television/video for training/development	77.3	67.5

Source: Superintendent Questionnaire item 29, Teacher Questionnaire item 38

Table 25

Extent of Training in the Instructional Uses of Television and Video, as Reported by Teachers

Period	Percent of Teachers
Ever received training in ITV	25.0
Received training in ITV within last 3 years	11.3

Source: Teacher Questionnaire item 34 and 36

Note: Analysis restricted to teachers with access to ITV.

Table 26

Availability of Television and/or Video for Instructional Purposes, as Reported by Teachers

	Percent of Teachers
Television/Video available	97.1

Source: Teacher Questionnaire item 6

Table 27

Arrangements for Viewing Instructional Television and Video, as Reported by Teachers

Arrangement for Viewing	Percent of Teachers
Class views program with another class or classes	43.1
Entire class views program without other class or classes	92.7
Small group from the class view program	11.7
Individual students are assigned to view programs	5.6
Assigned viewing before/after school	5.3
Encourage viewing before/after school	16.3

Source: Teacher Questionnaire item 7

Note: Multiple responses by teachers were possible. Analyses restricted to teachers with access to ITV.

Table 28

Use of Instructional Television and/or Video During the 1990-91 School Year, as reported by Teachers

	Percent of Teachers
Used ITV	79.4

Source: Teacher Questionnaire item 16

Table 29

Subjects in Which Teachers Used Instructional Television and/or Video during the 1990-1991 School Year, as Reported by Teachers

Substantive Area	Percent of Teachers
Art	11.3
Career/Vocational education	8.3
Computer science	2.5
English	27.5
English as second language	1.5
Foreign language	2.9
Guidance	8.9
Health/Nutrition	26.9
History	29.1
Home economics	1.7
Industrial education	2.6
Library/Information/Research skills	6.4
Math	19.5
Music	10.6
Physical education	4.9
Reading	42.0
Science	44.3
Social sciences	39.6
Special education	3.1
Other	4.0

Source: Teacher Questionnaire item 18

Note: Multiple responses by teachers were possible. Analysis restricted to teachers with access to and using ITV in SY 1990-91.

Table 30

Classroom Use of Instructional Television and/or Video Within the Last Month, as Reported by Teachers

	Percent of Teachers
Used ITV within last month	52.4

Source: Teacher Questionnaire item 23

Table 31

Trends in Teachers' Uses of Instructional Television and/or Video Over the Past Three Years, as Reported by Teachers

Trend in Use	Percent of Teachers
A lot more	8.1
A little more	23.5
About the same	47.4
A little less	12.5
A lot less	8.6

Source: Teacher Questionnaire item 32

Note: Analysis restricted to teachers with access to ITV.

Table 32-33

Difficulties Using Instructional Television and Video Resulting from Equipment and Programming, as Reported by Teachers

	Percent of Teachers Indicating			
Area of Difficulty	Often Difficult	Sometimes Difficult	Seldom Difficult	Never Difficult
Finding out about programs in advance	16.2	40.3	28.1	15.5
Having programs available when needed	20.0	40.9	27.1	12.0
Quality of programs in subject area	15.2	39.6	32.4	12.8
Having equipment available when needed	9.6	27.4	35.2	27.8
Having equipment in good condition	4.8	15.8	43.9	35.5
Structure/length of programs available	7.1	36.4	39.9	16.7
Obtaining titles desired	14.7	45.3	29.0	11.0
Sampling/assessing quality and appropriateness of programs before use	22.6	37.5	26.5	13.4

Source: Teacher Questionnaire items 17A-17H

Note: Analysis restricted to teachers with access to and using ITV in SY 1990-91.

Table 34

Student Outcomes Attributed to Instructional Television and Video, as Reported by Teachers

Student Outcome	Percent of Teachers
Students learn more when ITV used	51.1
Students comprehend and discuss content/ideas presented in ITV	70.6
Discipline problems increase after viewing	3.9
Students use new vocabulary included in ITV	36.1
Students follow up ideas mentioned in ITV	44.2
Enthusiasm about school work in general increases after viewing	39.3
Student attention spans decline after viewing ITV	7.6
Library use increases after ITV	19.7
Students watch more educational TV at home	18.4
ITV are preferred by students over other classroom media	40.6
ITV generates new interest in the topics	72.4
ITV increases student motivation to learn	45.3

Source: Teacher Questionnaire item 31

Note: Multiple responses by teachers were possible. Analysis restricted to teachers with access to ITV.

Table 35

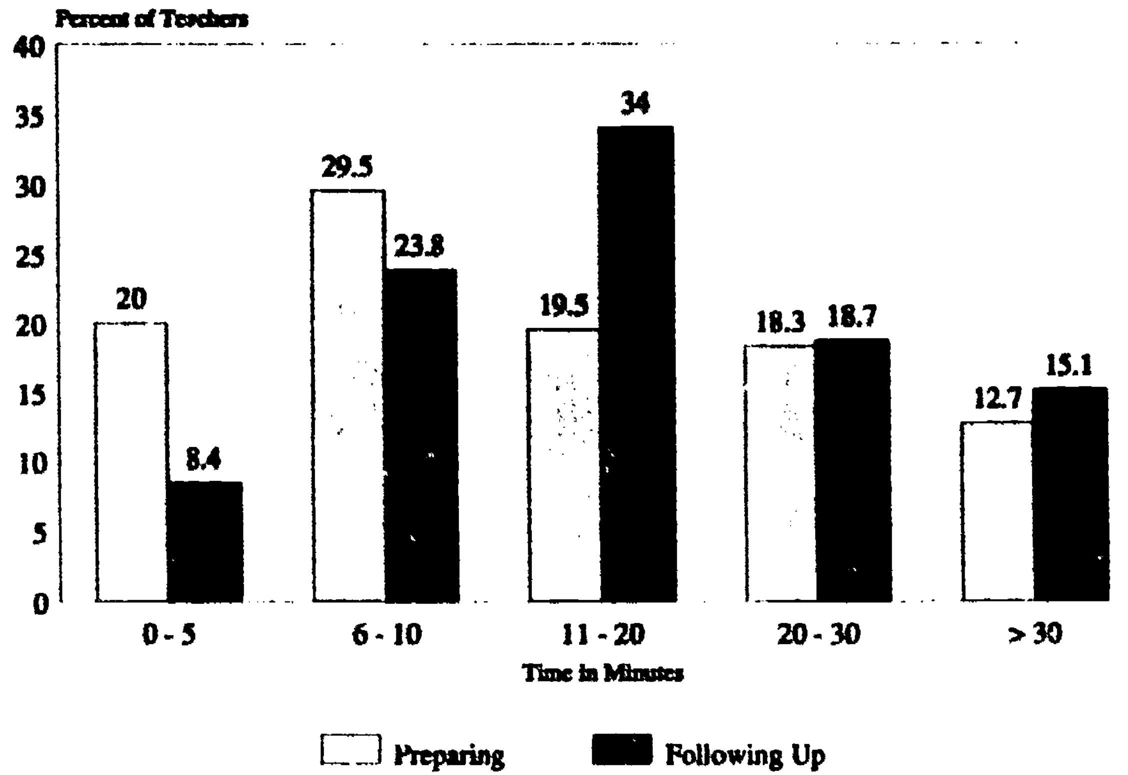
Personal Perceptions about Instructional Television and Video, as Reported by Teachers

	Percent of Teachers Reporting				
Area of Perception	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
TV and video help teachers teach more effectively	21.5	61.9	5.9	1.4	9.4
I want more training in ITV	13.3	43.4	16.8	5.0	21.4
Programming available to me is quite good	6.5	49.9	22.6	7.4	13.6
I do not feel comfortable working with ITV	2.8	11.8	44.6	23.0	17.7
ITV enables teachers to be more creative in their instruction	18.0	62.9	7.8	1.4	10.0
ITV limits instructional time with students	2.6	21.1	54.1	13.3	8.9
Many teachers use ITV just to get a break from teaching	9.2	35.2	31.9	13.2	10.5
ITV can have a positive impact on the quality of American education	28.5	62.8	2.3	0.6	5.8

Source: Teacher Questionnaire item 33

Note: Analysis restricted to teachers with access to ITV.

Figure 36
Time Spent Discussing or Otherwise Preparing for and Following Up on Lessons Using ITV, as Reported by Teachers



Source: Teacher Questionnaire items 25 and 26

Table 37A

Access to Teachers' Guides for Instructional Television and/or Video, as Reported by Teachers

Access to Teachers' Guides	Percent of Teachers
Guides provided to district/school and distributed	49.9
Guides provided directly to teacher	16.8
Guides not available	34.4

Source: Teacher Questionnaire item 26

Note: Multiple responses by teachers were possible. Analysis restricted to teachers with access to and using ITV in SY 1990-91.

Table 37B

Use of Suggestions from Teachers' Guides in Preparing for or Following Up on Programs, as Reported by Teachers

Frequency of Use	Percent of Teachers
Always use	4.4
Use most of the time	26.0
Use some of the time	49.7
Seldom use	14.0
Never use	5.9

Source: Teacher Questionnaire items 26 and 27

Note: Analysis restricted to teachers with access to ITV and Teachers' Guides and using ITV in SY 1990-91.

Table 38

Classroom Activities Used in Conjunction with Instructional Television and Video, as Reported by Teachers

Classroom Activity	Percent of Teachers
Classroom lectures and presentations	62.0
Classroom discussions	85.6
Examinations and quizzes	35.1
Written assignments	51.3
Homework assignments	27.9
Guest speakers and demonstrations	23.5
Field trips	20.7
Laboratory assignments/Field work	14.7
Extra credit	18.3
Don't relate classroom assignments to ITV	8.3

Source: Teacher Questionnaire items 28 and 19

Note: Multiple responses by teachers were possible. Analysis restricted to teachers with access to and using ITV in SY 1990-91.

Table 39

Effectiveness of Instructional Television and Video
with Student Characteristic Groups

		Percent of Teachers Indicating		
Student Characteristic	No Experience/ Unknown	Uneffective	Somewhat Effective	Very Effective
Typical or "average"	9.4	0.7	59.1	30.8
Learning disabled/other mild handicapped	39.8	1.8	30.8	27.6
Moderate/severe handicapped	72.1	3.0	14.2	10.7
Gifted and talented	26.8	1.5	32.3	39.4
Economically disadvantaged	22.6	2.1	43.7	31.6
Limited English proficient	59.8	3.2	22.4	14.6

Source: Teacher Questionnaire item 40

Note: Analysis restricted to teachers with access to ITV.

Table 40

Availability of Television and Video Equipment at Home, as Reported by Teachers

Equipment Availability	Percent of Teachers
Television set	99.8
Videocassette recorder	93.2
Video Camera	25.1

Source: Teacher Questionnaire items 41, 43, and 45

Table 41

Utilization of Video Equipment at Home to Record Programming for Personal or School Use Within the Last Month, as Reported by Teachers

	Mean Times Used	
Equipment Type	Personal Use	School Use
Videocassette recorder	4.0	1.4
Video camera	3.3	1.1

Source: Teacher Questionnaire items 44 and 46

Study of the School Uses of Television and Video

CORPORATION
FOR PUBLIC
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American Association of
School Administrators
(AASA)

American Federation of Teachers
(AFT)

Association for Educational
Communications and Technology
(AECT)

Council of Chief
State School Officers
(CCSSO)

National Association of
Elementary School Principals
(NAESP)

National Association of
Secondary School Principals
(NASSP)

National Education Association
(NEA)

Public Broadcasting Service
(PBS)

February 4, 1991

Dear Superintendent:

In a recent letter we requested your help in a study we are currently conducting to examine the availability, use, and support of instructional television and video in American schools. The enclosed questionnaire is designed to obtain information on such usage within your district. Please complete the questionnaire and return it to us in the enclosed postage-paid envelope as soon as possible.

Your participation in this study provides you with an opportunity to influence curriculum offerings available to classrooms in the future. Since we are requesting information from only a small proportion of the nation's school districts, your response to this questionnaire is extremely important, even if your school district does not use instructional television and video. The accuracy of our findings depends on a high rate of response from all school districts.

Only aggregate data will be reported; individual responses to these questionnaires will be held in strictest confidence.

If you have any questions or concerns regarding this study, I can be reached at 919/541-6538 or toll free at 800/334-8571. Thank you for your cooperation in this important effort.

Sincerely,

Thomas R. Curtin, Ph.D.
Project Director

Conducted by
Research Triangle Institute   P.O. Box 12194   Research Triangle Park, NC 27709-2194

DEFINITIONS

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Instructional Television: Any in-school uses of television programming and equipment for instructional purposes. This programming can include videotapes of movies or programs purchased commercially; recorded commercial, public, or cable television programs; as well as traditional educational television programs available by broadcast or videotape.

Instructional Television Fixed Service (ITFS): Closed-circuit television networks run by educational institutions under Federal Communications Commission licenses. The broadcasts are in a special microwave frequency range designated for educational television outside of the UHF and VHF range. Reception requires special equipment.

Interactive Video: An instructional program (usually operating within a computer and television/video system) designed in segments, in which viewer choices or responses to structured questions influence the sequence, size and shape of the program.

Live Televised Teaching: Instructional television and video involving distance learning, teleconferencing, and/or "camera in the classroom." It is often interactive with hookup through satellite, micro-wave, or fiber optic and phone lines.

Videocassette Recorder (VCR): Any unit designed to retrieve information from cassettes of videotape. Several tape formats are currently used in American schools, including 3/4 inch tapes (U-Matic), 1/2-inch tapes (BETA and VHS formats), and 8mm tapes.

Videodisc Player: Any device that is capable of retrieving information from videodiscs: 8- or 12-inch discs upon which frames of information are stored; thus, producing still or motion pictures.

STATEMENT OF CONFIDENTIALITY

This survey is being conducted by the Research Triangle Institute for the Corporation for Public Broadcasting. It represents the third in a series of School Utilization Studies funded by CPB to determine the extent to which districts, schools, and classrooms in the United States have access to and employ television and video for instructional purposes.

Data from the study are intended for aggregate statistical analysis only. All information which would permit identification of the individual respondent will be held in strict confidence, will be used only by persons engaged in and for the purposes of the survey, and will not be disclosed or released to others for any purposes.

Questions or concerns about confidentiality or any aspect of the study should be directed to:

Dr. Thomas R. Curtin
Research Triangle Institute
P.O. Box 12194-2194
Research Triangle Park, NC 27709
800/334-8571

SECTION A: GENERAL INFORMATION

Please supply the information in this section using school year 1990-1991 figures. This information will be used for our recordkeeping and data analysis purposes only and will not be distributed or appear in any reports.

1. **What is your title?** ______________________________

2. **Circle ALL grades which are taught in your district.** *(If ungraded, circle the nearest grade equivalents.)*

   Pre-K K 1 2 3 4 5 6 7 8 9 10 11 12

3. **What was the total Average Daily Attendance (ADA) in your district on or about October 1, 1990?** *(Half-day nursery school or kindergarten attendance should be counted as half-time for determining ADA. Please round your count to the nearest whole number.)*

   ________ ADA

4. **What will be the total current (1990-1991 School Year) operating expenditures for your district, excluding capital outlay?** *(Include administration, instruction, attendance and health services, operation and maintenance of physical plant, and fixed charges. Exclude capital expenditures and debt service.) Round your estimates to the nearest dollar.*

   $______________ District operating expenditures

5. **Which of the following best describes the area served by this school district?**

(Circle only one)

1. Urban area (Population of 100,000 or more)
2. Urban area (Population of less than 100,000)
3. Suburban area
4. Small town
5. Rural area
6. Other *(Please specify)*______________________

SECTION B: INSTRUCTIONAL TELEVISION AND VIDEO

6. **How are instructional television and/or video available in schools in your district?**

(Circle all that apply)

1. Direct off-air broadcast (i.e., signals received as they are aired) from public television
2. Direct off-air broadcast from commercial television
3. Cable or fiber system
4. Videocassette
5. Satellite system
6. Videodisc
7. ITFS (Instructional Television Fixed Service)
8. Don't know

7. How many television sets that are used for instructional purposes are there in your district which are owned by the district (or state)?

(If none, please enter zero)

__________ TV sets

8. How many videocassette recorders (VCRs) that are used for instructional purposes are there in your district which are owned by the district (or state)?

(If none, please enter zero)

__________ Videocassette recorders

9. How many videodisc players that are used for instructional purposes are there in your district which are owned by the district (or state)?

(If none, please enter zero)

__________ Videodisc players

10. Does your school system have a systematic process (e.g., replacement schedule, written procedures) for replacing old instructional television and video equipment?

(Circle one)

1. Yes
2. No

11. For each type of school listed below, please indicate the number of schools in your district (Column 1). In columns 2-5, please indicate the numbers of these schools possessing at least one: TV set (Column 2), videocassette recorder (Column 3), video camera (Column 4), and videodisc player (Column 5) for instructional use.

(Please complete all spaces as appropriate. If none, please enter zero)

	1 Number of Schools	2 Schools with TV Sets	3 Schools with VCRs	4 Schools with Video cameras	5 Schools with Videodisc
a. Elementary Schools	______	______	______	______	______
b. Middle/Junior High Schools	______	______	______	______	______
c. High Schools	______	______	______	______	______
d. Other Schools (e.g., Vocational/Alternative)	______	______	______	______	______
TOTALS	______	______	______	______	______

12. Does your district produce any of its own television or video programming?

(Circle all that apply)

1. No
2. Yes, for instructional use
3. Yes, for administrative use
4. Yes, for in-service training
5. Yes, for production experience for students
6. Yes, for teacher feedback of own performance
7. Yes, for student feedback of own performance
8. Yes, for sports/extracurricular activities

13. Please specify in Column 1 if you <u>have done</u> any of the following. In Column 2, indicate if you <u>plan</u> to do any of the following.

(Circle all that apply in each column)

	1 Achieved During Past 3 Years	2 Planned for Next 3 Years
a. Increase the number of TV sets	1	1
b. Acquire/increase videocassette equipment	2	2
c. Start videocassette library	3	3
d. Expand videocassette library	4	4
e. Acquire/increase videodisc equipment	5	5
f. Start videodisc library	6	6
g. Expand videodisc library	7	7
h. Acquire/increase satellite receiving antenna and equipment	8	8
i. Add connection to Cable TV system	9	9
j. Add interactive video capability	10	10
k. Acquire/increase production equipment	11	11
l. Develop a fiber optic link system	12	2
m. Acquire/increase large screen projection equipment	13	13

14. Does your school district use any live televised instruction (e.g., teleconferences, distance education programs) to offer single classes or courses to students when qualified teachers are not readily available to teach in person?

(Circle one)

1. Yes
2. No → *Skip to Question 17*

15. How is the live televised instruction delivered?

(Circle all that apply)

1. Satellite
2. Fiber or cable
3. Terrestrial microwave
4. Unknown

16. Does your live televised instruction have interactive capability?

(Circle all that apply)

1. Yes, voice or sound
2. Yes, video
3. Yes, keypad/keyboard
4. No interactive capability

17. Does your district have or participate in one or more Instructional Television Advisory Boards or similar bodies?

(Circle one)

1. Yes
2. No

18. Does your district have a formal plan or policy regarding the acquisition and/or use of programming or materials for instructional television and video?

(Circle one)

1. Yes *(Please attach a photocopy or description)*
2. No ——→ *Skip to Question 21*

19. Who participates in developing these plans and policies for programming and material acquisition and/or use?

(Circle all that apply in both columns)

1. District superintendent
2. District ITV supervisor
3. School board members
4. Building principals
5. Teachers
6. Counseling/Guidance/Psychology staff
7. Parents
8. Students
9. Community organizations
10. Local television station
11. Regional or state education agencies
12. Other *(Please specify)*________________

20. Which of the following factors determine which instructional television and video programs and related materials are approved for use in the school or classroom?

(Circle all that apply)

1. Cost of purchase/lease
2. Visual production quality
3. Audio production quality
4. Quantity of instructional content
5. Quality of instructional content
6. Task and age appropriateness of material
7. Suitability for special populations
8. Durability
9. Correlation/integration with curriculum

SECTION C: SUPPORT FOR INSTRUCTIONAL MEDIA

21. What will be the total current (1990-1991 school year) expenditures for all instructional media (i.e., television, video, audio/radio, computers, films, filmstrips, slides, etc.) in your district?

(If none, please enter zero. If exact figures are not available, please provide your best estimate.)

a. $____________ Total Media expenditures (excluding textbooks)

b. $____________ Expenditures allocated for instructional television and video only

22. How has district per capita financial support for instructional television and video changed over the past three years?

(Circle one)

1. Support has increased
2. Support has remained about the same
3. Support has decreased
4. Don't know

23. What will the district per capita financial support for instructional television and video be in the next school year (1991-1992)?

(Circle one)

1. Support will increase
2. Support will remain about the same
3. Support will decrease
4. Don't know

24. Funds for instructional television and video equipment tend to come from the following sources. Please estimate for your district approximately what percentage currently (1990-1991 school year) comes from each agency.

(If none, please enter zero in the appropriate spaces)

a. Federal grant funds .... ______%
b. State grant funds .... ______%
c. Other school district revenues .... ______%
d. PTA or other community group .... ______%
e. Corporate donors .... ______%
f. Other *(please specify)* ____________ .... ______%
TOTAL .... 100 %

25. Funds for instructional television and video programming and materials tend to come from the following sources. Please estimate for your district approximately what percentage currently (1990-1991 school year) comes from each agency.

(If none, please enter zero in the appropriate spaces)

a. Federal grant funds .... ______%
b. State grant funds .... ______%
c. Other school district revenues .... ______%
d. PTA or other community group .... ______%
e. Corporate donors .... ______%
f. Other *(please specify)* ______________ .... ______%
TOTAL .... 100 %

26. Which of the following are considered in decisions about how to allocate district funds for instructional television and video in the 1990-1991 school year?

(Circle all that apply)

1. Consultation with instructional staff
2. Consultation with administrative staff
3. Consultation with parents/community leaders
4. Consultation with school board
5. District guidelines
6. State guidelines
7. Federal guidelines
8. Educational and professional literature
9. Budgetary considerations
10. Formal needs assessment
11. Other *(Please specify)* ______________

27. Are in-service workshops on the use of instructional television available to the teachers in your district?

(Circle one)

1. Yes
2. No → *Skip to Question 29*

28. From which agency do the personnel who usually conduct these workshops come?

(Circle all that apply)

1. State department of education
2. School district
3. School building
4. Public television station or network
5. University or college
6. Other *(Please specify)* ______________
7. Don't know

29. Does your school district use television and/or video to deliver in-service training or development on any topic?

(Circle one)

1. Yes
2. No

30. Is there someone in your district who has district-wide responsibility for instructional television and video?

(Circle one)

1. Yes
2. No ——► *Skip to Question 34*

31. Approximately what percentage of that person's time is devoted to instructional television and video?

________%

32. How many other full-time positions are on the district-wide instructional television and video staff? *(Please report staff members in full-time equivalencies.) An FTE is the amount of time actually spent on a job divided by the amount of time normally considered full-time for that job. For example, a clerk who works half-time on instructional television and video would be .5 FTE.)*

_______ FTE positions

33. What types of services are provided by the instructional television and video coordinator and instructional television and video staff?

(Circle all that apply)

1. Distributes teacher guides
2. Provides newsletters or other information
3. Calls attention to special programs
4. Provides assistance with equipment
5. Provides utilization training/consultation
6. Works with subgroups of students
7. Records programs for teachers
8. Repairs and maintains equipment
9. Maintains videocassettes/videodisc libraries
10. Selects instructional television and video programs for purchase
11. Produces/assists with production of instructional television and video materials
12. Other *(Please specify)*________________________________

34. Please supply the information requested below. This information will be used only if we should need to recontact you about the questionnaire.

a. Name of individual completing questionnaire: ____________________

b. Telephone number: (_____) _____-__________

c. What is the best time to contact you? ____________________

Thank you very much for taking the time to fill out this questionnaire.

Please return this questionnaire in the envelope provided or mail to:

School Uses of Television and Video Study
Research Triangle Institute
Attn: Jennifer McNeill (4857-03)
PO Box 12194
Research Triangle Park, NC 27709-2194

If you would like to receive a summary report of the findings of this study, please provide your name and complete address.

Name: ____________________

Address: ____________________

____

CORPORATION FOR PUBLIC BROADCASTING

901 E Street N.W.
Washington, D.C 20004-2006

The Corporation for Public Broadcasting (CPB) was established as a result of the Public Broadcasting Act of 1967 to promote the development of a diversified public television and radio service for all of the American people.

The Corporation, neither an agency nor an institution of the Federal Government, was created as a free-standing, private, non-profit corporation to insure its independence as the public's representative in public broadcasting.

Its authority to act in the public interest stems from the 1967 legislation. Among CPB's responsibilities:

- Supporting public radio and television stations with direct grants to help meet operating and programming costs;
- Providing funds for the production and acquisition of innovative and high-quality programs for national distribution;
- Safeguarding the independence of local licensees and the freedom of expression within a decentralized public broadcasting community,
- Acting as the trustee for the funds appropriated by the Congress or contributed to CPB by other sources;
- Advancing the technology and application of delivery systems;
- Conducting research in matters relating to non-commercial educational television.

The Study of the School Uses of Television and Video is being conducted by the Research Triangle Institute for the Corporation for Public Broadcasting. All correspondence or other communication regarding this survey and other aspects of the study should be directed to:

Dr. Thomas R Curtin
Research Triangle Institute
PO Box 12194
Research Triangle Park, NC 27709-2194

800/334-8571 or 919/541-6538.

CORPORATION FOR PUBLIC BROADCASTING

Study of the School Uses of Television and Video

SUPERINTENDENT QUESTIONNAIRE

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Study of the School Uses of Television and Video

CORPORATION
FOR PUBLIC
BROADCASTING

February 4, 1991

Endorsed by

American Association of School Administrators (AASA)

American Federation of Teachers (AFT)

Association for Educational Communications and Technology (AECT)

Council of Chief State School Officers (CCSSO)

National Association of Elementary School Principals (NAESP)

National Association of Secondary School Principals (NASSP)

National Education Association (NEA)

Public Broadcasting Service (PBS)

Dear Principal:

Enclosed is the packet of materials that we mentioned in our previous letter requesting your participation in the Study of the School Uses of Television and Video. These materials include:

- Three questionnaires seeking information on the availability and use of television and video in your school. The attached Principal Questionnaire is for you to complete, and should take less than 30 minutes to finish. Please feel free to pass this instrument on to others in your school (e.g., an assistant principal or media specialist) to complete. Teacher Questionnaires are included for two of your teachers.
- Instructions (green sheet) for randomly selecting and recording the names of two classroom teachers who are to be given the teacher questionnaires.
- A postage-paid return postcard on which names of the selected teachers as well as the total number of full-time teachers in your school are to be recorded.
- Separate postage-paid return envelopes for each of the three questionnaires.

Please select the teachers, distribute the questionnaires, and return the teacher identification post card to us as soon as possible.

Your participation in this study provides you with an opportunity to influence curriculum offerings available to your classrooms in the future. Since we are requesting information from only a small proportion of the nation's schools, your response to this questionnaire is extremely important, even if your school does not use instructional television and video. Further, your response is important because information is also being requested from your district superintendent, and your questionnaire will supplement that information. The accuracy of our findings depends on a high rate of response from all schools and districts.

Only aggregate data will be reported, individual responses to these questionnaires will be held in strictest confidence.

If this package is not complete or if you have any questions or concerns, I can be reached at 919/541-6538 or toll free at 800/334-8571. Thank you for your cooperation in this important effort.

Sincerely,

Th Curtin

Thomas R. Curtin, Ph.D.
Project Director

Conducted by
Research Triangle Institute P.O. Box 12194 Research Triangle Park, NC 27709-2194

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Dr. Thomas R. Curtin
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709-2194

800/334-8571

SECTION A: GENERAL INFORMATION

Please supply the information in this section using school year 1990-1991 figures. This information will be used for our recordkeeping and data analysis purposes only and will not be distributed or appear in any reports.

1. **What is your title?** ______________________

2. **How many years (including this year) have you been employed as an educational professional (e.g., teacher, counselor, or administrator) in any public or private school?**

   __________ Years

3. **How many years (including this year) have you been employed in your current position?**

   __________ Years

4. **Circle ALL grades which are taught in your school.** *(If ungraded, circle the nearest grade equivalents.)*

   Pre-K K 1 2 3 4 5 6 7 8 9 10 11 12

5. **What was the total Average Daily Attendance (ADA) in your school on or about October 1, 1990?** *(Half-day nursery school or kindergarten attendance should be counted as half-time for determining ADA. Please round to the nearest whole number.)*

   __________ ADA

6. **Please estimate the percentage of your students who come from families in the following categories.**

(If none, please enter zeros)

   a. Lower income (Under $12,000/year) .... ________%
   b. Lower-Middle income ($12,000 - $32,000/year) .... ________%
   c. Upper-Middle income ($32,000-$60,000/year) .... ________%
   d. Upper income (Over $60,000/year) .... ________%
   TOTAL .... 100 %

7. **Is this school qualified to receive ESEA Chapter 1 funds?**

(Circle One)

   1. Yes
   2. No

8. Approximately what percentage of the students in your school are in each of the following racial/ethnic categories?

(If none, please enter zeros)

a. American Indian or Alaskan Native . . . . ________%
b. Asian or Pacific Islander . . . . ________%
c. Black, not of Hispanic origin . . . . ________%
d. Hispanic . . . . ________%
e. White, not of Hispanic origin . . . . ________%
TOTAL . . . . 100 %

9. How many teachers or instructional specialists are there in your school? DO NOT INCLUDE aides or non-teaching specialists such as guidance counselors or nurses in your calculations.

(If none, please enter zeros)

a. __________ Full-time teachers
b. __________ Part-time teachers

10. How many classrooms, laboratories, and other instructional spaces (e.g., band rooms, gym areas) are contained in your school?

__________ Instructional spaces

SECTION B: INSTRUCTIONAL TELEVISION AND VIDEO

11. How are instructional television and/or video available in your school building?

(Circle all that apply)

1. Direct off-air broadcast (i.e., signals received as they are aired) from public television
2. Direct off-air broadcast from commercial television
3. Cable or fiber system
4. Videocassette
5. Satellite system
6. Videodisc
7. ITFS (Instructional Television Fixed Service)
8. Don't know

12. How many television sets that are used for instructional purposes are there in your school which are owned by the school (or district or state)?

(If none, please enter zero)

a. Number of black and white sets .... ______

b. Number of color sets (under 45 inches) .... ______

c. Number of projection and large screen sets .... ______

TOTAL SETS .... ______

13. Describe the location of TV sets in your school?

(Circle all that apply)

1. Kept and used in specific classrooms, except for maintenance and repair
2. Kept and used in the media center or library
3. Rotated among classrooms on request
4. Kept and used in large rooms or auditorium
5. Other *(Please specify)* ______________________________

14. Which of the following are available in your school?

(Circle all that apply)

1. Video camera
2. TV studio in the school
3. Videocassette library in the school
4. Videocassette library maintained elsewhere by the district
5. Videocassette library maintained elsewhere by state or regional education agency
6. Videodisc player
7. Interactive video system
8. None of the above

15. How many videocassette recorders (VCRs) are available for instructional purposes in your school?

(If none, enter zero)

__________ Videocassette recorders

16. How many videodisc players are available for instructional purposes in your school?

(If none, enter zero)

__________ Videodisc players

17. Does your school produce any original television or video programs for school use?

(Circle all that apply)

1. No
2. Yes, for instructional use
3. Yes, for administrative use
4. Yes, for in-service training
5. Yes, for production experience for students
6. Yes, for teacher feedback of own performance
7. Yes, for student feedback of own performance
8. Yes, for sports/extracurricular activities

18. Does your school have access to cable television programming? *(Include any internal school or district cable channels)*

(Circle one)

1. Yes
2. No → *Skip to Question 20*

19. Please circle the names of the cable or satellite channels to which your school has access in the 1990-1991 school year.

(Circle all that apply)

a. ABC-TV (ABC)
b. Arts and Entertainment (A&E)
c. American Movie Classics (AMC)
d. Black Entertainment Television (BET)
e. Bravo (BRV)
f. CBS-TV (CBS)
g. Channel 1/Whittle
h. Cinemax (MAX)
i. Consumer News and Business Channel (CNBC)
j. Cable News Network (CNN)
k. CNN Headline News (CNNH)
l. C-SPAN (CSPAN)
m. Disney Channel (DIS)
n. Discovery Channel (TDC)
o. ESPN (ESPN)
p. Family Channel (FAM)
q. Fox Broadcasting (FOX)
r. Galavision (GALA)
s. Home Box Office (HBO)
t. Lifetime (LIFE)
u. Mind Extension University (MEU)
v. NBC-TV (NBC)
w. Nickelodeon (NICK)
x. Public Broadcasting (PBS)
y. Showtime (SHOW)
z. TBS Superstation (TBS)
aa. The Learning Channel (TLC)
bb. The Movie Channel (TMC)
cc. Turner Network Television (TNT)
dd. The Weather Channel (TWC)
ee. Univision (UNI)
ff. USA Network (USA)
gg. Internal school district channels (Channel developed for internal distribution by district)
hh. Other *(Please specify)* ______________________
____

SECTION C: SUPPORT FOR INSTRUCTIONAL MEDIA

20. Is there a person in your school building responsible for coordinating instructional television and video?

(Circle one)

1 Yes
2 No → *Skip to Question 24*

21. Does this coordinator for instructional television and video have specific training in media?

(Circle one)

1. Yes
2. No

22. What other responsibilities does this person have?

(Circle all that apply)

1 None
2. Administrative
3. Teaching
4. Library
5 Other instructional media
6. Other responsibility *(Please specify)* ______________________

23. What types of services are provided by the ITV coordinator?

(Circle all that apply)

1 Distributes teacher guides
2. Provides newsletters or other information
3 Calls attention to special programs
4 Provides assistance with equipment
5 Provides utilization training/consultation
6 Works with subgroups of students
7. Records programs for teachers
8 Repairs and maintains equipment
9 Maintains videocassette/videodisc libraries
10 Selects instructional television and video programs for purchase
11 Produces/assists with production of instructional television and video materials
12 Distributes surveys on utilization and/or needs assessments
13 Coordinates previews/screenings
14 Other *(Please specify)* ______________________

24. Generally speaking, which best describes the district practice regarding the use of instructional television?

(Circle one)

1. Strongly encourage use
2. Encourage use but leave to discretion of individual schools and teachers
3. Neither encourage nor discourage use
4. Discourage use but leave to discretion of individual schools and teachers
5. Strongly discourage use

25. Does your district make available to your teachers in-service workshops on the use of instructional television and video?

(Circle one)

1. Yes
2. No

26. Have you personally ever had training in the instructional uses of television and video?

(Circle one)

1. Yes
2. No ——→ *Skip to Question 31*

27. How was the training conducted?

(Circle all that apply)

1. Pre-service (during undergraduate or certificate training)
2. Graduate or continuing education
3. District in-service
4. Inservice by local public TV station
5. State Department of Education in-service
6. Workshop at professional meetings
7. Instructional Television Agency/Consortium in-service
8. Self-taught

28. Have you received training in the instructional use of television and video <u>within the last 3 years</u>?

(Circle one)

1. Yes ——→ *Continue with Question 29*
2. No ——→ *Skip to Question 31*

29. Within the last 3 years, which of the following have been included as topics in these in-service workshops on instructional television and video?

(Circle all that apply)

1. Selecting/ordering materials
2. Equipment operations
3. District/School access and use policies
4. Evaluation of media
5. Class preparation involving instructional television and video
6. Utilization and curriculum coordination/integration
7. Copyright protection
8. Other *(Please specify)* ______________________________

30. From which agency do the personnel who conduct these workshops come?

(Circle all that apply)

1. State department of education
2. School district
3. School building
4. Public television station or network
5. University or college
6. Other *(Please specify)* ______________________________
7. Don't know

31. What will be the total current (1990-1991 school year) expenditures for all instructional media (i.e., television, video, audio/radio, computers, films, filmstrips, slides, etc.) in your school?

(If none, please enter zero. If exact figures are not available, please provide your best estimate.)

a. $____________ Total media expenditures (excluding textbooks)

b. $____________ Expenditures allocated for instructional television and video only

32. How has the financial support for instructional television and video in your school changed <u>over the past three years</u>?

(Circle one)

1. Support has increased
2. Support has remained about the same
3. Support has decreased
4. Don't know

33. **What will the financial support for instructional television and video be in the next school year (1991-1992) in your school?**

(Circle one)

1. Support will increase
2. Support will remain about the same
3. Support will decrease
4. Don't know

34. **Funds for instructional television and video equipment tend to come from the following agencies. For your school building, please estimate for the current (1990-1991) school year what percentage comes from each agency.**

(If none, please enter zero in the appropriate spaces)

a. Federal grant funds .... ____%
b. State grant funds .... ____%
c. Other school district revenues .... ____%
d. PTA or other community group .... ____%
e. Corporate sponsors .... ____%
f. Other *(please specify)* ____________ ____%

TOTAL 100%

35. **Funds for instructional television and video programming and materials tend to come from the following agencies. For your school building, please estimate for the current (1990-1991) school year what percentage comes from each agency.**

(If none, please enter zero in the appropriate spaces)

a. Federal grant funds .... ____%
b. State grant funds .... ____%
c. Other school district revenues .... ____%
d. PTA or other community group .... ____%
e. Corporate sponsors .... ____%
f. Other *(please specify)* ____________ ____%

TOTAL 100%

36. Please supply the information requested below. This information will be used only if we should need to recontact you about the questionnaire.

a. Name of individual completing questionnaire: ______________________

b. Telephone number: (____) ____ - ________

c. What is the best time to contact you? ______________________

Thank you very much for taking the time to fill out this questionnaire.

Please return this questionnaire in the envelope provided or mail to:

School Uses of Television and Video Study
Research Triangle Institute
Attn: Jennifer McNeill (4857-03)
PO Box 12194
Research Triangle Park, NC 27709-2194

If you would like to receive a summary report of the findings of this study, please provide your name and complete address.

Name: ______________________

Address: ______________________

____

CORPORATION FOR PUBLIC BROADCASTING

901 E Street N.W.
Washington, D.C. 20004-2006

The Corporation for Public Broadcasting (CPB) was established as a result of the Public Broadcasting Act of 1967 to promote the development of a diversified public television and radio service for all of the American people.

The Corporation, neither an agency nor an institution of the Federal Government, was created as a free-standing, private, non-profit corporation to i. sure its independence as the public's representative in public broadcasting.

Its authority to act in the public interest stems from the 1967 legislation. Among CPB's responsibilities

- Supporting public radio and television stations with direct grants to help meet operating and programming costs.
- Providing funds for the production and acquisition of innovative and high-quality programs for national distribution;
- Safeguarding the independence of local licensees and the freedom of expression within a decentralized public broadcasting community;
- Acting as the trustee for the funds appropriated by the Congress or contributed to CPB by other sources;
- Advancing the technology and application of delivery systems;
- Conducting research in matters relating to non-commercial educational television

The Study of the School Uses of Television and Video is being conducted by the Research Triangle Institute for the Corporation for Public Broadcasting. All correspondence or other communication regarding this survey and other aspects of the study should be directed to

Dr. Thomas R. Curtin
Research Triangle Institute
PO Box 12194
Research Triangle Park, NC 27709-2194

800/334-8571 or 919/541-6538.

CORPORATION FOR PUBLIC BROADCASTING

Study of the School Uses of Television and Video

PRINCIPAL QUESTIONNAIRE

Study of the School Uses of Television and Video

CORPORATION FOR PUBLIC BROADCASTING

Endorsed by

American Association of School Administrators (AASA)

American Federation of Teachers (AFT)

Association for Educational Communications and Technology (AECT)

Council of Chief State School Officers (CCSSO)

National Association of Elementary School Principals (NAESP)

National Association of Secondary School Principals (NASSP)

National Education Association (NEA)

Public Broadcasting Service (PBS)

February 4, 1991

Dear Teacher:

In 1977 and 1983, the Corporation for Public Broadcasting (CPB) sponsored national studies of the use of television for instruction in American schools. These studies, the first of their kind to be conducted on a national scale in the United States, yielded information of great importance to educators, broadcasters, and the general public.

Eight years have passed since the last study, years marked by significant changes in student enrollment, funding for instructional materials, cost and availability of television and video equipment, and the variety of programming available for classroom use. To investigate these issues, CPB is sponsoring another study to update the previous research into the availability, utilization, and support of instructional television and video.

Your district superintendent and building principal have been notified of this broadly endorsed study and will receive similar questionnaires. Further, your Principal selected you and one other teacher according to a process which we have supplied. Please help our current effort by completing the enclosed questionnaire (it should take about 30 minutes) and returning it to us as soon as possible in the provided postage-paid envelope.

Your participation in this important study will be of great assistance to us and will provide you with an opportunity to influence curriculum offerings available to your classroom in the future. Since we are requesting information from only a small proportion of the nation's teachers, your response to this questionnaire is extremely important, even if you do not use instructional television or video. The accuracy of our findings depends on a high rate of response from our teachers.

Only aggregate data will be reported, individual responses to the study questionnaire will be held in strictest confidence.

If you have any questions or concerns, please do not hesitate to contact me. I can be reached at 919/541-6538 or toll free at 800/334-8571

Thank you for your cooperation in this important effort.

Sincerely,

TR Curtin

Thomas R. Curtin, Ph D.
Project Director

Conducted by
Research Triangle Institute   PO Box 12194   Research Triangle Park, NC 27709 2194

DEFINITIONS

Throughout this questionnaire several terms are used repeatedly. For consistancy in interpretation and ease in questionnaire completion, we have included their definitions below.

Cab'e Television: For the purposes of this study, consider cable television to involve only those schools connected to commercial or educational agencies' cable television systems. Connection to cable systems at home should be considered only with respect to programs that are recorded at home for instructional use at school.

Instructional Television: Any in-school uses of television programming and equipment for instructional purposes. This programming can include videotapes of movies or programs purchased commercially, recorded commercial, public, or cable television , rograms; as well as traditional educational television programs available by broadcast or videotape.

Instructional Television Fixed Service (ITFS): Closed-circuit television networks run by educational institutions under Federal Communications Commission licenses. The broadcasts are in a special microwave frequency range designated for educational television outside of the UHF and VHF range Reception requires special equipment.

Interactive Video: An instructional program (usually operating within a computer and television/video system) designed in segments, in which viewer choices or responses to structured questions influence the sequence, size and shape of the program.

Live Televised Teaching: Instructional television and video involving distance learning, teleconferencing, and/or "camera in the classroom." It is often interactive with hookup through satellite, micro-wave, or fiber optic and phone lines.

Videocassette Recorder (VCR): Any unit designed to retrieve information from cassettes of videotape Several tape formats are currently used in American schools, including 3/4 inch tapes (U-Matic), 1/2-inch tapes (BETA and VHS formats), and 8mm tapes.

Videodisc Player: Any device that is capable of retrieving information from videodiscs: 8- or 12-inch discs upon which frames of information are stored; thus, producing still or motion pictures

STATEMENT OF CONFIDENTIALITY

This survey is being conducted by the Research Triangle Institute for the Corporation for Public Broadcasting. It represents the third in a series of School Utilization Studies funded by CPB to determine the extent to which districts, schools, and classrooms in the United States have access to and employ television and video for instructional purposes.

Data from the study are intended for aggregate statistical analysis only. All information which would permit identification of the individual respondent will be held in strict confidence, will be used only by persons engaged in and for the purposes of the survey, and will not be disclosed or released to others for any purposes.

Questions or concerns about confidentiality or any aspect of the study should be directed to:

Dr. Thomas R. Curtin
Research Triangle Institute
P.O. Box 12194
Research Triangle Park, NC 27709-2194
800/334-8571

SECTION A: BACKGROUND INFORMATION

1. Circle all the grades which you teach this year.

(If ungraded, circle the nearest grade equivalents.)

Pre-K K 1 2 3 4 5 6 7 8 9 10 11 12

2. How many students do you teach? *(If you teach more than one class, indicate in A the number of students you teach in all classes. In B, indicate the number of classes you teach.)*

a. ________ Total number of students

b. ________ Number of Classes

3. Which best describes the setting in which you teach?

(Circle one)

1. I have control over the class time schedule determining the order of instructional activities during large blocks of the school day
2. My schedule is largely predetermined by a master building schedule. The "clock" signals the beginnings and endings of periods of time with a given group of students

4. Please indicate the subjects you have taught this school year.

(Circle all that apply)

1. Art
2. Career/Vocational education
3. Computer science
4. English
5. English as second language
6. Foreign language
7. Guidance
8. Health/Nutrition
9. History
10. Home economics
11. Industrial education
12. Library/Information/Research skills
13. Math
14. Music
15. Physical education
16. Reading
17. Science
18. Social sciences
19. Special education
20. Other *(Please specify)* ____________

5. How many years (including this year) have you taught?

______ Years

SECTION B: INSTRUCTIONAL TELEVISION AND VIDEO

6. Are television and/or video for instructional purposes available for you to use with any of your classes?

(Circle one)

1. Yes
2. No → *Skip to Question 41*

7. Various arrangements can be made to use instructional television and video. Which describes the arrangements you use?

(Circle all that apply)

1. Class views program with another class or classes
2. Entire class views program without other class or classes
3. Small groups from the class view program
4. Individual students are assigned to view programs
5. Assigned viewing before/after school
6. Encourage viewing before/after school

8. How is equipment made available for instructional television and/or video use with your classes?

(Circle all that apply)

1. Equipment is maintained in my classroom/laboratory
2. Equipment can be checked out from media center or AV department
3. Equipment is maintained and used in media center/special use classroom
4. Equipment can be checked out from department, grade-level office, or other source
5. Use my own personal equipment from home
6. Other *(Please specify)* ____________________

9. How is instructional television and video available in your school building?

(Circle all that apply)

1. Direct off-air broadcast (i.e., signals received as they are aired) from public television
2. Direct off-air broadcast from commercial television
3. Cable or fiber system
4. Videocassettes
5. Satellite system
6. Videodisc
7. ITFS (Instructional Television Fixed Service)
8. Don't know

10. **What kind of TV sets do you have available to use with your classes?**

(Circle all that apply)

1. None
2. Black and white
3. Color (less than 45 inches)
4. Projection/large screen

11. **Do you have access to a videocassette recorder (VCR) for instructional purposes in your school?**

(Circle one)

1. Yes
2. No ——→ *Skip to Question 15*

12. **From what sources do you obtain programming on videocassettes for instructional purposes in your school?**

(Circle all that apply)

1. Requested from collection maintained by state department of education or regional education agency
2. Requested from collection maintained by school district
3. Requested from collection maintained by library, department, or other office in school
4. Purchased from commercial vendor by school or district
5. Rented for use from video store
6. Recorded at home/from collection maintained at home
7. Checked-out from public library
8. Borrowed from another teacher or friend
9. Other *(Please specify)* ______________________

13. **If you want to record a program "off-air" (i.e., as the program is broadcast by the television station or transmitted by a cable system) and play it back for your class later, how is the recording accomplished?**

(Circle all that apply)

1. I record it at home
2. I record it at school
3. I request recording be done by other school personnel
4. I have no resource to record "off-air"
5. I have never wanted to record "off-air"

52-649 0 - 92 - 7

14. Please estimate the size of videocassette collections maintained by other educational agencies.

(Circle one on each line)

Videocassette Collection	Not Aware of Such a Collection	<20	20-50	50-100	>100
a. State department of education or regional education agency	1	2	3	4	5
b. School district	1	2	3	4	5
c. School	1	2	3	4	5

15. Do you have access to a videodisc player for instructional purposes in your school?

(Circle one)

1. Yes
2. No

16. Have you used instructional television and/or video this year (1990-1991 school year)?

(Circle one)

1. Yes
2. No → *Skip to Question 31*

17. Rate each of the following with respect to how frequently it presents a difficulty in using instructional television and video.

(Circle one on each line)

	Often Difficult	Sometimes Difficult	Seldom Difficult	Never Difficult
a. Finding out about programs in advance	1	2	3	4
b. Having programs available when I need them	1	2	3	4
c. Quality of programs in my subject areas	1	2	3	4
d. Having equipment available when I need it	1	2	3	4
e. Having equipment in good condition	1	2	3	4
f. Structure/Length of programs available for use	1	2	3	4
g. Obtaining titles I would like to use	1	2	3	4
h. Sampling and assessing the quality/appropriateness of programs before use	1	2	3	4
i. Other *(Please specify)* ____________	1	2	3	4

18. Please indicate the subjects for which you used instructional television and video this school year.

(Circle all that apply)

1. Art
2. Career/Vocational education
3. Computer science
4. English
5. English as second language
6. Foreign language
7. Guidance
8. Health/Nutrition
9. History
10. Home economics
11. Industrial education
12. Library/Information/Research skills
13. Math
14. Music
15. Physical education
16. Reading
17. Science
18. Social sciences
19. Special education
20. Other *(Please specify)* ____________________

19. From the list in Question 18, select the one subject in which you believe new instructional television and video programming is most needed for your classes and record the corresponding number (1-20) below.

_______ Number of area (1-20) in which programming is most needed

20. Have you ever used live televised instruction with your classes (e.g., teleconferences, distance education programs)?

(Circle one)

1. Yes
2. No

21. How many different instructional television series do you use regularly (i.e., 75% or more of all lessons in the series)?

(If none, enter zero.)

_______ Number of series

22. What percentage of the students you teach have been exposed to instructional television or video in your classroom within the last year?

(If none, please enter zero)

__________ percent

23A. Have you used instructional television and/or video in your classroom in the last month?

(Circle one)

1. Yes ——► *Continue with Question 23B on next page*
2. No ——► *Skip to Question 24*

23B. If you have used instructional television and video in the last month, please record the following:

1. Titles of any series, programs, or movies you are using or have used in the last month;
2. The substantive area of the instruction (e.g., math, history);
3. The numbers of students viewing each* (see the definition of unduplicated student counts below);
4. The supporting materials available for the programming;
5. How the programming was shown (e.g., as a series, a single program or movie, or program segment); and
6. How effective the programming was in meeting the learning objectives of your class.

1 Series/Program/Movie Title	2 Substantive Area (e.g., Social Studies)	3 Unduplicated* Number of Viewers	4 Curriculum Guide Availability *(Circle one)*	5 Program Type *(Circle one)*	6 Effectiveness in Meeting Learning Objectives *(Circle one)*
		______ Students	1. Available 2. Unavailable 3. Unknown	1. Series 2. Single Program/ Movie 3. Program Segment (≤ 20 min)	1. Highly effective 2. Somewhat effective 3. Not very effective
		______ Students	1. Available 2. Unavailable 3. Unknown	1. Series 2. Single Program/ Movie 3. Program Segment (≤ 20 min)	1. Highly effective 2. Somewhat effective 3. Not very effective
		______ Students	1. Available 2. Unavailable 3. Unknown	1. Series 2. Single Program/ Movie 3. Program Segment (≤ 20 min)	1. Highly effective 2. Somewhat effective 3. Not very effective
		______ Students	1. Available 2. Unavailable 3. Unknown	1. Series 2. Single Program/ Movie 3. Program Segment (≤ 20 min)	1. Highly effective 2. Somewhat effective 3. Not very effective
		______ Students	1. Available 2. Unavailable 3. Unknown	1. Series 2. Single Program/ Movie 3. Program Segment (≤ 20 min)	1. Highly effective 2. Somewhat effective 3. Not very effective

*An unduplicated count indicates the unique number of students viewing a particular ITV series, program, or segment. In other words, do not "double count" any students who might view the same program in two different classes that you teach.

Attach additional sheets as necessary

24. How long do you typically spend discussing (or otherwise preparing for) lessons using instructional television and video before the class views the series, individual program, or segment?

__________ Minutes

25. How long do you typically spend discussing (or otherwise following up on) lessons using instructional television and video after the class views the series, individual program, or segment?

__________ Minutes

26. Do you have access to teachers' guides for instructional television and video? *(For example, these guides might include curriculum guides to television or video programs, a teacher's manual, or listings of future programs)*

(Circle all that apply)

1. Yes — provided to district or school and then distributed to instructional staff
2. Yes — provided directly to me (e.g., by mail)
3. No → *Skip to Question 28*

27. Do you typically use suggestions from the teachers' guides in preparing for or following up on the programs?

(Circle one)

1. Always
2. Most of the time
3. Some of the time
4. Seldom
5. Never

28. How often are other classroom assignments related to content in instructional television and video programs?

(Circle one)

1. Always
2. Most of the time
3. Some of the time
4. Seldom
5. Never → *Skip to Question 30*

29. What classroom activities do you use in conjunction with instructional television and video?

(Circle all that apply)

1. Classroom lectures and presentations
2. Classroom discussions
3. Examinations and quizzes
4. Written assignments
5. Homework assignments
6. Guest speakers and demonstrations
7. Field trips
8. Laboratory assignments/Field work
9. Extra credit

30. Of the time you use instructional television and video in the classroom in a typical week this year, about how much time is spent on these different kinds of programming? (If you teach more than one group of students, answer for the total cumulative amount of time you use instructional television and video.)

(Circle one number on each line)

	TIME VIEWED PER WEEK					
	None	1/4 Hour	1/2 Hour	1 Hour	2-4 Hours	5+ Hours
a. Programs from ITV series (e.g., *Reading Rainbow*)	1	2	3	4	5	6
b. Programs from general public television (e.g., *Mister Rogers' Neighborhood, MacNeil-Lehrer News Hour*)	1	2	3	4	5	6
c. Programs on commercial television (e.g., *60 Minutes, After School Specials*)	1	2	3	4	5	6
d. Feature-length movie	1	2	3	4	5	6
e. Programs from cable or satellite channels (*CNN Classroom, Discovery Channel*)	1	2	3	4	5	6
f. Live televised instruction	1	2	3	4	5	6
g. All other programs	1	2	3	4	5	6

31. **Which of the following student outcomes have you personally seen in your classes which you would attribute to instructional television and video?**

(Circle all that apply)

1. Students learn more when I use instructional television and video
2. Students comprehend and discuss content and ideas presented in instructional television and video
3. Discipline problems increase after viewing
4. Students use new vocabulary included in instructional television and video
5. Students have followed up ideas mentioned in instructional television and video
6. Enthusiasm about school work in general increases after viewing
7. Student attention spans decline after viewing instructional television and video
8. Library use increases after instructional television and video
9. Students watch more educational TV at home
10. Instructional television and video are preferred by student over other classroom media
11. Generates new interest in the topic covered by programming
12. Instructional television increases student motivation to learn

32. **Are you using instructional television and video more or less this year than you have in the past 3 years?**

(Circle one)

1. A lot more
2. A little more
3. About the same
4. A little less
5. A lot less

33. **How do you feel about the following statements?**

(Circle one number each line)

	Strongly Agree	Agree	Disagree	Strongly Disagree	No Opinion
a. TV and video help teachers teach more effectively	1	2	3	4	5
b. I want more training in ITV	1	2	3	4	5
c. Programming available to me is quite good	1	2	3	4	5
d. I do not feel comfortable about working with ITV	1	2	3	4	5
e. Instructional television and video enable teachers to be more creative in their instruction	1	2	3	4	5
f. Instructional television and video limit the time for instructional activities with students	1	2	3	4	5
g. Many teachers use instructional television and video just to get a break from teaching	1	2	3	4	5
h. Instructional television and video can have a positive impact on the quality of American education	1	2	3	4	5

34. **Have you personally ever had training in the instructional uses of television and video?**

(Circle one)

1. Yes
2. No ———→ *Skip to Question 38*

35. **How was the training conducted?**

(Circle all that apply)

1. Pre-service (during undergraduate or certification training)
2. Graduate or continuing education
3. District in-service
4. In-service by local public TV station
5. State Department of Education in-service
6. Workshop at professional meeting
7. Instructional Television Agency/Consortium in-service
8. Self-taught

36. **Have you received training in the instructional use of television and video within the last 3 years?**

(Circle one)

1. Yes
2. No ———→ *Skip to Question 38*

37. **Within the last 3 years, which of the following have been included as topics in these workshops on instructional television and video?**

(Circle all that apply)

1. Selecting/ordering materials
2. Equipment operations
3. District/School access and use policies
4. Evaluation of media
5. Class preparation involving instructional television and video
6. Utilization and curriculum coordination/integration
7. Copyright protection
8. Other *(Please specify)* ____________________

38. **Does your school district use television and/or video to deliver in-service training or development on any topic?**

(Circle one)

1. Yes
2. No

39. **Generally speaking, which best describes the practice of your principal or building administrator(s) regarding the use of instructional television?**

(Circle one)

1. Strongly encourage use
2. Encourage use but leave to discretion of individual teacher
3. Neither encourage nor discourage use
4. Discourage use but leave to discretion of individual teacher
5. Strongly discourage use

40. **Based on your experiences, how effective is instructional television and video with the following categories of students?** *(Circle one number on each line. If you have no experiences with a student category, please indicate unknown)*

	Effectiveness of ITV			
	No experience/ Unknown	Uneffective	Somewhat Effective	Very Effective
Typical or "average" students	1	2	3	4
Learning disabled and other midly handicapped students	1	2	3	4
Moderately and severely handicapped students	1	2	3	4
Gifted and talented students	1	2	3	4
Economically disadvantaged students	1	2	3	4
Limited English proficient students	1	2	3	4

SECTION C: PERSONAL USE OF TELEVISION AND VIDEO

41. **Do you have a TV set in your home?**

(Circle one)

1. Yes
2. No ——→ *Skip to Question 43*

42. **Please estimate the number of hours you personally watch TV at home in a typical week?**

__________ Hours per week

43. **Do you have a videocassette recorder (VCR) in your home?**

(Circle one)

1 Yes ——→ *Continue with Question 44 on next page*
2 No ——→ *Skip to Question 45*

44. Please estimate the number of times you have recorded programs for personal or school use <u>within the last month</u>. *(If none, please enter zero.)*

a. __________ Times programs have been recorded for school use

b. __________ Times programs have been recorded for personal use

45. Do you have a video camera in your home?

(Circle one)

1. Yes
2. No → *Skip to Question 47*

46. Please estimate the number of times you have used this video camera to record events or activities for personal or school use <u>within the last month</u>. *(If none, please enter zero.)*

a. __________ Times video camera has been used to record for school use

b. __________ Times video camera has been used for personal use

47. Please supply the information requested below. This information will be used only if we should need to recontact you about the questionnaire.

a. Name of individual completing questionnaire: ______________________________

b. Telephone number (______) ______ - ____________

c. What is the best time to contact you? ______________________________

Thank you very much for taking the time to fill out this questionnaire.

Please return this questionnaire in the envelope provided or mail to:

School Uses of Television and Video Study
Research Triangle Institute
Attn: Jennifer McNeill (4857-03)
PO Box 12194
Research Triangle Park, NC 27709-2194

If you would like to receive a summary report of the findings of this study, please provide your name and complete address.

Name: ______________________________

Address: ______________________________

____

CORPORATION FOR PUBLIC BROADCASTING

901 E Street N.W
Washington, D.C. 20004-2006

The Corporation for Public Broadcasting (CPB) was established as a result of the Public Broadcasting Act of 1967 to promote the development of a diversified public television and radio service for all of the American people.

The Corporation, neither an agency nor an institution of the Federal Government, was created as a free-standing, private, non-profit corporation to insure its independence as the public's representative in public broadcasting.

Its authority to act in the public interest stems from the 1967 legislation. Among CPB's responsibilities:

- Supporting public radio and television stations with direct grants to help meet operating and programming costs;
- Providing funds for the production and acquisition of innovative and high-quality programs for national distribution;
- Safeguarding the independence of local licensees and the freedom of expression within a decentralized public broadcasting community.
- Acting as the trustee for the funds appropriated by the Congress or contributed to CPB by other sources.
- Advancing the technology and application of delivery systems.
- Conducting research in matters relating to non-commercial educational television

The Study of the School Uses of Television and Video is being conducted by the Research Triangle Institute for the Corporation for Public Broadcasting. All correspondence or other communication regarding this survey and other aspects of the study should be directed to

Dr. Thomas R. Curtin
Research Triangle Institute
PO Box 12194
Research Triangle Park, NC 27709-2194

800/334-8571 or 919/541-6538

CORPORATION FOR PUBLIC BROADCASTING

Study of the School Uses of Television and Video

TEACHER QUESTIONNAIRE

200

SENATOR BINGAMAN. Our second panel, we have Mr. Henry Cauthen, who is with South Carolina Educational Television; Mr. Dennis Cooler, who is with the North Central Regional Educational Laboratory in Illinois; and Daniel Schultz, who is the Assistant State Superintendent in the Michigan Department of Education.

Thank you all for being here.

Why don't we start with you, Mr. Cauthen.

STATEMENT OF HENRY J. CAUTHEN, CHAIRMAN, BOARD OF TRUSTEES, AMERICA'S PUBLIC TELEVISION STATIONS, AND PRESIDENT, SOUTH CAROLINA EDUCATIONAL TELEVISION NETWORK

MR. CAUTHEN. Thank you very much, Senator.

You asked us to try to present some vision of the classroom of the future, and I think you see that some of the elements are already beginning to fall in place, and I think it's tremendously important that we make sure that they fall in place in some sort of orderly fashion.

Right now, for example, in projects that we're involved in in South Carolina itself and other states in other parts of the country, we're reaching into the multicultural, inner-cities; we're reaching out to the rural remote populations. Educators in those areas are using distance learning technology to bring educational resources into their classroom that simply couldn't be brought there in any other way, and that's with the technology that is already available to us.

When the new digital technology that Howard Miller speaks of is available to us, we're going to be able to do much, much more of that.

What we're doing right now at this level is really the testing level of how to use the technology, which is an important period. What we are finding is that it's working, and it's working very, very well.

Really, at the core of what we are doing, the public broadcasting system has—as was pointed out—created the first satellite interconnection system, and it's dedicated to serving the public need. It already has in place a lot of the infrastructure that is needed to make this system work, and it's cost effective. And it is interconnecting not just public broadcasting stations. The primary responsibility is for PBS to reach the public broadcasting stations, but the public broadcasting stations are regional offices that, in many cases, serve educational needs of all sorts.

For instance, in South Carolina we interconnect not only the public schools and K-12, but we interconnect child-care centers and higher education institutions, the technical colleges, state and federal agencies, health care centers and hospitals. Virtually every user that might have need for the technology, we're able to reach and are reaching.

There are 340 public television stations and 32 state networks out there in this country that are trying to find the best means of using this technology to serve educational purposes at all levels, and I think that's important, because we don't need to recreate the wheel in this structure in order to disseminate this information.

We have the technology that's available through the public television stations to assist the schools, the colleges, the universities, the hospitals, the libraries, and other users that might have need of this technology. We have what you might call field offices scattered throughout the United States that are there to help them use the technology and to bring the technology to their door step.

The infrastructure that I speak of will be tremendously enhanced by PBS's new replacement satellite, Telstar 401. This, as you know very well, was funded by Congress and will be operational in 1993, with the six transponders that Howard Miller talked about and with the digital technology.

We are looking at it, and for South Carolina's purposes, we see the possibility of up to 20 channels of television and related technology over one transponder, and if you look at the number of transponders that Howard talked about that will be available, the system can be built upon and extended and expanded to meet educational needs as they develop.

That kind of orderly development process is what I would suggest is the way that we should try to proceed. The technology intermix is very important because the satellite that PBS is putting up and the VSAT technology that was spoken of interconnects in a seamless fashion with the telephone lines and other technologies that are available to us already.

So, we will have a situation where some states will be using one technology and some States will be using another, but the satellite itself will not care in terms of delivery, as long as we take care of the digital portion of it. Computers, some are not compatible with one another, and that's the kind of thing we're talking about. As long as we have that level of compatibility, the system is going to be very versatile, and it will serve multiple needs in education.

And it's not just the hardware that we're talking about, but it's also the people with the experience to build and operate a national system, a system that is developed, as I say hopefully, in an orderly way.

We did it in public broadcasting, building the first satellite interconnection system, and we're building the next generation right here today. Our country needs a system that provides compatibility while maintaining flexibility to work and meet the local needs, because each community and each state is going to approach this somewhat differently, as our experience has shown up to now.

A system that can truly revolutionize education is really right within our reach, and we don't have to wait until the year 2000 to make this happen, because we can begin immediately. In fact, we're already beginning as some of the experiments and some of the projects that are underway are already indicating how valuable the technology can be.

What do we need to do? You've asked the question, really what is the last mile? Well, the last mile can be a variety of things, but one of them can simply be putting a satellite dish at a school and putting a television receiver and a VCR perhaps in the classroom, and that teacher and those students will have access to resources that can also come from any part of this country. They don't come from PBS necessarily. They could, but they can come from South Carolina, or they can come from Kentucky, or they can come from Nebraska or Wisconsin, as is happening right now in the project that you will hear about—the SERC project.

What we have is a vast reservoir of resources that are available in education and public television stations around the country, and this satellite system is going to allow us to tap and share with the rest of the country.

Without that kind of orderly structure and without taking advantage of the resources that we already have in place, we will be a long time getting something else up and running.

With the satellite, we can have the equal access, and it's important that we have that. Because if we don't have equal access with all schools, there are going to be a lot of students that simply are not going to have the resources available to them to pursue the careers or college of their choice or whatever other desired career paths that they might want to take, but we can prevent that from happening. We can ensure that every child in this country can have access to what they need.

We have in South Carolina a project that is very important, and again satellite technology is an important part of that. It's a program aimed at training Head Start workers, the Head Start teachers, the ones who take care of the children in the day care centers. But the primary focus of this program is working with rural and migrant camps, Native Americans and Alaskan village populations.

We're going to work with all those groups, and it's going to come out of South Carolina, but we're also going to tie in the public television station in Chicago that will help us produce portions of this. It will be live and interactive instruction that will provide specialized training to meet varying socioeconomic conditions, language, and cultural backgrounds. Because of this project, there are going to be a lot of children that would have been disadvantaged that will get a healthy first start.

I think it's important to just look back a moment and realize that today's young students are growing up in the electronic age. This is their technology and their culture, and it's time that we harness that and turn them loose with it, because they are going to use this technology if we make it available to them. With a public telecommunications system firmly in place, the door is wide open for delivery of any curriculum materials.

The stations have years of experience in utilizing and producing educational programming of all sorts—the type of delivery systems. They have forged partnerships with education at the local, state and multi-state level, and no one can match the experience of public broadcasting in this area.

What I have described is a telecommunications system for the Nation. It is already operational, accessible, cost effective, and ensures equity. By building on—and I emphasize building on—this existing infrastructure, the Federal Government can avoid duplication and waste as it extends that technology to every classroom.

By investing in a public system, we ensure that our society will never be divided into information haves and have-nots for educational purposes. The cornerstone of public television's mission is education and public service, and we're determined to serve all Americans, regardless of their financial means or where they might happen to live.

Our mission will not change as business or regulatory conditions change. Thus, it's important that we rethink how new and existing resources will be used.

For example, in South Carolina we are now providing statewide educational services on a multi-channel basis. We offer more than a hundred hours of instruction every day. Yes, more than a hundred hours every day, and we utilize virtually every technology that is out there. We use satellite, we use ITFS, we use fiber optic, we use cable, we use microwave, we use broadcast service, we use computers, and we use interactive key pads. All of these are available in South Carolina, and we are using right now up to 12 simultaneous channels of instruction and have plans within two years of adding 20 additional channels of instruction to that.

I point this out not as a way of bragging about South Carolina, but as a way of showing that in one of the nation's poorest States we've been able to put together this kind of telecommunications system for the service of education at all levels. It's costing us less than 1 percent of our state's education budget—less than 1 percent to put together the most sophisticated educational communications system that any state has. With the aid of the federal support that is going to come through the new digital satellite system and with the aid of other federal support that has come along the way, we've been able to enhance and expand what we've done with state dollars.

It's not going to be an expensive proposition in relative terms. If we can afford to spend what we are spending on education in this country today, if we can take just 1 or 2 percent of that and rethink how we use it, we can create a telecommunications highway that will serve all of education. I know of no other means of bringing about that kind of change without major increases in funding and perhaps decades of planning and development.

We can't afford to waste another generation of children, Senator, seeking complex solutions to what to me is a very simple process of using what is already available. As new technologies develop and are created, they will only enhance what we already have available to us through public and educational broadcasting in this country. All we need to do to make it happen is to have the courage and determination to bring about change, because that is really all that is necessary.

Because of this technology making quality education equally available to every child is for the first time really truly within our reach, and I want to emphasize that. For the first time ever, we have the means of making quality education on any subject equally available to every child in this country, and the only thing again standing in its way is whether we have the determination to do that.

Senator, I thank you for putting a spotlight and a focus on this issue because I think it's tremendously important. We have the resources at hand and can do a lot with what we already have, and we'll be able to do much, much more when the PBS satellite is in place and the public broadcasting and education broadcasting system is standing there ready to help in resolving some of our Nation's educational problems.

SENATOR BINGAMAN. Thank you very much.

[The prepared statement of Mr. Cauthen follows:]

PREPARED STATEMENT OF HENRY J. CAUTHEN

We have been asked here to offer a vision of the classroom of the future. That classroom in many ways is beginning to take shape today. For example, in the multi-cultural inner cities and in remote rural areas, many classrooms are utilizing interactive technologies to make quality education both accessible and challenging.

The core of this effort is public broadcasting, the first national media system interconnected by satellite to provide educational programming, services and equal access to all citizens.

Public broadcasting has a strong infrastructure already in place to effectively address education reform. It can cost-effectively interconnect schools, child care centers, higher education institutions, technical colleges, state and federal agencies, and health centers across the country. It has the power to organize partnerships at every level and share resources to combat the education crisis.

With over 340 television stations and 32 state networks, this nation already has many of the lanes of the public telecommunications highway needed for education in the 21st century. It offers for the first time a solution to the problem of providing equity and accessibility at all levels.

This infrastructure will be greatly enhanced by PBS's replacement satellite, Telstar 401. Funded by Congress and on schedule to become operational in 1993, the satellite will have six transponders. With advances in digital compression technology, public television will be able to provide up to 20 channels on most of these six transponders <u>simultaneously</u>. Each channel can deliver high quality 2-way video and audio services for education.

Further, advances in the remarkable VSAT technology will make it possible to provide interactive voice, data, facsimile and slow scan video services. Telstar 401 will become the education satellite for the United States, greatly expanding our reach and service to all citizens.

And it's not just the hardware. It's also the people with the experience to build a national system, a system that is developed in an orderly and efficient way. We built the first satellite interconnection system and we are building the next generation today -- both space and ground segments. We need a system that provides for maximum compatibility, while maintaining the flexibility to suit local needs. Public broadcasting knows how to construct such a system.

What this means is that the technology and expertise that can truly revolutionize education in America are already within our reach. We don't have to wait till the year 2000 to make it happen. By simply installing a satellite dish at a school, and a television set and VCR in the classroom, teachers and students can participate in live interactive lessons. They will have access to critical subject areas that would not otherwise be available to them. Without this equal access to education, many students will be blocked from entering the college of their choice or limited in pursuing their desired career paths.

SERC, which you will hear more about today, is a prime example of interactive distance learning at its best. A similar project based in my state will provide training to Head Start teachers working primarily with rural, migrant, Native American and Alaskan village populations. The training will include education, health, social services, and parent involvement. We will also offer specialized training to meet varying socio-economic conditions, language and cultural backgrounds. Because of this project, many disadvantaged young children will get a healthy first start in life.

Today's young students are growing up in the electronic age, getting their information through television and working with computers, video games, and other electronic devices. It is their technology--their culture. It's time we harness the power of the technology for something positive.

With a public telecommunications infrastructure firmly in place, the door is wide open for the delivery of any curriculum materials. Individual stations can provide the critical local components of the system. They have years of experience in utilizing all types of delivery systems, and have forged partnerships with educators at the local, state and multi-state level.

Public television also has nearly 200 production studios. They are staffed by experienced professionals who can produce instructional programming, as well as resource materials, to assist teachers in utilizing the technology. No one can match our experience in this area.

What I have described is a telecommunications system for the nation that is already operational, accessible, cost-effective and ensures equity. By building on this existing infrastructure, the Federal Government can avoid duplication and waste as it extends technology into every classroom.

And by investing in a public system, we ensure that our society will never be divided into information haves and have nots for educational purposes. The cornerstone of public television's mission is education and public service. We are determined to serve all Americans, regardless of their financial means or the population density of where they live. Our mission will not change as business or regulatory conditions change.

Our priority, then, is to rethink how resources can be reallocated to enhance this highway that already exists for education. For example, in South Carolina we are now providing education services on a multi-channel basis statewide. We offer more than 100 hours of instruction each day, using as many as 12 simultaneous channels of instruction, for less than 1 percent of our state's education budget.

If we can provide this level of service in one of the nation's poorest states, we can certainly afford to do it on a national level. It is reasonable to estimate that less than 1 percent of the nation's education budget would be required to install the necessary satellite receiving equipment, or other locally appropriate systems, to reach unserved schools across the country. Another 1 percent would provide the necessary funds for the development of programming and course materials.

Just consider that for a moment. For less than 2 percent of the funds presently allocated for education, we can dramatically impact education. I know of no other means of bringing about this kind of change without very major increases in funding and perhaps decades of planning and development. We cannot afford to waste another generation of children seeking complex solutions when so much can be done with what already is available to us.

We must further develop and fully utilize the extraordinary resources public broadcasting offers us. As other technologies are developed and refined, they will only enhance what can be done with the existing public system. Because of this technology, making quality education equally available to every child is, for the first time, within our reach.

Let me repeat that. It is an extraordinarily important fact. Yes, for the first time ever, we have the means of making quality education on any subject equally available to every child in this country, and the only thing standing in our way is whether we have the will, the determination, and the courage to engage in the difficult process of bringing about change.

If we truly want to make it happen, we can. I believe we have that will, determination, and courage . . . and the time to start is now.

SENATOR BINGAMAN. Mr. Gooler, why don't you go right ahead. If you could summarize your statement in 8 or 10 minutes, that would be great so that we can get on and have a little time for questions.

STATEMENT OF DENNIS D. GOOLER, DIRECTOR OF TECHNOLOGY, NORTH CENTRAL REGIONAL EDUCATIONAL LABORATORY, OAK BROOK, ILLINOIS

MR. GOOLER. Mr. Chairman, thank you for inviting me to participate in this hearing.

I am Dennis Gooler. I direct the technology efforts at the North Central Regional Laboratory in Chicago. We are an agency that serves seven states in the Great Lakes.

It's entirely appropriate in a discussion of last mile infrastructure to approach the topic from a technical point of view, and this morning we have already heard a number of technical discussions about the nature of this infrastructure.

I would underscore many of the points that my colleagues have made, but today I would like to approach the topic from a slightly different perspective; namely, the perspective of the kids and teachers who will use whatever it is that comes through this last mile.

If we are to accomplish the critical goals that we have set for education, our students need to be active learners. They need to be manipulating and interpreting and synthesizing information from many, many sources. They need, as a matter of business as usual, to be communicating with other students in their classroom, their school, their state, and throughout the country and the world. Classrooms, in other words, need to be dynamic places where students are directly involved in shaping their own learning objectives and strategies.

To achieve this kind of learning environment, each student—irrespective of their location, their family experience, or their socioeconomic condition—must have regular and ongoing access to the world's information resources and to the tools needed to act on those resources.

We have mapped out telecommunications and other delivery systems in our seven states. There are tremendous highways and complexes of electronic highways available in our states, but very, very few students can get access to the resources moving on those highways. In too many cases, the student's view of the world is shaped by access to a single, often outdated textbook.

Teachers need to be able to respond to and manage individual student needs and aspirations in ways that have never been possible before. Teachers need to be able to construct collaborative and individualized learning opportunities for their students, and teachers need the instructional resources and tools that professionals in almost any other profession simply take for granted: the capacity to communicate with others, to continue their own education, and to draw on research and development information to improve practice. Yet, for most teachers, contemporary electronic highways are as nonexistent as they are for students.

So, what must be done to create the last-mile technology so that learners and teachers can gain ready access to the information and tools of the information age? That is, from the perspective of educators and learners, what must the last mile infrastructure and the greater information resource system to which that last mile connects, provide for our classrooms?

Well, I see at least the following. One, these systems must provide movement of all forms of information to the classroom level and, indeed, to the individual student level. Video, quantitative and qualitative databases, audio, textual material, instructional program software, textbooks, research and development information, raw data, magazines and journals, virtually any kind of information that is out in the world, should be available to our kids and teachers.

Second, the system needs to have the capacity to store and redistribute information on request within the school or the classroom. To be most useful and to accomplish most learning goals, the system should permit each user to work on whatever information he or she needs at the time that they need it.

Individual students and teachers should be able to communicate through various forms of electronic communications with other students and experts outside the confines of their classroom. Teachers also need to be able to regularly and easily communicate with other teachers and experts. In other words, the teaching profession needs to be a profession in the best sense of that term.

The last-mile infrastructure must make it possible for users to combine video, data, text, and other forms of information in their attempts to understand a phenomenon, to carry out research or to create a product.

The kind of learning environments made possible by the technologies that we are discussing today present complex challenges for instructional management within classrooms. The technology systems that bring massive information resources to the classroom must also include provisions for teachers and students to manage all of this, to monitor what is being done and with what results. And in creating the last-mile infrastructure, the Nation as a whole must be concerned with issues of standards, compatibility, obsolescence, front-end costs and recurring costs.

So, what might be appropriate Federal Government roles in supporting and implementing a last-mile infrastructure that would permit the creation of the kind of classroom and learning environment I have outlined?

I see at least several roles. I believe that the Federal Government does need to play a strong role in causing the development of standards for hardware and software and telecommunications that are intended for use in classrooms. I don't know the right timing on this, Mr. Chairman, but I am convinced that unless some of those standards exist, schools are helpless in the wake of incompatible hardware and software and changes and are simply going to be unable to move.

Second, I think that the Federal Government might look to support research and development leading to the creation and manufacture of powerful affordable multi-media work stations that are intended for individual student and teacher use.

Third, the Federal Government might develop or encourage favorable rate structures for classroom telecommunications. It will do us little good to get the last mile into the classroom if the daily usage rates exceed our capacity to pay.

Fourth, the Federal Government might focus in some way on the development of user interface processes so that students and teachers do not have to learn and master a bewildering array of ways to gain access to these information resources.

The Federal Government might consider supporting an Institute for Educational Technology Training and Applications, whose purpose it will be to develop strategies of materials needed to prepare teachers to use these technologies. It will simply not happen by chance.

And, finally, the Federal Government might consider ways to support the design and development of curricula that reflect the use of vast information resources and tools for using those resources.

A few years ago a bridge on Interstate 90 in Upstate New York collapsed with agonizing consequences. A major component of our transportation infrastructure had atrophied to danger levels.

In contrast, the information resources infrastructure that is fundamental to the future success of our young people, our teachers, and indeed the long-range social and economic condition of this Nation is yet to even be built. It is evident that the need to invest in our classrooms, to provide the information resources and tools our young people must have, is no longer a luxury, but is rather a necessity. We must address this last-mile phenomenon as quickly and as flexibly as possible, but we must do so keeping in mind the perspective of the users.

Thank you, Senator.

SENATOR BINGAMAN. Thank you very much for that.

[The prepared statement of Mr. Gooler follows:]

PREPARED STATEMENT OF DENNIS D. GOOLER

To create classrooms in which students are active learners, using the most current information to pursue both individualized and collaborative learning projects, both students and teachers must have access in a vast array of information resources, and the tools needed to use those resources. Telecommunications and educational technologies will be needed to supply such information resources and tools. While electronic highways capable of transporting vast amounts of potentially relevant information resources increasingly surround our nation's schools, relatively small amounts of such information actually makes it into our classrooms. To date, schools have been unable to put together and maintain the "last mile" technologies needed to access information resources.

Building that last mile into our nation's classrooms requires attention to hardware, software, and finance issues of considerable complexity and importance. But last mile discussions must also include attention to what teachers and students need from last mile technologies, what will actually be available once the last mile has been built, and how teachers, administrators, and learners will be prepared to take advantage of the information resources and tools that will be available in classrooms. The last mile discussion thus involves more than technical issues, but conceptual issues as well. It is to these latter issues I will direct most of my comments.

From the perspective of educators and learners, what must the last mile infrastructure, and the greater information resources systems to which the last mile connects, provide for classrooms? I see at least the following:

1. Movement of all forms of information to the classroom level and, indeed, to the individual student user level. Forms of information include: video; quantitative and qualitative databases; audio; textual material; instructional program software; and other forms of information that can be digitized. Examples of kinds of information would include: instructional programming; textbooks; research and development information; "raw" data of a variety of kinds; multi-

media packages; training programs; magazines, both print and video; and virtually any other form of information that may be useful in teaching and learning.

2. capacity to store and redistribute information on request within the school or classroom. That is, the system should permit off-line usage of information resources initially distributed through the electronic highway system. To be most useful, and to accomplish most learning goals, the system should permit each user to work on whatever information he or she needs at a given time, irrespective of what other learners need at that same moment.

3. **Electronic communications capacity.** Individual students and teachers should be able to communicate through various forms of electronic communications with other students in a classroom or within the school. The capacity should also exist to permit students to communicate with other students in their state, region, throughout the United States and the world. Students should also be able to regularly communicate with experts in content areas in which students are working. Similarly, teachers should be able to regularly and easily communicate with other teachers and experts.

4. **Integration of information resources.** Students and teachers need the capacity to integrate a variety of kinds of information resources into a given instructional activity or project. That is, the last mile infrastructure must make it possible for users to combine video, data, text, and other forms of information in their attempts to understand a phenomenon, to carry out research, or to create a product. Further, the technology system should facilitate integration of the substance it delivers into curriculum and instructional plans.

5. **Effective system and instruction management capacities.** The technology systems that bring information resources and tools into the classroom must include workable provisions for teachers and students to manage the flow of information, to monitor what is being done with the information, and with what results. The kind of learning environments made possible by the technologies we are discussing also presents complex problems in instructional management. If adequate system and instructional management programs are not available, the instructional programs envisioned herein will simply collapse on themselves.

Transforming classrooms from their present nature to the kind of information and communications-rich environment suggested above means children will not be learning only from outdated and limited textbooks; children will not be penalized because of where they happen to live, as all children will have access to the world's information resources; teachers will function as the kind of professional they should be. What is being described goes well beyond many education reform proposals. But the environments described cannot exist unless or until individual classrooms are able to tap into the worldwide electronic highway system.

There are undoubtedly a number of ways the last mile can be technically constructed. Much of the needed hardware and software already exists that might form the basis of the last mile technology infrastructure. Certain components of that infrastructure will require serious examination, however. For example, it will be important to develop a powerful, yet affordable, multimedia workstation intended for use by individual students and teachers. Ways must be found to make regular telecommunications affordable. Common interfaces must be created so that users do not have to learn complex and different interfaces to use each electronic database or communications program. Thus, will existing technologies may be useful in creating the last mile infrastructure, new technologies may be required to make the system as robust as it needs to be.

What might be appropriate Federal government roles in supporting and implementing a "last mile" infrastructure that would permit the creation of the kind of classroom learning environment I've outlined? I see at least the following roles:

1. Play a strong role in causing the development of standards for hardware, software, and telecommunications intended for use in classrooms. Schools simply cannot afford to deal with rapid obsolescence and incompatibility in hardware and software. Without such standards, the last mile will never be closed.

2. Support research and development leading to the creation and manufacture of powerful, affordable multimedia workstations intended for individual student and teacher use, that will permit learners and teachers to take full advantage of information technology tools.

3. Convene representatives of federal agencies interested in telecommunications policies, vendors, and regional communications companies to develop favorable rate structures for use by schools of long distance calls.

4. Support research focusing on the development of common and usable user interface protocols, such that students and teachers are not faced with having to learn and master a bewildering array of interface requirements to use different hardware, software, and communications configurations. Until such protocols are developed, technologies will not become transparent tools in classrooms, and thus will not be used to their maximum.

5. Support and coordinate efforts to make available for learners and teachers in the nation's classrooms information resources from networks such as NSFNET; materials and programs from the regional laboratories, research centers, and NDN; and information and products available from businesses and industries, professional associations, and other similar organizations.

6. Support an Institute for Educational Technology Training and Applications, whose purpose it will be to develop strategies and materials needed to prepare new teachers, as well as teachers already in the nation's classrooms, to effectively create the kinds of dynamic learning environments outlined earlier. This Institute would serve as a resource for existing teacher education programs, and continuing professional agencies such as intermediate service units, and would especially concentrate on ways to use information technologies to train teachers (and learners, parents, community members, etc.) in how to use technologies.

7. Support projects focusing on the design and development of curricula that reflect the use of vast information resources, and tools for using those resources.

8. Establish an Institute on Education Technology Planning and Policy, and charge that Institute with the tasks of: 1) Staying abreast of technology developments and forecasting potential uses in education; 2) Formulating prototypic policy at state, regional, national, and local levels that will reflect the potential uses of telecommunications and educational technologies to improve education; 3) Regularly convening meetings of policy makers, vendors, and practitioners to ensure continued partnerships between education and business around these powerful issues of technology uses in education.

A few years ago, a bridge on Interstate Highway 90 in Upstate New York collapsed, causing the death of a number of people. That incident drove home the point that a major component of our transportation infrastructure had atrophied to dangerous levels, with potentially devastating consequences. I suggest to you that the information resources infrastructure that is fundamental to the future success of our schools, and thus to the long-range social and economic condition of our nation, is not simply a victim of atrophy, but that in fact the infrastructure has not even been built at all. For all the reasons I have outlined today, it is apparent that the need to invest in our classrooms, to provide the information and tools our young people absolutely must have for their future survival, is not luxury but necessity. The last mile phenomenon must be resolved as quickly and as flexibly as possible. Even in schools where investments in technology have been made, a plateau of use is being achieved. Without access to the complex of electronic highways, and without quality materials moving on the highways, that plateau cannot be overcome. But for most schools, even minimal technology investments have not been made.

SENATOR BINGAMAN. Mr. Schultz, why don't you go right ahead.

STATEMENT OF DANIEL SCHULTZ, ASSISTANT STATE SUPERINTENDENT FOR EDUCATIONAL TECHNOLOGY AND GRANTS, MICHIGAN DEPARTMENT OF EDUCATION

MR. SCHULTZ. Thank you, Mr. Chairman, and good morning.

My name is Daniel Schultz, and I'm the Assistant State Superintendent for Educational Technology and Grants in the Michigan Department of Education. On behalf of the Michigan State Board of Education and Department, I am very pleased to be here today and have the opportunity to highlight one state's experiences in developing instructional telecommunication systems and offer some comments on the steps the Federal Government could take in supporting classroom initiatives and technology.

It has been noted that public education is the last major labor intensive industry to begin to use technology in its day-to-day business. With this perspective, the topic of today's hearing is of critical importance.

In response to national calls for school reform, proposals for schools of choice and initiatives dealing with the restructuring of schools, State Departments of Education, schools, colleges, and universities are exploring innovative ways to use telecommunication technology for teaching and learning.

In this context, telecommunications must be defined in the broadest sense, as accessing and communicating information via technology. Telecommunications is receiving unprecedented attention, and our public education systems must be included in this debate. Increasingly, the successful operation of schools and businesses hinges on the efficient exchange of voice, data and video signals.

One of the most efficient examples of telecommunications technology in use today are the lottery systems operated by 33 states and the District of Columbia. We have done a better job in this country of electronically linking party and convenience stores with our state capitols than our schools. And with a satellite dish on virtually every automobile dealership, it's easier to communicate with sales managers than school superintendents.

It begs the question. Why haven't similar communication networks been created for our schools?

Michigan's experience in connecting buildings and classrooms through telecommunications for instruction has resulted in over 40 different interactive distance learning projects, half of which are active and offering courses today. This represents a hybrid system using coaxial cable, twisted pair, microwave, ITFS, and fiber optic technologies. These telecommunication systems are used to provide instruction for students, training programs for teachers, and site-to-site meetings among administrators.

Michigan has shown that a hybrid multiple technology system can work. Yet, in a State that has an infrastructure with over 150,000 miles of fiber optic cable, less than 1 percent is being used for instruction. Like many other states, the fiber optic capacity that exists is not being used due to regulatory, pricing, or other last-mile issues.

Should schools be put in the position of competing with private industry and creating their own telecommunications systems? We have examples of that. States should build on the investments that already have been made.

In 1990, in Michigan, a state-level telecommunications task force recommended a strategy for capitalizing on the State's communication resources. The task force specifically recommended building telecommunication partnerships between businesses, communities, governments, and schools; providing quality training programs for educators; providing incentives and competitive grants to encourage the deployment of telecommunication technology in schools; coordinating a telecommunications network for education; supporting efforts of post-secondary institutions in training a marketable work force; and encouraging the establishment of new entrepreneurial ventures that draw upon the untapped potential of telecommunications technology.

In Michigan recent legislative initiatives are addressing the State's current telecommunications policy, which was initially written in 1913, and there is significant regulatory interest on the part of the Michigan Public Service Commission.

SENATOR BINGAMAN. You had a telecommunications policy in 1913?

MR. SCHULTZ. Initially drafted in 1913.

SENATOR BINGAMAN. That would be an interesting document to read. [Laughter.]

Go right ahead.

MR. SCHULTZ. Financing for telecommunication projects is a continuing concern in the educational community. With approximately 30 states experiencing serious fiscal problems, it's unlikely that states will be in a position to contribute to a national telecommunications network.

A new development from the private sector has accelerated interest in instructional telecommunications. Michigan has the fourth largest number of middle and high schools subscribing to the Whittle Communications' Channel One news program. What prompted over 10,000 schools across the country to sign three-year contracts with Whittle Communications?

Channel One has raised a national debate regarding the use of commercial advertising in schools. Clearly, the Whittle organization has touched a responsive chord, and school districts responded for financial, programmatic, and symbolic reasons. It suggests how urgent the need is to acquire technology no matter of how basic.

As the consumer electronics industry rushes to marry personal computers, television, video cassette recorders, compact disks, and telephones, multimedia applications for education are already being marketed. Multimedia software integrating voice, graphics, music, text, and video images will soon be available to the mass market, and parents will be pressured to purchase the latest electronic notebook. These portable laptop devices are capable of connecting with telephone lines to communicate with computers.

The problem on the horizon for elected officials and policymakers is the question of equity. How do you assure that children of low-income parents and those in rural, sparsely populated areas have access to these new tools? How do you assure that the system of public-tax supported libraries—traditionally the place where knowledge, information and ideas could be acquired free of charge—continue to be available for all Americans?

Public library collections are diminishing at an alarming rate, and—as Mr. Cauthen has noted—we risk a society of information haves and have-nots. There is an opportunity to reinvest in our libraries by installing sophisticated computer-based transmission and retrieval systems.

A priority must be based on training for classroom teachers, administrators, students and parents as access to information increases via technology. Consumers must be competent in finding, selecting, analyzing and summarizing information to solve problems. What is needed is a program similar to driver education to help people access and navigate these electronic highways.

Typically, there is a technical vocabulary that is commonplace among engineers and telecommunication providers, but it is often viewed as a foreign language by educators and consumers. As a result, critical decisions involving teaching and learning are deferred to those least knowledgeable about the instructional process.

With telecommunications, schools can offer an expanded and high-quality curriculum. Schools will be able to choose televised programming available from across the nation and from other countries. With these changes, the curriculum will need to be more individualized, focused on the solution of actual problems, building job skills and awareness of different cultures, beliefs and values.

Incentives are needed to reduce the number of students who drop out of school, and provide alternative programming for those who have dropped out, and increase equity in rural areas. Telecommunications offer adult learners, particularly those with transportation problems or child-care needs, opportunities for high school completion and job skills training.

Telecommunications should also be used to serve the education and rehabilitation needs of individuals in correctional institutions. It has been shown that the more years of education a person has completed, the less likely he or she will be involved in criminal activities. Over 80 percent of this country's prisoners are high school dropouts. Nationally, an average of $21,000 a year is spent to house each prisoner, a figure which far exceeds the per pupil expenditure in any state.

As new technologies become available for learning, a different kind of classroom develops, an inquiry-centered classroom of the future. Technology serves as the backbone for this new learning environment. Through the use of technology, students experience greater access to information and resources.

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I have submitted some written materials that go into great detail about these new classrooms, which I will, in the interest of time, skip over here.

If the Federal Government makes a long-term commitment to telecommunications and puts funding behind it, the private sector will respond. With national and state policy that requires or provides incentives for telecommunication providers to work with the educational sector, coordinated systems for schools will develop.

In conclusion, telecommunications and educational technology can provide new opportunities for teaching and learning, but they are not a panacea to the problems facing educational institutions. The following points are essential to realizing an integrated high-tech telecommunications network for all schools:

— There should be incentives for improvement of local government services.

— Any telecommunications system should represent the needs of all levels of education, kindergarten through graduate school and adult training.

— National standards should be developed based upon existing model classrooms.

— An information database should be developed, which includes specifications for instructional telecommunications systems.

— National standards for electronic data interface are essential.

— Joint ventures between users and providers should be encouraged to simplify operation of new technological tools.

— The ultimate objective for instructional telecommunications systems is to become as ubiquitous and invisible as a telephone call.

— The gap between society's information haves and have-nots needs to be narrowed.

— Decisions must be based on solid engineering, technical studies and demonstrated needs and increased efficiency.

— Training programs for educators and administrators are critical to ensure maximum use of telecommunications systems.

— Telecommunications systems can provide greater equity in the delivery of educational services.

— And the education community must participate in strategic planning to ensure better use of scarce resources.

It's obvious that an investment in instructional telecommunications is an investment in the future.

Thank you very much for the opportunity.

[The prepared statement of Mr. Schultz, together with additional material, follows:]

PREPARED STATEMENT OF DANIEL SCHULTZ

Good morning, Mr. Chairman. My name is Daniel Schultz and I am Assistant State Superintendent for Educational Technology and Grants for the Michigan Department of Education. On behalf of the Michigan State Board of Education and Department of Education, I would like to thank the members of the Subcommittee on Education, Arts and Humanities and the Joint Economic Committee for the opportunity to highlight one state's experiences in developing instructional telecommunications systems and offer some comments on the steps the federal government could take in supporting classroom initiatives in technology.

It has been noted that public education is the last major labor intensive industry to begin to use technology in its day to day business. With this perspective, the topic of today's hearing, Educational Technology in the Classroom, is of critical importance.

In response to national calls for school reform, proposals for schools of choice, and initiatives dealing with the restructuring of schools, state departments of education, along with schools, colleges and universities, are exploring innovative ways to use telecommunications technology for teaching and learning. In this context, telecommunications must be defined, in the broadest sense, as accessing and communicating information via technology.

Telecommunications is receiving unprecedented attention and our public education systems must be included in the debate. Increasingly, the successful operation of schools and businesses hinges on the efficient exchange of voice, data and video signals.

One of the most efficient examples of telecommunications technology in use today are the lottery systems operated by 33 states and the District of Columbia. We have done a better job in this country of electronically linking party and convenience stores with our state capitols, than our schools. And, with a satellite dish at virtually every automobile dealership, it is easier to communicate with sales managers than school superintendents. It begs the question; why haven't similar communication networks been created for our schools?

Michigan's experience in connecting buildings and classrooms through telecommunications for instruction has resulted in over 40 different interactive distance learning projects; half of which are active and offering courses today. This represents a hybrid system using coaxial cable, twisted pair, microwave, ITFS (Instructional Television Fixed Services), and fiber optic technologies. These telecommunications systems are used to provide instruction to students, training programs for teachers, and site-to-site meetings among administrators.

Michigan has shown that a hybrid, multiple-technology system can work. In a state which has an infrastructure with over 150,000 miles of fiber optic cable, less than 1% is being used for instruction. Like many other states, the fiber optic capacity that exists is not being used due to regulatory, pricing, or other 'last mile' issues. Should schools be put in the position of competing with private industry and creating their own telecommunications systems? States should build on the investment that already has been made.

In 1990, a state-level Telecommunications Task Force recommended a strategy for capitalizing on the state's communication resources. The Task Force specifically recommended:

- Building telecommunications partnerships between businesses, communities, governments, and schools.
- Providing quality training programs for educators who use telecommunications technology to deliver instruction.
- Providing incentives and competitive grants to encourage the deployment of telecommunications technology in schools.
- Coordinating a telecommunications network for education.

- Supporting the efforts of postsecondary institutions in training a marketable workforce.
- Encouraging the establishment of new entrepreneurial ventures that draw upon the untapped potential of telecommunications technology.

Recent legislative initiatives are addressing the state's current telecommunications policy, and significant regulatory interest has been shown by the Michigan Public Service Commission.

Financing for telecommunications projects is a continuing concern in the education community. With approximately 30 states experiencing serious fiscal problems, it is unlikely that states will be in a position to contribute to a national telecommunications network. As it is, competition for existing resources is keen.

A new development from the private sector has accelerated interest in instructional telecommunications. Michigan has the fourth largest number of middle and high schools subscribing to Whittle Communication's Channel One news program. What prompted over 10,000 schools across the country to sign three-year contracts with Whittle Communications? Along with two minutes of commercial advertisements presented during the Channel One programming, a school receives approximately $50,000 in television, video, and satellite equipment. Channel One raised a national debate regarding the use of commercial advertising in public schools. Clearly, the Whittle organization touched a responsive cord, and school districts responded for financial, programmatic, and symbolic reasons. It suggests how urgent the need is to acquire technology, no matter how basic.

As the consumer electronics industry rushes to marry personal computers, television, videocassette recorders, compact discs and telephones, multimedia applications for education are already being marketed. Multimedia software, integrating voice, graphics, music, text and video images, will soon be available to the mass market and parents will be pressured to purchase the latest "electronic notebook". These portable, laptop devices are capable of connecting with telephone lines to communicate with other computers.

The problem on the horizon for elected officials and policymakers is the question of equity. How do you assure that children of low-income parents and those in rural, sparsely populated areas have access to these new tools? How do you assure that the system of public, tax-supported libraries, traditionally the place where knowledge, information and ideas could be acquired free of charge, continues to be available for all Americans? Public library collections are diminishing at an alarming rate. We risk a society of information haves and have-nots. There is an opportunity to reinvest in our libraries by installing sophisticated, computer-based transmission and retrieval systems.

A priority must be placed on training for classroom teachers, administrators, students and parents as access to information increases via technology. Consumers must be competent in finding, selecting, analyzing, and summarizing information to solve problems. What is needed is a program similar to "driver education," to help people access and navigate these electronic highways.

Typically there is a technical vocabulary that is commonplace among engineers and telecommunications providers, but often viewed as a foreign language by educators and consumers. As a result, critical decisions involving teaching and learning are deferred to those least knowledgeable about the instructional process. Schools end up with an engineer's fantasy, but an educator's frustration.

With telecommunications, schools can offer an expanded and higher quality curriculum. Schools will be able to choose televised programming available across the nation and from other countries, not just locally. Connections will be strengthened between K-12 school districts, community colleges, and universities. Library collections would be accessible by students no matter where they live.

With these changes, the curriculum will need to be more individualized, focused on the solution of actual problems, building job-skills and awareness of different cultures' beliefs and values. Incentives are needed to reduce the number of students who drop out of school, provide alternative programming for those who have dropped out, and increase equity in rural areas. Telecommunications offer adult learners, particularly those with transportation problems or child care needs, opportunities for high school completion and job-skills training.

Telecommunications should also be used to serve the education and rehabilitation needs of individuals in correctional institutions. The more years of education a person has completed, the less likely he/she will be involved in criminal activities. Over eighty percent of this country's prisoners are high school dropouts. Nationally, an average of $21,000 a year is spent to house each prisoner, a figure which far exceeds the per pupil education expenditure in any state.

As new technologies become available for learning, a different kind of classroom develops -- an inquiry-centered classroom of the future. Technology serves as the backbone for this new learning environment. Through the use of technology, students experience greater access to information and resources.

These classrooms will have the following features:

- Student and teacher explorers work together in teams that practice the strategy of cooperative learning;
- Student teams work separately on subtopics within a common classroom theme.
- Students are encouraged to investigate knowledge domains on their own and form hypotheses based on information uncovered in their independent research.
- Students learn by doing.
- Students get hands-on training experimenting with numerous group problem-solving strategies.
- Students learn how to respond to unexpected, chaotic situations, take risks, and support each other through the learning process.

In addition to these remarks, I have submitted written testimony which describes how all of these concepts work in a unique model classroom facility that has been in operation in Michigan for the past three years and has attracted national interest from the media, corporate sector, and other states.

If the federal government makes a long-term commitment to telecommunications and puts funding behind it, the private sector will respond. With a national, and state policy that requires or provides incentives for telecommunications providers to work with the educational sector, coordinated systems for schools will develop.

In conclusion, telecommunications and educational technology can provide new opportunities for teaching and learning; but they are not a panacea to the problems facing educational institutions. The following points are also essential to realizing an integrated, high-tech telecommunications network for all schools.

- There should be incentives for improvement of local government services.
- Any telecommunications system should represent the needs of all levels of education- kindergarten through graduate school, and adult training.
- National standards should be developed, based on existing model classrooms.
- An information data base should be developed which includes specifications for instructional telecommunications systems.
- National standards for electronic data interface (EDI) are essential.
- Joint ventures between users and providers should be encouraged to simplify operation of new technological tools.
- The ultimate objective for instructional telecommunications systems is to become as ubiquitous and invisible as a telephone call.
- The gap between society's information haves and have-nots needs to be narrowed.
- All decisions must be based on solid engineering, technical studies, demonstrated needs, and increased efficiency.
- Training programs for educators and administrators are critical to ensure maximum use of telecommunications systems.
- Telecommunications systems can provide greater equity in the delivery of educational services.
- The education community must participate in strategic planning to ensure better use of scarce resources.

An investment in instructional telecommunications is an investment in the future. Thank you very much for the opportunity to come here today, and I am prepared to respond to your questions.

An Inquiry-Centered Classroom of the Future

By
Fred D'Ignazio and Daniel Schultz

Putting Both Feet into the Future

The inquiry-centered classroom of the future will emphasize four themes:

1. It will reinforce the vital leadership role of the teacher.
2. It will integrate technology into critical areas in the curriculum.
3. It will offer start-up strategies for schools with severely constrained budgets and minimal in-school technology expertise.
4. It will link advanced technologies to advanced teaching strategies.

This last theme will make the classroom a true learning environment of the future. In many of the innovative projects in education, only one foot is placed in the future while the other foot is quietly, invisibly mired in the past. For example, an advanced-technology project may use older teaching strategies which have not been supported by current research or by recent test scores. Or an experimental classroom may be trying new teaching and learning strategies without making effective use of advanced technology.

Half a Solution

Classrooms experimenting with advanced teaching strategies are often devoid of technology.

Half a Solution

Classrooms using advanced technologies often employ older teaching strategies

The inquiry-centered classroom of the future will combine advanced multimedia technologies with advanced teaching and learning strategies, including

- Cooperative Learning
- Thematic Teaching
- Guided Inquiry
- Apprenticeship
- Group Problem-Solving
- Critical Thinking

Cooperative Learning Student and teacher explorers work together in teams that practice the strategy of cooperative learning which has been developed and tested in classrooms for the past ten years, based on research conducted at The Johns Hopkins University and the University of Minnesota. Teams perform self-managed, self-guided inquiry. Students are responsible for their own learning and for their teammates' learning. Students rotate the role of leader and other roles. No student is supposed to know everything, but all students are encouraged to make a contribution.

Thematic Teaching The teacher functions as classroom leader, head explorer, knowledge-specialist, process-facilitator, de facto team member, and final arbiter. The teacher combines several curriculum units under powerful umbrella themes, such as China, the American Constitution, whales, space exploration, etc. The themes contain units across the curriculum and apply curricular topics to real-world problems and issues. Student teams work separately on sub-topics within a common classroom theme. Teams work together collaboratively under the teacher's direction to integrate their independent research into a single, interactive product.

Guided Inquiry The teacher teaches not by telling students facts and answers but by posing problems, mysteries, and questions that challenge student teams to investigate knowledge domains on their own. The teacher guides the students' inquiry at all times to help the students approximate the most recent findings in each field and to encourage students to form creative and dramatic interpretations of their own. Some credit is given for "correct" answers, but even more credit goes to students who are able to articulate their line of reasoning, form hypotheses based on information uncovered in their independent research, and who take on the responsibility for encouraging their classmates' learning through the inquiry process.

Apprenticeship Learning by doing in the presence of a master. In the classroom the teacher is the master, and student apprentices approach subjects as "apprentice teachers." In this role they are challenged to do deeper processing to better understand a given subject. They must learn to communicate their understanding clearly and effectively to their fellow classmates. And they must "show what they know" kindly and gently so they can build their classmates' self-esteem, self-confidence as learners, and ultimately their knowledge of the subject.

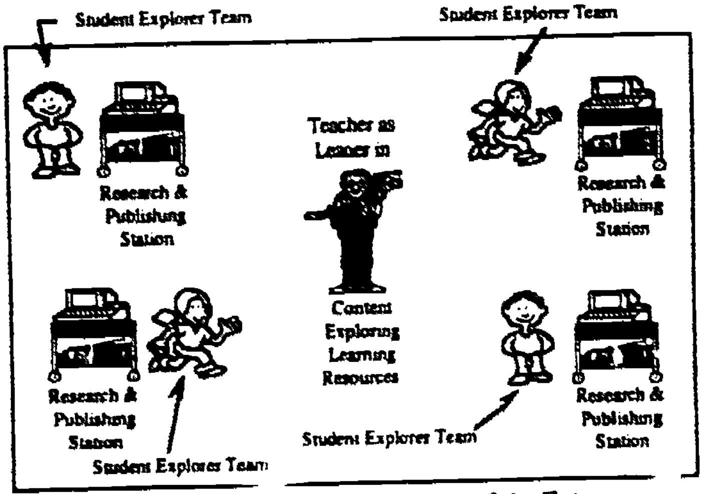
Group Problem-Solving Students get hands-on training experimenting with numerous group problem-solving strategies. They learn verbal strategies, written strategies, computerized strategies, etc. The teacher constantly challenges the group with interesting problems that would be too long or too complex for any individual to solve on their own. Students learn that they are smarter, quicker, and more powerful as a team than they are on their own. Yet they develop pride in their individual contributions and in the way those contributions move the entire group forward.

Critical Thinking The classroom of the future is not for the faint-hearted. (Of course, neither is the world of the future!) The teacher's strategy is to place the students in confusing, chaotic situations in which they understand only partly what is expected of them and how they must get there. The student teams learn to nurture and support each other as a strategy for coping and survival. The teams occasionally fail in their missions, but they learn that failing isn't the end of the world. They learn that mistakes are occasions for learning and they learn how to maximize the learning arising from their mistakes. They learn that to complete their missions they must take risks, go out on a limb all the time, and figure out how to complete their tasks successfully most of the time.

Inquiry Centers

The classroom of the future will model an inquiry-centered classroom of the 1990s in which the teacher acts as the leader, guide, and evaluator of several student knowledge explorer teams. Each explorer team will use an advanced multimedia and telecommunications inquiry center to collaboratively:

- Δ Conduct investigative research into the world around them.
- Δ Capture images and sounds from the real world to develop a multimedia database.
- Δ Create dramatic story problems and simulations as decision-making exercises for fellow students.
- Δ Create presentations and publications to show to other classes, the students' parents, and their community.



Inquiry-Centered Classroom of the Future

Computer and video networks will tie all the classroom workstations together for the easy, quick, "invisible" exchange of images, sounds, and spoken and written text among student research teams. In addition, the classroom will be wired to the outside world via cable TV, fiber optics, telephone lines, and satellite dish. This allows the student inquiry teams to "dial up" world news as it breaks, online information services, students in other classrooms, and outside experts, as a part of their research and investigation into a vital curricular topic.

Merging Technologies

The inquiry centers will combine the following technologies:

- Audio
- Video
- Computer
- Telecommunications
- Distance Learning
- HyperMedia

Audio Student and teacher explorers create audio data bases using sounds they have captured from their classroom, school, and community, and from electronic sound sources, including broadcast TV, broadcast radio, cable, records, tapes, compact discs, etc. The sounds are digitized, stored on computer disk, and linked thematically with images, text, animations, etc.

Video Explorers use video cameras, still-image recorders, video digitizers, and computer "screen-grabber" cards to capture images from the real world and save them as disk files in their computer. The images are linked thematically with sounds, text, animations, etc.

Computer The computer acts as the hub of each explorer team's inquiry center. It is used to capture, store, process, transform, communicate, and publish the explorer teams' findings.

Telecommunications Student and teacher explorers conduct their investigation into different subjects (e.g., biology, literature, geography, or plane geometry) by linking their computers to computers in other classrooms -- both down the hall and around the world. Explorer teams interview leading experts and decision-makers via modem and telephone. They conduct these interviews over t[illegible] ter and record original quotes, images, documents, sounds, etc. on their multimedia dat[illegible] orer teams in classrooms separated by thousands of miles conduct joint investigations by [illegible] unicating images, sounds, text, animations, etc. over phone lines from computer to computer.

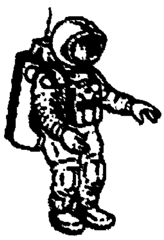
Distance Learning Two-way data, voice, and video carriers in the classroom of the future enable explorer teams to "plug into" other researchers and experts in the local community and across the planet. Teams invite master teachers from science, business, government, or the arts to their teleclassroom as "teachers for a day." Guest teachers may be invited to lecture, or, more frequently, to conduct joint inquiry activities with the student teams in the teleclassroom. (A "teleclassroom" is a cluster of physical classrooms wired together with two-way interactive data, voice, and video carriers.)

HyperMedia Explorer teams will return from their expeditions and create interactive informational products in the form of presentations, publications, tele-presentations, or tele-publications. The team products will be in the form of hypermedia which integrates music, text, images, live-action video, spoken voices, colorful animations, etc. into challenging simulations of real-world situations. The teams' classmates who use the products will have to solve a challenging problem or problems. They will take on the role of real-world actors (explorers, policymakers, scientists, peacemakers, or everyday people) who are faced with dramatic problems and who have to make decisions based on imperfect information and too little time. The products' users will be challenged to work together collaboratively and effectively to discover the best course of action in as little time as possible.

A Vehicle of Knowledge and the Imagination

The mission for each explorer team will be similar to that of the Starship Enterprise from the famed *Star Trek* TV and movie series: *to boldly go where no learner has gone before.*

Each inquiry center will be a vehicle of knowledge and the imagination, piloted by a team of student explorers. One week the vehicle might take a team of explorers off to Neptune, the next week to a meeting of the Continental Congress, the week after to a fish-processing plant on the southern coast of Iceland. Each voyage the students make will be centered around an important topic or theme chosen by the teacher which integrates critical subjects in the curriculum. The student explorers will journey to the farthest reaches of time and space, but they will always begin their journey in the classroom's library and in the world just outside the classroom door.



The students' mission, during a typical unit, will be to map the worlds that they discover, and to develop multimedia presentations and publications that encourage fellow classmates to follow in their footsteps. All products the students develop will be interactive, designed to engage their classmates in critical thinking, problem-solving, and decision-making in a dramatic, real-world scenario. The philosophy of the classroom will be "Make It and Take It," so that the students can take the tapes, disks, and papers they create back home to show their families.

The classroom teacher will be at the helm of "Mission Control," emphasizing the critical leadership role played by the teacher in the classroom of the future. The teacher will guide the student explorer teams, keep them on track, and help them climb out of the black holes that they will fall into on their journey. The teacher will propose the major areas of inquiry, train students in vital process skills required to conduct their research at peak effectiveness, monitor each teams' progress in their investigation, and evaluate their success in sharing their journeys with others.

Michigan's Teacher Explorer Centers

For the past three years the state of Michigan has run a model classroom of the future program funded by the Michigan State Board of Education. The model classrooms, dubbed "Teacher Explorer Centers," have been set up at three sites:

- East Lansing Public Schools, East Lansing, MI
- Oakland University, Rochester, MI
- Bay de Noc Community College, Escanaba, MI

During this time the Teacher Explorer Centers have trained over four thousand K-12 teachers and administrators from 150 school districts around Michigan and from 18 states around the United States. In addition, we have conducted a "collaborative inquiry laboratory" for another 1,000 Michigan students.

For More Information

Please contact the paper's authors if you would like more information:

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SENATOR BINGAMAN. Thank you very much.

Let me ask a question which any of you could respond to. In looking around at what could be done nationally to upgrade instruction in our schools, one thing which occurs to me, and I'm sure it has occurred to a lot of people, is that we have general agreement on the advanced placement courses that are available to high school students, and I guess we have those in a lot of different subjects now, and I don't know how many.

As I understand it, the quality of that course work is not questioned. I've had teachers explain to me that they felt very comfortable, because they knew exactly what the content of the course was; they had instructional materials on how to teach it; they had tests that determined whether they had taught it; and it was a compact piece of the curriculum that they felt very comfortable with.

Why can't, or maybe it is available, but it would seem that providing that instruction in advance placement courses, on a national basis for all schools that wanted to access it, would be a very natural thing to do. So, if there is a school in my state, whether they have a teacher who can teach whatever it is or not—calculus or Japanese or American history—advanced placement or whatever course, they could go ahead and give the students that wanted to take that course the opportunity to do so by plugging into a national system. Now, why isn't that an appropriate objective for us to pursue, or maybe that is being pursued somewhere. Is that being done, or something similar to that being done, at the present time on a national basis?

MR. CAUTHEN. Senator, yes, it is. The SERC project, for instance, is doing just that in terms of the advanced placement courses in Russian, in Japanese, in calculus and others.

SENATOR BINGAMAN. Now, you're reaching what, 24 states?

MR. CAUTHEN. Twenty-four states now, that's right, and then there are several other distance learning projects that are reaching other states. So, yes, it is an appropriate thing.

SENATOR BINGAMAN. You're providing advanced placement courses to those 24 states, and do you have that capability available for all the schools in those states or just those that have hooked up to your satellite system? How many actual schools are participating in that? When we say 24 states, it sounds like half the kids in the country have that opportunity. Is that accurate?

MR. CAUTHEN. Not at all, no. The project's going into its fourth year, and funding really has been the question of how far it has expanded, and it has not reached anything like the total population. It's just a small percentage of the population, but the testing [illegible] can be [illegible]. The question is the cost of doing it.

SENATOR BINGAMAN. And that involves the [illegible] of the satellite dishes?

MR. CAUTHEN. The satellite dishes and the satellite time, because with the live interactive instruction, you don't teach 100,000 students at one time. You have a finite group of students so that they can interact.

SENATOR BINGAMAN. Now, the satellite time that you refer to, is this new PBS satellite going to help solve that problem for you?

MR. CAUTHEN. It certainly will, because right now on the SERC project, when we started out, we were having to purchase one transponder to transmit a program. Then, the second year we needed two. One transponder now with the digital technology will carry many channels. So, the cost, you just divided it, and if we were paying three or four hundred dollars an hour for that, it's divided by 8 or 10 or 12.

SENATOR BINGAMAN. But now that new satellite will be available for your use in broadcasting these courses that you're broadcasting to your schools?

MR. CAUTHEN. PBS is working on the means, yes, of making that available. There will be a charge, but it will be far less than what we are now having to pay from a commercial lender.

SENATOR BINGAMAN. And the main obstacle, as you see it, is that cost of using the satellite at the present time?

MR. CAUTHEN. Absolutely, that's it.

SENATOR BINGAMAN. Do any of you have comments on that? Mr. Gooler?

MR. GOOLER. I was going to say that there are a number of systems offering such courses, and in general, depending on how well those courses are constructed and made available, people are quite pleased with those courses.

What we are finding in our region is that our teachers are interested both in full courses delivered that way, but increasing also interested in having information brought into the classroom that they can then construct into their own courses and integrate into their own curricula.

But certainly the course idea you've talked about is being done, and it's pretty widely accepted, I believe.

SENATOR BINGAMAN. How extensively is it being used? I mean is this purely an experimental thing we're sitting here talking about, or do a lot of teachers out there have this opportunity? I have the sense that if I had a panel of teachers sitting in front of me randomly selected from around the country, they would tell you all this stuff is pie in the sky, and they're teaching with books and pencils.

MR. GOOLER. I believe that the coverage of such courses is very, very limited, and it is a function and part of the ability to receive it, the costs involved and so forth. So, the widespread penetration of this thing is quite limited at the moment.

MR. SCHULTZ. It's our experience in Michigan that it's available in some places in Michigan. It is limited due to some of the financial aspects related to subscribing.

There is another perspective on this, too, and that is that there is interest in it, but there are also local values and local school district spins on programming that school districts feel very strongly about. With the decentralized system we have in this country, there is not a lot of interest in school districts for a national advanced calculus or chemistry program.

SENATOR BINGAMAN. As I understand it, there is a lot of interest in taking the advanced placement course in calculus around the country.

MR. SCHULTZ. Very definitely.

SENATOR BINGAMAN. So, all I'm saying is that you would just use the technology available to facilitate the taking of that course. I'm not suggesting anything else.

MR. CAUTHEN. Senator, there is an interesting spinoff that we found on this, too, and that is that the teachers who work in those classrooms with the students, the facilitating teachers at the local site in the language courses, for instance, we found out that teachers of other languages want to be those facilitators. They're learning Russian and Japanese, but the math teachers who don't know calculus want to be in there. They want to learn it. We're spreading and extending the quality of the teaching force in that process, and we didn't expect that to happen.

MR. GOOLER. There is another offshoot of this, Senator, which you will probably hear. It's not an insurmountable problem, but one to be aware of. The distance delivery of courses presents interesting problems related to teacher certification. In some states, this has been solved, but in others it's a real battle about who needs to be in the classroom into which these courses are being beamed. Must it be a certified teacher in the content of the satellite instruction or not? This is a particularly critical problem in rural schools that may want to bring in courses for which they have no teachers substantively qualified, and certification requirements in some areas prohibit that from happening. It's an interesting problem.

SENATOR BINGAMAN. Is it one that you think the Federal Government should address?

MR. GOOLER. Certification remains a state province, I believe, and my guess is that there would be significant concern about federal involvement in this particular problem, unless one started to move toward a national certification of teachers, with reciprocity across State lines and so forth. It is an issue that I believe must be looked at if we are going to really expand technological alternatives.

SENATOR BINGAMAN. Well, I could go on again with a lot of additional questions, but we have another panel, and I think I'll stop at that point and allow the others to come and give their testimony, as well.

Thank you very much for being here.

Our final panel today is Cecilia Lenk with the Massachusetts Corporation for Educational Telecommunications; Sally Johnstone with the Western Cooperative for Educational Telecommunications in Boulder, Colorado; Gregory Liptak with the Mind Extension University; and Gary Vance, also with SERC.

Thank you all for being here. I appreciate it very much.

Why don't we start with you, Ms. Lenk, and just go right across the table there.

STATEMENT OF CECILIA LENK, PH.D., PROJECT DIRECTOR, REACH FOR THE STARS, THE MASSACHUSETTS CORPORATION FOR EDUCATIONAL TELECOMMUNICATIONS

Ms. LENK. Good morning, Senator Bingaman. I'm delighted to be here.

Over the past seven years, I have been involved in designing and implementing three major educational projects that use telecommunications technologies to improve science and mathematics in elementary and secondary schools. These projects are the National Geographic Kids Network, the TERC Star Schools Network, and, currently, Reach for the Stars. These projects are among the largest telecommunications-based curriculum projects in education. They have been funded by the National Science Foundation, the U.S. Department of Education Star Schools Programs, the National Geographic Society, and private foundations and corporations, including businesses in the telecommunications industry. Together these telecommunications-based projects are reaching students and teachers in thousands of schools throughout the United States.

It is important to recognize what we have learned from these three projects about the potential impact of telecommunications in education. The National Geographic Kids Network and the TERC Star Schools projects are built around computer-based telecommunications. Participating classes undertake cooperative experiments in areas of current scientific interest, such as acid rain, chaos theory, and radon. Through a wide area computer network, students and teachers share data, questions, and observations with other classes on the network and with professional scientists.

Reach for the Stars integrates a broad range of technologies. With a focus on improving science education in the middle grades, this project is developing innovative products and distance learning programs for the entire educational community, students, teachers, school administrators, and parents. The Reach for the Stars products and programs bring together multiple technologies, including interactive satellite broadcasts, computer-based telecommunications facsimile machines, computer software, videotapes and interactive video disks.

The evaluation findings from these three projects indicate that telecommunication technologies, combined with hands-on, inquiry-based activities, are effective in improving learning and teaching in science and mathematics. Students learn important content, sharpen their analytical skills, are motivated, and gain an appreciation for science and mathematics. Importantly, these telecommunications-based curricula encourage students to take an active role in their own learning. This finding is especially true for girls, minorities, learning disabled children, and students with typically poor academic performances.

Data from these projects also indicates that this telecommunications approach to science and mathematics education can change how teachers teach. Many teachers involved in these projects report that they have modified their teaching styles to allow for more student exploration and collaborative learning. Additionally, these three projects show that telecommunications technologies are effective mechanisms for providing teachers with much needed professional development and the ongoing support required to strengthen teaching and learning in their classrooms.

These projects show how important telecommunications can be to improving our Nation's schools. They also point out some of the barriers that we have to address if we are to use telecommunications effectively and widely. The overwhelming majority of classrooms and schools today are very poorly equipped to take advantage of existing telecommunications technologies, let alone technologies that might become available in the next five years. These programs, funded by the U.S. Department of Education and the National Science Foundation, have assisted schools in acquiring equipment, but tremendous needs remain.

A good example of this is the telephone line problem. In every telecommunications project that I've been involved in, participating schools have been required to install and maintain a telephone line for use with a computer modem. In far too many cases, putting this telephone line in a classroom has been the major barrier to giving students and teachers effective access. Installation costs and monthly service fees for telephone lines strain school budgets. Additionally, the idea of a telephone in a classroom is novel. Very few classrooms today actually have a telephone line. Teachers and students involved in these telecommunications projects frequently use the line in the school library, the computer lab, the school office, or their own homes. So, this might be considered as a first step in developing a telecommunications infrastructure for American classrooms. Put a telephone line, which can be used with a modem for interactive distance learning programs, in all classrooms.

As a result of my work, there is no question in my mind that telecommunications technologies must be key components of our Nation's efforts to improve elementary and secondary education. It is also clear that the Federal Government must provide consistent leadership if telecommunications resources are to be widely available in classrooms and if elementary and secondary school teachers, students and administrators are to use these technologies effectively to improve teaching and learning. To achieve these outcomes, the efforts of state and local governments must be supported by the Federal Government.

It is important to recognize that achieving the last mile—fully integrating telecommunications technologies into American classrooms—is a multifaceted, ongoing and long-term task. It involves the development of a national information system that integrates current network systems and will give students access to audio, video and data transmissions. Clearly this network system must include components specifically designed for the needs of elementary and secondary schools. It also requires creating an organizational structure for the national information system that can coordinate the use of telecommunications in elementary and secondary schools. Achieving the last mile means that technological and cost barriers to using telecommunications in classrooms must be eliminated. Schools must be able to acquire the hardware and software necessary to use this information system and have the ability to update and replace outmoded equipment. Programming and structural materials and other educational resources for classrooms must be readily available. Finally, the K-12 educational community must be prepared and supported as they incorporate telecommunications into their educational programs.

The Federal Government can support this effort in the following ways:

— Provide large-scale and long-term funding to physically connect elementary and secondary schools into the current national telecommunications infrastructure and to allow schools to take advantage of new technologies as they become available.

— Continue to support the design and development of the national research and education network, NREN, which will fully interconnect elementary and secondary schools with colleges, universities, research laboratories, and other educational institutions.

— Support standards and protocol for network systems that integrate telecommunications technologies, data, voice and video.

— Assure that elementary and secondary schools can utilize telecommunications technologies at very low costs.

— Develop mechanisms to provide technical assistance to schools, districts, and states in developing long-range telecommunications plans.

— Support the development, evaluation and dissemination of telecommunications-based instructional materials and other resources for elementary and secondary school classrooms.

— Support the research and development of hardware, software, and services specifically designed to facilitate the use of telecommunications in education.

— Support professional development programs for teachers, school administrators, and communities around telecommunications, including assisting school districts and communities to participate fully in these innovations.

— Support research around the effective use of telecommunications in elementary and secondary schools, including research into how these technologies can extend learning into homes.

— Coordinate and integrate the efforts of federal agencies involved in the use of telecommunications in education.

— And, finally, review and revise federal policies and regulations on telecommunications to promote, expand and improve the use of telecommunications in education.

The cost of widespread integration of telecommunications into elementary and secondary education will be high, and it is unlikely that most local school districts could find the funds to accomplish what needs to be done. The key players involved in financing this critical initiative are the Federal Government, individual state governments and businesses, particularly the telecommunications industry.

The Federal Government must be integrally involved in the funding process over a long-term time. What is required is consistent large-scale and long-term federal funding. In addition to increasing the funds available to federal agencies who have programs in educational telecommunications, funding mechanisms that should be considered are:

— Creating large-scale programs in educational telecommunications similar to the U.S. Department of Education Star Schools program.

— Developing mechanisms to fund telecommunications projects through multiple federal agencies.

— Developing a program of low-interest loans for schools, districts, and States to build the necessary telecommunications infrastructure and to acquire or upgrade equipment.

— Developing funding programs that are jointly funded by the Federal Government and the telecommunications industry, and developing incentives for the telecommunications industry to invest in elementary and secondary education.

I am committed to educational telecommunications. The potential of this technology to improve education in our Nation's schools cannot be underestimated. I want to assure that all children in all schools systems in the United States have equal access to these critical technologies.

Thank you.

SENATOR BINGAMAN. Thank you very much. That was an excellent summary of some of the things that we need to be looking at here.

[The prepared statement of Ms. Lenk, together with additional material, follows:]

PREPARED STATEMENT OF CECILIA LENK

1. Integrating telecommunications into classrooms: The experience from three major projects

Over the past seven years, I have designed and implemented three major education projects which use telecommunications technologies to improve elementary and secondary science and mathematics instruction: the National Geographic Kids Network; the TERC Star Schools Project; and currently, Reach for the Stars. The National Geographic Kids Network is funded jointly by the National Science Foundation and the National Geographic Society. The TERC Star Schools Project and Reach for the Stars are funded by the U.S. Department of Education Star Schools Program. Together these telecommunications-based projects are reaching students and teachers in thousands of schools.

The NGS Kids Network and the TERC Star Schools Project are built around computer-based telecommunications. Participating classes undertake cooperative experiments in areas of current scientific interest such as acid rain, chaos theory, radon, and water quality. Through a wide-area computer network, students and teachers share data, questions, and observations with other classes on the network and with professional scientists.

Reach for the Stars integrates a broad range of video, computer, and telecommunications technologies. With a focus on improving science education in the middle grades, this project is developing and disseminating innovative inquiry-based products and distance-learning programs for the entire educational community—students, teachers, school administrators, and parents. The Reach for the Stars products and programs bring together interactive satellite broadcasts, computer-based telecommunications, facsimile machines, computer software, videotapes, and interactive videodiscs.

As evidenced by the evaluation findings from these three projects, telecommunications technologies combined with hands-on, inquiry-based activities are effective in improving learning and teaching in science and mathematics. Students learn important content, sharpen their analytical skills, administrators, school committee members, and parents from the participating districts in discussions around technology and improvement of science education. Scheduled to be completed in September, 1992, Reach for the Stars will disseminate the results of this work nationally.

2. The role of the Federal government in establishing and supporting telecommunications in education.

As a result of this work, there is no question in my mind that telecommunications technologies must be key components of our nation's efforts to improve elementary and secondary education. It is also clear, based on my experience with these projects, among the largest and most innovative telecommunications projects in elementary and secondary education, that the Federal government must provide consistent leadership if telecommunications resources are to be widely available in classrooms, and if elementary and secondary school teachers, students, and administrators are to use these technologies effectively to improve learning and teaching. All children and all school systems in the United States must have equal access to these technologies. Schools must be able to use current technologies and take advantage of future technologies. To achieve these outcomes then the efforts of state and local governments must be supported by the Federal government.

Achieving the "last mile"—fully integrating telecommunications technologies into American classrooms—is a multifaceted, on-going, and long-term task. It involves the development of a national information system that integrates current network systems and provides access to audio, video, and data transmissions. This network system must include components specifically designed for the needs of elementary and secondary schools. It also requires creating an organizational structure for the national information system that can accommodate school districts. Achieving the "last mile" means that technological and cost barriers to using telecommunications in classrooms must be eliminated. Schools must be able to acquire the hardware and software

are motivated, and gain an appreciation for science and mathematics. Importantly, these telecommunications-based curricula encourage students to **take an active role in their own learning. This finding is especially true for girls, minorities, learning-disabled children, and students with typically poor academic** performances.

Data from these projects also indicate this telecommunications approach to science and mathematics education can change how teachers teach. Many teachers participating in these projects report that they have modified their teaching styles to allow for more student initiative, open-ended exploration, and collaborative learning. Telecommunications offers teachers opportunities to take on new roles—learning with their students. Additionally, these three projects show that telecommunications technologies are effective mechanisms for providing teachers with much-needed professional development and the ongoing support required to strengthen teaching and learning in their classrooms.

Telecommunications offer new opportunities for school districts and communities. Working with 59 schools and districts throughout the six New England states and New York, Reach for the Stars is specifically addressing how schools and districts can best use multiple educational technologies to improve their science programs. Each of these schools has developed its own plan for participation in the project, choosing from among the Reach for the Stars technologies, programming, and products and meshing these choices with its own on-going science curriculum.

A critical component of the Reach for the Stars project is the development of a science improvement team at each school site. Based on their needs and their experience with Reach for the Stars, each team will produce a school Science Action Plan to implement after the grant period. Recognizing that change involves the entire educational community, the project is using a series of interactive distance-learning programs, delivered via satellite, to link teachers, necessary to use this information system and have the ability to update and replace outmoded equipment. Programming, instructional materials, and other educational resources for classrooms must be readily available. Finally, the K-12 educational community must be prepared and supported as they incorporate telecommunications into their educational programs.

We have a great deal of work to do to bring schools into the 21st century. In undertaking this task, the role of the Federal government must include the following:

- Provide large-scale and long term funding to physically connect elementary and secondary classrooms into the current national telecommunications infrastructure and to allow schools to take advantage of new technologies as they become available.

- Continue to support the design and development of the National Research and Education Network (NREN) which will fully interconnect elementary and secondary schools with colleges, universities, research laboratories, and other educational institutions.

- Support standards and protocols for network systems that integrate telecommunications technologies—data, voice, and video.

- Assure that elementary and secondary schools can utilize telecommunications technologies at very low cost.

- Develop mechanisms to provide technical assistance to schools, districts, and states in developing long-range telecommunications plans.

- Support the development, evaluation, and dissemination of telecommunications-based instructional materials, applications, and other resources for elementary and secondary school classrooms.

- Support the research and development of hardware, software, and services specifically designed to facilitate the use of telecommunications by students, teachers, school administrators, and communities.

- Support professional development programs for teachers, school administrators, and communities around telecommunications, including assisting school districts and communities to participate fully in these innovations.

- Support research around the effective use of telecommunications in elementary and secondary schools, including research into how these technologies can extend learning into homes.

- Coordinate and integrate the efforts of Federal agencies involved in the use of telecommunications in education.

- Review and revise Federal policies and regulations on telecommunications to promote expand, and improve the use of telecommunications in education.

3. Achieving the "last mile": Connecting classrooms into the telecommunications infrastructure.

The overwhelming majority of classrooms and schools today are very poorly equipped to take advantage of existing telecommunications technologies. Programs funded by the U.S. Department of Education and the National Science Foundation have assisted schools in acquiring equipment, but tremendous needs remain. Few schools and districts are ready to take advantage of future telecommunications applications.

In every educational telecommunications project I have been involved in, participating schools have been required to install and maintain a telephone line for use with a computer modem. In far too many cases, this telephone line has been the major barrier to giving students and teachers effective access to telecommunications. Schools have limited funds. Installation costs and monthly service fees for telephone lines strain school budgets. Additionally, the idea of a telephone in the classroom is novel. Very few classrooms today actually have a telephone line. Teachers and students involved in telecommunications frequently use the telephone line in the school library, the computer lab, the school office, or their own homes. So this might be considered as the first step in developing a telecommunications infrastructure for American classrooms—put a telephone line, which can be used with a modem and for interactive distance-learning programs, in all classrooms.

But we cannot simply give classrooms access to current technologies. We must equip schools now so that they can take advantage of what is available today, as well as equip them to be able to use what will become available in the next decade and beyond. The key components which must be in place if elementary and secondary schools are to fully integrate telecommunications into their educational programs fall into five major categories:

3a. Installing cabling and equipment.

Schools and classrooms need the internal wiring to connect into a national telecommunications network as well as into district and school-based networks. Although a variety of transmission technologies are used now, if we are to provide schools with access to what may be available in the future, we must install high-capacity communications lines in classrooms so they can receive audio, data, and video transmissions. Although schools may not immediately be able to use these resources, the high cost of installing cabling in schools, particularly retrofitting older schools, necessitates installing a system that will serve schools well for many years.

Additionally, most American classrooms require the hardware and software that are needed to participate in audio, data, and video applications. Although computers are widespread in schools, not all classrooms have a microcomputer. Equipment in schools is often old and many schools find it difficult to update their existing equipment.

The minimal equipment that classrooms should have includes a video monitor, one or more microcomputers, a modem, a printer, and a telephone. The classroom microcomputers should be linked into a school-based local area network, so teachers and students can communicate within their own building. Additionally, teachers and students should have access to facsimile machines, VCRs, interactive videodisc players, and video cameras (for two-way video interactions).

3b. Developing an organizational structure to facilitate K-12 telecommunications.

Interconnecting elementary and secondary education into the national telecommunications system requires that we establish an organization which will coordinate and support the use of telecommunications in K-12 schools and districts. Similar to the network organizations that support higher education, we need to develop similar organizational structures to support telecommunications in elementary and secondary education. K-12 educators are beginning to develop such organizations and should be supported. In particular, we need to provide linkages between groups involved in video and data telecommunications.

3c. Providing professional development and support.

The third component of building an effective system for educational telecommunications is providing teachers, administrators, and the entire educational community with professional development and ongoing support. In order to make informed decisions, schools and communities must become aware of the telecommunications options available to them and the ways in which they can benefit from these technologies.

A critical component of this effort, must be ongoing support, including access to up-to-date information, as schools and communities implement these technologies. The telecommunications system itself, through electronic mail, computer bulletin boards, and distance-learning programs, can be a primary mechanism for providing support.

3d. Developing and disseminating curriculum materials, programming, and other telecommunications resources.

We cannot provide access to the technology alone. The fourth component in developing an educational telecommunications system for American classrooms is assuring that innovative instructional materials and programming, and other educational resources (for example: large data sets, bibliographic databases, and access to supercomputers and remotely-sited telescopes) are readily available to teachers and students.

We need to undertake additional research in how telecommunications can best be used in education. We also need to build on the results of the current work and develop and disseminate programs and curricular materials widely. An example of the type of innovative telecommunications-based materials that need to be further developed and disseminated is found in an approach to teaching science and mathematics called "Network Science."

Network Science gives teachers and students the opportunity to do science and mathematics—to actually experience for themselves the excitement of inquiry and discovery. Using the capacity of telecommunications technologies, we can provide students and teachers with the tools and resources they need to undertake scientific and mathematical inquiry. The common elements of the Network Science approach includes:

- Hands-on, project-oriented activities which emphasize cooperation, problem-solving, data collection, and data analysis.
- Investigations into meaningful and important science and mathematics topics, such as acid rain, radon, chaos theory, and astronomy.

- The sharing of data, ideas, and results with other schools through telecommunications.
- Collaboration both within and outside the classroom among students and teachers.
- The involvement of professional scientists and researchers in student investigations through the network.
- The integration of multiple technologies including computers, distance-learning broadcasts, facsimile machines, and interactive videodiscs.

Network Science is one example of an effective use of telecommunications in elementary and secondary education. There are similar examples in other disciplines. However, most of the work to date has been on a relatively small-scale. Consistent funding must be available to develop and disseminate innovative telecommunications-based curricula and programming in all subject areas.

3e. Developing a user-friendly system.

It is critical that we design a national telecommunications system that does not lead to "information overload," but rather facilitates use and promotes communication. The NGS Kids Network was one of the earliest and largest educational projects to use computer-telecommunications on a nationwide scale. From the inception of the project, we recognized that the technology could not be the barrier. Teachers and students needed to do science, not deal with technology. Throughout the design of the software and network, we wanted to make the software simple, intuitive, powerful, and engaging. Today, the NGS Kids Network is used in thousands of classrooms worldwide. In the vast majority of cases, teachers can participate successfully although they have little or no formal staff development.

The basic premise of the NGS Kids Network software—the elimination of technological barriers and hurdles—must underlie all our efforts in educational telecommunications. For the most part, the existing telecommunications systems available to schools are difficult to use, require unnecessary amounts of time, and are unduly expensive. Research and development is needed to design interfaces for educational telecommunications systems, including hardware and software, that are easy-to-use, integrate multiple technologies (audio, video, and data), require little or no training to use, and intelligently handle large amounts of information.

4. The technological options currently available to classrooms.

Classrooms today can take advantage of educational projects on wide-area computer networks and video programming delivered via satellite; cable television; broadcast television; Instructional Television Fixed Services (ITFS); microwave; or fiber optics. Video programs range from non-interactive programs to interactive ones which use either one-way video, two-way audio systems or two-way full video and audio communication. Because of differences in the transmission systems in different parts of the country, as well as the lack of the necessary equipment in schools themselves, not all these technologies are currently available to all classrooms.

Each of these technologies requires a somewhat different mix of hardware and each has their own costs. My experience has been primarily in the areas of wide-area computer networks and interactive satellite broadcasts therefore my remarks in this section will focus on what a classroom would need if teachers and students were to use programming involving these two technologies.

Computer-Based Telecommunications

To participate in currently-available computer-based telecommunications projects, such as the NGS Kids Network, or to access electronic mail systems, databases, and computer-based bulletin boards and conferences, a classroom needs the following equipment:

- A microcomputer, preferably a recent model.
- A computer modem, preferably at least 2400 baud.
- A printer.
- Telecommunications software
- Access to a direct, outside telephone line that does not go through a switchboard or operator.

Individual projects and services may require specific types of equipment and software. Based on the published educational prices of the major computer vendors, the hardware and software costs for the equipment listed above are approximately $2000. The installation and monthly service fees for the telephone line will add additional costs. If a toll call is required to access computer-based services this can substantially increase costs. In addition, commercial products and services will have access or subscription fees.

Interactive Satellite Broadcasts.

Interactive satellite broadcasts are typically one-way video, two-way audio. Teachers and students view a television broadcast and interact with the on-camera personnel in real time via a telephone connection. To participate in such interactive distance-learning programming delivered via satellite, teachers and students must have access to the following equipment:

- A satellite downlink. In order to maximize the programming available to schools, these downlinks should be steerable, programmable, and able to receive both C and Ku transmission.

- A television monitor suitable for viewing by a group of students or an entire class.

- A portable telephone to use during the interactive broadcasts.
- A VCR.

Based on current prices, the costs for the necessary equipment will be about $7500. Equipment costs can be greatly reduced if a single satellite downlink is used to provide programming to an entire district. Schools can be connected to the downlink via the local cable television system or other network. A fixed dish will lower costs, but also reduce the amount of programming schools can access. Full two-way video and audio communications require are considerably more expensive to equip and generally link relatively few sites.

A wide variety of distance-learning programs are currently available in all subject areas. For example, the Massachusetts Corporation for Educational Telecommunications (MCET) provides schools with electronic field trips, scientist and artist-in-residence programs, academic courses on the human genome.

Additional costs to participate in interactive distance-learning programs may include: subscription fees to a program provider (typical annual subscription fees are $2000-$5000); course fees for individual students (typically $250 per semester); and fees for staff development courses.

5. Financing the telecommunications needs of classrooms.

The cost of widespread integration of telecommunications into elementary and secondary education is extremely high and it is quite unlikely that most local school districts could find the funds to accomplish what needs to be done. The key players involved in financing this critical initiative are the Federal government, individual state governments, and business, particularly the telecommunications industry.

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The Federal government must be integrally involved in the funding process over a long period of time—what is required is consistent, large-scale, and long-term Federal funding. In addition to increasing the funds available to Federal agencies who have programs in educational telecommunications, funding mechanisms that should be considered are:

- Creating large-scale programs in educational telecommunications similar to the U.S. Department of Education Star Schools Program. Changes to the this funding program would include increasing the length of the projects from two to at least five years.

- Developing mechanisms to fund telecommunications projects through multiple federal agencies.

- Developing a program of low-interest loans for schools, districts, and states to build the necessary telecommunications infrastructure and to acquire or upgrade equipment.

- Developing funding programs which are jointly funded by the Federal government and the telecommunications industry.

- Creating incentives for the telecommunications industry to invest in education.

REACH FOR THE STARS

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Assistant Project Director: Barbara Ahern

Project Goals and Activities

Reach for the Stars is a two-year (October 1, 1990-September 30, 1992) $9.6 million project funded by the U.S. Department of Education Star Schools Project. Reach for the Stars is designed to improve science education in middle grades (grades 5-8) by integrating distance-learning and other educational technologies with instructional strategies that emphasize investigative problem-solving and cooperative learning. The project works with teachers and whole classes of students at all levels of interest and achievement. A critical component of the Reach for the Stars is the involvement of administrators, school committee members, and parents in this innovation process. To accomplish the goal of improved science education, the Massachusetts Corporation for Educational Telecommunications (MCET) and its Telecommunications Partnership of leading educational organizations are focusing on five key areas:

1. Develop, adapt, and disseminate innovative programming and products which use multiple technologies, including interactive satellite broadcasts, computer telecommunications, videodisc, and fax. These programs and products are being developed for students, teachers, school and district-level administrators, school committee members, and parents (see list of programs below).

2. Implement the Reach for the Stars interdisciplinary and multi-technology approach to science education in 59 schools and districts in the Northeast. At each school, a team of two teachers, one focusing on science, one on another discipline, are collaborating to implement the Reach for Stars programs and products which suit the needs of their students and schools. Each teacher team has developed a Participation Plan which details how they will implement the Reach for the Stars products and programs during the 1991-92 school year.

   A critical component of the project is the development of a science improvement team at each site. This team can include the participating teachers, technology and discipline-specific coordinators, school-building and district administrators, and school board members. Based on their needs and their experience with Reach for the Stars, each team will produce a school Science Action Plan to be implemented after the grant period.

3. Provide assistance and support to teachers, schools, and districts at the demonstration sites in improving science instruction.

   Staff development is an essential component of science education reform. Reach for the Stars is providing staff development and on-going support to participating teachers. In addition to site visits to schools, Reach for the Stars has held one-day workshops and a one-week summer institute for teachers and teachers can participate in several distance-learning staff development workshops during the school year. Using the capabilities of a computer network, electronic mail and conferences keep teachers and Reach for the Stars staff in daily contact.

The teleconference series for school committee members, superintendents, parents, teachers, and other members of the community are critical to involving the community in this innovation.

4. Evaluate the innovation process at the demonstration sites.

   Reach for the Stars is developing substantial formative and summative evaluation programs which will contribute to knowledge about how to improve middle grade science education. Under the direction of Dr. Barbara Flagg, the project is undertaking formative evaluation of Reach for the Stars programs and products.

   The Regional Laboratory for Educational Improvement of the Northeast and Islands is conducting summative evaluation of the project. The summative evaluation process includes documentation of project activities, documentation of the change process at the demonstration sites, and the development of intensive case studies at ten sites.

5. Disseminate the products of Reach for the Stars regionally and nationally.

   Reach for the Stars will disseminate two types of products: curricula and distance-learning programming for students, teachers, administrators, school committees, and parents; and case studies of the innovation process. These products will be disseminated through MCET's distance-learning network, the Mass LearnPike, other regional and national distance-learning networks, and direct marketing of telecourses and products.

The Reach for the Stars Telecommunications Partnership

Reach for the Stars has created a Telecommunications Partnership of leading educational institutions throughout the Northeast. The members of the Telecommunications Partnership are:

Product Developers

The Chedd-Angier Production Company
Education Development Center (EDC)
Museum Institute for the Teaching of Science (MITS)
Museum of Science, Boston
Talcott Mountain Science Center
Technical Education Research Centers (TERC)
Tom Snyder Productions
WGBH Educational Foundation

Technical Assistance Providers

Chapter 1 Computer Cooperative Center
Education Development Center (EDC)
Lesley College
Merrimack Education Center (MEC)
The Regional Laboratory for Educational Improvement of the Northeast and Islands

Supporting Institutions

Archdiocese of Boston
Connecticut State Department of Education
Delaware-Chenango-Madison-Otsego (New York) Board of Cooperative Educational Services
Massachusetts State Department of Education
Nassau County (New York) Board of Cooperative Educational Services
New Hampshire State Department of Education
Rhode Island State Department of Education

Contributing Institutions

Apple Computer Corporation
Bank Street College
Challenger Center for Science Education
Digital Equipment Corporation
Interactive Video Science Consortium
Prodigy Services Company
Toxics Use Reduction Institute, University of Lowell

Selection of the Demonstration Sites

The Reach for the Stars demonstration schools and districts were chosen in collaboration with the Archdiocese of Boston, the Departments of Education in the six New England states, and two Boards of Cooperative Educational Services (BOCES) in New York.

The selection process varied by state, although in all cases the selection process was based on the criteria outlined in the initial Reach for the Stars proposal. The major criteria used in selecting the demonstration sites in all seven states included the following:

- Eligibility for Chapter 1 funding.
- Demonstrated commitment, involvement, and support of the project from school and district administrators.
- Demonstrated commitment from two teachers (one a science teacher, and one focusing on another discipline) to work together as a team in implementing interdisciplinary science programs and products.

- Commitment by the school and district to produce a long-range action plan for improving science education in the school and district.

The demonstrations sites include public, private, and parochial schools as follows:

- Connecticut — 4 schools (3 public schools and 1 private school)
- Maine — 3 public schools
- Massachusetts — 37 schools (32 public and 5 parochial schools)
- New Hampshire — 3 public schools
- New York — 4 public schools
- Rhode Island — 5 public schools
- Vermont — 3 public schools

School Equipment

The equipment package each demonstration site received includes the following:

- Saturn 3.1 meter C/Ku band, steerable, programmable satellite downlink.
- Sharp 27" TV Receiver.
- Sharp VHS Videotape Recorder.
- Pioneer Laserdisc Player.
- Macintosh LC 2MB computer with 40 MB hard drive.
- Apple Stylewriter printer.
- Apple Personal Modem 2400.
- AT&T Portable Telephone.
- Claris MacWrite and MacPaint software.
- PacerLink telecommunications software.
- Bretford cart.

For the duration of the grant the equipment is owned and insured by MCET. Ownership of the computer equipment will be transferred to the schools at the completion of the project. Arrangements for the satellite downlinks are described in your Mass LearnPike contract or in a memorandum from Reach for the Stars dated February, 1991.

Reach for the Stars Programs and Products

INSTRUCTIONAL PROGRAMMING FOR STUDENTS

- Science News

  Science News is a series of monthly 15-minute broadcasts that focus on research currently being done in the areas of the environment, ecology, and astronomy at museums in New England and New York.

- On the Shoulders of Giants

  The Talcott Mountain Science Center will deliver ten interactive broadcasts in their *On the Shoulders of Giants* series which focus on contemporary scientists who are involved in ecology, environmental science, and space science.

- The Animal Communicators

  Developed by Alan Hein, professor of behavior and communication at MIT, and Steven Mahoney, a science teacher from Cambridge, Massachusetts, this telecourse for students integrates live, interactive broadcasts with the Interactive NOVA videodisc, *Animal Pathfinders*.

INSTRUCTIONAL PRODUCTS FOR STUDENTS

- Animal Pathfinders

  Animal Pathfinders is an interactive videodisc program that combines video footage and slides recorded on laserdiscs with a computer database of related information that lets students go on simulated field trips to study the habitats and behaviors of a variety of animals in their natural environments.

- The Great Solar System Rescue

  The Great Solar System Rescue is an interactive videodisc on planetary science developed by The Chedd–Angier Production Company and Tom Snyder Productions. The module is designed to foster informed classroom discussions,
  motivate small group research and individual learning, and challenge students to become interdisciplinary thinkers.

- Race to Save the Planet

  Developed by WGBH, this interactive videodisc and videotape series is an adaptation of the CPB Annenberg television series *Race to Save the Planet*.

- The Changing Earth

  During the second year of the project, The Chedd–Angier Production Company and Tom Snyder Productions, Inc. will produce an interactive videodisc and curriculum materials package focusing on the theme of the Earth as a changing ecosystem.

- TERC Computer–Based Telecommunications Units

  Adapted from the TERC Star Schools materials, The Technical Education Research Centers (TERC) have developed three units, *Trees*, *Solar Energy*, and *Polls and Surveys*, that use computer–based telecommunications for data sharing and analysis among participating classes.

- The Regional Student Weather Network

  Developed by the Talcott Mountain Science Center, the *Regional Student Weather Network* is a multi-media weather and technology project. Students in the weather network use a computer network to access current weather data available through AccuWeather, a national weather service, and to share local weather observations with other classes in a ten–state area.

- Science–By–Mail

  Science-By-Mail involves students in hands-on problem solving with scientists as pen pals. We will also invite families of students at the demonstration sites to participate in *Science-By-Mail*.

- Insights

  Developed by Education Development Center (EDC) with funding from the National Science Foundation, *Insights* is a series of interdisciplinary science modules designed for students in urban schools in grades 5-8.

INSTRUCTIONAL PROGRAMMING FOR TEACHERS

- Science for the Middle Grades

  This five–session series of hands-on workshops, developed by EDC, will help middle grade teachers and science coordinators understand and work with the process of science.

- MOSAIC: Museum of Science Aquatic Investigations for the Classroom

  Developed by the Museum of Science, Boston, this teleconference series for teachers involves them in hands–on activities in environmental science and ecology. Teachers at the downlink sites will receive a package of classroom materials for use with their students.

- Thinking to Learn: Infusing Critical Thinking in Content Areas

  Adapted from a highly successful workshop series on critical thinking, this year–long interdisciplinary telecourse for teachers is being developed and taught by David Perkins, Harvard University, and Robert Swartz, University of Massachusetts. Topics for sessions include: teaching thinking with content area instruction; decision making; creating opportunities for thinking; engaging students in metacognition; infusing analytical skills to enhance understanding; and understanding through design.

PROGRAMMING FOR PRINCIPALS, SUPERINTENDENTS, SCHOOL COMMITTEE MEMBERS, AND SCIENCE IMPROVEMENT TEAMS

- Putting it All Together: Reach for the Stars

  This series, developed by EDC, is an expansion of the program originally entitled "*The Critical Role of Science Education.*" Changes to the format and audience for this series have been made in response to the results of our evaluation of the series' first session, aired in May, 1991.

  This six-session program involves superintendents, school board members, teachers, principals, parents, and science improvement team members in an ongoing dialogue about science reform and the need for improving science at the middle grades level. Session topics include: scientific literacy, inquiry-based teaching and learning, assessment, and developing Science Action Plans.

- Superintendents' Roundtable

  The discussion in this one-session teleconference will build on the series, "*Putting it All Together: Reach for the Stars,*" and will focus on the role of the superintendent in supporting improvement in science education at the district level.

- Principals' Roundtable

  In this follow-up session to "Putting it All Together: Reach for the Stars," principals will discuss the latest research in middle level science and issues in managing change in their schools and supporting teachers in introducing new methods in science education.

PROGRAMMING FOR FAMILIES

- Promoting Science Learning

  This two-session series for families of middle grade students will assist them in understanding what good science education is and provide strategies to use with children that build on the school curriculum. This series is developed by EDC.

- Science-By-Mail

  Science-By-Mail has been designed for use by families at home. We will distribute information about this low-cost program to families of students at our demonstration sites. Through the teleconference series for families, we will demonstrate how *Science-By-Mail* can be done at home.

SENATOR BINGAMAN. Ms. Johnstone, please.

STATEMENT OF SALLY M. JOHNSTONE, DIRECTOR, WESTERN COOPERATIVE FOR EDUCATIONAL TELECOMMUNICATIONS

Ms. JOHNSTONE. Senator Bingaman, thank you very much for inviting me to talk with you. You are going to hear a reiteration of some of the points that Dr. Lenk has just made, realizing that we have never met or talked or shared direct information, but obviously have come to some of the same conclusions.

By way of following up on a few things that came up earlier that you had mentioned at the beginning of this that we in this country seem to lack a clear vision of how teachers should use these telecommunicated technologies, and what I guess I'm trying to suggest, and I've heard several other panelists suggest, as well, is that the role of the vision is to empower teachers to understand how to use these technologies. It is the role of the State and Federal Governments to set the goals, not to determine exactly how these telecommunication tools are used. Rather, to help give the knowledge of how to use them to the teachers and have the teachers make the specific determinations of use.

Another interesting element that has come up that I feel the need to point out, since I'm representing the educational community in the Western United States, in a sense, is that we've talked about nationally delivered programs that are available in virtually every state from some vendor or another. The vendors include SERC, ESD-101 up in Washington State, TI-IN, and a number of other independent groups that are working in this area. It is important to keep in mind that there is an awful lot of very innovative, very effective educational programming that is going on at the local and regional level that you'll probably never hear about here, and that's because they don't have a national voice. There are small school districts, or clusters of school districts, throughout the rural areas of the West, and there are examples in virtually every state in the West, where it is the ingenuity of the local community recognizing their needs to either bring programming in from the outside or, more interestingly, find support within the local community to develop telecommunications networks to meet their needs. They are usually assisted with a little bit of seed money from either the State or the Federal Government to create these networks.

One example of this is in the San Luis Valley in southern Colorado and norther New Mexico. We have yet to bridge that line between the two states, but we are trying to work with the school districts there to do that. A local initiative, tying together what those school districts saw as common community needs, developed a network. I think they had about a $5,000 seed grant from the state, but that much was enough to get something started, and they were able to link those different school systems to offer not just AP courses, but the kinds of courses that they needed for their own communities.

Something that I hope you will not lose sight of is the tremendous need for what we have called local control or initiative, and it is only the locality that truly understands the full range of educational needs in their own community. To have a federal program that would in some way supersede that would be devastating to the diversity in this country.

Let me switch into some of the prepared materials that I believe you have, and I assume goes into some kind of record. I also want to mention something that I forgot to include, which is a report that we just put out of what is happening in the Western States, and I will give that to someone after this session, and hope that it would be of value to someone.

SENATOR BINGAMAN. Okay. We will include that in the record, as well.

Ms. Johnstone. Okay, great. The organization that I represent is a cooperative among the 16 Western States and includes school districts, as well as colleges and universities, education agencies, and a variety of different people. But what we have been able to do in the last two years is not only track what is going on, but be a focal point for information in both directions. That is, from the outside world into these various state efforts as well as from these state efforts, sometimes into the outside world.

We have also helped to develop some regional programs. One, in fact, from my colleague here, Mr. Liptak with Jones Intercable, using again combinations of education and industry, all of whom have the desire to raise the standards of the area with regard to education.

Let me address this last-mile issue for just a moment, and I would like to suggest, as have several other people have also suggested today, that the last mile—what is delivered on that last mile, and how that last mile is used—is equally critical to whatever the technology system ends up being.

I would also like to suggest that it is highly critical that teachers not just be given a window from the outside world into their classroom for their students, but rather that they have a way to share information in two directions.

The simplest solution to that, and one that has been brought up several times this morning, is the notion of working toward having every classroom in this country have a phone line, a simple phone line, and I would like to add to that that it may involve changing the way we define "universal phone service" in this country. Right now I believe it is defined along the lines of standard dial, single party line service, and the goal is to have every household in the country hooked up.

Instead, what we are talking about now is digitally switched—a touch tone kind of service—and, again, not ignoring the notion of having each classroom in the country hooked up.

I would also like to suggest that it may be possible to finance this much along the lines that the 911 emergency services have been financed in several of the states, and I realize that this is a state-by-state effort, but it may be that there could be some federal leadership in this area.

Typically, there is some kind of surcharge, although it may be called something else, that is added to people's phone bills, that in turn makes it possible for a regional phone company to offer a universal 911 emergency service statewide.

I also don't want to suggest that this could be done automatically. There is a lot of complexity to that, and obviously a lot of concern with regard to how those charges are levied and how they are regulated, and that again goes back to the State Public Utilities Agencies.

I would like to also reiterate a suggestion that my colleague, Dr. Lenk made; that is, it makes a great deal of sense at this point to follow up on some of the marvelous work that has been done with regard to the Star Schools effort, which provided seed money to make a lot of changes and a lot of new programs develop in the way that we're delivering education.

What we need at this point, I think, and very critically, is to again empower the teachers to know how to use the technologies that we're trying to make available to them. It is impossible to explain the critical need in that arena, and it is reiterated every time I talk to people in schools.

You were right just a few minutes ago when you said, if you had a panel of teachers sitting here and you asked them about these nationally delivered programs, most of them would say, "well, you know, sure, it would be a great idea, but I've never heard of it."

The notion that we're talking about now is bringing these tools directly to the teachers, but also empowering those teachers to know how to use them and integrate them into their curriculum. In addition, to know how to help their students learn using this variety of informational tools.

I would also suggest that this doesn't require any kind of national agency, that there are a number of these efforts going on now, not only in the federal labs that are around the country, but in many colleges and universities that are offering teacher training kinds of activities.

There are State Departments of Education that are trying to work in this area, but all of them are hampered by low funding. It's not a glamorous area, but it's so critical to make this kind of change that it has to be done. The notion of perhaps establishing some kind of Star-Schools-like grant program, to enable these regional and local efforts to expand with regard to empowering these teachers, I think, would go a long way.

The rest of my information is available in print, and I will leave it there and let us get on.

Senator Bingaman. All right. Thank you very much.

[The prepared statement of Ms. Johnstone, together with material subsequently supplied for the record, follows:]

PREPARED STATEMENT OF SALLY M. JOHNSTONE

I. Thank you for opportunity to let you know what the members of the Western Cooperative for Educational Telecommunications think is important in this area.

II. Background

A. Personal: My degrees are in experimental psychology ... my intensive studies and later teaching was in the area of how people process information (learning and memory). Thus my view point is closely tied to that of the learner and the teacher.

B. Organization: The Western Cooperative for Educational Telecommunications is a collection of about 150 school districts, departments of education, colleges, universities, and state agencies throughout the 16 western states along with interested corporations. This cooperative is two years old. Our parent organization, the Western Interstate Commission for Higher Education (WICHE), is an educational compact that was created about 40 years ago by the legislatures in 13 states and signed by then President Eisenhower to assist the region in "sharing educational resources and assisting states with educational policy decisions." The founding of the Western Cooperative is one of the many ways WICHE continues its mission. There are three other regional educational compacts in the country. One among the New England states, another involving the southern states and the third has just been formed between mid-western states. The Southern Regional Education Board is currently working toward forming an analogous organization to the Western Cooperative for Educational Telecommunications.

C. I wanted to point out these arrangements between the states to highlight something you all know, but I believe is critical to keep in mind in these hearings. An important aspect of education in <u>this</u> country is its orientation to the local community's needs and its control by that community. I do not think we want to shift that emphasis from the community, but rather empower the community to educate its children with the best tools available.

III. You asked about the "last mile" issue and I would like to suggest that it begs the questions of what is to be delivered that "last mile" and what role the federal government should play in determining what that is. I would like to suggest the following:

A. In order to effectively reach students in the classroom, there must be a multi-service connection with whatever resources an individual teacher chooses to use. One way to accomplish this is to legislatively expand the definition of universal phone service to include digitally switched, touchtone service that must be available in every classroom (not school). Also to create a special "long distance" rate for instructional use.

1. Rational

a. Teachers are cut off from their community when they are in their classrooms. It is very hard for teachers to contact parents, or even their front office in an emergency. With digitally switched, touchtone service, they would be able to participate in in-service sessions to which they would otherwise not have access. They would be able talk to colleagues to help them solve classroom problems.

b. Without phone lines into every classroom it is almost impossible to connect computers to modems which in turn will allow connection to a wide base of resources currently available and planned. The federal money expected to be available to support the development of the National Research and Education Network (NREN) will not be put to the best use unless this "last mile issue" is solved.

c. Phonelines in classrooms can provide access to interactive, enrichment programs (the tools they need), as well as full courses, if they were needed. As I have been reminded, only an individual teacher knows his or her students. Every child has a different learning rate and no nationally delivered class can be tailored to all the learners' needs. Nationally delivered classes have been quite successful for special students (advanced placement, highly motivated remote students, etc.), but may not be as effective for all learners. We cannot afford to leave "average" students behind.

d. Digitally switched phone lines in classrooms can make available links through voice, data, and low bandwidth video (compressed/still-frame). These links can be to regional and national resources, other schools, and international groups.

2. Financing: Just as 911 emergency services are financed in some states by surcharges to everyone's phone bills, so this socially critical educational service might be financed in the same manner (with careful supervision by states' public utilities agencies of the telephone companies' actual costs and charges).

IV. The federal government can assist with courseware by training teachers how to use these tools.

A. Perhaps a national grant program (like Star Schools) focused on training teachers to effectively use telecommunication tools could be developed. This would allow local and regional efforts already underway to expand and to offer services that might not otherwise be affordable to assist the teachers.

B. A national directory of available resources that is maintained and easy for the classroom teacher to use would be critical. This may be part of the NREN.

C. One approach to funding this type of training and clearinghouse service might be to have a "check off" on our income taxes. Designating tax dollars for specific educational services could be a very popular concept.

V. In summary, I would like to suggest that our teachers need easy access to educational electronic tools, and the training to use them effectively. I hope your efforts will empower teachers to develop into the "guides" to knowledge they can become and thus effectively reform our educational system. I am reminded of an old saying that somehow seems relevant: "Give someone a fish and they will eat for a day. Give them a fishing pole and teach them how to fish and they will eat for a lifetime."

Research on Telecommunicated Learning: Past, Present, and Future

By SALLY M. JOHNSTONE

ABSTRACT: Research on media-assisted distance education has been conducted since the 1930s, and most studies agree that when such courses are well designed, they are as effective as those taught in a traditional environment. Most of this research is based on a limited population however, and the extent to which it can be generalized to other groups is questioned. More recent research focuses on broader issues, such as new models of distance learning and interactivity strategies for learners at a distance. There are still some unanswered questions relating to the most effective types of interaction between learners and their teachers.

Sally M. Johnstone earned a master's degree from Virginia Polytechnic Institute and a doctorate from the University of North Carolina, Chapel Hill, in experimental psychology. She taught psychology before becoming an academic administrator at the University of Maryland University College, then served as the first director of its Center for Instructional Telecommunications. She now directs the Western Cooperative for Educational Telecommunications in Boulder, Colorado. She has published several articles on educational uses of telecommunications technologies.

ALL over the country educational administrators from elementary to post-secondary levels are being faced with demands to provide educational equity to students regardless of the students' location. Generally, these demands are not accompanied by the massive amounts of funding that would be required if traditional methods—requiring new buildings, new teachers, new support personnel, and new support systems —were used. Consequently, administrators in increasing numbers are seeking new ways to effectively deliver classes to students. Distance learning has become an attractive option.

The solution to the administrator's dilemma has centered on the use of recently developed telecommunications technologies that allow students to be linked with faculty via phone lines, cable television, broadcast and microwave networks, and satellites. The media being used range from telephone conferencing, telephone/computer conferencing (audiographics), one-way video with audio interaction, and two-way video to computer conferencing. In the past few years the use of such systems by educators has proliferated dramatically.

In order to speed up the development of these systems to serve elementary and secondary school students, the federal government is investing millions of dollars through the Star Schools Grants Program. The systems developed under this program are already serving thousands of learners around the country.[1] In a 1988 survey of universities and colleges that were members of the National Continuing Education Association, 81 institutions in 39 states reported using a variety of telecommunications technologies to serve their students at a distance.[2] During the 1989 legislative sessions, 9 of the 15 western states surveyed established some type of educational telecommunications planning process. Of those 15 states, 4 already had educational telecommunications systems in place.[3]

1. Frank Withrow, "Star Schools Distance Learning: The Promise," *Technological Horizons in Education Journal*, 17(9):62-64 (May 1990).

2. Sue Willis and Susan E. Bridwell, *Directory of Distance Education through Telecommunications* (Washington, DC: National University Continuing Education Association, 1989).

3. Dwight Dively, *Educational Telecommunications in the West: 1989 State Legislative Actions*, WICHE 2A195 (Boulder, CO: Western Interstate Commission for Higher Education, 1989).

WHAT DO WE KNOW ABOUT EFFECTIVENESS?

The sudden investment and activity in this way of linking students and teachers brings up the question of what we really know about its effectiveness. As it turns out, researchers have been examining this issue ever since the early days of radio.

Early research on electronic media instruction

As early as 1939, the effectiveness of instruction via radio was investigated. Researchers divided 300 Detroit public school students into two groups matched for sex, grade, and measured intelligence. One group listened to their 15 lessons over radio. The students in the other group were taught the same lessons by traditional methods and were not permitted to listen to the radio broadcasts. All of the students took the same tests throughout the course of the experiment. The investigators reported that those students taking their classes via radio performed as well as or better than those in a traditional classroom.[4]

In the 1960s, at least five review articles were published examining hundreds of studies comparing televised instruction and traditional classroom instruction. The conclusions reached by each of the reviewers agreed that, at worst, there were no significant differences in learning achievement between these modes of delivery. In several cases, the televised instruction resulted in higher test scores.[5]

Effectiveness of interactive, telecommunicated learning

Typically, the effectiveness of distance learning has been measured by comparing test scores and other achievement measures of students who are taught in the face-to-face, traditional classroom with those of students who are taught at a distance using telecommunications technologies. The evidence seems to support an equality of test scores. Will Kitchen made a report to the Senate Committee on Labor and Human Services on the use of interactive television in rural school districts in Minnesota.[6] No statistically significant differences in achievement between the instructional-television students and their peers taking a wide variety of elective courses in traditional classrooms were found for the years between 1983 and 1986.

Robinson reviewed the progress of a distance-learning consortium of four rural Illinois school districts.[7] The consortium was formed in 1983 to increase the number of courses that could be offered in each of the schools, to promote achievement as measured by mastery of advanced-level course work, and to increase the efficiency of the teachers' instructional time. The review concluded that the project effectively achieved its goals of expanding the curriculum and increasing teacher efficiency. In addition, the students in the remote instructional-television classroom scored just as well as their counterparts in traditional classrooms.

While these students may be learning as much as their peers in traditional classrooms and responding positively to the technology, there is evidence to suggest that, if given the option, they would prefer a face-to-face environment. In a 1987 survey of students taking classes deli-

4. D. C. Cook and C. L. Nemzek, "The Effectiveness of Teaching by Radio," *Journal of Educational Research*, 33(1):105-9 (1939).

5. Maureen P. Gibbins, "The Effectiveness of Technology Applied to Instruction: A Summary of the Research Literature" (Paper prepared for the Center for Communications, San Diego State University, 1989), pp. 2-5.

6. Will Kitchen, "Education and Telecommunications: Partners in Progress," ERIC ED 282 601 (Testimony before U.S., Senate, Committee on Labor and Human Services, 11 Mar. 1987).

7. Rhonda S. Robinson, "An Investigation of Technical Innovation: Interactive T.V.," ERIC ED 2[illegible] (Paper delivered at the Annual Convention of the Association for Educational Communications and Technology, Anaheim, CA, [illegible] 1986).

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ered over a satellite network, 70 percent indicated they would choose a traditionally taught course over the satellite course.[8] Some of the reasons these students gave were too much work, some difficulty in hearing, difficulty in contacting the teacher, and inadequate teacher preparation and training. They also said, however, that they appreciated the increased number of course offerings and the interesting instruction. It should also be noted that this network was just beginning in 1987 and has matured since that time.

If these technologically delivered classes are the only way some of these students can have the opportunity to take a particular class and if they learn the material as well as their peers in traditional classes do, it seems that the classes are effective.

Nonetheless, it may be that "effectiveness" needs a broader definition than test scores. With regard to elementary and secondary school activities, Batey and Cowell point out some other aspects of the effectiveness of distance learning.[9] These include a positive attitude on the part of students, higher levels of communication between schools and districts, greater levels of parental involvement with the courses, and the ability of teachers and students to apply to other areas abilities acquired in order to use new technologies in an educational setting.

Adult learners

More analytic studies have been conducted using college-level and other adult learners. Just as with the younger learners, there are many studies that compare the achievement measures of older students in teleconferenced classes with those of older students in face-to-face classes. A variety of adult learners have been examined—noncredit students, undergraduate students, graduate students, laboratory subjects, and so forth—in a variety of content areas. There is general agreement that delivering classes via teleconferencing is as effective for learning as are traditional classes.

Blackwood and Trent examined learning differences between adult students in a noncredit finance course; some of the students were taking the class by audioconferencing and the others by a traditional, face-to-face teaching method.[10] The investigators found no differences between the two groups in the amount of learning. Puzzuoli looked at the differences between resident students and remote students taking college classes via audioconferencing with a graphic component. His analysis indicated that the achievement scores of the remote students were

8. Bruce O. Barker, "The Effects of Learning by Satellite on Rural Schools," ERIC ED 284 693 (Paper delivered at Learning by Satellite Conference, Tulsa, OK, Apr. 1987).

9. Anne Batey and Richard N. Cowell, *Distance Education: An Overview*, ERIC ED 278 519 (Portland, OR: Northwest Regional Educational Laboratory, 1986).

10. Helen Blackwood and Curtis Trent, *A Comparison of the Effectiveness of Face-to-Face and Remote Teaching in Communicating Educational Information to Adults*, ERIC ED 028 324 (Manhattan: Kansas State University, Cooperative Extension Service, 1968).

equal to or better than the scores of the resident students.[11] Finally, Hoyt and Frye concluded that undergraduate and graduate students taking teleconferenced classes performed as well on a variety of measures as students taking identical on-campus classes.[12]

A more complex analysis of teleconferencing and the factors that influence effective learning was reported by Chapanis.[13] He concluded that some communications tasks typically used in classes are as effectively accomplished over a telecommunications system as in a face-to-face classroom. These include exchanging information, solving problems, and generating ideas.

Vandehaar analyzed the basic configuration and procedures of teleconferencing classrooms in terms of how they encourage or limit student development within a paradigm described by Arthur Chickering, a student-development scholar. She concluded that while student cognitive development is comparable to that in traditional classes, the teleconferencing environment as it is currently being used does not foster multiple dimensions of student development. She suggests that the barriers to development are not a direct result of the teleconferencing environment per se but rather of limited or inappropriate teaching behaviors on the part of instructors.[14]

Even though there are no measured differences in achievement, adults, like younger learners, seem to prefer face-to-face teachers when they are given a choice. In a study comparing instruction via teleconferencing, face-to-face teaching, and a combination of the two methods, Davis reports that as face-to-face contact increases, so does the learner's satisfaction with the instructional method.[15]

Although students, regardless of age, seem to learn course materials equally well in traditional and telecommunicated situations, some differences in student reactions have been noted. As mentioned previously, students often prefer the face-to-face setting. We do not know whether this is a reaction to a novel learning setting or whether it actually has some effect on overall learning that is not reflected in test scores. Some would argue that teachers do more than just present material. They interact with the student, answer questions, encourage the student, and assist the student in understanding the les-

11. David A. Purnell, *A Study of Teaching University Extension Classes by Telelecture*, ERIC ED 042 961 (Morgantown: West Virginia University, 1970).

12. Donald P. Hoyt and David W. Frye, "The Effectiveness of Telecommunications as an Educational Delivery System," ERIC ED 070 318 (Manuscript, Kansas State University, 1972).

13. Alphonse Chapanis, *Human Factors in Teleconferencing Systems: Final Report*, ERIC ED 163 902 (Baltimore, MD: Johns Hopkins University, Department of Psychology, 1976).

14. Debb Vandehaar, "Learning between Here and There: Quality Teleconference Classrooms," in *Teleconferencing and Electronic Communications V*, ed. L. Parker and C. Olgren (Madison: University of Wisconsin—Extension, Center for Interactive Programs, 1986).

15. Delores J. Davis, "Evaluation and Comparison of Teleconference Training with Face-to-Face Training and the Effects on Attitude and Learning" (Ph.D. diss., Drake University, 1985).

sons. Since the advent of telecommunications systems that allow students and teachers to be linked for two-way communication, it seems possible to have the vital aspects of the teacher-student relationship preserved at a distance.

WHAT ARE THE LIMITS OF OUR KNOWLEDGE?

Most simple comparisons of distance and traditional students do indicate that learning is equivalent for these groups, but there are limits to our ability to generalize from these findings. In 1989 the congressional Office of Technology Assessment compiled a comprehensive report on the use of technology for distance learning. The report makes it clear that the vast majority of the literature on effectiveness is based on highly motivated adult learners.[16]

The typical distance-learning program in secondary schools has targeted highly motivated, college-bound students.[17] Evaluations of such programs indicate that these high school students seem to enjoy the experience and score as well on class tests as their peers who are physically present with the teachers.[18] The question of the effectiveness of distance learning for other, less motivated students remains unanswered, however.

In a 1987 review of effectiveness literature, Eiserman and Williams[19] found no studies that compare different content areas and none comparing the effectiveness of instruction using different instructional designs. What seems to work with one specific course may not be as effective with different types of courses.

Helen Warriner-Burke[20] points out that a televised teacher is not able to provide the individual encouragement and opportunity for practice that are essential for successful foreign language learning. We cannot assume that, because a calculus course can be effectively taught at a distance, a foreign language class would be equally effective using the same technical delivery systems and the same instructional design concepts.

Another concern arises when one tries to generalize results from studies that compare resident college students and off-campus students. These

16. U.S., Congress, Office of Technology Assessment, *Linking for Learning: A New Course for Education*, OTA-SET-430 (Washington, DC: Office of Technology Assessment, 1989), p. 44.

17. The one exception to this is in the area of computer-assisted instruction, which is widely regarded as an effective tool for raising achievement among low-achieving students, increasing student motivation to learn, and increasing student attention. This research is summarized in U.S., Congress, Office of Technology Assessment, *Power On: New Tools for Teaching and Learning* (Washington, DC: Office of Technology Assessment, 1988). The current article does not claim to cover the research on technologies considered as "teaching tools."

18. Withrow, "Star Schools Distance Learning."

19. William D. Eiserman and David D. Williams, *Statewide Evaluation Report on Productivity Project Studies Related to Improved Use of Technology to Extend Educational Programs*, subreport 2, *Distance Education in Elementary and Secondary Schools: A Review of the Literature*, ERIC ED 291 350 (Logan, UT: Wasatch Institute for Research and Evaluation, 1987).

20. Helen P. Warriner-Burke, "Distance Learning: What We Don't Know Can Hurt Us," *Foreign Language Annals*, 23(2):129-33 (Apr. 1990).

off-campus students are usually a little older than their on-campus counterparts. They are usually employed, and, frequently, they are taking classes that have direct relevance to the work they are doing. In other words, these may be two different populations, and the comparisons may be reflecting more than just the instructional environment.

WHAT WE NEED TO KNOW

Twenty-four years ago, Chu and Schramm suggested that the question is not whether media can be used to teach but how they can best be used to teach.[21] This brings up several categories of inquiry that will be fruitful for future researchers.

Instructional design

In the conclusion of an extensive review of the literature on distance-learning effectiveness, Nil Whittington pointed out that the most critical element in student achievement is effective instructional design and instructional techniques regardless of whether the instruction is delivered by television or by traditional means.[22] This seems to be the bottom line for all instructional delivery.

What are the instructional design principles that make distance learning most effective? How can instructional designers take better advantage of all the technologies currently available to assist learners and not be limited by our current standards of the traditional face-to-face classroom?

Support for teachers and students

In a survey of faculty using telecommunications technology to teach distance learners, one of the most frequently mentioned suggestions was to provide faculty with more training.[23] The training desired was not only on how to use the technology but also on strategies for teaching students at a distance. As Vandehaar's analysis strongly suggests, teleconferencing teachers may not be using appropriate teaching behaviors to help their students fully develop.[24] What are the minimal support systems that instructors need in order to translate their face-to-face classes into telecommunicated class sessions?

Different teleconferencing systems—audiographic, one-way television, two-way television—have all been reported to be effective learning and teaching tools. What instructional strategies are necessary for the effective use of each of these systems? What instructional support is necessary for teachers to be able to use each of these systems effectively?

21. Godwin C. Chu and Wilbur Schramm, *Learning from Television: What the Research Says*, ERIC Document Reproduction Service, ED 109 985 (Washington, DC: National Association of Educational Broadcasters, 1967).

22. Nil Whittington, "Is Instructional Television Educationally Effective? A Research Review," *American Journal of Distance Education*, 1(1):47-57 (1987).

23. Kay W. Gilcher and Sally M. Johnstone, *A Critical Review of the Use of Audiographic Conferencing Systems by Selected Educational Institutions* (College Park, MD: International University Consortium, 1988).

24. Vandehaar, "Learning between Here and There."

There is another critical group of questions concerning the needs of learners. We know that distance students want all the obvious services provided in a traditional setting, such as library access and advising.[25] What other services and support do they need to make the learning experience as rich as possible? What is there in the face-to-face class that might be incorporated into distance-learning strategies?

Different student populations

There is very little research on how well different populations respond to distance learning. At a recent conference on distance-learning issues for teachers,[26] a teacher of learning-disabled children pointed out that she thought that teaching with interactive television might be very effective for her students. She mentioned that these students seem to have an easier time paying close attention to television than to people. This is an interesting observation that warrants further research.

As previously noted, there is very little information on whether the average secondary school student would respond as well as do those highly motivated students who have been involved in the dista ing projects. Do average need more personal cont much support be provided facilitator who may be a goc but not an expert in the sub taught? We do know that with knowledge of their students' characteristics ca effect on student achievem what types of skills would fa need in order to provide a the secondary or elementa student?

Interactivity

One of the assumptions in the design of most cont distance-learning systen need for interaction betv dents and their teachers. D and students need to see on for effective learning and i to take place? Is real-time teacher or student-studen tion really the best or only

Robert Whitney, a te English at Millsaps Colleg sissippi, reports that conferenced discussions be stu. ents reflect higher leve cal thinking than do traditi discussions and papers.[28] finding was reported in a learning setting by Norman

25. Connie L. Dillon and Charlotte Gunawardena, *Learner Support as the Critical Link in Distance Education: A Study of the Oklahoma Televised Instruction System*, Oklahoma Research Center for Continuing Professional and Higher Education Report (Norman, Oklahoma Research for Continuing Professional and Higher Education, Jan. 1990).

26. "Teaching and Learning at a Distance," Workshop jointly sponsored by the University of Northern Colorado and the Western Cooperative for Educational Telecommunications, Greeley, CO, June 1990.

27. Jere Brophy, "Teacher Ir Student Achievement," *America gist*, 41(10):1069-77 (Oct. 1986).

28. Robert Whitney, "VAX Not Computer Conference to Teach Cr ing," *Instructional Computing Up* 1990, pp. 3-5.

29. Norman Coombs, "Compu puter and Audio Teleconfere Instructor's View," *New Horizons* ucation, 8:1-7 (Fall 1989).

He reports on a comparison between computer and audio conferencing, which he uses in place of face-to-face class discussions between his telecourse students. Coombs notes that one of the great advantages of the computer conference is its democratic setting. Everyone is perceived on a similar basis regardless of physical handicaps, regional or national accents, usual assertiveness in face-to-face discussions, and other characteristics that would tend to put students on unequal footing in the usual classroom setting.

Can computer-conferenced student-teacher and student-student interaction be more effective than traditional types of interaction? Can the democratic nature of computer conferencing allow students who typically do not engage in classroom discussions to be more likely to express their thoughts in this mode? Is this a possible means of encouraging active participation in the learning process on the part of those students that our traditional classroom procedures do not effectively reach?

SUMMARY

In brief, teleconferencing is making classes available to students who otherwise would not have access to them. There is a long history of research establishing that students can learn effectively via electronic media. The research questions that now face us are of a different order. They are more detailed, more probing, and more specific. Research must now address the issues of how best to use all educational resources—distance-learning strategies included—to bring quality education to all learners.

SENATOR BINGAMAN. Mr. Liptak, go right ahead.

STATEMENT OF GREGORY J. LIPTAK, PRESIDENT, MIND EXTENSION UNIVERSITY

MR. LIPTAK. Thank you, Senator, for permitting me to come from Colorado to present testimony on this important issue.

Yesterday, Colorado had six inches of new snow. All of our ski areas are open, and we invite everybody to come. That is, of course, if you choose not to go to New Mexico. [Laughter.]

SENATOR BINGAMAN. Anyone who can't get into Taos, we would be glad to have you go on up to Colorado. [Laughter.]

MR. LIPTAK. I'm the President of Mind Extension University—the Education Network—the Nation's fastest growing basic cable television service.

Our parent company is the nation's ninth largest cable television operator, and we're the principal cable TV operator in New Mexico, serving the Albuquerque metropolitan area, as well as the Cities of Grants and Soccoro.

In my brief testimony today, I would like to make two points concerning distance education.

Point number one. The U.S. cable television industry today serves more than 55 million cable TV subscriber households and is now the dominant means of the delivery of television to the American public.

Two years ago, most of the Nation's cable television operators, called MSOs or multiple system operators, agreed to participate in a project called Cable in the Classroom. These 43 MSOs represent 82 percent of all U.S. cable television households.

We agreed to do the following: All of the cable systems operated by each multiple system operator would provide one standard cable drop and free basic service to all consenting public junior and senior high schools passed by our cable distribution systems within our franchised areas by December 1992. We also agreed to provide cable service to all consenting state accredited private schools by the end of September 1994.

Now, many cable companies are going far beyond this minimum commitment. Many are wiring all of the classrooms, raising money to support distance learning projects in their communities, and so forth.

Joining with our major program suppliers, we agreed we would provide educational programming offered without commercials by the programmer members to the participating schools.

Further, all of these MSOs agreed that all participating schools will have a minimum of one video cassette recorder, one television monitor, and one equipment cart in every school.

Well, I'm pleased to report that as of today nearly 1,600 cable television systems in the United States are participating in this Cable in the Classroom project. At this time, participating cable systems passed more than 18,400 junior and senior high schools, and 15,500, or 84 percent, have received cable service as of this date.

In your state, Senator, for example, 81 percent of all the consenting public and private junior and senior high schools passed by cable have today had cable service made available.

This multimillion dollar commitment has also produced a magazine called "Cable in the Classroom" that currently has a circulation of more than 56,000. This document summarizes all of the program commitments by the various suppliers.

Because of this aggressive program, I suggest to you that I do not believe the Federal Government should make any investment in hardware to deliver distance education. Satellites, earth stations, and distribution systems are all in place and available.

The cable industry, with a full video pipeline into 60 million homes, presents, I think, an efficient delivery system that is already in place for the delivery of materials. System operators have committed to make service available at no charge. Also, there are other transmission techniques that you've heard about today—fiber optic systems, ITFS, low-power television, which are available.

In my judgment, the cost of constructing a totally new redundant infrastructure for educational purposes is not only prohibitive, but also unnecessary, and especially in view of the sites that have already been developed by the earlier Star Schools funding programs.

On the horizon, as we've talked about today, new technological developments hold great promise. With video compression technology brought to market over the next decade, there will be a major expansion of cable television channel capacity.

In my judgment, the schools of the future will have access to several channels on cable television systems and will be able to offer a variety of distance education programs to their districts.

Most cable TV systems will be coming up for franchise renewals over the next three to four years, and from what I see around the country, school districts and cities are making absolutely certain that a variety and a number of channels are available on these refranchised systems.

I think it would cost billions of dollars to construct a new redundant television distribution system by fiber optics cable across America. Construction of new satellite systems will require the placement of expensive satellite receive stations at every school.

To me the only practical and cost-efficient distribution system for the delivery of materials is cable TV. All levels of government and all of our major schools should work with their local cable systems in this last cost-effective mile to take full advantage of this incredible commitment that the cable television industry has made to America.

Now, my second point concerns the funding of distance education in the United States. First of all, our company has mounted Mind Extension University, the Education Network. The channel was founded four years ago by my chairman, Glenn Jones. His concept [illegible] America a school, to combine the technologies of cable and satellite, to create a nationwide electronic classroom without walls.

Today, we serve 17 million cable and satellite dish households, with an additional 3 million expected by the end of the year. Therefore by early next year, with 2.9 persons per household, perhaps as many as 50 million Americans will have access to the channel.

The network has been called a life-long learning resource for a community, because it presents several major program elements. As you've heard, we offer the live interactive direct instructional material from the TI-IN Network, advanced placement courses in mathematics, science, foreign language, as well as student enrichment and staff development.

In addition to secondary instruction, we offer graduate and undergraduate courses, a MBA program from Colorado State, and a bachelor's degree completion program from the University of Maryland and a variety of other materials for the Nation's consumers. We are affiliated with 20 of the country's most prestigious colleges and universities, including Penn State, Kansas State, the University of South Carolina, and Colorado State.

The secondary school programming from the TI-IN Network was the original recipient of a Star Schools grant in 1988. The TI-IN United Star Network provided interactive instructional services to 316 sites, serving more than 20,000 students with credit and noncredit courses and more than 100,000 teachers.

The OTA has documented the effectiveness of this approach to distance education in its report to Congress—Linking for Learning. In fact, the success of TI-IN and the demonstration Star Schools project led OTA to introduce TI-IN to Mind Extension University, thus providing a low-cost efficient way to disseminate quality education into schools and into the living rooms of America.

I want to encourage you to help fund the ongoing program development for these networks. Some of the poorer schools that were involved in the early Star Schools funding simply have not had the financial wherewithal necessary to continue the program once the demonstration project ended.

Money is need to finance the development of programming at the local school level. Help the schools across America, particularly educationally and economically disadvantaged schools in both rural and urban settings, to pay the modest sums necessary, to provide access to master teachers and distance learning techniques.

I'm sorry that both Senators Thurmond and Simon had to leave early, because both of them have appeared on our network and have talked on an interactive basis to students in their home states using this technique.

I know I speak on behalf of my colleagues in the cable industry when we say we're ready to provide the last mile, the distribution system necessary to bring this material into America's classrooms. We can, in Glenn Jones' words, bring the facilities of satellite and cable TV together in order to make all America a school.

Thank you, sir.

SENATOR BINGAMAN. Thank you very much.

[The prepared statement of Mr. Liptak follows:]

PREPARED STATEMENT OF GREGORY J. LIPTAK

Thank you, Mr. Chairman, and members of the Committee for permitting me to come from Colorado to present testimony on this important issue.

I am the president of Mind Extension University: The Education Network, the nation's fastest growing basic cable television service. In my brief testimony this morning, I would like to make two points concerning distance education.

Point #1 - The United States cable television industry today serves more than 55 million U.S. cable TV subscriber households and is now the dominant means of delivery of television to the American public.

Two years ago most of the nation's cable television operators, called "MSOs" or "multiple system operators", agreed to participate in a project called "Cable in the Classroom." These 43 MSOs represent 82% of all United States cable television households. We agreed to do the following:

All of the cable systems operated by each multiple system operator would provide one standard cable drop and free basic service to all consenting public junior and senior high schools passed by our cable distribution systems within our franchised areas by December 1992. We also agreed to provide cable television service to all consenting state-accredited private schools by the end of September 1994.

Joining with our major program suppliers, we agreed that we will provide educational programming offered without commericals by our programmer members to the participating schools. Further, all MSOs agreed that all participating schools will have a minimum of one video cassette recorder, one television monitor, and one equipment cart in each school.

I am pleased to report that as of today nearly 1,600 cable television systems in the United States are participating in this Cable in the Classroom project. At this time, participating cable systems passed more than 18,400 schools, and 15,500 (or 84%) had received cable service.

This multi-million dollar commitment has also produced a magazine, "Cable in the Classroom", that currently has a circulation of more than 56,000.

Because of this aggressive program, I suggest to you that I do not believe that the federal government should make any investment in hardware to deliver distance education. Satellites, earth stations, and distribution systems are all in place and available. The cable television industry, with a full video pipeline into nearly 60 million homes, presents an efficient system that is already in place for the delivery of educational materials. System operators have committed to make service available at no charge. Also, there are other transmission techniques - fiber optic distance learning providers to create a nationwide "electronic classroom without walls." ME/U, as it is known, continues to be the fastest growing cable network in America, currently serving more than 17 million cable and satellite-dish households, with an additional 3 million expected to be launched by early 1992. Therefore, by early next year, with 2.9 persons per household, perhaps as many as 50 million Americans will have access to the channel. The network has been called a "lifelong learning resource" for a community because it presents several major program elements. On school days, it retransmits the live, interactive, direct instructional material provided by The TI-IN Network of San Antonio, Texas. Offered are classes in foreign language, mathematics, science, and student enrichment programs, as well as professional staff development for teachers. One real-life story of distance learning success concerns Remigio "Mico" Perales, a young man from Nordheim in south Texas, population 369. Mico took his advanced mathematics and science courses - not available in his high school curriculum - via this interactive televised distance-learning vehicle. His performance earned him a scholarship to Massachusetts Institute of Technology.

In addition to secondary instruction, Mind Extension University delivers graduate and undergraduate courses, including an MBA program and a bachelor's degree completion program. We offer a literacy program, GED preparation, and English-as-a-Second-Language program. With the Library of Congress, we present each week the Global Library Project. This project, funded by a $1 million grant from our company, seeks to bring to the nation the largest repository of information in the world. A number of your colleagues have already appeared on some of the programs.

We are affiliated with 20 of the country's most prestigious colleges and universities including Penn State, Kansas State, the University of South Carolina, and Colorado State University. Our secondary school program provider, The TI-IN Network, was the managing partner of an original recipient of a Star Schools grant in 1988. The seed money you provided enabled The TI-IN United Star Network to provide interactive instructional services to 316 sites, serving more than 20,000 students with credit and non-credit courses, and more than 100,000 teachers. The Office of Technology Assessment has documented the effectiveness of distance education, and of TI-IN's approach in its 1989 report to Congress, "Linking for Learning" A New Course for Education." In fact, the success of the TI-IN research and demonstration Star Schools project led OTA to introduce TI-IN to The Mind Extension University network, thus providing a low-cost, efficient way to disseminate quality education, not only just to schools but also into the living rooms of America.

I want to encourage you to help fund the ongoing program development for these networks. Some of the poorer schools that were involved in the early Star Schools funding simply have not had the financial wherewithal necessary to continue the program once the demonstration project ended. Money is needed to finance the development of programming at the local school level - help the schools across America - particularly educationally- and economically-disadvantaged schools in both rural and urban settings to pay the modest sums necessary to provide access to master teachers and distance learning techniques.

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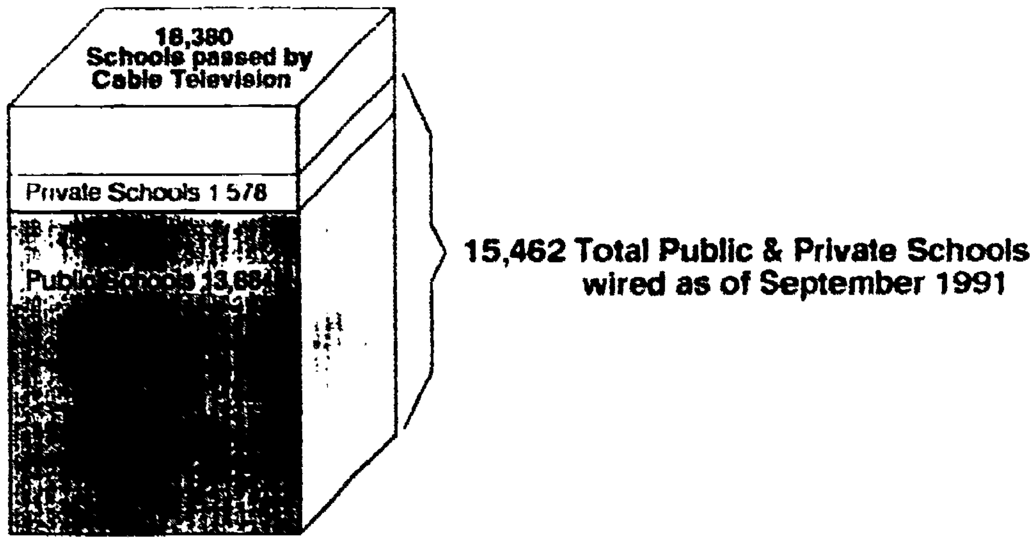
Progress Report 10/31/91

CABLE IN THE CLASSROOM: 43 Cable Television Multiple System Operators (MSO's) which represent 82% of all U.S. Cable Television subscribers have agreed to provide a cable drop and free basic service to both public and private junior and senior high schools passed by cable within their franchise areas.



SENATOR BINGAMAN. Mr. Vance, why don't you go right ahead.

STATEMENT OF GARY N. VANCE, EXECUTIVE DIRECTOR, SATELLITE EDUCATIONAL RESOURCES CONSORTIUM (SERC) ON TECHNOLOGY IN THE CLASSROOM

MR. VANCE. Thank you, Senator.

Just as an aside, I'm very pleased to be here, but if you would like, those of us who don't share the beauty of your mountains in the West, we would be happy to come to both Taos and Aspen, and we could do some comparative studies for you. [Laughter.]

I am the Executive Director of the Satellite Educational Resources Consortium—better known as SERC—which is a leading national, nonprofit provider of distance learning courses. We are based in Columbia, South Carolina.

Although I'm here this morning wearing the hat of a technology representative, before I get into the technology side of things, I was for 15 years a classroom teacher, and it is my experience in the classroom and working with students of varied backgrounds and interests that led me to my fascination with a belief in the uses of technology to stimulate learning.

Last week I had the privilege of sitting in a SERC classroom in Austin, Texas, and for 50 minutes I shared with five high school students their experience as they reviewed for tests in our Japanese One course with their telephone tutoring partners in rural Drew, Mississippi.

I watched those students as they helped each other, and I absorbed some of their energy as they demonstrated what happens when students take responsibility for their own learning, while using the powerful tools at the command of public television, in a strong, effective teaching curriculum. For me that is what SERC and distance learning in general is all about.

The growth in SERC enrollment has been phenomenal and exciting. We started with a pilot semester in 1989, involving 59 schools and 363 students with two courses, and this fall we are serving over 500 schools and over 5,000 students in 12 high school courses in 23 States. We are going to pick up that twenty-forth one that was mentioned a while ago.

Every day 17 SERC high school classes meet via satellite and audio bridge for live interactive classroom instruction in math, science, and foreign languages—subjects such as Japanese, Russian, pre-calculus, physics, and probability in statistics.

SERC student enrollment this fall is up roughly 10 percent over what it was last year, despite the fact that most school districts are suffering from budget cuts and program retrenchment. We obviously are on the right track, and I think the success of SERC lies in two key factors.

The most of these is the fact that SERC is an equal partnership of the State Departments of Education and the State Educational Television Networks in our participating states. We are unique in that respect.

So far as I know, we are the only distance learning provider whose governing structure provides an equal voice for the masters of the technology and the masters in the classroom, but that is the secret of our success, and I believe most strongly that any successful, new federal adventure in this area must have at its heart this same kind of equal partnership.

The second key to our success has been the fact that we seek to tap all of the existing technologies. Our name has the word "satellite" in it, and that is our dominant delivery mechanism, but satellite is by no means the only technology we work with.

Some SERC courses are being delivered to schools this morning by an ITFS system, while in other areas, schools do get our courses over cable, and still other classes are broadcast over the air just like a regular television program. We are also exploring how some of our states can use their new fiber networks to deliver SERC courses, and in using all of these delivery systems, we rely heavily on the telephone company, one of our most valuable technology partners.

Let me now turn to some of the specific questions you raised about the use of educational technology. I think that before we can answer many of the key questions, it's critical that we first identify what kind of an educational model we want that technology to serve, and you've heard many suggestions as to what that might be this morning.

It's important as we look at the possibilities of technology that we do not operate from the assumption that we are trying to replicate a student and a teacher looking at each other and talking. We live in the information age, and the learning process is becoming much too complex for that approach to work.

Rather, we need to be empowering, in addition to the teachers, the students to be responsible for their own education by making available instructional resources both in live real time, such as through our interactive courses and study groups, and via databases readily available as the students' journey of discovery requires more information.

As I saw in that classroom in Austin last week, students can take responsibility for their own learning, helping each other and moving at their own pace and questioning, all in a way that makes the process of learning exciting, challenging, and rewarding.

Interactive distance learning can allow students to communicate with students from other parts of the country, to interact with other cultures, to have direct contact with key policymakers through satellite seminars, and to tap the resources of the best research universities in the world. In short, it can provide access to almost limitless sources of information.

So, how do we go the last mile to see that all students have access to those kinds of information resources?

We have literally scores of schools in virtually every one of SERC's 23 states who would like to use SERC courses, but they lack the financial resources either to acquire the necessary equipment or to pay the student enrollment fees that we require to cover our costs.

Going the last mile would require the Federal Government to help buy the technology distribution system within local schools—the reception system, most likely a satellite dish; computer access capability; telephone linkages, along with the necessary wiring and such standard equipment as televisions and VCRs.

I hav^ recommended satellite technology not because I think it's the only deuvery system, but because I believe that satellite technology is, at least in the short run—and by that I mean the next 6 to 10 year—the most cost effective technology for getting the widest range of resources into the hands of the largest number of students.

Satellite downlinks—commonly called dishes—will enable every school to have access to almost every signal that is currently available, or is likely to be available, in the next decade, and they allow each school to decide for itself which signals it wants to choose, from a press conference in France to a university-based course in agriculture that may come from the Midwest. No other current delivery mechanism provides this range of options and degree of choice.

Such a program of assistance to local schools, however, should not be in lieu of federal assistance to those national, distance learning providers who have the burden of effectively erecting and maintaining the national learning linkages and the high quality courses now available through the course producers. It will take careful central planning and central resources to take advantage of all of the opportunities offered by technology.

You asked as well about the appropriate federal role in curriculum development. I think that there should be an active role, not in the sense that the Federal Government should guide the decisions about what constitutes the curriculum for a given subject area, but by facilitating the distinctions of the barriers between states and school districts—as you heard between New Mexico and Colorado—that lead through local choice to mutual acceptance of common curriculum objectives.

As a practical matter, SERC and other distance learning providers are already offering a national curriculum. In our courses of Japanese and Russian, for instance, these courses are being offered with full high school credit in 23 states, and they are a viable choice for schools making local decisions, but they are available at the national level.

It was federal money through Star Schools that enabled us to develop these courses, and without both the federal money and commitment to offering courses on a multistate basis, we could not have developed either Japanese or Russian and the fine quality they represent.

But I think the manner in which we crafted these courses is also instructive. The Federal Department of Education did not dictate to us what should be in those courses. Rather, the members of our consortium who produced the courses conferred with the leading experts around the country and, most importantly, with the educators in each of our states to determine what that course would need in order to pass muster in each state.

I think that hits at the issue of certification, and I suspect that is realistically the way to deal with national curriculum issues. The role of the Federal Government is to provide the boost that gets people together across state lines. In our case, it was the Star Schools preference for multi-State consortia, and to help them with the resources that will enable them in partnership with our professional colleagues in other states to craft a satisfactory curriculum.

At the same time, we must make sure that any new curricula will reflect the changing role of the teacher, from a disseminator of information to a facilitator of learning challenging the student, and manipulating the technology and linking each learner in the most appropriate way to all of the information and ideas that await them beyond the four walls of the classroom.

In conclusion, Mr. Chairman, I think that there are some fairly obvious but important lessons from the SERC experience.

The first, as I have suggested, is not to become so absorbed by the technology that we lose sight of the educational purposes that should underline the drive for technology.

The second is that we should build on the infrastructure that the Federal Government has already put in place. There is no need to create new structures that basically replicate existing distance learning programs or delivery systems. It makes more sense, instead, to simply build upon and expand those structures and systems that are working effectively.

The third is that all agencies of the Federal Government need to share in this national mission of establishing a distance learning network. This is not just a concern of the Department of Education. It needs to include agencies as diverse as the National Endowment for the Humanities or the Environmental Protection Agency, and it may take a fairly forceful nudge from Congress to get some of these agencies to recognize and facilitate the national commitment to educational technology.

And, finally, we do have to make sure that we are working to keep all of the technologies integrated and working together. As a practical matter, I doubt that we will ever conclude, at least in the short run, that there will only be one dominant technology. At SERC we are going to use them all—satellite, telephone, VSAT, cable, and all of the others you've heard about—but I want to underscore that it is still the people and the human resources that make this work.

We will continue to need the expertise of the educational television community in producing course work and the educators to ensure that the material actually gets used in the classroom. We are not talking about replacing teachers. We're talking about giving them a wonderful array of new tools and resources that they will use as they guide students along a exciting voyage of discovery and intellectual growth.

Mr. Chairman, I am pleased that you are putting these issues squarely before the Congress and the American public. At SERC we look forward to working with you as you provide the technology that will enrich our students' voyage.

Thank you.
[The prepared statement of Mr. Vance follows:]

PREPARED STATEMENT OF GARY N. VANCE

Good morning, Mr. Chairman. My name is Gary Vance and I am Executive Director of the Satellite Educational Resources Consortium (SERC), a leading national non-profit provider of distance-learning courses, based in Columbia, South Carolina.

I am pleased to have the opportunity to appear before you this morning because I believe that the experience of SERC, a pioneer in crafting a national distance-learning structure, can be beneficial to you and the Committee as you explore the next steps that we as a nation should be taking to ensure that all students --regardless of the location, size, or financial condition of their schools--have access to the rich array of educational resources that distance learning technology offers.

Let me say at the outset that I am here to talk about technology, and I am wearing the hat of a technology representative. However, I was a classroom teacher for 15 years before I got into the technology side of things. It is precisely that experience in the classroom, working with students of varied backgrounds and interests, that led to my fascination with, and belief in, the uses of technology to stimulate learning.

Last week I had the privilege of sitting in a SERC classroom in Austin, Texas, and sharing 50 minutes with five high school students as they reviewed for tests in our Japanese I course with their telephone tutoring partners in rural Drew, Mississippi. I watched those students as they helped each other, and I absorbed some of their energy as they demonstrated what happens when students take responsibility for their own learning while using the powerful tools at the command of public television and a strong effective teaching curriculum. For me, that is what SERC is all about.

SERC was one of four multi-state consortia that received funding for the first two years of the federal Star Schools program. We stand as evidence, I hope persuasive evidence, of the value of making a strong federal commitment to a national program of distance learning resources. To help you understand better the relevant lessons of our experience in distance learning, let me explain how SERC operates and review with you our experience in using distance-learning technology to enhance the education of young people across America.

What is SERC?

SERC is a consortium of state departments of education and state educational television networks, representing a 50-50 partnership between those professionals responsible for curriculum in each state and those with the technical expertise to deliver the courses via the best technology available.

Back in 1988, when SERC applied for Star Schools funding, we had 18 state members; this fall, we have 23 state members and we are having discussions with almost a half dozen other states who have expressed an interest in joining our consortium.

The following states (and cities) are now members of the SERC partnership:

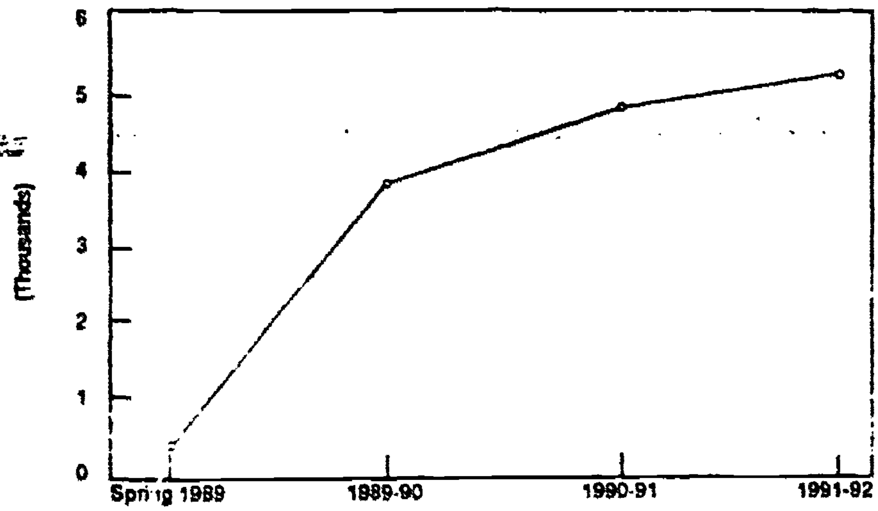
Alabama	Mississippi	Texas
Arkansas	Nebraska	Virginia
Florida	New Jersey	West Virginia
Georgia	New York	Wisconsin
Iowa	North Carolina	
Kentucky	North Dakota	Detroit, MI
Louisiana	Ohio	Kansas City, MO
Maine	Pennsylvania	New York City, NY
Michigan	South Carolina	

SERC met your Committee's call to address the need for interactive advanced math, science, and foreign language courses for geographically and economically disadvantaged schools. This year, students in small remote high schools, some with fewer than 500 students in all four grades, are able to take Japanese, Russian, Latin, Advanced Placement Economics, Discrete Math, World Geography Honors, Physics, Pre-Calculus, and Probability and Statistics.

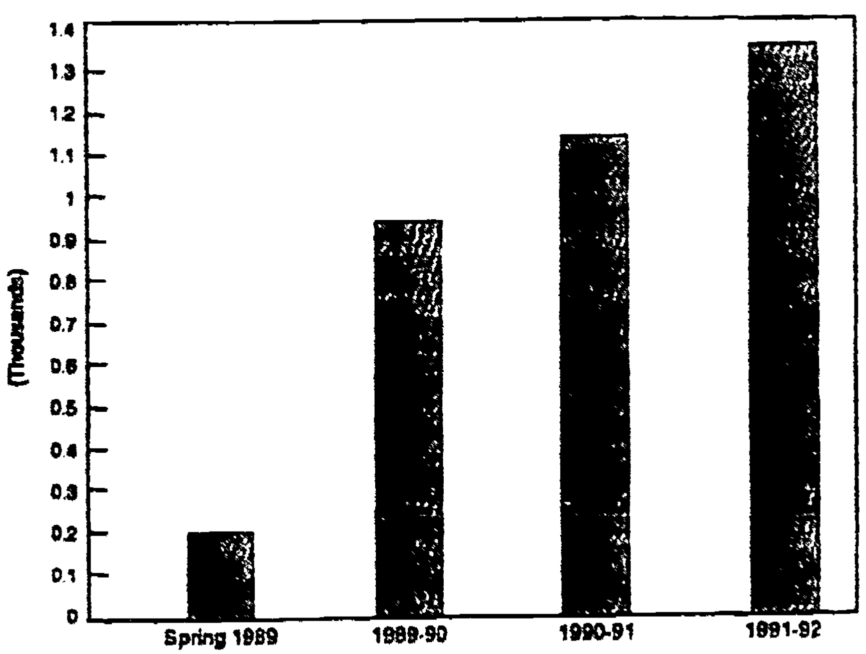
The growth in enrollment in SERC courses has been phenomenal and exciting, as the graph on the following page illustrates. We started with a pilot semester involving 59 schools and 363 students with two courses. In our first full year of operation we had 3500 students enrolled in credit courses. This fall we are serving over 500 schools and more than 5000 students in 12 high school credit courses.

Perhaps more important than the total numbers of students and schools served are the characteristics of SERC schools. Last year 71% of SERC schools were eligible for Chapter I funds, and 60% of our schools are located in rural areas. Three-fourths of our schools have fewer than 1000 students.

SERC STUDENT GROWTH



ENROLLMENT GROWTH OF SERC JAPANESE I COURSES



In addition to our high school courses, this fall for the first time we are offering 118 hours of interactive staff development courses, with topics including math, art, bilingual education, and critical issues facing educators in the 1990's. Teachers in more than 600 schools, including schools in several states that are outside of our consortium, are currently enhancing their professional skills through these SERC courses.

How Do SERC Classes Work?

Everyday 17 SERC classes meet, via satellite and audio-bridge, for live classroom instruction. These classes are taught by highly qualified and experienced master teachers located in four different states.

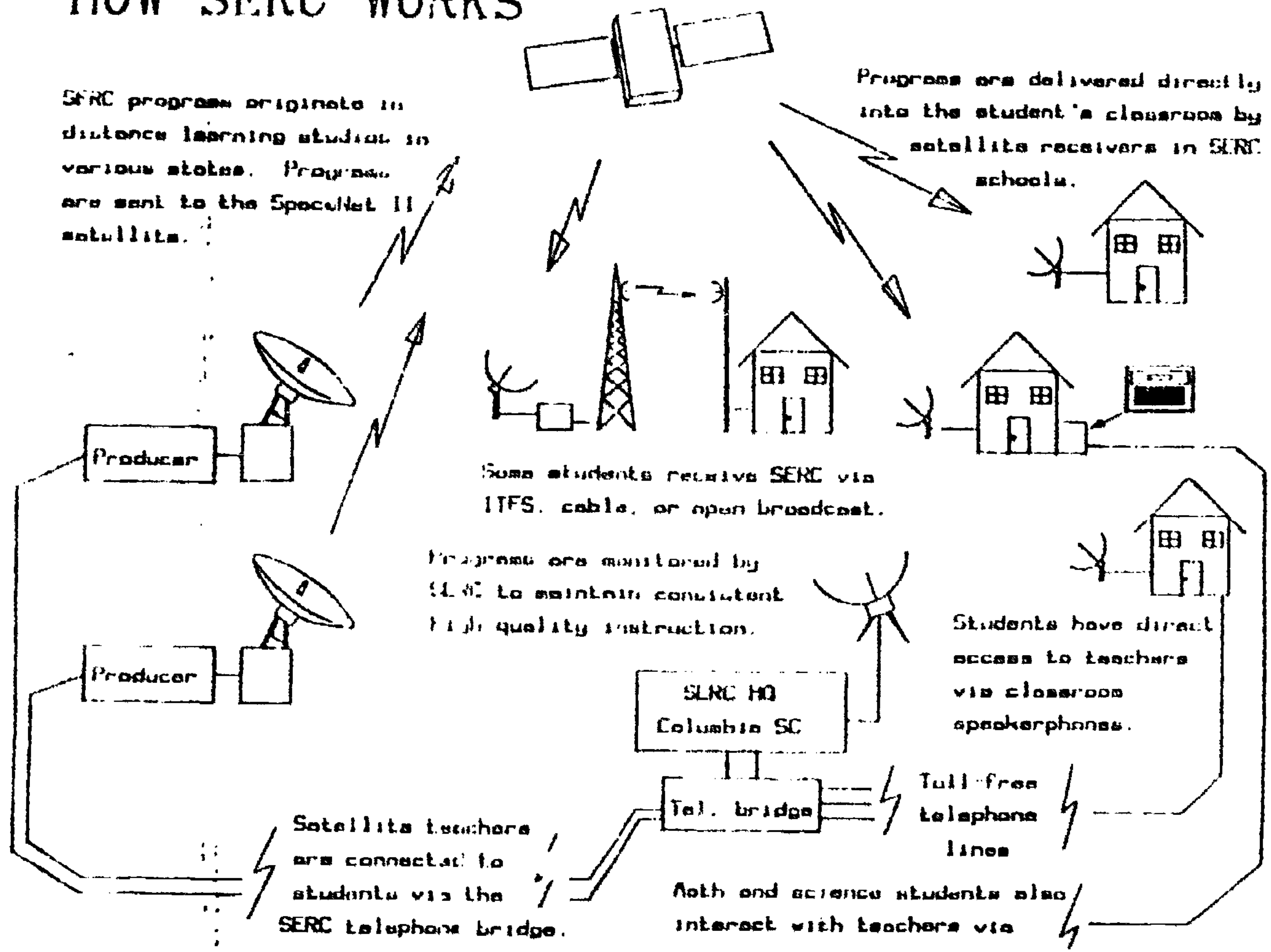
Although the class may involve as many as 300 or 400 students in 23 states, there are normally no more than four students--and sometimes only one--taking the class in any one school. We require a classroom facilitator to be in the room with the students to coordinate the class at the school, but, in general, the students manage their own classes, working closely with the student workbooks and their textbooks.

Depending upon the subject, the students may be on-line (on the telephone) throughout the class. (Some classes rotate which schools will be on line.) The students can be expected to be called upon, by name, just as though the teacher were in their classroom, and they likewise may ask questions of the master teacher.

SERC courses are full-credit, graded classes, just like every other course that the student takes. Each of our courses is fully accredited in each participating state (due in large part to the participation of state departments of education in determining our curriculum offerings). Each master teacher prepares tests for the students and the exams are returned to the master teacher for grading. SERC sends a numerical grade to each student's school at the end of each six weeks, the semester, and the year. The classroom facilitator in the local school assigns the final letter grade, based upon the individual school's system of converting numeric scores to letter grades.

Our language courses operate a little differently so that we can expose our students to native speakers. Students are divided into groups of 10-12, and on the telephone days each week, they call and speak with native speakers for 20 minutes of conversational class. These are highly structured classes, and the students are graded on their participation and performance.

HOW SERC WORKS



Teachers and tutors are available after class and throughout the day during office hours. Students and classroom facilitators are encouraged to call and talk with the teacher if problems occur. We use the feedback from the facilitators to help gauge the pacing for the class and identify problems to resolve.

Interestingly, Mr. Chairman, for our students the technology very quickly becomes secondary, merely a part of the classroom background. As one of our students recently commented, "The technology becomes transparent." And the focus becomes not the technology but the subject matter of the class.

How Important Was Federal Funding?

It is highly unlikely that so much could have been accomplished so quickly, with the level of cooperation that characterizes SERC, without the federal Star Schools money. Although some of the research and planning for SERC had already been completed, the funding gave just the incentive and encouragement that was needed to move widespread distance-education from the drawing board to the classroom. Particularly in light of what has happened to local and state education budgets in the past two years, I am quite sure SERC would still be in the concept stage if it were not for Star Schools.

SERC has used the Star Schools money to leverage both financial support and the time commitment of scores of education officials. It has used the federal support to attract financial commitments from both the public sector (through state and local education agencies) and the private sector (through corporate and foundation support).

The matching funds were used in large part to equip schools with satellite receive equipment and classroom technologies, including the interactive keypads used for the math and science courses. The first-year Star Schools grant of $5.6 million generated an additional $5.2 million in state dues, equipment matches and student fees. The second-year grant of $4.1 million generated $6.1 million from state membership fees, student fees and foundation funding. In all, with an investment of $9.7 million, SERC has generated an additional $11.3 million for equipment and course production and delivery.

As these numbers suggest, SERC did not use the federal money to offer a free ride to states and local schools. From the beginning each state joining SERC put up $20,000 for an annual membership fee. This year, we have a flexible membership fee structure with the largest states paying $35,000. In addition, either the state or the local school districts had to supply a match (often roughly 50%) for the satellite receiving equipment. Finally, each local school must pay a per-student fee for SERC courses. This truly is a federal-state-local partnership in the fullest sense of the word.

SERC's experience underscores the critical role the federal government must fill in helping make this technology available to large numbers of schools and students.

<u>What Are the Major Costs for SERC?</u>

I think the best way to help you and the committee begin to get a feel for the costs involved in using this interactive technology is to share with you the major expenses that SERC has incurred as it has worked to outfit schools and provide quality courses. The basic categories of our current costs are outlined below:

<u>Satellite transponder</u>. SERC operates on a Ku-band split transponder. This allows SERC to provide two courses simultaneously during the school day, beginning at 8 AM and ending at 4 PM Eastern time. SERC also provides two hours of staff development programming two days per week after regular class hours. To accommodate this, we lease time on a privately owned satellite, five days a week, 10 hours a day for nine and a half months. The cost of the satellite transponder time is $910,000. Leasing the transponder full-time (year-round, 24 hours-a-day, seven days a week) would likely cost $1.6 million.

<u>Satellite uplink</u>. SERC reimburses the producing entities for their costs to access the satellite from each producing site through the use of uplinks. The average cost is $200 per hour for uplink services. SERC provides multiple sections of each of its twelve courses, with each section requiring separate uplinking. If SERC were to buy the uplink equipment for any of its producing entities, that equipment would cost between $400,000 and $500,000 per uplink.

<u>School downlinks and classroom technology</u>. To participate in SERC courses, most schools need a satellite downlink (commonly called a dish) and receiver, a television, VCR, speaker phone, and the necessary internal wiring to connect the downlink to as many classrooms as desirable. SERC strongly recommends

that schools use so-called "steerable" downlinks, which enable schools to choose information resources that are offered on satellites other than the one that carries SERC's courses. The total cost for this package of local school equipment at this time is roughly $8,500 per school site.

Audio bridge. Telephone interaction between teacher and student and students with other students lies at the heart of the SERC model. This requires an elaborate telephone audio bridge system to accommodate the large number of students participating in SERC courses. With the current technology, a single audio bridge has 48 phone lines available for simultaneous use. SERC has just added a fourth audio bridge, at a cost of $60,000 to make it possible for greater numbers of students to participate in our most popular courses. Consequently, we now have 192 telephone lines available. The total cost of providing the interactive telephone components to all SERC students is over $200,000 per school year for the "800" long distance service.

Mr. Chairman, these are the costs directly associated with the equipment involved in distance learning. SERC also incurs significant costs in developing the courses we offer and in providing the staffing necessary to serve large numbers of students in hundreds of different locations across the country.

What Are the Secrets to SERC's Success ?

As the numbers outlined earlier demonstrate, SERC's student enrollment this fall is up roughly 10% over what it was last year--despite the fact that most school districts are suffering from budget cuts and program retrenchment, and these new technology-oriented programs are frequently, unfortunately, the first to feel the budget knife.

This is our third successive enrollment increase in our three-year operation. We obviously are on the right track.

Accordingly, I am happy to share with you both our success stories and our frustrations--lessons that I believe are critical to the erection and utilization of a national distance learning infrastructure.

The most important secret to our success is the fact that SERC is an equal partnership of the state departments of education and the state educational television networks in our participating states. We are unique in that respect.

So far as I know, we are the only distance learning provider whose governing structure provides an equal voice for the masters of the technology and the masters in the classroom. But that is precisely what has enabled us to succeed, and I believe most strongly that any successful new federal venture in this area must have at its heart that same kind of equal partnership.

The second key to our success has been the fact that we seek to tap all of the existing technologies. Our name has the word "satellite" in it, and that is certainly our dominant delivery mechanism, but satellite is by no means the only technology we work with. In Wisconsin, Michigan, and Ohio, for example, SERC courses are being delivered to schools this morning by an ITFS system, while in other areas schools get our courses over cable. In Mississippi, some of our courses are broadcast over the air, just like a regular television program, and we are now discussing with Mississippi how to use their new statewide fiber network to deliver SERC courses.

And, in using all of these delivery systems, we rely heavily on telephone technology, with the telephone company being one of our most valuable technology partners.

In short, we think we are succeeding because we consider every available technology as a potential delivery mechanism for our courses. We work with whatever technology the local school may have available to deliver SERC courses to students.

<u>What Should Be the Educational Model for the New Technology?</u>

Before we get too far into identifying what kind of technology we need in our schools, we must first identify what kind of educational model we want that technology to serve. Technology simply for the sake of technology will neither significantly improve education nor attract large numbers of interested students.

It is important, as we look at the possibilities of technology, that we do not operate from the assumption that we are trying to replicate a student and a teacher looking at each other and talking. There is far too much information to learn for that approach to work. We have passed the age when the teacher is simply the disseminator of information and the student is the passive recipient.

Rather, we need to be empowering the student to be responsible for his or her own education by making available instructional resources both in live real time (such as through interactive study groups or formal courses) and via data bases that can be accessed whenever the student gets the urge to explore. As I saw in that classroom in Austin last week, students can take responsibility for their own learning, helping each other, moving at their own pace--all in a way that makes the process of learning exciting, challenging, and rewarding. At the same time, this model greatly enhances the role of the teacher as a facilitator of learning who prods, synthesizes, and stretches the learning experience of the student.

Interactive distance learning can allow students to communicate with students from other parts of the country, to interact with other cultures, to have direct contact with key policymakers through satellite seminars, to tap the resources of the best research universities in the world, and to have access to seemingly limitless sources of information--from the latest transmission from a NASA space shuttle, which is already available, to the vast resources of the Library of Congress which right now remain beyond the reach of most students.

How Do We Go the Last Mile?

With that as the backdrop, let me address your question about what we need to do to go the last mile in getting technology into the classroom. And it is here that I turn to those frustrations in our experience that I mentioned a little earlier. We have literally scores of schools in virtually every one of our 23 states that would like to have access to SERC courses but they lack the financial resources either to acquire the necessary equipment or to pay the student enrollment fees necessary to cover our operating costs.

Going the last mile would require the federal government to buy, or at least help buy, the technology distribution system within local schools--this means the reception system, most likely a satellite dish, computer access capability, telephone linkages, along with the necessary wiring and such standard equipment as televisions and VCR's. Our experience suggests that it currently costs roughly $8,500 to completely outfit a school with this equipment.

Outside of the Star Schools program, there is to my knowledge no major federal program that will help schools with these costs. And yet, as CPB's recent study points out, a disturbingly large percentage of schools lack much of this equipment.

I have recommended satellite technology, not because I think it is the only delivery system--as I mentioned earlier, we are working with the full range of delivery technology--but because I believe satellite technology is, at least in the short-run, and by that I mean the next six to ten years, the most cost-effective technology for getting the widest range of resources into the hands of the largest number of students.

Satellite downlinks, commonly called dishes, will enable every school to have access to almost every signal that is currently available or is likely to be available in the next decade, and they allow each school to decide for itself which signals it wants to choose, from a press conference in France to an English class in Japan to a university-based course in agriculture. No other current delivery mechanism provides both this range of options and this degree of choices. Yet, if students are to be empowered with responsibility for their own learning, they must be afforded the widest possible set of options in educational resources.

To help ensure that schools enjoy these diverse choices, you may want to consider creating a new federal program of direct grants distributed on a formula basis, solely for local schools to use with distance learning. Those schools without equipment could use the grants to help get downlinks, computer linkages, phone connections, and the like, while those schools that already have the necessary equipment could use the grants to help pay for additional distance learning courses for their students, access to expensive data bases, and local coordination of the distance-learning options.

These funds will encourage local school districts and states to break down the artificial barriers that separate them from broader learning opportunities and resources. And they will help ensure that all students and teachers--not just those in affluent, suburban school districts--have access to the widest variety of courses, data bases, and instructional resources.

Such a program of assistance to local schools, however, should not be in lieu of federal assistance to those national distance-learning providers who will have the burden of effectively erecting and maintaining the national learning linkages. Just as the technology breaks down barriers, so it will take central planning or central resources to take advantage of all the opportunities offered by the technology. This cannot be done at the local school level any more than a sophisticated interstate highway system could be constructed by a complicated series of local highway construction grants.

Establishing the national infrastructure--both in terms of putting the technology and its equipment linkages in place and in terms of operating and implementing the curricula or instructional framework that uses the technology to put resources at the student's disposal--are enormously expensive. No single state is likely to have the resources to erect a large number of effective structures, and the fragmented planning of thousands of local school districts by definition is unlikely to produce the sort of integrated approaches that will work effectively. That will inevitably put the burden for the national programs--and again I mean both the technology (the equipment), and the learning strategies and their implementation--squarely on the federal government.

How Does This Infrastructure Fit with Curriculum Development?

You asked as well about the appropriate federal role in curriculum development. I think there should be an active role--not in the sense that the federal government is necessarily guiding the decisions about what constitutes the curriculum for a given subject area, but by facilitating the destruction of barriers between states and school districts that will lead to mutual acceptance of common curriculum objectives.

As a practical matter, SERC is already offering a national curriculum in Japanese or Russian, two of our most popular course offerings. Because those courses are being offered in [illegible] states with full high school credit, they are a viable choice for schools making local decisions but available on a national level.

And it was federal money that enabled us to develop those courses, pilot them, and polish them into the outstanding, popular courses they now are. Without both the federal money and the federal commitment to offering courses on a multi-state basis, we could not have developed either Japanese of Russian.

However, I think the manner in which we crafted those courses is also instructive. The Federal Department of Education did not dictate to us what should be in those courses. Rather, the members of our consortium who are responsible for producing the courses conferred with the leading experts around the country and--most importantly--with the educators in each of our states to determine what that course would need in order to pass muster in each state.

Consequently, it was through the active and direct involvement of the education professionals in each of our 20 plus states that we were able to craft courses that would count for credit in all the schools in each state.

And that, I suspect, is realistically the way to deal with national curriculum issues in the future. The role of the federal government is to provide the boost that gets people together across state lines (in one case it was the Star Schools preference for multi-state consortia) and then to help them with the resources that will enable them, in partnership with their professional colleagues in other states, to craft a satisfactory curriculum.

Two additional points are also relevant to the discussion of curriculum changes. The first is that any new curricula should reflect the changing role of the teacher in the school restructuring that will occur as a consequence of the advances in technology. As previously noted, the teacher is no longer the dispenser of information. Instead, the teacher's dominant role is that of facilitator, manipulating the technology in the most appropriate ways to put at the disposal of the student the maximum amount of information from outside the four walls of the classroom. Any new curricula must be built upon this reality.

In short, a curriculum that uses the technology simply to deliver a"talking head" teacher to students would be an enormous waste of the resources provided by the technology.

The second is that the development of all these new resources does not necessarily fly in the face of the education community's current emphasis on site-based curriculum development. As the information sources available as a result of a wider menu of options from which to choose is creating and implementing a curriculum that meets the needs of the students in his or her particular school. Rather than restricting the teachers' options, the technology will allow teachers to individualize local courses that tap several, not just one, of the very best offerings in the nation in that subject.

<u>What Other SERC Lessons Offer Guidance for Federal Policy?</u>

I think there are some fairly obvious, but never-the-less important lessons from the SERC experience. The <u>first</u>, as I have suggested, is not to become so absorbed by the technology that we lose sight of the educational purposes that should underlie the drive for technology.

It is critical that educators be in the driver's seat as we determine the appropriate role of technology in our schools. One would think that that to be a self-evident observation, and yet it has been my experience that we sometimes have a tendency to push the educators to the sidelines once the subject becomes technology.

The <u>second</u> lesson is that we should build on the infrastructure that the federal government has already put in place. There's no need to create new structures that basically replicate existing distance-learning programs. It makes more sense, instead, to simply build upon and expand those structures and systems that are working effectively.

Earlier this year, this committee took a major step toward that goal when it amended the Star Schools Act to allow prior grantees to compete for continued federal funding.

Similarly, as you will no doubt hear from Howard Miller or Henry Cauthen, Congress should build on the existing commitment it has made on the PBS satellite. Federal support for additional satellites at this time is unnecessarily expensive and ultimately impedes the easy access to diverse information sources.

The third is that all agencies of the federal government need to share in this national mission of establishing a distance-learning network. This is not just a concern of the Department of Education. We at SERC have been distressed to discover that many federal agencies possess little understanding of the benefits of distance learning and make even less commitment to encouraging the development of distance-learning resources.

I am pleased that the Appropriations Committee Conference Report on the National Science Foundation's appropriations for next year provides strong encouragement to NSF to work with all existing forms of distance learning. That's an important step in the right direction.

But this cannot just be limited to NSF--it needs to include, as well, agencies as diverse as the National Endowment for the Humanities or the Environmental Protection Agency. And it may take a fairly forceful nudge from Congress to get some of these agencies to recognize and facilitate the national commitment to educational technology. Otherwise, we will be erecting a technological infrastructure without trying to get the maximum benefits from it, and that results in wasted taxpayer dollars and diminished opportunities for students to learn.

Finally, we have to make sure that we are working to keep all of the technologies integrated and working together. As a practical matter, I doubt that we will ever conclude, at least in the short run, that there will be only one dominant technology. We're going to use them all--satellite, fiber, VSAT, cable. But we have to make sure that they all cooperate with each other. Otherwise, we can never establish the kind of national infrastructure that I believe you wisely wish to see.

Mr. Chairman, as you can see, I easily get carried away when I begin considering the potential that this technology offers in stimulating that thirst for knowledge which I believe lies within every young American.

It is my wish to underscore a vital point. While we are talking about an infrastructure, it's still the people and the human resources that make this work. We will continue to need the expertise of the educational television community in producing course work, and without the educators to ensure that the materials actually get used in the classroom. We are not talking about replacing teachers. We're talking about giving teachers a wonderful array of new tools and new resources--resources that the teachers will use as they guide students along an exciting voyage of discovery and intellectual growth.

I look forward to working with you and the committee as you help chart the path of that voyage.

SENATOR BINGAMAN. Thank you very much.

Let me ask you, Mr. Vance—or any of the rest of you that want to comment—SERC has about 100 hours of instruction per day.

MR. VANCE. That was what South Carolina Educational Television provides in South Carolina through their network.

SENATOR BINGAMAN. I see, in South Carolina.

MR. VANCE. Right.

SENATOR BINGAMAN. How much instruction do you provide?

MR. VANCE. We are on the air with three channels, counting our Kentucky partner, for eight hours a day.

SENATOR BINGAMAN. Now, you are on the air and you are only interactive in the sense that one of these students who is watching your Japanese course could get on the phone and talk to the teacher?

MR. VANCE. The interactivity is largely through telephone interactivity. It's either on the air or with tutors when they are not on the air. So, there is a great deal of interactivity that occurs there.

SENATOR BINGAMAN. And you're reaching about 5,000 students this year with that?

MR. VANCE. Right.

SENATOR BINGAMAN. Why shouldn't those same courses be carried on cable for all the schools in the country?

MR. VANCE. They should. We embrace that concept. I still believe that we need to remain satellite based, because there are still many rural schools who do not have access to some of the other delivery systems that may be available.

And I also would share with you my view that satellite downlinks still empower schools to pick up any of the resources that they may wish to use, whether it be NASA select or that press conference in France that I mentioned that might just not be available through any other system.

SENATOR BINGAMAN. Well, I agree, and it would be great to have satellite hook-up for every school like they do in Kentucky now.

If the main obstacle to getting this telecommunications instruction is the equipment and the cost of enrollment in the courses ... your cost of operating those courses is not dramatically increased as you add more and more students.

MR. VANCE. No. Our main cost at the present time is our transponder cost.

SENATOR BINGAMAN. Right.

MS. LENK. Senator?

SENATOR BINGAMAN. Yes, go right ahead, Ms. Lenk.

MS. LENK. I would like to add two points here.

One is the work that we are doing in Massachusetts and in the region of New England is to install a satellite dish within a single district, and then to link into the cable system to deliver that throughout the entire community, and that seems to be a very effective way. Fortunately, in

New England, most of the region is reached by the cable system, and that's a very good strategy to use.

I would also like to point out that we are also experimenting with multiple telecommunications technologies, interactivity combining distance learning and computer networking so that we can increase the kinds of interactivity students have, and they are not limited to single phone calls. That way we feel we can reach more students and involve them over a longer term than a single session of a program might be.

SENATOR BINGAMAN. How many students in Massachusetts are taking advantage of this?

MS. LENK. Right now, we have approximately half of the communities in Massachusetts involved in our network. We hope to reach about two-thirds by the end of the year. I should point out that this is funded by the federal program, but also by the Commonwealth of Massachusetts who has been very supportive.

Programs vary. Sometimes, we will have a thousand or more students participating in an electronic field trip, and at other times, we may be giving a smaller advanced course to only a few students, but we feel we are reaching students in probably about 1,500 schools.

SENATOR BINGAMAN. Well, it sounds like you're doing much better than SERC, as far as actually reaching students.

MS. LENK. It's a very different model that we're using than SERC, and in fact, we don't duplicate SERC. We use SERC's and other distance learning networks, their experiences. They are producing many of the advanced courses in foreign languages and advanced placement courses that we do not offer because they are already available through those networks, and we encourage our members, because they have satellite dishes that can reach those networks, to use them. I don't have figures on how many of them are doing that, although I know some of them are.

What we produce rather are smaller modules that are used by whole classes of teachers with teachers. They are supplementary or enrichment to the programs. So, what we are doing I think is very different than what SERC is doing, and it complements and we applaud what SERC is doing and other distance learning networks.

MR. VANCE. I would agree with that, and one difference that you have to look at is that in the SERC model, or in many of the other distance learning models offering secondary-for-credit courses, there is normally an enrollment fee charged for each student, which would not be the case in some of the enrichment things that you're doing in that model that we also applaud.

SENATOR BINGAMAN. I guess my bottom line concern is that you are pleased with the fact that you had a 10 percent enrollment increase, and certainly that's better than no enrollment increase. I guess, though, it strikes me that if we continue on that same trend line, 10 percent a year, and we are now at 5,000 students, it's going to be about the year 3000 before we get any significant number of kids taking advantage of these opportunities.

What Mr. Liptak referred to as something which I gather is going to be available, cable access is going to be available in schools very broadly in the next year or year and a half. If cable would carry those programs, then you have a dramatic increase in the number of people who can take advantage of them if they want, not that anybody has to tune in that channel, but if they want to they could.

MR. VANCE. Again, in the SERC model, the public television partners are facilitating that to some extent. Prior to taking this job, I worked for the public television station in Cleveland, and we delivered the courses throughout the Cleveland area on an ITFS system, which is a microwave system to schools.

In some places, it is being done by cable. In Mississippi courses are being delivered over their public television network. So, all of these delivery systems are important. I think what we have to do is look at the specific region. As Cecilia has said, in the Northeast you have heavy population density where there is no problem. In some rural areas, I believe there still is. Mr. Liptak may wish to respond to that.

SENATOR BINGAMAN. Yes, Mr. Liptak.

MR. LIPTAK. Senator, there is certainly no legal reason why Mr. Vance or any distance learning provider couldn't come to a cable television operator and seek access for their program service, and many are doing that.

On a practical basis, however, the cable industry in America today is generally out of channels. There are now 110 program services up on the domestic communications satellites, and the average capacity of a cable television system in America today is somewhere around 42 or 44 channels.

In terms of the development of cable over its 30-year history, the industry began offering one channel, then went to 3, 5, 12, 19, 36, and today's state-of-art cable systems are probably delivering 70 channels. As you look at this history, cable systems have reconstructed themselves every five to seven years, adding this new channel capacity, which is very expensive, by the way, to do.

However, in today's economic environment, there is no money, hardly any money available to commercial enterprises for the upgrade of communications facilities; be they cable, broadcast, television broadcast, radio, etc., because of the highly leveraged transaction rules. There are a lot of things impinging upon a cable operator's ability to upgrade their cable systems. Money is not available to do that.

So, the seers say that in the past it has been a 5- to 7-year upgrade period, but we may be looking at a 10 to 12-year upgrade period. But as these cable franchises are renewed by their municipalities, you can be certain that the cities are going to require additional channel capacity, because all the cities want all of the services that can be delivered. So, in that environment, then, municipalities and schools ought to be looking toward getting additional channels available.

SENATOR BINGAMAN. What you're saying is that cable is not going to be able to provide this kind of instruction over the reasonable near term because there are no channels available.

MR. LIPTAK. Well, sir, I would say this to you, that we hope that the cable industry will continue its support of our product, yes. We are offering one distance learning option, Mind Extension University. We have a staff of people that are working with cable operators across the nation, and Mr. Vance or anyone can organize a similar staff and go after that access, but it's going to be decided on a community-by-community basis, and it's a tough, expensive sales job to get this access.

SENATOR BINGAMAN. Yes, Ms. Johnstone.

MS. JOHNSTONE. Let me try and pull a little bit of this together that I think addresses the issue here to some extent. What is happening in Massachusetts is not atypical in densely populated areas where cable is available. Nonrural areas where there is a local community access channel that is dedicated to one, or possibly to more than one, I think that's what Mr. Liptak was referring to with the renegotiations that are coming up.

So, as a local community decides, we demand of our cable franchise one or two or more educational access channels, and then the community makes the decision as to what goes over those channels, and in that case, SERC can be used, TI-IN or any of these products that are currently up on a satellite can be pulled in and redistributed over the cable system and thereby making it cheaper for the schools to be able to receive those programs, but it becomes a community decision.

SENATOR BINGAMAN. I could keep going for quite a while. You've all given very good testimony. I think rather than continue to belabor this, I'll try to review your testimony in a little more depth and then maybe contact some of you following that.

Thank you very much. I think it has been a very informative hearing.

We will conclude the hearing.

[Whereupon, at 12:00 Noon, the Subcommittees adjourned, subject to the call of the Chair.]

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