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ABSTRACT
               This hearing was held to explore the use of
technology in education, and how the government can better encourage
its use across the country. It is hoped that hearings of this nature
will draw attention to the nation's deficiencies in
telecommunications and technologies in schools, and that the country
will be able to fill those gaps in the near future with the help of
educational experts, government agencies, telecommunications and
technology companies, as well as the business community. The hearing
begins with statements by Congressmen Lehman, Hastert, and Cooper.
Additional testimony about the use of telecommunications technology
in education was provided by the following persons: Lois
Harrison-Jones, Superintendent of Boston Public Schools; John T.
Kernan, Chairman and CEO of the Lightspan Partnership, Inc.; Shirley
M. Malcom, Head of the Directorate for Education and Human Resources
Programs, AAAS; Ron Rescigno, District Superintendent, Hueneme School
District; Linda Roberts, Director and Special Advisor, Office of
Educational Technology, Department of Education; and Connie Stout,
Director, Texas Education Network, TENET Project, Computation Center,
University of Texas at Austin. The prepared statement of Richard W.
Riley, Secretary of Education, is also included. (MAS)

ACCESS TO TELECOMMUNICATIONS TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON TELECOMMUNICATIONS AND FINANCE

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

SECOND SESSION

SEPTEMBER 30, 1994

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ACCESS TO TELECOMMUNICATIONS TECHNOLOGY

FRIDAY, SEPTEMBER 30, 1994

House of Representatives,
Committee on Energy and Commerce,
Subcommittee on Telecommunications and Finance,
Washington, DC.

The subcommittee met, pursuant to notice at 9:45 a.m., in room 2123, Rayburn House Office Building, Hon. Edward J. Markey (chairman) presiding.

Mr. LEHMAN [presiding]. The hearing will come to order.

Chairman Markey will be along very shortly. He is detained at a breakfast downtown and is on his way here, but we will begin the hearing this morning without him.

I am Congressman Lehman. The hearing this morning is on the education and access to telecommunications technology.

I want to thank you all for coming and I want to thank Chairman Markey for holding this hearing on an issue that affects our Nation on the most basic level, the ability to properly prepare our young people for a rapidly changing world of information and commerce.

There is much talk about the information superhighway and how the information revolution will affect our Nation's economic competitiveness. We usually discuss the information revolution in terms of maximizing worker productivity and improving the bottom line for business in the global economy. But there is one major sector in our Nation that is being left to scavenge back on the home front during the information revolution. That sector is education. Students cannot be adequately prepared for use of technology in the workplace if they are not educated with computers and other technology in the classroom.

Being able to program the VCR, play video games, is simply not good enough. We as community leader, as policymakers and as concerned Americans, must take the lead in helping our schools take advantage of computers, telecommunications and other technologies to ensure that our children are eager to take on the world and its educational resources.

We have seen remarkable changes in learning technology over the past quarter century, and yet technology has not transformed schools to the degree that it has transformed other aspects of our society. In fact, a teacher from the little red schoolhouse of the last century, could walk into many classrooms today and feel comfortable, because so little has changed.

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While many schools have and use computers in instruction, few schools have the capacity for any degree of two-way voice and data and digital networking with databases, and with other schools. Only 12 percent of U.S. classrooms even have a telephone. Only 4 percent of teachers have a modem, and only 4 percent have access to the Internet. This information from an NEA survey.

The classroom remains isolated and simplistic at a time when the world is becoming interactive and complex. We are letting our budgetary and other constraints limit the possibilities for our students, our future work force. Instead of yielding to these constraints, I believe we must push ahead with innovative ways of meeting our children's technological needs.

Early year this year, Congress mailed the initial plans to meet these needs when we passed the Goals 2000 legislation, which incorporated the use of technology and telecommunications in achieving the national education goals. This legislation, as well as the Elementary and Secondary Education Act reauthorization, which does include a title for technology for education for the first time, set the standards which schools must aim for. Unfortunately, the schools have not been provided with the tools to meet these standards.

A report by the National Institutes of Standards and Technology underscored this fact when it determined that the computer base in elementary and secondary schools is completely inadequate to meet the telecommunications applications of today. The report notes that 80 percent of the computer base—of 80 percent, over 50 percent are Apple-IIs or older. This puts the students-to-computer ratio of 14 to 1 in the United States in proper perspective, as most of the equipment is obsolete. If there are 14 students sharing one computer, and that computer is 10 years or at least 4 generations old, it is obvious that very little innovation is taking place.

While these computers are adequate for routine tasks, such as games and drills, education software is no longer developed for them and the students are definitely not learning to use equipment that they will encounter in the workplace. This is like teaching students to drive on a modern highway in a Model T. That is assuming that the teachers are able to teach the students how to drive.

Less than half of school districts in the United States have an introductory computer course for their teachers. Because of this lack of formal training, teachers must learn as they go along, and often only when the school computer is available. As a result, it takes teachers an average of 5 to 6 years to develop expertise in computer use, which can be relayed to their students. This from a recent NEA study.

An additional gap in the quality of educational technology is the lack of connections between schools and businesses. For example, in a State that boasts of cutting-edge technology companies, it is appalling that my State of California ranks dead last nationally in the computer-per-student ratio.

I believe that business and schools should link up to provide our children with effective technologies that will prepare them for our modern workplace. That is why I, along with Congressman Lewis and Congressman Cooper, have introduced legislation which would provide incentives to businesses to share outdated equipment with

schools and establish a fund to improve schools' telecommunication capabilities.

The Classroom Technology Act encourages elementary and secondary schools, colleges, libraries and other information sources to join together to share the resources they have through telecommunications. Once the urban and rural regions of the country are linked, connections to national networks of information and programming will be much easier to make.

I strongly believe that the convergence of information and telecommunications will allow students to overcome income, geography and other barriers to learning. This could only benefit us as a society and as a Nation, because these students will grow up more aggressive and well rounded when it comes to information technology.

I hope that from these hearings we will increasingly be able to draw attention to our deficiencies in telecommunications and technology and that we are able to fill those gaps in the near future with the help of educational experts, government agencies, telecommunications and technology companies, as well as the business community. To fail in this endeavor will be to doom our young people to a second-rate education and our Nation to a second-rate future.

I think this is a great challenge we have before us. This is a very exciting area, but one we have to embark on as a Nation if the students of today are really going to be able to compete in the world that is unfolding before us. Time is of the essence and I think we have gotten on this road not a moment too soon.

I yield to the gentleman, to Mr. Hastert.

Mr. HASTERT. Thank you, Mr. Chairman.

We are here this morning to explore the use of technology in education and how we can better encourage its use across this country. The issue is certainly related to the previous questions that we considered in this subcommittee in encouraging the development of the information superhighway. Because this is the last hearing of this subcommittee in this Congress, it may be appropriate to take a moment to commend the past work of the committee on H.R. 3636 and H.R. 3626.

I hope we are able to bring a bill to the Floor in the next Congress that will bring open and fair competition to the telecommunications industry. The development of the superhighway will continue to be stalled, and hence education will continue to be stalled, until we are able to foster this freedom in the marketplace.

Thus, I see this hearing as an opportunity to learn more about the role of technology in education. I am particularly interested in the role of distance learning technologies, because I have a consortium of 13 schools involved in a distance learning network involving the Illinois high-tech high school and math and science school and spreading that knowledge out to a consortium of other schools in a network around it.

This is centered at Waubonsee Community College, which has been named the Center for Distance Learning in the State of Illinois. So there is very intense interest out there. I understand we need to move the technologies along to make sure that this continues to happen. I have seen this technology make a significant dif-

ference in the region. I hope to hear about more technologies and how they can be used to enhance education.

And education, I guess, we need to look at from different views. As Mr. Cooper and I have been involved in an exercise in the future of health care in this country, we see hospitals downsizing, we see more home health care, we see the need to be able to educate home health care providers—people who are doing that work outside of the traditional medical communities. It is telecommunications that is going to have to be a lifeline of information and services to those people. So we need to move forward. We need to move forward on, quote, unquote, "the superhighway." And I am looking forward to the testimony we have today.

Thank you, Mr. Chairman.

Mr. LEHMAN. I thank the gentleman.

At this time the Chair will recognize the gentleman from Tennessee, Mr. Cooper, for 5 minutes.

Mr. COOPER. I thank Chairman Lehman for his great leadership on this issue, and it is a pleasure to be at this hearing with both Chairman Lehman and my good friend, Denny Hastert.

Although telecommunications legislation does seem dead for this year, I think that this hearing can set the agenda for the next Congress in helping us establish the information superhighway. I am disappointed that we could not pass legislation this year. I think that we lost a major opportunity to get a head start in helping the youth of America. Too often, the interests of the industry have been the focus of congressional debate, instead of the welfare of the public.

The information superhighway will enhance the lives of millions of Americans and the most important benefit, in my opinion, will probably be the enormous expansion of educational services. Whether it is education narrowly defined or the broad array of continuing education services that many, including our own health care providers, will depend on.

One of my priorities as a legislator has been to expand educational opportunities for all of our people, especially our youth. I am especially aware of this need because my district is primarily rural. I can see the potential for first-rate education for every child in Tennessee and in rural America, but it will require a national effort.

These are tough fiscal times for our country. There are many good initiatives that deserve funding, but we are in a budget crunch. The challenge before us is to ensure our children's future without pushing us deeper into debt.

Tennessee has an innovative program called the 21st Century Classroom. It is making great strides in improving the quality of learning, but the problem the State is running into is that schools still have leaky roofs and limited classroom space. How can we pay for advanced technology when we can't even maintain the buildings to house them? We have to create new partnerships with industry to provide incentives to help our schools and to leverage limited resources.

I am an original cosponsor of Rick Lehman's Classroom Technology Act of 1994. It is not the solution to all of our problems, but it is a solid first step toward a solution.

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I especially like the provision that grants businesses tax breaks for donations of technology equipment to schools. Since the turnover for computers is less than a year these days, this program could be a watershed for many of our schools.

There is another problem that must be addressed to realize the full potential of technology in the classroom. As Chairman Lehman pointed out a while ago, sometimes it takes 5 to 6 years to enable a teacher to become an effective user and sharer of technology. This is simply unacceptable.

These days equipment is second rate after 6 months. We must ensure that our teachers are trained to utilize new tools before even they have it in their classrooms. It would be a tragedy to connect every school to the superhighway, only to have them travel at minimum speeds.

Our task is not easy. And in this information age, we not only have the desire, but the tools for a world-class education system. What is left is to create a blueprint for how to achieve that system.

I thank the Chair.

Mr. LEHMAN. I thank the gentleman for his comments.

At this time, I will call the first panel up to the desk here. That would be Hon. Linda Roberts, Director, Special Advisor, Office of Education Technology; Dr. Lois Harrison-Jones, superintendent of Boston Schools; Mr. John T. Kernan, chairman and CEO of Lightspan; Dr. Ron Rescigno, from Hueneme School District in California; Ms. Connie Stout, the director of Texas Educational Network; and Dr. Shirley L. Malcolm, head, Directorate for Education and Human Resources Program of the American Association for the Advancement of Science.

Thank you all for joining us today.

As this may be, as Mr. Hastert pointed out, the last hearing of this committee, but I really think it is the beginning of an important journey for the committee and for the Congress and for our country into the future. And I think as this issue develops and the policies are created, everyone will remember that they were in the room here for the first time we took this up in a serious manner.

Welcome, Ms. Roberts. And I know that Secretary Riley had intended to be here today. We understand that the death of his father unfortunately prevented that and our sympathies are certainly with him. But are equally delighted to have you here today.

And I will just ask that each of the witnesses will—we will put your entire statements and the materials into the record, and ask that you summarize as best you can.

And I will recognize Ms. Roberts first.

You may proceed.

STATEMENT OF HON. LINDA ROBERTS, DIRECTOR AND SPE-
CIAL ADVISOR, OFFICE OF EDUCATIONAL TECHNOLOGY, DE-
PARTMENT OF EDUCATION; LOIS HARRISON-JONES, SUPER-
INTENDENT, BOSTON PUBLIC SCHOOLS; JOHN T. KERNAN,
CHAIRMAN AND CEO, THE LIGHTSPAN PARTNERSHIP, INC.;
RON RESCIGNO, DISTRICT SUPERINTENDENT, HUENEME
SCHOOL DISTRICT; CONNIE STOUT, DIRECTOR, TEXAS EDU-
CATION NETWORK, TENENT PROJECT, UNIVERSITY OF
TEXAS, AUSTIN, COMPUTATION CENTER; AND SHIRLEY M.
MALCOM, HEAD, DIRECTORATE FOR EDUCATION AND
HUMAN RESOURCES PROGRAMS, AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE

Ms. ROBERTS. Thank you very much.

I would like to submit Secretary Riley's written statement for the
record. As you know, he very much wanted to be here today to lend
his strong support for the committee's work on telecommunications
policy. He especially asked me to convey to you his appreciation for
your willingness to take on very difficult and sensitive issues in the
ever-complex technology arena.

Personally, however, it is also a great pleasure to be here today,
especially as I think about how far we have come in the past dec-
ade or more. As you well know, the role of technology and tele-
communications in education has changed radically.

Before joining the Secretary as his Special Advisor on Tech-
nology, I had the privilege to serve Congress at the Office of Tech-
nology Assessment. For a long time, technology, be it use of com-
puters, telecommunications or even video technology, were seen as,
quite frankly, nice, but not necessary. Today we in the Department
of Education, and I believe we in the field, and you in Congress,
firmly believe that technology is an essential component for achiev-
ing a world-class education for every student, be they students in
Tennessee, in California, in Illinois, all across the country. And
there really is an incredibly strong consensus for our use of tech-
nology in effective ways.

When schools and districts started to examine the role of
networking and distance learning and on-line information re-
sources, they really had a hard time in getting the attention of the
major providers or the technology experts in our universities and
research centers. Today, however, education is increasingly seen as
the partner in building and deploying the National Information In-
frastructure. And my message is we have truly come a long way.

On Wednesday, I traveled to Boston to meet with groups plan-
ning Massachusetts' educational technology network. As in other
States, educators, superintendents, teachers, school board mem-
bers, State officials, are working with the business and industry
community and the providers in both the public and private sector
to bring the information highway to students all across their State.
As in other States, key players are grappling with costs, tele-
communications rate policies, the need for teacher training, the
need for better instructional resources, and they are grappling with
the need for institutional change.

In Indiana or Ohio, in Massachusetts or Nebraska, the concerns
are similar. But the solutions are different. A Conference of State
Telecommunications Leaders, was held in Texas last week, and

jointly sponsored by the National Science Foundation, the Department of Education, and the Department of Commerce. This conference, which, by the way, was ably put together by Connie Stout and the University of Texas at Austin, made clear to all of us that States are really making significant investments to build technology capacity.

Some States are having an easier time than others in allocating funding resources and in developing workable solutions. In working with their local phone companies and cable companies, States and communities are finding that rate structures can vary widely, and that leadership at all levels is essential.

I would like to just reiterate the major point of our testimony and the major point that the Secretary has been making over and over again in his meetings with Members of Congress, with the FCC, and other leaders in government. The technologies that we have today and those that are on the horizon are powerful tools to meet our Nation's education goals. If we are to meet those goals, all students, not some students, must have access to them. Both the connections to new telecommunications and information resources and the basic access services to these resources, in the Secretary's view, if they are for learning, ought to be free. In other words, you shouldn't have to worry if you are a teacher or student about what it is going to cost to do the work of learning.

But we know that there are tremendous investments that have to be made. And if they can't be free, then at least they should be as affordable as possible; so that we can ensure that all our educators and our students get the maximum benefit from these new resources.

In my remaining time, I want to highlight what we are doing at the Department of Education to work towards these goals. In fact, as our testimony shows, the administration's efforts and the efforts of other Federal agencies along with the States, and the private sector, are working to help us realize the potential of the information infrastructure for education and lifelong learning.

We have really begun to assume our leadership role in the Department of Education. We believe we can convene the key players. We started it last May in our National Conference on Technology, and we continued it this past week in Texas. We expect to convene key teams of State planners, all of whom are working on technology, in March of this year, and bring them together with the private sector, with the other Federal agencies, so that we can continue to not just plan but implement, really implement the use of technology.

I am particularly pleased about what has happened in the Goals 2000 program. Because what has happened with a very small amount of Federal dollars is that we have been literally able to leverage State planning efforts, bringing the right people together in the States. So far 38 States have applied for this money and we expect more to do so after the election.

As you noted, our new technology authority in the Elementary Secondary Education Act will enable us to take planning to implementation, to provide technical assistance and teacher training, and to offer technology challenge grants that will bring the best of our thinking in the educational field and in the software and appli-

cations development sectors, to create the kinds of tools and the kinds of learning communities that can make a difference.

Certainly, we will continue to do research and development because we have got to learn more about effective practice and how technology and content can come together. We have to design better tools. We have to think about the kinds of support we can provide within technology systems that give teachers the training they need, and they need it, on-line, and on demand.

We think we can do a lot more with assessment and we can do it together. It is not just the Department of Education, but it is the other Federal agencies that are equally involved in this arena, as our testimony shows. Clearly, we need to know more about who really has access.

You cited a study by the National Education Association. We intend for the first time to go out to the field in a national survey of schools' connectivity, schools' access to information and on-line information resources, the extent to which the broadband network capacities are in fact reaching our classrooms. This survey was approved by the Office of Management and Budget, I am happy to tell you, in record time. And we will be out in the field within a month and we will have very good data by January of this year. We worked on this survey with input from the FCC and the NTIA, because we recognize that this information will be enormously useful to them as well.

I want to just hit one more time the issues of telecommunications regulations and policy. This is a very, very contentious issue and we understand how high the stakes are. But it is important to understand that we have to protect the investments that our schools are making to build connectivity connections, to build resources, and we can't end up saddling them with a system that is totally out of reach and totally unaffordable. And what was so striking at our conference in Texas was the tremendous disparity of rates that are being cl arged to schools for these learning resources across the country. In articular, rural communities seem to be paying a very high premium for access.

So I can assure you that the Secretary intends to continue to work closely with Reed Hundt, with the Congress, and with the States, to ensure that educators get affordable access to the NII.

Lastly, I want to mention the interagency coordination that is going on. In my view, it is unprecedented. We are truly working together at the program level in the agencies, thinking about how do we, as a combined sustainable set of programs, build capacity and build and deploy applications and resources to our schools and to our communities.

I think that our Texas conference is a really wonderful example of how we can work together and how we will continue to work together. Certainly we have only begun and we have much more to do to truly bring the power of these technologies to our students, to learners of all ages, to really make a difference in the opportunities for learning. We look forward to continuing to work with this community to see this happen.

Thank you very much and I will be happy to answer your questions.

[The prepared statement of Richard W. Riley follows:]

Testimony of Secretary Richard W. Riley
Subcommittee on Telecommunications and Finance
Committee on Energy and Commerce
U.S. House of Representatives
September 30, 1994

Mr. Chairman and Members of the Committee:

Thank you for allowing me the opportunity to testify on the potential of telecommunications and information technologies for education. It is indeed a pleasure to appear before the committee that -- again and again -- has come up with solutions to some of the most complex challenges facing our country. Mr. Chairman, I have seen the results of this Committee's work across the country, and it has made a profound difference for the American people.

I appear before you today because changes are sweeping through American schools, libraries, colleges, and universities in every state of the union. Many of these changes result from the introduction of telecommunications and information technologies into education -- ranging from easily available tools such as voice mail systems, local area networks, and electronic mail to more complex communications technologies, such as two-way video and voice communication and access to the worldwide Internet.

In my testimony today, I wish to make a single, important point: the technologies I have described are powerful tools to meet our nation's education goals. If we are to meet those goals, all students must have access to them.

I join Vice President Gore and many others in commending Members of the House for passing H.R. 3636 - legislation that would provide a competitive structure ensuring affordable rates for telecommunications services, and that would permit the Federal Communications Commission (FCC) to set preferential rates for schools and libraries. I urge the Committee to revisit these issues in the next Congress.

I would like to recommend some additional steps that I believe are necessary to make these tools broadly available. Both the *connections* to new telecommunications and information resources and *basic access services* to these resources should be free or as inexpensive as possible to educators and students to ensure that we get the maximum benefit as a nation from these new resources. If we do not take these steps, Mr. Chairman, we will deepen the socio-economic divisions that now threaten our nation.

The Costs of Access

There is no doubt that a sustained investment will be necessary to build the National Information Infrastructure (NII) for education. Rough estimates indicate that the cost of this infrastructure will range from $3 billion to $8 billion per year for K-12 schools alone. The private sector, state governments, and school districts have begun to make significant investments. It has been estimated that total annual expenditures for educational technology (including hardware, software, and network equipment) is approximately $1.2 to $1.5 billion. State governments alone are now spending approximately $700 million on technology for K-12 education. For example, the North Carolina legislature recently made $42 million available competitively to school districts to develop the North Carolina Information Highway. This investment represents a quarter to a third of overall spending on supplies and equipment.

Mr. Chairman, I do not expect that the federal government will be able to contribute any large amount to this investment in infrastructure. We must, therefore, work together to establish a regulatory framework for telecommunications firms that will ensure the development of the NII for education.

Why Provide Access?

Goals 2000, the nation's strategy for meeting the eight National Education Goals, asks us to hold all our children to high standards of achievement. The law provides support for states and school districts as they develop new, high standards for what students should know and for planning to help focus all educational efforts on reaching these standards. I believe that the effective use of communications and information technologies are absolutely necessary for meeting these goals.

Results from schools around the country and from research indicate that technology does make a difference. Some of these improvements are obvious: voice mail and local area networks result in increased communications between teachers and staff, and closer connections between teachers and parents. The Internet brings valuable and current information into schools that outstrips even the best university library.

There are also strong research and evaluation data. Telecommunications and information technologies have been shown to increase interaction between instructors and low-performing students while not decreasing traditional forms of contact. Projects around the country like the Christopher Columbus Middle School in Union City, N.J., the Val Verde School District in California, and the Science Collaboration Project ("Co-Vis") between high schools in Illinois and scientists at Northwestern University -- recently shown on "Good Morning America" -- have reported results such as dramatic increases in test scores, decreases in teacher and student absenteeism, success in awakening interest in students who have not responded to traditional instruction, and important learning experiences for students who have been able to interact and work with students, teachers, and professionals around the world. Research on the use of telecommunications and other technologies by students with disabilities has indicated that almost three-quarters of school-age children with disabilities were able to remain in a regular classroom and 45% were able to reduce school-related services. Based on the results of these and other projects, there is a compelling case for teachers and learners to have full access to technological tools.

It is important to recognize that while some schools have applied technology to education with success, others have met with frustration. Features of successful schools are worth mentioning: first, there is a plan that defines what the technology is to do, what it will cost, and how it fits into teachers' instructional strategies. Second, investments in hardware and software are matched by spending for staff development and on-site technical support. Third, computers are connected to each other via local area networks, and to the outside world via the Internet, to increase productivity and access to information. And finally, technology is treated in these schools as an instructional tool just like the blackboard and textbooks, and therefore is present in every classroom, not just in a computer lab, library or media center.

Another reason for giving all students access to telecommunications and information technology is the direction of the American economy. Most new high-paying jobs require skills in finding, analyzing, and manipulating information, and information technologies play an important role in keeping U.S. businesses competitive in world markets. The *Wall Street Journal* reported a few weeks ago that these technologies are essential to many industries, and "sophisticated computer networks ...have become information factories that speed innovation and compress product cycles -- American companies are their undisputed masters." Students who are adept users of information technology clearly have an advantage in a highly competitive job market. Further, if these technologies have done so much to increase the profitability of American business, then we must apply them in the nation's schools. In addition, for many students with disabilities, technology provides a means to work and become productive citizens.

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¹*Wall Street Journal*, "High-Tech Edge Gives U.S. Firms Crucial Lead in Computer Networks," September 9, 1994, p. 1.

Giving our students access is important not just to help them today but also to build a nation of learners who are prepared to use information for their entire lifetimes. The private sector should be looking to develop a future market of Americans who will use new telecommunications resources, not just looking to make a profit from selling services to schools. If we provide connections to the schools today, the payoff in the future will be very great, especially for telecommunications firms.

Finally, I would like to draw clearly the connection between communications technologies and improving the way students learn and instructors teach. Educators who make full use of technology have found that it leads to other educational reforms including more individualized instruction; an emphasis on meeting the needs of all students, regardless of socioeconomic status or disability; increased attention to challenging content and complex problem solving in the curriculum; more flexible use of time in the school day; teacher professionalism; greater parental involvement in education; and better linkages between schools a .d the workplace. These reforms are critical to meeting the National Education Goals, and communications and information technologies will help schools to reach them.

In light of all the benefits of greater use of technology, we must ensure that these benefits do not accrue to students in wealthy communities alone, or only to schools whose leadership, staff, and communities have made a commitment to technology. The dramatic success of some schools, while others -- especially in rural areas and inner-city neighborhoods -- remain in dire straits, tells us that equity is already a problem. As you will see, making technology available to all learners is the guiding principle of our efforts.

The Administration's Agenda for Communications and Information Technologies

The term "National Information Infrastructure" (NII) represents the Clinton Administration's vision for the future of telecommunications and information technologies. It describes a seamless web of communications networks, computers, databases, and consumer electronics that will put vast amounts of information at our fingertips. It will tie together our telephone system that reaches 99% of homes; the cable systems that are available to more than 92% of homes; the broadcast television and radio stations; the cellular telephone system and other wireless networks; satellites that soon will offer programming directly to owners of dishes no larger than a salad bowl; and enormous databases of information. The Administration's vision communicates a clear commitment to universal service and open access. The NII is being built by the private sector with the federal government facilitating and providing incentives for its development. The Administration's goal is that all classrooms be connected to the NII by the year 2000.

What will the NII look like in schools? Consider the following scenario

> A principal sends out an electronic mail message to his teachers and staff at 7:10
> a.m. about a one-day seminar on instructional methods, and by 7:30, he has
> received enough responses from teachers to know that the seminar will be well-
> attended -- without having to wait until the next staff meeting. Meanwhile
> teachers in the building exchange messages with each other via e-mail about
> individual students' progress, lesson plans, and other information, and they tap
> into the school's connection to the Internet to read messages from other educators
> across the country and to access up-to-the-minute information about the current
> Space Shuttle mission, which two teachers are using to inspire interest in physics
> and earth science. At 8:15, students turn on their classroom televisions to watch
> the daily news and announcements, a ten-minute production of the day's news
> stories reported and videoclips shot on computers by the school's students.
> After returning home from work that evening, one student's mother calls a special
> hotline and listens to a pre-recorded message from the teacher on the day's
> homework assignment. She leaves a brief message for the teacher to ask for ideas

on ways to help her daughter do better in math She also listens to the next day's
school menu to see whether she should make lunch for her daughter.

This scenario has, in fact, occurred at the Webster Elementary School in St. Augustine, Florida -- one of the state's model technology schools. The communications technologies used in this school are all easily available today. There are other schools in the country that use technology in more complex ways, such as two-way video and voice communication, collaborative scientific experiments completed by students around the world, computer servers used to store students' work so that it can be reviewed by teachers and shared with other students, and laptop computers taken home by students and used to access information at home by modem.

From the point of view of education, there are three parts of the NII. First, the network infrastructure that connects sites around the world, including the hardware, software, and network equipment in schools and learning sites that allow people to access the network; second, the software, curriculum tools, libraries and other sources of information that are valuable to educators and students -- broadly labeled 'applications'; and finally, the development of new skills and abilities in the nation's teachers, instructors, and education administrators. All three of these components - network infrastructure, applications, and skilled people - are necessary parts of the NII

I wish to emphasize that physical infrastructure is only part of the necessary investment. The other two parts of the NII - applications and people - will require significant investments as well. Unless private sector developers and educators design applications that help children learn, and teachers and other school staff are given opportunities to learn how to use these new tools, we will not see the benefits of the NII The Department's strategy, outlined below, focuses on all three of these components

**The Department of Education's Strategy for Expanding Access to -- and Use of --
Telecommunications and Information Technologies**

Having reviewed briefly the requirements for developing the NII for education, I would like to describe the steps we are taking to help make telecommunications and information technologies available to all learners

National Long Range Plan The first and most important step is the development of a national, long-range plan for the use of technology in education This plan, described in the Goals 2000, Educate America Act, will involve the development of a national vision for how technology can improve learning It will be released next year after extensive dialogue with educators and the public, and the plan will describe not only the federal course of action, but the actions underway at state, local, and school levels

State and Local Technology Planning The second piece of the Department's strategy is the support of planning for the use of technology in education at the state and local level. Our Goals 2000 program makes available planning grants to states to integrate technology use into their overall education improvement plan To date, 36 states have applied for or received Goals 2000 technology planning grants Through conferences and other means, we are also providing technical assistance to states to help them resolve the difficult issues raised in the planning process

Once a state has an approved Goals 2000 education improvement plan, grants will be available to assist in implementing the state plans, including support for local planning. With a vision for technology's role in education in place, many states will use a portion of these implementation grants to help build a technology infrastructure Eisenhower Professional Development Program grants will complement these state and local plans by providing support for teacher training for technology and other areas Technical assistance will also be available to states and districts for implementing their plans and making full use of federal education resources

New ESEA Authority. I anticipate that the reauthorized Elementary and Secondary Education Act (ESEA) will expand the role of the Department in technology. Among other activities, the legislation will authorize support for community partnerships that advance the use of telecommunications and information technologies for education and funds for technical assistance and training consortia.

Research and Development Agenda. While we know a great deal about how the use of telecommunications and information technology improves education, there are still significant gaps in our understanding. There is also little in the way of high-quality software and applications that help students achieve high academic content standards. For example, while information technology holds great promise for making possible in-depth assessments of student performance, there are no working examples that show educators how this might be done. There are also few easy-to-use "authoring tools" available to help teachers rapidly assemble multimedia presentations for their classes. The National Science and Technology Council's Committee on Education and Training (CET), led by Deputy Secretary of Education Madeleine Kunin, is developing a research agenda in learning productivity with input from experts inside and outside the federal government, so that federal research and development dollars can be focused on high-priority areas.

Four high-priority areas have been initially identified: (1) research on learning and cognitive processes to improve the understanding of the learning process and how technology can best support that process; (2) new models for evaluating learning and learning productivity; (3) development of high-quality, affordable learning tools and environments for use in a variety of settings including schools, workplaces, and homes; and (4) demonstrations of innovative technology and networking applications on how the NII can be used for advanced instructional systems. The sixteen agencies that make up the CET are working together to provide federal leadership in this area.

In addition, the Department's Office of Educational Research and Improvement (OERI) is developing a long-term R&D agenda that will examine the impact and effectiveness of telecommunications and information technologies in areas such as early childhood development, school achievement, school finance and governance, libraries, and lifelong learning.

Finally, the National Institute on Disability and Rehabilitation Research (NIDRR) within the Department of Education is supporting research and development concerning access to the NII for individuals with disabilities. This research holds the promise of benefitting the educational system at all levels.

Telecommunications Regulation. The Administration supports giving the FCC and state regulatory commissions the authority to provide preferential rates for hooking up libraries, schools, and other educational institutions. I have met several times with Reed Hundt, the Chairman of the FCC, and I plan to work closely with him and with Congress to address policies pertaining to telecommunications rate structures for K-12 schools and other educational institutions.

Telecommunications providers and state public utilities commissions are also important partners in providing access. There is tremendous variation in the telecommunications rates paid by schools across states, and even within states. The Department will work with state and local governments to identify ways to ensure that educators get the affordable access to the NII.

NCES Survey. The Department's National Center for Education Statistics (NCES) is conducting a fast-response survey this fall to gather information on the availability, access, and uses of telecommunications in elementary and secondary public schools. This survey will provide us for the first time with baseline information about access to and usage of telecommunications. Given the equity issues presented by the application of technology in schools, we must have good information about current access and usage.

<u>Pilot Projects</u>   There are simply too few visible, well-understood examples of schools, school districts, and communities that are making effective use of telecommunications and information technologies   We need to support a limited number of pilot projects to provide visibility to these efforts and to expand our knowledge about the changes that occur in schools. The Department recently awarded grants to ten such projects, focusing on the uses of telecommunications technologies to support teacher professional development.

<u>Interagency Coordination</u>   The Department of Education is working closely with the Departments of Commerce and Energy, the National Science Foundation, NASA, and other federal agencies whose activities are supporting the NII in significant ways. For example, the Department of Commerce's Telecommunications and Information Infrastructure Applications Program (TIIAP) is expected to support projects in several school districts this year, and the National Science Foundation's Network Infrastructure for Education and Applications of Advanced Technologies programs are supporting critical R&D projects in technology for education. I am working to ensure that these efforts reinforce the Department's own work.

In addition, the Committee on Applications and Technology of the interagency Information Infrastructure Task Force produced a collection of papers entitled "Putting the Information Infrastructure to Work", which includes a paper on using the NII to improve education and lifelong learning. This paper, prepared by the Department of Education, sets goals for incorporating advanced information technology into schools, and outlines a strategy for reaching these goals.

Agencies throughout the government are also embarking upon coordinated efforts to determine the needs of educational institutions. For instance, NCES, in coordination with the Department of Commerce's National Telecommunications and Information Administration (NTIA), and the FCC, is conducting a survey (noted above) of schools to determine the existing telecommunications capabilities within the schools and the resources necessary to connect all classrooms to the NII. In a parallel effort, the Bureau of the Census plans to survey computer use in homes, including the extent to which children interact with computers. NTIA, through a Notice of Inquiry, has initiated a comprehensive review of universal service and open access issues which also may encompass concerns related to education and technology. Finally, the National Science & Technology Committee on Education and Training (noted above), which consists of representatives from a multitude of agencies, is addressing interagency coordination of federal R&D policy on education, training, and technology.

The steps I have outlined are all directed at a single goal: helping to provide access to new tools based on telecommunication and information technologies. Until educators and learners have these tools, we will never meet our ambitious national education goals, and I believe that leadership from the federal government can help to make them available.

Thank you for the opportunity to discuss these pressing national issues with the Committee. I look forward to your comments and advice on these matters.

Mr. LEHMAN. Thank you very much.

At this time we have a vote on, on the Journal. And I will go there and dispense with that and be back here just as quickly as I possibly can.

Be about 10 minutes, we will hear from Mr. Kernan next.

Thank you.

[Brief recess.]

Mr. LEHMAN. The committee will resume.

And at this point, we will hear from Mr. Kernan.

We will put, again, your entire statement in the record. Ask you to summarize, and recognize you.

You may proceed.

STATEMENT OF JOHN T. KERNAN

Mr. KERNAN. Thank you, Mr. Chairman.

I am John Kernan, and I am the chairman and chief executive officer of the Lightspan Partnership. I also founded the largest education software company in the world, Jostens Learning, and I have been a cable operator.

My new business, Lightspan, is an alliance of some of the leading talent in the fields of education, interactive design, and entertainment. We are building interactive educational programming for the new broadband television networks that will be deployed in this country over the next 10 years.

Mr. Chairman, I will like to make just two observations and then draw a conclusion. The first observation is that the biggest problem with the use of telecommunications technology in American schools really doesn't have anything to do with technology.

The biggest problem is the problem of time. Kids are in school 6 hours a day, but as a recent Department of Education report, called "Prisoners of Time," concluded, less than 3 hours of those 6 hours are actually spent on the curriculum. The other 3 hours are spent on assemblies and field trips and AIDS education and a whole variety of other noncurricular activities.

So even if we connected every classroom of every American school, with every other classroom, with every library, with every on-line database, there would be very little extra time for the use of this material that could be accessed through these connections, unless we cutback even more on instructional time devoted to the basic skills like reading, mathematics and science.

So I hear people say it would be great if every child could do a 2-hour project on the Internet every day. But where would the 2 hours come from? But students have lots of time after school that they are now spending watching entertainment television and playing video games.

Observation number two, network providers like telephone companies and cable television companies in general see very few real revenue opportunities in the schoolhouse. But they are very anxious to hook up student homes with a whole range of new entertainment and shopping and information services.

So as a conclusion, a home-school connection could be the solution for the educator's need for more learning time, and the cable television operator or telephone company's need or desire for new business.

What if there was a program that delivered entertainment-grade—just like movies and video games—entertainment-grade real curriculum, real curriculum in reading and mathematics and science, to schools and to students' homes over next-generation television systems, and what if the material was, in the words of an 8 year old: Cool enough that students would actually choose math over Nintendo?

And what if the network providers, cable companies and telephone companies, were paid just a very modest amount of money, say, the marginal cost of doing it, a very modest amount of money by the school district to connect every child, rich children and poor children, every child, every child's home to the schoolhouse? That is exactly what our company, Lightspan, does, Lightspan Partnership.

We work with school districts to get cable operators and telcos to provide a home-school connection for every child. It is a connection that provides—and we built the curriculum—entertainment-grade, interactive curriculum that parents work on with their children on the home television.

We think that this concept could increase learning time by basically stealing it from the television watching and the game playing time. It could provide incentives to cable operators and telephone companies to add an education content to their other services, because they are really interested in the home.

It could get parents involved in their kids' learning, like parents used to be. And it might also provide a partial issue to this—a partial solution to this issue of universal service. Because the schools would buy it for all the children, the low-income children and the upscale children. And we really could have a situation where we were connecting the whole community together into a whole new generation of learning opportunities.

Thank you.

[The prepared statement of John T. Kernan follows:]

TESTIMONY OF JOHN T. KERNAN
CHAIRMAN AND CHIEF EXECUTIVE OFFICER
OF THE
THE LIGHTSPAN PARTNERSHIP, INC.

I want to thank you, Chairman Markey, and members of the Subcommittee, for giving me the opportunity to testify here today. I also want to commend you for the leadership and foresight you have shown in crafting telecommunications legislation that paves the way for all people to participate in lifelong learning through the national information infrastructure.

My name is John Kernan, and I am the Chairman and Chief Executive Officer of The Lightspan Partnership, Inc. (Lightspan). Lightspan is an alliance of leading talent in the fields of elementary education, interactive software design, and feature film and television entertainment. It is building interactive educational programming that combines the educational depth of comprehensive curriculum with the motivational appeal of video games. This programming, which will meet most curriculum needs in grades K-6 in mathematics and in reading/language arts, will be available for teachers to use in their classrooms during the school day, and for students to interact with in their homes after school hours.

Today I have been asked to testify on how telecommunications technology can benefit education, and how equitable access can be achieved. The national information infrastructure presents a rare opportunity to carry out Vice President Gore's educational vision of giving "every American, young and old, the chance for the best education available to anyone, anywhere." Through interactive television networks that link schools to homes and allow children and their families to interact with exciting and challenging educational materials and on-line databases, this dream can be realized.

Today I would like to discuss three issues:

• What Lightspan is doing to support educational reform through the use of telecommunications networks.
• How connecting schools and homes through interactive networks will make equitable access to the information superhighway a reality for rich and poor alike, and
• What public policy issues need to be considered to expedite the educational deployment of the national information infrastructure.

I.   **What Lightspan Is Doing To Support Educational Reform Through**
       the Use of Telecommunications Networks

In the last decade, Americans have mounted a major effort to reform education. Today, this reform movement is attempting to reach National Education Goals[1] by defining higher standards for content and student achievement, and framing new systems of accountability to ensure that schools educate and students learn. These goals will only be met, however, if American students spend more time learning, families become more actively involved in

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then children's schooling, and more time and resources are devoted to professional
development for teachers

A. Increasing The Time Students Spend On Learning By Extending
The School Day Into The Home

In a 1983 report entitled A Nation at Risk, the National Commission on Excellence in
Education found that students in the United States lagged behind their international
counterparts in testing and achievement scores. The Commission attributed this educational
inadequacy in part to the fact that American students spent less time on learning than did
their foreign counterparts.[2] Over ten years later, little has changed. In fact, in a recent
report entitled Prisoners of Time, the National Education Commission on Time and
Learning concluded that time is the missing element in our great national debate about
learning and the need for higher standards for all students. According to the Commission,
the reform movement of the last decade is destined to fail unless it is harnessed to more
time for learning.[3]

Time hinders education in two key ways. First, educators are required to do their job
within very restrictive time constraints. The school year is limited to an average of 180
days[4], and the school day is limited to an average of 5-6 hours.[5] Yet a large portion of this
limited academic time is stolen to make room for a host of non-academic activities such as
personal safety, consumer affairs, AIDS, conservation and energy, family life, and drivers
training — as well as traditional non-academic activities, such as counseling, gym, study
halls, homeroom, lunch and pep rallies.[6] The net result is that less than three hours of
learning time per day is spent on core academic subjects.[7] In contrast, students abroad are
required to work on demanding subject matter at least twice as long.[8]

Second, there is a fundamental problem with the way schools use the time they have. No
matter how complex or simple the subject matter, schools assign each subject the same
amount of time (the national average is 51 minutes per class period).[9] The fact that people
learn at different rates, and in different ways with different subjects is not taken into
account. Students are simply processed on an assembly line scheduled to the minute, and
left to learn what they can within the allotted time frame. Our usage of time virtually
assures the failure of many students.[10]

Although both the National Education Commission on Time and Learning and the U.S.
Congress have recognized that American students need to spend more time on core
academic subjects if they are to meet world class standards,[11] merely extending the time
spent in school is not the answer. One reason is cost. Extending the time that students
remain in school will significantly increase the cost of education. Several sources have
estimated that the national cost of each additional day of school will exceed $1.1 billion.[12]
Even more important, however, is the way the time is used. If students are to spend more
time learning, time must be used in new, different and better ways. Merely adding more
time will not, per se, translate into greater or more effective education, and may even be
counterproductive.[13]

The emerging national information superhighway may provide a cost-effective solution to both these problems. Although students spend approximately 70 percent of their waking hours outside of school,[14] much of this time is spent watching television and playing video games.[15] Moreover, the majority of students spend less than one hour a night on homework.[16] As one teacher who has seen her students become less conscientious in completing their homework assignments from year to year lamented, "I'm fighting against Nintendo!"[17]

One solution to the homework problem is to beat Nintendo at its own game. In experiments where computers and telecommunication networks were put into children's homes, time spent on reading, writing, and learning cognitive and technical skills increased, as did academic performance.[18] Moreover, for children living in troubled or dangerous neighborhoods, the computers and telecommunication networks that were put into their homes became a vital window to the world during long hours spent indoors after school.[19]

But the mere acquisition of technology is not enough. Creative software and innovative applications that excite and motivate students while teaching them core academic subjects such as math, reading and science must be available to all students in their homes after school hours if we are to succeed in increasing the time students spend on learning.[20] This is where the Lightspan mission intersects with educational reform efforts.

To increase the time students spend on core curriculum activities, Lightspan is building interactive programming that combines the educational depth of comprehensive K-6 curriculum with the motivational appeal of video games. This programming, which will meet most curriculum needs in grades K-6 in mathematics and in reading/language arts, will be available for teachers to use in their classrooms during the school day, and for students to interact with in their homes after school.

With respect to the appropriateness of instruction, Lightspan's interactive programming is ideally suited to help students find and nurture their ability to learn. For the slow student, the programming provides the student with a patient tutor that helps the student grasp and manipulate the educational concepts. For the faster learner, the programming allows for in-depth exploration while emphasizing higher order thinking and problem solving. Importantly, Lightspan's educational programming makes all children feel successful. And success is the greatest motivator of them all.

The ability to have a direct home-school connection will make a profound difference in American education. The teacher will be able to present a lesson in class, and have the students explore the concepts discussed in the lesson at home via interactive television networks. Accordingly, one way to increase the amount of time that students spend on their studies is to extend the school day into the home through interactive programming that students will be motivated to use.

B. Increasing Family Involvement

The most accurate predictor of a student's achievement in school is not income or social status, but the extent to which that student's family is able to (1) create a home environment that encourages learning; (2) express high but not unrealistic expectations for their children's achievement and future careers; and (3) become involved in their children's education at school and in the community. When schools help families develop these three conditions, children from low-income families and diverse cultural backgrounds get higher grades and test scores, have fewer placements in special education, have higher graduation rates, and have greater enrollment in postsecondary education.[21]

Although collaboration with families is an essential component of a reform strategy, the social and economic realities of the 1990s inhibit rather than reinforce parental involvement in the education process. Single parent households and households where both parents work are becoming the rule rather than the exception. At the end of the day, families have little time or motivation to help with homework or otherwise participate in their children's education. When problems related to drugs, alcohol, illiterate parents, and other family-related problems are added to this equation, the situation becomes even worse.

Many educators do not know how to even begin to reach out to and engage these hard to reach families. Often members of these families are intimidated by school, because they themselves were not successful as a student. Or, they may not feel qualified to monitor their child's education. Thus, schools must find a way to reach these families on their own terms.

Once again, home-school interactive television networks may be the answer for improving communication between families and schools, and allowing families to monitor and participate in their children's education without feeling intimidated. These networks will not only be extending serious learning into the home, but also will allow parents to see what their children are learning at school. As Chairman Markey recently observed, when "Little Mary or Johnny is doing homework in the middle of the living room, eyes glued to the family television ... Mom and Dad can't avoid knowing what their daughter or son has for homework."[22]

Because all the information will be digital, parents will be able to access the interactive programming at a time that is convenient to their schedules. In addition, in collaboration with experts in the field of parent-teacher relations, Lightspan will produce and incorporate parenting modules into the programming to help parents better understand what their children are being taught, and to provide them with simple activities that they can do around the house to reinforce the formal curriculum.

The two-way communication which interactive television networks provide will allow teachers and parents to communicate with each other. This will help parents keep in touch with what is going on in their child's education. When home-school voice messaging was introduced into at-risk homes in New York City as part of Nynex's Project Tell, parents

overwhelmingly welcomed the opportunity for greater awareness and involvement in their children's educational progress.[23] Similarly, when the IT Network of Dallas tested an interactive system in Birmingham, Alabama which enabled parents in 40 homes to view teacher lesson plans, their children's homework assignments, and even their own children's work, parents became more actively involved on a day-to-day basis in their children's education.[24] And where computers were put into inner city homes, parental contacts with teachers greatly increased.[25]

Finally, connecting schools to homes through interactive networks is likely to benefit the entire family as much as the student. In Project Tell, when computers were put in the homes of children, the computer became a learning resource for family members of all generations.[26] Accordingly, interactive networks have the potential to provide lifelong learning to an entire family - - not just the children.

C. Increasing Professional Development for Teachers

Schools are notorious for not setting aside sufficient professional development time to train teachers and staff. Unlike their foreign counterparts who take advantage of continuous and daily opportunities for professional development, American teachers are given little time for preparation, planning, cooperation, or professional growth.[27] As a result, teachers often are not able to keep abreast of developments in their field

Given the complexity of today's technological society, successfully educating students requires learned teachers in the classroom - - teachers who are current in the developments of their subject area. To keep pace with changing content standards, teachers need ongoing coursework in their discipline while they continue to teach their subjects.[28]

Even the United States Congress has recognized that intensive and sustained professional development for teachers and other school staff is imperative if we are to succeed in our National Education Goals.[29] Accordingly, Congress has prescribed that by the year 2000, the nation's teaching force will have access to programs for the continued improvement of their professional skills and the opportunity to acquire the knowledge and skills needed to instruct and prepare all American students for the next century.[30]

But American teachers, like American students, are prisoners of time. By the time they finish with their teaching and administrative responsibilities, there often is no time left to attend professional development courses or engage in educational discourse with their colleagues. Once again, connecting the school and the home may help to redefine how we think about teacher training. Clearly teachers need to be able to access professional development materials at any time, in any place, and without lugging huge manuals around

To accomplish this Lightspan is doing two things. First, it is collaborating with teachers educators, and entertainment experts to build professional development programming that demonstrates how master teachers explain various concepts and how they deal with the slow, the fast, or the disruptive student, among other things. These materials will be

available to teachers in their homes and in their schools at any time through interactive television networks. The materials will be relevant, short (since teachers are tired at the end of the day), and entertaining enough to encourage teachers to access them.

In addition, the interactive networks will allow teachers to electronically communicate with each other. In this way, a teacher who has success with a particular methodology can share the experience with his or her colleagues. And less experienced teachers will be able to find mentors. Through interactive television networks teachers will no longer have to work in isolation from their colleagues. They will be able to learn, share and communicate easily with one another.

II. How The Home-School Connection Will Bring About Equitable Access

A. Preventing A Society of Information Haves and Have-Nots

As technology and telecommunications proliferate in American schools and homes, educators increasingly fear that children from low-income communities, already faced with enormous disadvantages, will fall further behind in the acquisition of knowledge and skills that could lead to better careers and lives. Walking through violence ridden streets to school each day, these children present a formidable challenge to educators and legislators alike. A failure to give them access to twentieth century information resources puts their future, and the future of the communities in which they live, at risk.

Schools themselves often lack the resources to prepare these students for the technological future. Computer technology is unevenly distributed, with schools in the top quintile having nine times as many computers as those in the bottom quintile.[31] Moreover, even though interactive multimedia instruction can improve achievement and save time and costs,[32] 80 percent of the installed base of computers in American schools is obsolete and incapable of supporting multimedia graphical applications.[33]

Although landmark telecommunications bills, such as H.R. 3636, will make it possible for schools to be connected to the national information infrastructure,[34] this is only a first step. Empirical evidence shows that students who can access technology and telecommunications networks from their homes have an enormous advantage over those who can not.[35] As Chairman Markey has stated, "When the economy increasingly runs on information, and that information moves through communications pipelines, to be connected to information is to be plugged into the economy."[36]

The dilemma for schools, therefore, is how to prepare students for a world that is dependent on computers and telecommunications technology when the schools themselves cannot afford computers and computer networks for their schools? Fortunately, the evolving technological and legislative landscape provides an affordable solution.

B. Equitable Access Through Interactive Television

Today few poor and minority students have computers in their homes.

Although over 50 percent of children from high-income homes own computers, less than 5 percent from low-income homes have them. Moreover, 22 percent of white primary school children have computers in their homes, but less than 7 percent of African American and Hispanic children do.[37] This statistic shows that, if dependent on computers, the information highway may divide us rather than bring us together.

With the selling price of computers in the $1,000 to $2,000 range, it is fair to say that this disparity of access to home computers is not going to be solved in the near future. Schools do not have sufficient resources to provide their classrooms with optimal numbers of computers, so it is unlikely that they could afford to make a computer available in every student's home.

On the other hand, virtually everybody in the United States owns a television set. Studies indicate that over 99 percent of all homes have at least one television, and many homes have two or three.[38] While television viewing is currently a passive activity, the increasing convergence of television and computer technologies will soon allow television viewers to provide information as well as receive it. The advent of interactive television therefore presents a very desirable solution to giving all of our children access to the information superhighway. Here is how it will work.

The cable television industry currently has a multi-billion dollar fiber optic/coaxial cable broadband infrastructure that runs past 95% of American households, and connects approximately 60% of them to the network. This plant can carry more than 900 times the amount of information available over the copper wire used by the local telephone companies.[39] At the same time, the local telephone companies, which provide telephone service to 94 percent of homes,[40] are upgrading their wires with coaxial cable and fiber optics so that they will be ready to provide full interactive video and information services as soon as the law permits them to do so. Connected to the proper technology, this hybrid coaxial/fiber optic network is capable of delivering fully interactive services.

While there are many different interactive television technologies available, one approach employs a switched, two-way, broadband cable network that links the consumer to shared sources of interactive content and services. A sophisticated computer in a set-top box which sits on the television set transforms the data from the cable or telephone network into interactive data and graphics which are displayed on the consumer's television. It also transmits information from the consumer back to the service provider along the same route.[41]

These interactive set-top boxes give televisions the functionality of computers at a fraction of the cost. They will allow students to access instructional programming as well as multiple on-line databases and each other. And as with cable set-top boxes today, the cable or telephone company that provides the services will probably provide the boxes for free when you sign up for their services. Therefore, at next to no cost, schools will be able to connect their students to the information superhighway.

C. Using Competition to Ensure That Poor and Rural Communities
Are Wired For Broadband

The single most important change affecting the implementation of interactive television is legislation such as H.R. 3636 that this Committee has drafted and the House has passed H.R. 3636, if ratified, will remove many of the current cross-ownership restrictions of the 1984 Cable Act, thereby allowing telephone companies to provide cable television services in their local area, and cable companies to provide local telephone service and access to long distance carriers. This will allow the world to quickly move from one where telecommunications companies specialize in one service - local telephone, cable, cellular, long distance, etc. - to the broadband digital age in which everyone offers everything Telephone companies are anxious to take their rightful place in the interactive future by offering video and information services, and cable companies are anxious to offer telephony.

The effect of this deregulation will be to create a new level of competition as telecommunications providers compete with each other for business in each and every community. This increased competition will have beneficial effects on the price, universal availability, variety and quality of communications services. It also will benefit schools Schools have what interactive television providers want - 30 million families and therefore 30 million potential customers. And interactive television providers have what schools want - the knowledge of how to get the 48 million school children in our nation to tune into their programming after school

Accordingly, cable and telephone companies will have a strong incentive to compete for these school/home networks. Families with children are the ideal demographic group to sell other services to, and the networks that connect schools to homes will deliver all the families with children in an entire community. Because the service provider would not have to acquire these customers individually by selling them one by one, the competition for this ideal package of subscribers will be enormous.

Moreover, the incentive to be the provider of the school/home networks will not be restricted to just wealthy communities. Studies indicate that consumer demand for cable and telephone services is actually greater in less affluent and minority communities.[42] This is because video on demand and cable television is a less expensive form of entertainment than going to movies or traveling. Similarly, rural communities are likely to be good customers since they are not near to other kinds of entertainment. Accordingly, the economic incentives exist to encourage telecommunications providers to build interactive networks that connect the school to the home in inner city and rural communities as well as in suburban communities

In return for being allowed to put in in the school/home connection, telecommunications companies will carry the interactive educational curriculum programming at bulk rate discounts that are affordable to schools. They also are likely to provide the interactive set top boxes that will make the consumer's television set function like a computer. Since the

hardware costs will be taken care of, school technology budgets can be spent for educational software and network usage charges rather than hardware which so quickly becomes obsolete.

III. Public Policy Considerations

The following public policy considerations will help to expedite the educational deployment of the national information infrastructure

Free school linkage: The model that cable operators use to sell their services is to give their customers a free cable hook-up (including the set-top box), and then charge for usage. Schools need to fit into this model   Although it is fair for schools to expect to be connected to the information infrastructure, once connected, they should expect to pay, albeit very low amounts, for usage fees   If service providers can make just a little bit of revenue, they will be anxious to put interactive home-school networks in all school communities

Universal Service   For years, universal service has meant providing person to person voice communications to all Americans at affordable prices   The promise of the national information infrastructure, however, is that people throughout the world will be able to share almost unlimited amounts of information, including text, data, images, video and sound   In education, this will permit students to access resources far outside the classroom and school library   To make the infrastructure a unifying rather than divisive force, every school child in the United States must be given access to this infrastructure at school as well as at home   There should be no information "have-nots." As with telephone service, universal service should include service to the home   People should not have to wait in line to get information any more than they have to wait in line to make a telephone call

Open Competition: For the reasons set forth in this paper, the best policy for assuring that interactive multimedia services are brought into the home of every school child is to have wide open competition among anyone who can provide the service. Private investors already are building an infrastructure of wires, computers, people and information Competition will keep the cost of these services down and promote innovation. Competition, therefore, ought to be encouraged   The only restrictions ought to be around issues of universal service, so that no segment of our society is prevented from participating in our economy, and interoperability, so that information that travels over one network can reach disparate networks easily and accurately.

Innovative Models. Traditionally government dollars have funded educational technology projects that succeed only as long as the funding continues. A better approach may be to use scarce government dollars to fund innovative educational models that will spur entrepreneurial activity and be economically viable.   As the administration has acknowledged, the key to building an information infrastructure lies with the private sector [46] Unlike the space program, where only the government was in the position to support the necessary research and development, with the information superhighway, the

most important role of the government is to plant seeds necessary to ensure that the infrastructure will be used for the public good. The rest of the infrastructure will take care of itself.

Conclusion

The national information infrastructure has the potential to become the vehicle for improving education and lifelong learning throughout America in critically important ways. This will only happen, however, if all students have access to the infrastructure in their schools and in their homes. Interactive television networks, which connect schools to homes, will bridge income and racial gaps in our society by giving every child the opportunity to participate in our information oriented economy. Through these networks, students will be able to access exciting educational materials outside the typical nine to three school day, teachers will be able to access professional development materials in their homes and collaborate with their colleagues at any time, and families will be able to stay in contact with their children's schools. In addition, all people connected through interactive television networks will have the capability of accessing the internet and other on-line data bases. The networks will therefore help students, families and their teachers become active life long learners in the information age that has been brought about by the digital revolution. This may be the greatest long term benefit of the information superhighway.

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[1] National Education Goals were first adopted by the nation's governors in 1989 for attainment by the year 2000. The goals have been incorporated into GOALS 2000: Education American Act; Pub. L. No. 103-227, 108 State. 125, § 102 (1994) (codified at 20 U S C. §§ 5812). The eight goals state that by the year 2000: 1) all children in America will start school ready to learn; 2) the high school graduation rate will increase to at least 90% ; 3) all students will leave grades 4, 8 and 12 having demonstrated competency over challenging subject matter including English, mathematics. science, foreign languages, civics and government, economics, arts, history, and geography; 4) the Nation's teaching force will have access to programs for the continued improvement of their professional skills; 5) United States students will be first in the world in mathematics and science achievement; 6) every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy; 7) every school in the United States will promote partnerships that will increase parental involvement and participation in promoting the social, emotional, and academic growth of children.

[2] National Commission on Excellence in Education, A Nation at Risk: The Imperative for Education Reform (Washington, D.C. GPO, April 1983), 21-22.

[3] National Education Commission on Time and Learning, Prisoners of Time (Washington, D C GPO, April 1994), 7

[4] Carol Copple, Michael Kane, Douglas Levin, and Shirah Cohen, "Briefing Paper: The National Education Commission on Time and Learning," Pelavin Associates, Inc.. April 7, 1992, 5. State legislatures mandate minimum standards for the length of the academic day for elementary, middle and secondary schools. Individual schools have the freedom to exceed mandated standards and to develop alternative calendars and schedules. However in the United States, districts and schools tend not to go beyond the mandated minimum standards in setting the length of the school day and year.

[5] Ibid , 6

[6] Prisoners of Time, 15

[7] Ibid

[8] Ibid , 25. Se also, Juster and Stafford, "The Allocation of Time Empirical Findings, Behavioral Models, and Problems of Measurement," The Journal of Economic Literature, June, 1991.

9 Ibid., 15

10 Ibid

11 Ibid., 32. According to the Commission, "reclaiming the academic day means providing at least 5.5 hours of core academic instruction time daily." See also Goals 2000 Educate America Act, Pub. L. No. 103-227, 108 Stat. 125 (1994) (codified at 20 U.S.C. §§ 5801 et seq.). See also the Improving America's Schools Act of 1994, S. 1513 § 1001(b)(4). "In order for most students to master challenging standards in core academic subjects... students and schools will need to maximize the time spent on teaching and learning the core academic subjects."

12 Copple et al., "Briefing Paper: The National Education Commission on Time and Learning," 40-42.

13 H.M. Levin, Clocking instruction: A reform whose time has come? (Palo Alto, CA: Stanford University Institute for Research on Educational Finance and Governance, 1984), and Copple et al., "Briefing Paper: The National Education Commission on Time and Learning," 21. "Increasing the 'costs' to students by making them spend more time in what is often an oppressive and uninspiring environment may actually increase dropout rates and turn some students off to further learning."

14 Reginald M. Clark, "Why Disadvantaged Students Succeed: What Happens Outside School Is Critical," Public Welfare, (Spring 1990): 17-23.

15 Arthur D. Sheekey, "Remaking Public TV," The American School Board Journal, (May 1994): 40, and Copple et al., "Briefing Paper: The National Education Commission on Time and Learning," v. Young people between the ages of 2 and 17 spend more than three hours every day watching television, and in the typical U.S. household, the television is on for a total of seven hours and 41 minutes daily. Jeanne B. Funk, "Reevaluating the Impact of Video Games," Clinical Pediatrics, (February 1993): 89. Ninety percent

16 Copple et al., "Briefing Paper: The National Education Commission on Time and Learning," iv

17 Gabriella Stern, "Education: Kids' Homework May Be Going the Way of the Dinosaur," Wall Street Journal, 11 October 1993, Sec. B. 1

18 The Stanton/Heiskell Center for Public Policy in Telecommunications and Information Systems, Project TELL: Telecommunications for Learning: Third Year Report to NYNEX, (New York: The City University of New York, May 1994), 2, 73, and Saul Rockman and Kristan Mayer, The Buddy System, 1988-1993: A Synthesis of Research Findings and Recommendations for Future Research and Action, (San Francisco: Submitted to the Corporation for Educational Technology, January 1994), 21

19 Project TELL, 54, 90.

20 Interactive Educational Systems Design, Report on The Effectiveness of Technology in Schools, 1990-1994, (Washington, D.C.: Software Publishers Association) 1, 4. Research indicates that the use of technology as a learning tool can make a measurable difference in student achievement, attitudes and interaction with teachers and students. Interactive video is especially effective when the skills and concepts to be learned have a visual component and when the software incorporates a research-based instructional design. In a recent study, students receiving instruction via interactive video earned achievement scores that averaged 50% more effective than students receiving conventional instruction. Results were significantly higher when teachers used interactive video as a supplement to traditional instruction than when it was used to replace traditional instruction.

21 Anne T. Henderson and Nancy Berla, eds., A New Generation of Evidence: The Family is Critical to Student Achievement, (Washington, D.C.: National Committee for Citizens in Education, 1994), and Strong Families, Strong Schools: Building Community Partnerships For Learning, (Washington, D.C.: U.S. Department of Education, September 1994)

22 Remarks of Congressman Edward Markey before the National Education Computing Conference, June 13, 1994, Boston, MA

23 Project TELL, 2

24 Armstrong, "The Learning Revolution"

25 Rockman and Mayer, The Buddy System, 8

26 Project TELL, 53

27 Prisoners of Time, 36

28 Ibid., 21

[29] Improving America's Schools Act of 1994, H.R. 6, § 1001(c)(7)

[30] Goals 2000 - Educate America Act, public law 103-227, 103rd Congress, March 23, 1994, 20 U.S.C. § 5812

[31] Information Infrastructure Task Force Committee on Applications and Technology, Putting the Information Infrastructure to Work, Report of the Information Infrastructure Task Force Committee on Applications and Technology, (Washington, D.C.: National Institute of Standards and Technology, U.S. Department of Commerce, 1994), 15

[32] Ibid., 6

[33] Ibid., 14-15.

[34] "National Communications Competition and Information Infrastructure Act of 1994," H.R. 3636 (103rd Congress, 2nd Session); "Communications Act of 1994," S. 1822 (103rd Congress, 2nd Session)

[35] Michael E. Martinez and Nancy A. Mead, Computer Competence: The First National Assessment, (Princeton, NJ: Educational Testing Service, April 1988), 5, 39; Project TELL, 2, 5, 30, 51, 97; and Rockman and Mayer, The Buddy System, 306, 11

[36] Congressman Edward Markey, "More Than Just Movies on Demand," Roll Call Telecommunications Policy Briefing Special Edition, 15 November 1993, 6

[37] Project TELL, 47.

[38] "The Social Compact," Congressional Quarterly Special Report: The Information Arena, 14 May 1994, 38, and "Systems for Measuring and Reporting Television Report," Statistical Research, Inc., 29 August 1994

[39] Congressman Dan Schaefer, "Pitting RBOC vs. RBOC," Roll Call Telecommunications Policy Briefing Special Edition, 15 November 1993, 3

[40] Jorge Reina Schement, Beyond Universal Service, (Washington, D.C.: Benton Foundation, 1994), 3

[41] Harry Jessell, "BA Hopes to Launch Video Dialtone in Fall," Broadcast and Cable, 10 January 1994, 66

[42] PNR & Associates, Spending and Saving on Communications Services by Minorities, (Philadelphia, PA: April 1994), 1-4

[43] Information Infrastructure Task Force, The National Information Infrastructure Progress Report - NII Principles And Actions...A Checklist of the Clinton Administration's Progress September 1993-1994, (Washington, D.C.: Information Infrastructure Task Force, September 1994), 5

Mr. LEHMAN. Thank you very much.

We will hear from Dr. Harrison-Jones.

And I know that Ms. Roberts has to leave, so maybe we will ask you some questions after we finish with Ms. Jones here. You may proceed.

STATEMENT OF LOIS HARRISON-JONES

Ms. HARRISON-JONES. Thank you very much.

Mr. Chairman, members of the Telecommunications and Finance Subcommittee, I am delighted to be here as a member of this panel. As stated, I am Lois Harrison-Jones, superintendent of the Boston Public Schools.

Like school districts throughout this country, we in Boston find ourselves in an extraordinary position regarding the use of technology and telecommunications. On one hand, we have a number of programs that are widely perceived as national models in the use of technology to enhance education,

We have an exceptionally robust relationship with the business community in the city, one which has resulted from the contribution of millions of dollars in hardware, software and technology support to our schools. Compared to many urban school districts around the Nation, we are ahead in creating the capability, and in all of our schools, for the use of telecommunications in our cla...srooms.

All of this being said, we also find on the other hand, that we are severely limited in our ability to take a significant leap forward in the use of technology, mostly because of a lack of funds to do so. And as innovations in technology are booming, especially in the ways they can be used for classroom instruction, our capability to make use of these achievements has been severely constrained by serious limitations in capital and training resources necessary to make full use of new technology.

This technology gap between what is available in the schools and what the schools can afford obviously will have the greatest impact upon children of families that are economically disadvantaged. Those students, of course, depend more heavily on the schools than do others for them to have equity in terms of program offerings and services.

We are moving ahead, however, exploring new uses of technology, at a growing number of our schools in Boston. And yet, I feel that we are falling behind.

We have had to cut basic educational services as fiscal constraints resulting from reduced resources from local, State and Federal sources have forced us, as other districts throughout the country, to cut our budgets significantly this the past few years. This is a time when the exciting innovations in telecommunications should have had their broadest applications in the classrooms of our children, who are challenged by special needs, language barriers, or family economic constraints.

I need not remind you that in Boston we are especially impacted by the number of young people for whom English is a second language. We provide instruction for youngsters in more than 9—and next year will be in 12 different languages.

Despite this, however, we believe that we have some models of programs in technology and communications, and I would like to share them with you, because we would like to expand upon these.

The problem that we have is we have a number of exciting things happening, but until that is institutionalized and can be replicated on a broader scale, it will have no systemic or institutional impact upon the achievement of our youngsters as can be measured or observed. One of our most significant achievements to date in technology is BosNet, a local telecommunications bulletin board that enables teachers and students in classrooms to communicate with their peers throughout the city.

This was started 4 years ago with a small external grant, and now BosNet has to be completely funded by the Boston School Department. Every school has been equipped, or at least it has at least one cable drop, which enables the school to become connected to a telecommunications network.

We have also established, at least some telephone lines in each of the schools. We have piloted the use of the information highway in one of our high schools. Again, piloting, 1 out of 20, is not going to respond to the need. But nonetheless, we know that it works. It works at this particular high school.

It was started through the generosity of the business community and a small competitive grant from one of our providers. The school has been able to establish labs throughout and it has technical means to connect to a large database of publications.

Teachers and students are using this technology on a daily base. Every teacher has been trained, and the quality of research papers, the use of computers, as a bilingual instructional device and a new level of ability has been—is evident in terms of the students' performance in writing, in mathematics, and really in the design— teaching designs.

This program is serving as a model for the city as a whole, and we have, with our new mayor, a commitment to work with us in another capacity, it is with our Boston Public Library, to bring Internet into all of our schools over the next several years. Now, this we feel is having to be a significant—will require a significant commitment, but it will have a significant impact.

We also have programs, some at a particular elementary school where we are piloting the use of technology and communications as an instructional tool for special-needs students. This school is working with a program that the acronym is CAST, the Center for Adaptive Special Teaching, to provide professional development for teachers in how to harness the enormous potential of technology for teaching students with special needs.

We have established a center in the city for special education and technology. We are working with a local college, Emanuel College, where hundreds of our Boston public school teachers receive training and graduate credits as participants in training courses and seminars conducted at the center.

Then, of course, through our own Office of Technology, we have— we conduct, we organize and conduct courses each year. We have just negotiated a Center for Leadership Development where we will infuse training in technology as a part of that offering.

We have some extraordinary programs in our schools using computers to work with parents as well. One school that is heavily impacted by parents who are recent arrivals from various parts of China, have now developed a means by which parents are actually instructed in the use of computers by their children who have learned applications during the school hours. And the parents learn English and computer skills, while the children learn their native language.

Twelve years ago in our city through a municipal bond, there was the establishment of funds for the purchase of some stand-alone computers. But we know that computers bought 12 years ago are virtually obsolete now. We have not been able to systemically replace or systematically replace or upgrade this hardware, except through a school-by-school patchwork approach funded by business partners or externally funded grants.

And as we know, stand-alone computers are no longer state-of-the-art anyway. When computers are networked or connected to one another, their usefulness as learning tools, we all know, is greatly enhanced. And then last year, I would like to share this with you because it is an attest to how computers can be such—can have such an impact upon children.

Last January, Senator Kennedy came to our city and heard from a young man who gave testimony there that he was seriously visually impaired. He had been blind since childhood. He spoke about how his grades and his chances for continuing his education in college dramatically improved once he was able to gain access to current, adaptive technology. His grades, as he said, shot up. And through the use of technology to help overcome the restrictions created by his disability, he became the class valedictorian, and today is studying at Harvard University.

In terms of recommendations as I close, I have three basic recommendations to make as we talk about telecommunications and the impact upon public schools. One has been touched upon, in fact two of the three have.

There is certainly a need for a revenue stream for the schools to help them solve their major capital expenses.

And then second, we need to address the significant need for professional development, ongoing professional development to make sure that the people who we are asking to work with technology are comfortable and capable of using it.

And then thirdly and finally, another place that we can use technology, one that we would like to use it more effectively, is in the area of student safety. Those of us who work in urban school districts particularly need to find more effective and more efficient ways of dealing with this very, very thorny issue.

The Boston schools for many years used simply FM radios to expedite these seemingly mundane but necessary tasks of management. We have now reached the limit of existing radio capacity and are actively soliciting approval to open a new group of UHF channels, which up until now have been held in reserve by the FCC. The subcommittee, hopefully, can be helpful to us in unlocking that channel.

As we groped with the many, many demands upon education today, we need the support, we need the help at all levels, and es-

pecially the national level. This is a national problem and I think pleading for a national solution is the only way that the United States I think is going to maintain its leadership in an increasingly global marketplace.

I thank you very much for the opportunity to share these thoughts with you.

[The prepared statement of Lois Harrison-Jones follows:]

PREPARED STATEMENT OF LOIS HARRISON-JONES, SUPERINTENDENT OF SCHOOLS, BOSTON, MASSACHUSETTS

Mr. Chairman and Members of the Subcommittee on Telecommunications and Finance: We find ourselves in an extraordinary position in the Boston Public Schools regarding the use of technology and telecommunications.

On the one hand, we have a number of programs that are widely perceived as national models in the use of technology to enhance education. We have an exceptionally robust relationship with the business community in the city, one which has resulted in the contribution of millions of dollars in hardware, software, and technology support to our schools. Compared to many urban school districts around the nation, we are way ahead in creating the capability in all our schools for the use of telecommunications in our classrooms.

All this being said, we also find, on the other hand, that we are severely limited in our ability to take a significant leap forward in the use of technology, mostly because we lack the funds to do it.

As innovations in technology are booming, especially in ways that can be used for classroom instruction, our capacity to make use of these achievements has been severely constrained—by serious limitations in the capital and training resources necessary to make full use of new technology.

This technology gap—between what is available and what schools can afford—will have its greatest impact on the children of families that are economically disadvantaged. Those students who can depend upon more affluent parents to provide them with the means at home to gain access to the information highway will develop at an increasingly faster rate than those dependent on schools for the same access, especially if the schools are not fully equipped to help them.

We are moving ahead—exploring new uses of technology in a growing number of our schools. Yet we are falling behind. We have had to cut basic educational services, as fiscal constraints resulting from reduced resources from local, state, and federal sources, have forced us to cut our budgets for the past four years in a row. This is a time when the exciting innovations in telecommunications should have their broadest applications in the classrooms of children who are challenged by special needs, language barriers, or family economic constraints. These are the children upon whom this new technology can have its greatest impact. And yet our schools simply do not have the means to help them in a systematic way, and are dependent upon an incessant patchwork of fund-raising even to be able to introduce a few of the wonders of modern computers and communications.

We have a growing number of programs and services in Boston that are considered models in the use of technology and telecommunications as an enhancement to education.

One of our most significant achievements to date in technology is BosNet—a local telecommunications "bulletin board" that enables teachers and students in classrooms to communicate with their peers throughout the city. Four years ago, we started this telecommunications system with a small external grant, and since then have been able to build up to a level of 1,000 regular users. BosNet is aimed at reducing the isolation of the individual classroom and giving teachers and students a classroom-based means for quickly and effectively communicating throughout the city. BosNet is now funded completely by the Boston School Department.

Every school in Boston now has at least one cable "drop" which enables the school to become connected to a telecommunications network. We also have established—in every school in the city—two dedicated telephone lines for the use of telecommunication. These two related advances—dedicated lines and cable drops in every school—are important steps toward enabling every school to gain access to the "information highway" that is increasingly being seen as a necessary route toward a successful future for all of us.

We have piloted the use of the Information Highway in one of our high schools, with surprising results. At Brighton High, through the generosity of the Boston business community and through a competitive grant from Apple Computers, the

school has been able to establish computer labs in ten classrooms with the technical means to connect to a large data base of publications. The quality of the work being done through this program is exceptionally high. Teachers and students are using the technology on a daily basis. Every teacher in the school has been trained. The quality of research papers, the use of computers as a bilingual instructional device, and the new level of ability the school has for teaching design, writing, math, and other aspects of the high school curriculum is way beyond what they were able to do before the labs were in place.

The Brighton High program is serving as a model for the city as a whole. We have a new commitment, from the Mayor of Boston, Thomas Menino, along with the Boston Public Library, to bring "Internet" into all our schools over the next several years. This is a significant financial commitment. As you know, access to Internet gives its subscribers the ability to gain electronic access to literally hundreds of publications that can be used by teachers for planning lessons and by students for conducting research and developing new levels of self-learning skills.

We also have programs such as the model at the Harvard Kent Elementary School, where we are piloting the use of technology and telecommunications as an instructional tool for special needs students. The school is working with "CAST"—the Center for Adaptive Special Teaching—to provide professional development for teachers and administrators in how to harness the enormous potential of technology for teaching students with special needs. The Harvard Kent is a uniquely ambitious model in technology applications for physically and intellectually challenged students.

We have also established in Boston a center for the use of technology in special education. At Emmanuel College, hundreds of our Boston Public School teachers receive training and graduate credit as participants in training courses and seminars conducted at the Center. This Center is supported and staffed by the Boston Public Schools and provides direct support to classroom teachers working with our severely handicapped student population.

Addtionally, our own Office of Instructional Technology organizes and conducts twelve courses every semester for Boston teachers in the uses of technology. These courses are completely voluntary, and are paid for by the participants. Three hundred teachers each semester are taking advantage of a full menu of courses in technology and telecommunications.

We also have some extraordinary programs in our schools using computers as teaching tools. Just one example is our Parents as Partners program at the Josiah Quincy School. The program uses computers donated by the Bank of Boston and software and instructional time paid for through competitive grants. Parents as Partners provides Quincy School parents from Chinatown with instruction in English and in the use of technology in after-school hours. Parents are actually instructed in the use of computers by their children,who have learned the applications during school hours. The parents learn English and computer skills while the children learn their native language. Parents become actively engaged through Parents as Partners in their children's learning experiences at the school.

We have learned in Boston that technology can help teachers and students make an important educational leap, when the school has the combination of equipment and instructional skills to use it. Through business, philanthropic, and competitive grants, many of our Boston schools have created innovative programs like those at Brighton High and the Josiah Quincy Elementary School. For us, the challenge is to make these available to every school, and to find ways for schools to become self-regenerating: where new technologies are available as well as the skills to use them.

Twelve years ago the City of Boston through a municipal bond issue established funding to enable our schools to purchase Apple 2E and IBM Personal Computers for our schools. We established computer labs in nearly every school through this funding source.

One of the dilemmas of this however has been that once the funds were spent, they were gone. Computers of twelve years ago are virtually obsolete now. We have not been able to systematically replace or upgrade this hardware, except through a school-by-school, patchwork approach funded by business partners or externally funded grants. Stand-alone computers are no longer state-of-the-art anyway. When computers can be networked, or connected to one another, their usefulness as learning tools is greatly enhanced.

However, it is a very expensive proposition to fully network existing stand-alone computers. In some of our schools, such as the McCormick Middle School and the Josiah Quincy Elementary Schools, we have been able to network our computers effectively, funded by the Bank of Boston. In other schools such as English High, the hardware has been networked through competitive grants. Each network upgrade costs approximately $50,000 per lab. The cost for this as a system, especially one

that has wrestled with the possibility of laying off teachers every year during the present decade, this expense is a very dear one.

Last January at West Roxbury High School, Senator Edward Kennedy conducted a hearing as part of the development of his legislation for support of technology in education. At this hearing, one of our students from Boston Latin School talked about the impact technology had upon his life. The student was seriously visually impaired—blind since childhood. He spoke about how his grades—and his chances for continuing his education in college—improved dramatically, once he was able to gain access to current adaptive technology. His grades "shot up," as he put it. Through the use of technology to help overcome the restrictions created by his disability, he became the class valedictorian and today is studying at Harvard University.

All of our children in Boston should be able to gain access to state-of-the-art technology for instruction, particularly through telecommunications. As funds continue to be cut for public education, however, the gap that presently exists between students from inner city, low-income families and their counterparts in more affluent communities is only going to widen. Parents who can buy computers, subscribe to Internet, put terminals and modems in their children's bedrooms, and communicate electronically with their children's classrooms âre to see great results in their children's education. Parents who cannot afford steps are going to rely increasingly on their public schools to provide them. Where schools cannot do so, the inequities between those who have and those who don't will become increasingly apparent in test scores and other indicators of academic progress.

The problem for school systems like Boston is that technology is a major capital investment. We spent a lot of money putting a cable drop in every Boston school. The truth is that we should have a cable drop in every classroom in every school. We dedicated two phone lines for each of our 119 schools. Every teacher should have his or her own telephone line. We can only begin to imagine the possibilities for Boston school children, if every one of our classrooms were equipped with computer hardware, modems, telephone lines, and access to Internet.

The bond issue in Boston 12 years ago raised $4.5 million and that was not enough to put hardware in all our schools. Today, it would cost $12 million to put a telecommunications work station for every teacher in Boston. This would not include any of the training or equipment necessary to connect students to these networks. Ironically, students that have not learned as well through more traditional forms of teaching are often the ones who need technology the most, yet get the least, and the least consistently. Even though we are ahead of many school systems, our best efforts are still in the "pilot" or "demonstration" stages. where a few entrepreneurial teachers or administrators have written a grant or won a contest and gotten some hardware for their school.

(1) **There needs to be a revenue stream for schools** to help them solve these major capital expenses. This will require a major funding initiative that cannot be borne by the budget cutting measures that school systems have had to follow in order to do anything innovative and systemic over the past few years. Technology is not a substitute for teaching or books. It is a means through which teachers can use their teaching skills in more focused ways to help students learn to become life-long learners. Computers and telecommunications are increasingly essential tools that all educators will need in order that their students be competitive in a global economy. We can no longer do it with pencil and paper alone, because our students will fall too far behind.

(2) **We also need to address the significant need for professional development, if we are going to make full use of the promise in telecommunications.** Computers, modems, and other expressions of technology demand a process of continuous learning, to stay abreast of rapid changes. The costs of retraining teachers and providing means for their continuing enrichment are significant, yet must be provided if the technology is to be put to best use. Any revenue stream must take into consideration the dual needs of equipment and keeping its users equipped, if the expense is to be worthwhile.

School systems and school leaders have an important role to play in this retooling process. Our curricula in every subject must be rethought to take full advantage of the new opportunities and demands in a society when so much more information is going to be readily available to young people. We need to spend less of our time in classrooms transmitting a body of knowledge to students and more time teaching them to use their own skills to learn themselves. This is a major shift in pedagogy, one that is gradually taking place in all our schools, yet one that needs to be sped up if our children are going to compete successfully.

This is the part of the equation that schools must contribute: the retooling of curriculum, teaching priorities, and classroom strategies to fully engage our students

in a changing economy. Where we need help is in the high initial costs of equipment, the longer term costs of servicing and renewing that equipment, and the training to make full use of technology.

(3) **Another place we need help is related to student safety**. This is also an area in which the federal government can also play a role. Telecommunications in a large public school system includes the use of two-way wireless devices. It is the optimal medium when people need to communicate during the school day. School safety is enhanced by the use of two-way radio for managing student security and expediting the boarding and deboarding of children from school buses or for obtaining assistance during medical emergencies and other situations involving the physical welfare of students.

The Boston Public Schools has for many years used FM radios to expedite these seemingly mundane but necessary tasks of educational management. We have now reached the limit of existing radio capacity and are actively soliciting approval to open a new group of UHF channels which up to now have been held in reserve by the FCC. I am advised by my Chief of School Safety that he needs Channel 15 in the 476 megahertz range. This Subcommittee can be helpful in unlocking that channel.

Our plans for the new channels will not only expand the use of wireless communications but will add state-of-the-art applications including transfer of confidential data between school operations; transmission of faxed information between classrooms and the main office; and the implementation of alarm and control functions in buildings for energy management and resource allocation.

If a hurricane came along and blew the roofs off of our city schools, no one would expect that the money to fix them should come at the expense of paying teachers or buying books. We have a growing national problem as a result of innovations in telecommunications: schools serving children without family means to provide computers and training are going to fall further and further behind. The cost for all schools to take advantage of technology is enormous. We need a strident commitment from all sources, local, state, and federal, that can enable schools to make the significant jump in capital expense to get wired and ready for telecommunication.

In the past three years, even as our own Office of Instructional Technology has increased the number of teachers it has served with courses and seminars in technology, its staffing operation has had to be cu: This sort of Peter-to-Paul robbing will never enable our schools in the city to stay at pace with our more affluent suburbs, and it will never allow us to catch up to nations where there is a more strident commitment to education as a major national priority.

We need leadership at the national level. This is a national problem pleading for a national solution. It is the only way the United States can maintain its leadership in an increasingly global marketplace. What better Congressional Subcommittee than Telecommunications and Finance to provide the bold leadership that is needed?

Mr. Chairman, thank you for providing me with this opportunity to speak to you and your Congressional colleagues in order to provide an outline of the importance of telecommunications in the educational lives of students in Boston and in urban systems throughout the nation.

Mr. LEHMAN. Thank you very much.

As I said, we are going to have to let Ms. Roberts go. And let me say, we certainly appreciate your being here today.

But I do want to ask you a couple questions, if I may. And I think what we will do is leave the record open and submit additional questions that I know will come out in writing to you.

Ms. ROBERTS. Right, we would be very happy to answer those questions.

Mr. LEHMAN. Thank you.

This is an issue where it is easy to talk in generalities, and we can identify the problem in generalities. And it is much harder to get to the specifics, both of what exactly needs to be done and how to go about doing it.

And there are—I guess like health care, there are a lot of moving parts here and a lot of different—a lot of players on the field. There are a couple, I think, rather provocative comments in Secretary Riley's discussion, and I want to just lead you to them.

He says at the beginning, it says: Both the connections to new telecommunications and information resources and basic access services to these resources, should be free, or as inexpensive as possible to educators and students to ensure that we get the maximum benefit as a Nation from these resources. If we do not take these steps, we will deepen the socioeconomic divisions that threaten our Nation.

And later he says: I do not expect the Federal Government will be able to contribute any large amount to this investment in infrastructure. We must, therefore, work together to establish a regulatory framework for telecommunications firms that will ensure the development of the NII for education. And I guess that is where this committee lands right smack in the middle of the issue and where the issues join.

Do you care to expand, maybe fill in a little more specifics of what the S·cretary has in mind there?

Ms. ROBERTS. Yes. First of all, in terms of the connections to the resources. In the first place, if you will recall, the Vice President specifically challenged the regional Bell operating companies to think about how, as they were deploying expanded capacity to communities, to businesses, that they consider directly providing the connections to schools. And, in fact, in a number of instances, there really have been very significant efforts that have moved forward in this area.

In particular, I point out the Pac-Bell efforts in California, the Ameritech announcement in Indiana, and more recently a very interesting solution that seems to have been worked out in West Virginia with Governor Caperton and Bell Atlantic. So, our sense was that at the very least, the connections to schools could be doable, just the way many cable companies already provide the connections to cable in many schools.

What that doesn't take care of is the internal wiring, the internal cabling to build the local network that would bring the resources to the classroom. And in that case, our sense was that there could be help in that area. In some cases, the telcos and the cable companies have gone even further, but in many cases, States like Florida have actually set up funding for infrastructure building so that eventually every school will be an intelligently wired school and the conduit will be there for the long term.

In terms of the basic charges, there we are talking about the rate structures that are in place right now, where we think that we can work with you and with the FCC, and even potentially with the State regulators, to think about how these rates could be made more affordable, particularly preferentially for education.

Mr. LEHMAN. Well, I am sure——

Ms. ROBERTS. It is very contentious, and we know that. But the Secretary really believes that it is his job to talk about the principle of all of this. And then let me say something else. As States are seriously planning the technology for their educational institutions and working with institutions to do this, there really is an opportunity to understand what the full range of costs are. And also, then, ultimately to think about how this can be funded in a more reasonable way.

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There have been a number of proposals to think about funding for technology, and in fact we are going to undertake a study that looks at funding alternatives. In no way do we think this is not a serious issue.

Mr. LEHMAN. I appreciate that and I certainly commend you and the Secretary for your attitude.

Dr. Harrison-Jones, you heard her comments about the great disparities that exist in her area. The same is true in mine. I have schools side-by-side, some state-of-the-art, some right out of the last century. And frankly, it is not always the socioeconomic ditches in the schools. Some of our poorer schools have better systems because of the particular nuances of the funding.

In fact, I have got one high school in my district that is one of the top ROTC programs in the country, and the Navy has funded a state-of-the-art computer center there for the ROTC program. while side-by-side, the rest of the school doesn't have anything. So there is these—it is—there are huge disparities and they are not—they don't necessarily follow normal lines.

Are we getting—we have all these different studies we cite that are a piecemeal look at this. Are we getting an overall picture of where we are at in this country? Are we gathering that kind of information so we can make judgments more accurately on a larger scale?

Ms. ROBERTS. I think that is absolutely critical, and we need to do that. We are going to begin part of that process through the National Center for Educational Statistics survey of telecommunications to schools. We see that as providing the beginning of real baseline data that will, in fact, point to the disparities, we hope, and give us a sense of where they exist.

But I would also recommend that you look at the next Office of Technology Assessment Report. I still have a lot of contact with OTA. and the study that is going to be released, I am pretty sure, by early January looks at technology and teaching the extent to which we are making progress and where we are not.

But part of our problem—and I would point this out to you, and I don't think it is surprising—is that most of what we do in education is State and local. I, too, have been surprised at the fact that I can find schools and sometimes even districts where one would not predict that there would be so much technology being deployed and being deployed effectively because in terms of economics this is not an area where you would expect to see these resource.

When you start to look at it and you try to understand why—why can this district do it and this school do it, there are islands of excellence, and what it comes down to is a couple of things. One is leadership.

I just spent time with Leona Williams, who is the superintendent of the Val Verde School District in California, and what she described is a process that she undertook to look directly at her budget. With not a single new dollar, this superintendent was able to significantly change her district's resource base for technology, for education and for learning.

I talked to another superintendent in Perry, Ohio, and I heard the same story.

What I think we need to do is look at what these people have done and ask ourselves what did they give up, what did they do differently because, in part, we are talking about major institutional changes as well. So that is the second piece.

And I think the third piece is we look at how we in Federal programs, we require people to do things with technology and provide separate streams of funding in Chapter 1, in other math and science and education programs. But we really don't ask for people to think about these resources in a comprehensive way and encourage them to deploy those resources to benefit kids and to benefit schools. So I think we can do a better job on our side as well, and Congress can help us there.

So it is a long answer, and it is a lot of things: It is people. It is leadership. It is being lucky enough—for example, if you are in Tennessee—I was just thinking about Mr. Cooper—if you are near the Oak Ridge National Laboratory, and you are in Knoxville, and you are in Oak Ridge, and you are in Anderson county, you have a network in place because the Oak Ridge National Laboratory people decided this was something they wanted to do on their own time and make it available.

We have to begin to really think about how we use all the resources that are available across the country.

Mr. LEHMAN. Finally, let me ask you this: Do we have any comparisons here, information, that would tell us where we stand in this whole issue versus other countries—the Germans, the French, the British, the Japanese?

Ms. ROBERTS. To my knowledge, there is no fully comparable data. However, there is a major study on the use of computers in our classrooms. That is an international study that looks at the United States and other areas. It is called the IEA study. As I recall, we have pockets of excellence, we have islands of excellence in the United States, but we don't come nearly as uniformly close to the base of technology that some countries have been able to achieve largely because education is a Federal, if you will, or a national system.

But what the IEA study shows and what other anecdotal evidence also points to is that, in terms of the cutting edge, we have the cutting edge examples, and the real challenge is how do you scale up? How do you scale, as Dr. Jones has pointed out, from a model project here to a whole system that is using these resources effectively?

Mr. LEHMAN. Thank you very much. I appreciate your being here today and, again, give our sympathies to the Secretary. Look forward to working with you on this issue.

Ms. ROBERTS. Thank you for inviting us. I think this is the first time we have come to testify before your committee, and we are delighted to be here, and we know we have a lot of work to do. We are eager to move forward.

Mr. LEHMAN. Thank you. Very good, we appreciate that.

Dr. Rescigno, we will put your entire statement in the record, ask you to summarize and welcome you out from California.

STATEMENT OF RON RESCIGNO

Mr. RESCIGNO. Thank you, Congressman, members of the committee. We do have three Californians here, I believe, two, myself and Linda and John Kernan.

Ms. ROBERTS. No. I wish I was.

Mr. RESCIGNO. Sorry about that. I am also very familiar with your school district, Congressman. We have had many visitors from Fresno to our school district.

I am a school superintendent, been one for 16 years, which sort of breaks the mold in California, at least. The average tenure is about 3 years—or anywhere, right? Sometimes I think I am as much a part of the problem as part of the solution because I have been in public education for 36 years, both on the East Coast and the West Coast.

Eleven years ago, when I was appointed superintendent of the Hueneme School District, we set out with a vision to try to bring equal opportunity to all of our students. The Hueneme School District is a district of close to 8,000 students, multicultural district, multiracial district, 60 percent Hispanic, 30 percent of those nonEnglish speakers, blacks, Asians, typical of what you would find in southern California, our migrant population, and we have a very large Navy base close by. It is a Seabee base. And we also have a very large Naval Air Force base close by, so we are pretty typical of an urban center in southern California.

The vision was to try to bring something to our students that would be exciting, motivating and pay off dividends in the long term. Now, after 11 years, in my testimony—my written testimony—we have been pretty specific in terms of what we have tried to accomplish.

I think the bottom line with us is that we did accomplish fantastic things with the use of network technology and student learning. Our kids have generated achievement scores that are absolutely fantastic. We can compare very favorably with students throughout the United States, as our results show. And also, as our results show, that there is a direct relationship between the use of network computer technology and student achievement. I think that is a very powerful statement. And it has been proven by the University of Southern California in a 4-year study.

Now what did we attempt to do? We attempted to focus on the learner and bring the resources to the learner. When we tried to do this 11 years ago a lot of people, including, I think, John, who had visited us on several occasions, thought, wow, what are they trying to do here?

We tried to create network environments, which we did, called smart classrooms, which were multimedia environments that were networked inside classrooms and ultimately throughout the school. And we also tried to work with the teachers in terms of developing the necessary tools for them to work in that environment.

As we went through this program, we were visited by various people throughout the State of California, and, ultimately, we were

selected as one of six model technology schools in the State of California.

Now, as you know, Congressman, there are over a thousand school districts in the State of California, 30 million people in that State, and there are only six that are model technology schools. So we should be doing something with technology, and we should be showing some results because we did get some effort from the State of California to help us do this.

Our results show very clearly that network technology allows you to create a new learning environment for students. But, beyond that, something happened, and I think that is the reason why I am here.

There was an article in USA Today several weeks ago which indicated our relationship with a large telecommunication company, MCI, as well as the Council of Urban City Schools, as well as the possibility of a grant being awarded by the Department of Commerce. What it said was that our school district was working to develop electronic curriculum which then could be produced on a CD-ROM which would allow that curriculum to be used throughout the United States over a network, a superhighway, whatever.

Now, what we have tried to do in the Hueneme School District, not only have we tried to do connectivity issues, of which we are doing with the Department of Defense, schools to schools throughout the United States, real time telecommunications and working through simulated activities, we also have extensive work with our local cable company. We are applying the tools in real time activities.

But what we have done is we have tried to create a public school as a nonprofit institution or foundation. And just—if you know of Yogi Berra, basically, it is a nonprofit foundation for profit, and what we have attempted to do was to create a new role for the teacher. The teacher is able to bring together all of these multimedia programs with good solid instructional strategies. And, whatever you think of California, we have terrific curriculum out there, bringing that all together.

And then with a relationship with a private company which has the worldwide license for CD-ROM fractal technology, which is fairly extensive and fairly good technology in terms of the compression, decompression kinds of things that you have to do with video. We were bringing that together so that we could produce a product that would be replicated and used throughout the United States.

What we found out was that what we could do as educators was create the intellectual skeleton through this electronic curriculum. Then a private company, preview publishing company, was able to bring in a Hollywood producer to bring that all together so that we could begin creating multimedia technology that worked in our classrooms.

Because every time people came to visit us—and if you read this testimony, you will see over 3,000 visitors have visited us since 1983 from all over the world and from all over the United States—they wanted our curriculum. Where is the electronic curriculum? How do you put that together?

Well, it is put together in 250 different pieces because of all the different resources you are using but bringing it together into one common medium and then putting some value to it.

Now, what we thought about was, okay, that is our intellectual property. We own it. And we worked out a deal with the company through which they would pay us for the teacher's time off so we would have the teacher with one leg in the classroom and one leg out of the classroom working on this kind of curriculum. And it became very exciting because teachers were anxious. They liked that idea of doing some research and development on their curriculum. They really were excited about it.

And, as a result of that, we worked out an agreement with this company to produce CD-ROM technologies, and we hope that by the end of June we will have our first two series in the marketplaces.

Along with that, we have a relationship with MCI to set up a network between us and northern California and Savannah, Georgia, to see if we could store and send this kind of curriculum so youngsters from different parts of the United States could be interacting with real time—with simulations and real time activities.

Those are some of the kinds of things we have learned from the technology and some of the kinds of things we think the future is going to hold for our children. So, basically, that is what we have done initially. Why we are here is because of that article in USA Today, I believe, because of what we are trying to do with the teacher in terms of changing the learning paradigm and making the teacher much more entrepreneurial in the way they deliver instruction to the classroom and the way we can use their intellectual property.

I might want to explain also to you that I do have recommendations listed in the report regarding what Congress and the Federal Government can do. I might refer you to two things that we are doing currently with the Federal Government.

The one thing we are doing with the Department of Defense— you might ask how does a school district in Port Hueneme work with the Department of Defense. Well, we were granted a cont ct because of some of the mature educational models that we have developed, one of them being this nonprofit foundation for technology, the other being this relationship in the development of electronic curriculum, to see if we could scale up some of these models to larger school districts. And we are attempting to do that in the Savannah Chatham School District in Georgia, and the Department of Defense sees this as a way to take a good hard look at whether or not our successful models can be scaled up to a large school district in the south.

The second thing is part of the recommendations regarding Congress is the whole idea of subsidies. You have heard Dr. Jones talk about that, but, you know, we have been subsidized for a long time from the Federal Government, at least our district has, using Chapter 1. I think that it is very important that we look at the subsidy issue, especially in terms of under-accessed student populations.

And traditionally the information centers in the United States have been schools, libraries and community centers, and I would

suggest that the end user is where the subsidies should be, not on the pathways. Traditionally, we have always in school business have been concerned about our own networking and whatnot, and we have had marketing people come in.

Mr. MARKEY [presiding]. If you could just wrap up in 20 seconds.

Mr. RESCIGNO. Thank you very much for listening to me and for having me here. I certainly appreciate the opportunity, Mr. Chairman. Thank you very much.

Mr. MARKEY. You will have more opportunity during the question and answer period. Thank you.

[The prepared statement of Ron Rescigno follows:]

Ron Rescigno, Ed.D., D.H.L.
Superintendent, Hueneme School District

A NEW AGENDA "THE SMART WAY"

Hueneme School District

Figure 1
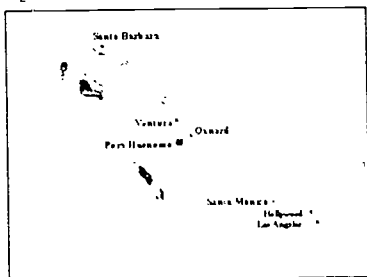
The District, founded in 1873, is located in the city of Port Hueneme on the Pacific Coast, 65 miles northwest of Los Angeles and 40 miles south of Santa Barbara, California. (Figure 1)

The Hueneme School District educates approximately 7,800 kindergarten through eighth grade students housed in nine K-6 elementary schools and two junior high schools. The work force includes approximately 550 employees

Figure 2

District Ethnic Percentages
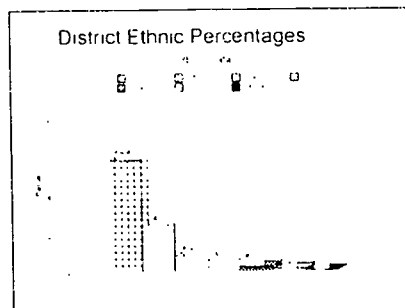
with 311 teachers, 217 service employees, and 22 school and district administrators. The 1994 budget exceeds 30 million dollars, with a per student cost of approximately $4,060, including federal and state support. Roughly 16 percent of the student body receive Aid for Dependent Children, 58 percent qualify for free and reduced meals, and 30 percent are identified as limited or non English speaking. (Figure 2)

Change and Progress

During the last decade, experience in the Hueneme School District has documented that major fundamental change and progress takes place in the organization and management of public school education, the public school curriculum, and student achievement as a result of the intelligent use of electronic information networking technologies. Change is with us all the time. It is inevitable. Change is accompanied by a lack of permanence and stability, but the progress that occurs from change is positive, and worthy of pursuit.

Our country is involved in a significant industrial and social paradigm shift. The mechanical technology that created the Industrial Revolution has been largely replaced by technology ushered in by the likes of Bill Gates and the Micro-Soft Corporation, neuron networks, high speed computing, three-dimensional holography, virtual reality, and more! In private industry, smart electronic tools have replaced industrial age mechanical systems with technical and human information processing systems. In any innovative, competitive business that hopes to succeed, people aren't being told to work harder, and more people aren't being hired; instead the whole operation is being restructured to work SMARTER. For public schools, the ability to electronically deliver networked multi-media to the student learner--combining audio, video, still images, graphics, text, and animation--intelligently integrated with people and curriculum is providing the catalyst for fundamental change and progress in the way children learn.

# THE ORGANIZATION AND MANAGEMENT OF PUBLIC SCHOOL EDUCATION

The focus of organization and management in U.S. public school education

has been largely concerned with the social organization which delivers knowledge
to the group. This fundamental organization has, for nearly a century, included
teachers, textbooks, school buildings, school buses, instructional aides, custodians,
etc. Unfortunately, the maintenance of this rather rigid organization has become
an end in itself, and a subject of well-deserved criticism throughout the past
decade. The true end of public education is student mastery of knowledge and
skills. The central challenge to educational organizations in the information age
centers on the effective and efficient mediation of knowledge and skills to the
learner via an organization that is flexible, responsive, and outcome-based. The
heart and soul of electronic information technologies is the effective and efficient
transfer and mediation of knowledge. Data bases, electronic communication
systems, knowledge networks, and networked multi-media will change the basic
organization of public schools. We need to think in terms of learning networks
not traditional schools. Learning networks are flexible and dynamic. Learning
networks force new collaborative strategies with emphasis on people working
together in complex tasks. Learning networks can dramatically improve student
mastery of information age knowledge and skills

The true integration of networked
technology requires a management and
organizational approach which emphasizes six key
technologies:

Figure 3

INTEGRATION-
SIX KEY TECHNOLOGIES

1   Human Factors;
2.   Communication Networking,
3   Data;
4   Image;
5   Voice; and
6   Word. (Figure 3)
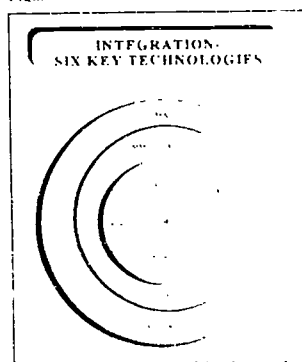
Throughout an eleven year period from 1983 to 1994, this integration strategy ha

fulfilled one of the "promises" of interactive technology by initiating a radical restructuring of the traditional public school educational organization in the Hueneme School District.

Stages

The District has evolved through various developmental stages of educational technology during the last decade. Starting with stand alone computers in classrooms, the District evolved through:

- Computer Assisted Instructional Labs in All Schools;

- Computer Assisted Instruction Electronically Distributed (Networked) to Individual Classrooms;

- Introduction of Stand Alone Multi-Media Interactive Technology
    -Laser Disc Players

    -Video Players (VCRs)

    -Compact Disc Players

    -Cable Programming

    -Satellite Programming

    -Internet Connections:

- The Integration of Technologies and Networking Capabilities Into the Smart Classroom;

- The Integration of Smart Classrooms Into A Smart School:

- Smart School extension through the INTERNET and other electronic highways into a "Virtual School House."

The Smart Classroom

The Smart Classroom is a classroom supported by an electronic infra structure which provides the capacity and connectivity necessary for all data, voice and video applications. The Smart Classroom creates an interactive learning environment where all learning--the theoretical with the practical, the abstract divine with the senses- is the focus of education. Where the computer and

other electronic devices are the primary information deli'ery system for the basics of the academic subjects, and where human resources education is centered on the creation of student products. The Smart Classroom makes learning interactive for all students, allowing the teacher time to attend to the needs of each student, personalizing and individualizing the learning experience. Since the development of the original concept--a computer managed multi-media classroom--the Smart Classroom has evolved through eleven different generations into the current and most technologically advanced model.

The first and second generation Smart Classrooms were specially designed to give the teacher a spectrum of tools to individualize instruction in order to teach more effectively. (Figure 4) Desk units were created to conceal color monitors beneath glass desk tops. The geometry of the desks creates concentric rings when joined together The resulting arrangement is rather like that of a symphony orchestra with the teacher as the conductor and facilitator of the learning process. The electronic network is capable of delivering audio, video, and data in a seamless fashion to the learner. A multitude of electronic curriculum materials allows each learner to be exposed to the learning modality that best fit his or

Figure 4
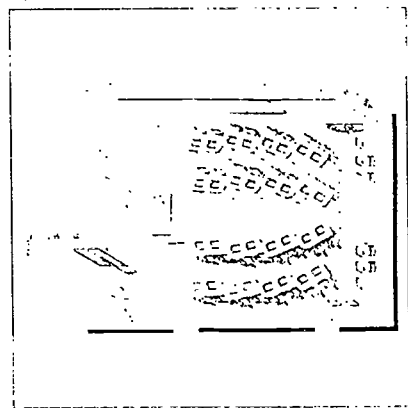
her learning style. The classroom's electronic curriculum is designed to expose students to critical thinking in earth, life, and physical science. Over 350 curriculum resources are programmed to accommodate for individual student achievement, learning styles, learning speed, and motivation

The third and fourth generation Smart Classrooms incorporate a learning cluster concept with five learning cluster areas designed into the classroom environment. (Figure 5) Each cluster has the electronic capability of processing information to individuals or groups of students for particular learning or teaching strategies. Driven by a network that has the capability to send and store data, video, and audio, the learner can process and create innovative solutions to problems in the study of history, geography, and language arts. The classroom design places the teacher at the front center of the tiered learning clusters. The purpose of the classroom design is to create a total human learning environment with a layout emphasizing people instead of machine technology.

Figure 5
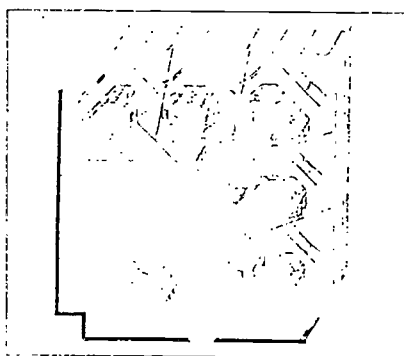
Students in the third generation U.S. History Smart Classroom work individually on content software with the greatest portion of their time being spent working in cooperative groups with simulated activities. Students working in groups are asked to solve historical problems by searching data-based software and historical software simulations. Emphasis is placed on participation in making decisions, setting goals, planning, taking action as a group, and producing a quality product.

The fourth generation Language Arts/Reading Smart Classroom approaches learning from an environment that allows the student to improve his/her writing, reading, listening, and speaking skills by interfacing with electronic simulations. The classroom incorporates computer managed electronic music as a form of student expression and communication by integrating language arts and the fine

arts Similarities between the basic elements of music, and the basic elements of language are electronically interfaced in a learning environment that emphasizes the learner's visual, aural, and audible senses.

The fifth and sixth generation classrooms, the Smart Lab 2000, is an extension of the school's math, and science curriculums, allowing for a major focus on the application of knowledge and skills. (Figure 6) Emphasis is placed on connecting learning to students' daily lives and opportunities for future study and careers. Students are pressed to interact with information, complete tasks, and to operate within the constraints and demands of the work world outside the classroom.
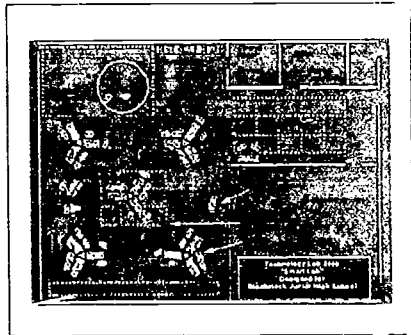
Figure 6

The Smart Lab is a responsive learning environment where students interact with an extensive collection of computers and peripherals to simulate real-world applications of the new and powerful technologies that drive our world. Working in teams at island-like work/learn stations, students engage directly in the observation, exploration, application, and assessment of technological phenomena and related principles of science and math. In addition to computers, the power of laser disks, CD ROMS, video tapes, and other advanced learning tools give students hands-on minds-on experiences in the areas of robotics, computer-aided manufacturing, systems simulations, word processing, computer assisted publishing, satellite technology, pneumatic structures, monorail transportation, wind energy, aerodynamic testing, space-frame construction, hydroponics, and more A synergistic, interdisciplinary program of instruction accompanies this

classroom. Science as relies individualized, open-ended learning paths that sharpen their conceptual skills while facilitating creativity and discovery learning.
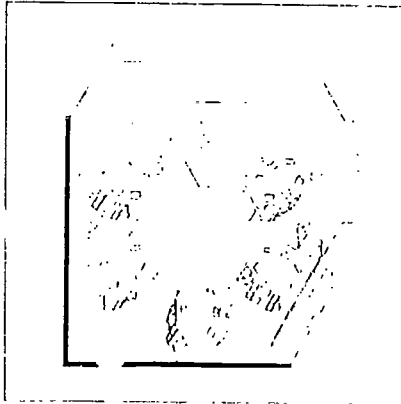
Following the sixth generation Smart Classrooms, hybrid or prototype extensions evolved in other subject disciplines in junior high schools and elementary grades, and included Science, English as a Second Language, Language Arts/Black Studies, Math. and Geography. (Figure 7)

Figure 7

Prototype Science Smart Classroom   **Prototype ESL Smart Classroom**
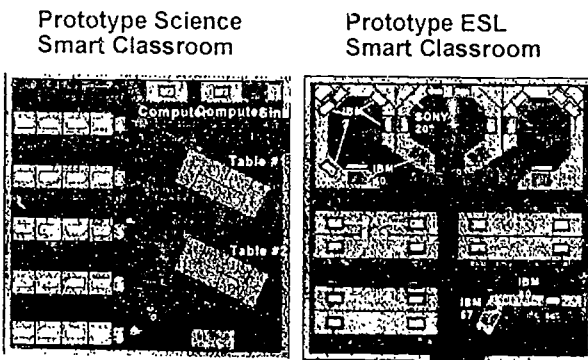
The 11th Generation Smart Classroom Math evolved from the best instructional practices and learning environments of the previous Smart Classrooms. (Figure 8) The purpose of the Smart Math Classroom is to empower all students mathematically to improve academic achievement. Mathematically empowered students think and communicate, draw on mathematical ideas, and use mathematical tools and techniques. Emphasis is given to student interaction and written communication.

Figure 8

Flat-top, spacious work stations are available for students to work together on products and investigations. The hardware is recessed below these work stations, so the focus remains on applications and interaction among students. Lessons extend several days or even weeks. Students concentrate on large mathematical ideas and their interconnections. Math strands such as number, measurement, geometry, and logic are studied as part of unifying ideas such as patterns and proportion.

A variety of tools including manipulatives, calculators, computers, videos, and laser discs are continually available for student use. Computers are used to analyze data rather than perform drill of basic facts. Teachers and students become proficient in the use of software including word processing, the use of spread sheets, graphing programs, and data bases to display results and identify patterns. Students use software to manipulate text, graphics, and video images in ways that promote exploration and discovery.

Learning-centered software allows the student to think and use information to solve and create problems. Immediate feedback is available electronically. Student writings, products, visual presentations, and reports are kept on electronic notebooks. These notebooks are used for observation and interviews for purposes of assessment. Writing clarifies, reveals thinking, and plays a major role in the Smart Math Classroom. Teachers evaluate written work in mathematics on the basis of the thinking it reveals in clear, concise written explanations.

The classroom boasts "state-of-the-art technology" including a network driven by a Pentium 90 CPU where audio and video data can be stored, and then accessed by pupils on demand. Students call up video, audio, and data and store the information needed at their own computer station. Electronic portfolios are developed by co-registering video and audio with text and then stored in the

computer data base. This Smart Classroom has a virtual capability. It is linked directly to every classroom in the District by coaxial cable, and directly into the Internet, and more specifically, to the National Education Supercomputer Program (NES) by telephone and modem connections. It is anticipated that in partnership with MCI this classroom will have a direct T1 telecommunication link to classrooms in Northern California and Savannah, Georgia.

The Smart School

The Smart School, driven by electronic networking systems, creates a new style for school organizations. The Hueneme School District is searching for an understanding of the proper balance between human and technical information processing. It appears that many of the competencies necessary for learning will continue to rest on the human side as we are called upon to create a work environment of shared values and goals.

Networking technology places total initiative for decisions at the student-teacher level. Experts are responsible for exercising initiatives for student learning and overall school organizational responsibility. This learning model eliminates the need for school organization and administration as we know it. The successful use of networked technology to create new school environments rests on attitude, courage, and will. The major obstacles to the integration of networked technology are the current rigidity of school organizations, classroom practices, and a lack of visionary leadership. However, the speed of change in high tech and its' ability to accommodate the learner will force the creation of new school and classroom organizational structures that ultimately will lead to a future of unlimited learning, a "Virtual Classroom," and then a "Virtual School House."

"A Virtual School House"

Recently much has been written and spoken about the "Information Highway," the Internet, the wide range of services the Internet makes available to educators and its' potential positive impact on student learning. The Internet was created by the Department of Defense 25 years ago to allow government work to continue even if part of the network was destroyed as a result of a nuclear attack. It is a limitless international network of networks that enables people with computers of all kinds to share services and communicate directly, as if they were part of one giant, seamless, global computing machine.

Early on, the Hueneme School District had free single access connection to the Internet as one of six designated "Model Technology Schools" projects in the state of California. Using direct dial-up service, District teachers have mastered the Internet topography. Teachers and students have been involved with programs connected through the Internet, including the Upjohn "Science Grasp" Network: Scholastic Network and Electronic Schoolhouse through America On-Line; the Lawrence Livermore Labs' National Education Supercomputer Program; and in a California State Public School Project for Telementoring, gaining Internet access using GINA (Graphical Interface for Network Access) for students and teachers. The Hueneme School District did not consider the Internet as the model "Superhighway." It is only one component of the nation's communications infrastructure. From an educational application and student learner consideration, we were interested in the intelligent movement and management of information in multiple forms with its' use being determined by the end-user, i.e., teacher/student.

While continuing to experiment with very simple, single access connections to the Internet that benefit only a few, the District began to vigorously pursue a program to connect all classrooms and staff on-line with a known

telecommunications network that was economical and had "real time" capabilities. Our vision was to create a user-friendly "network of networks" combining real-time voice, video, and multi-media by interfacing with the District's local area networks, the Internet, a coaxial cable television system and instructional network (INET), and existing telephone lines with real time telecommunications connections.

Jones Intercable, Inc. INET: In 1989 the District aggressively pursued a joint venture with Jones Intercable, Inc., a large commercial cable television company. Today, the Hueneme School District and Jones Intercable, Inc. are providing students and teachers new experiences in learning through the effective and efficient use of telecommunications technology. Jones Intercable, Inc. has provided Hueneme School District with 60 miles of INET cables connecting schools and classrooms from point-to-point and point-to-multi-points. The INET delivers real-time video, audio, and data to students and teachers. This interactive multiple-direction system allows students and teachers opportunities to reach out from the traditional classroom to the frontier of a new and exciting learning paradigm.

The development of this new learning paradigm--the "VIRTUAL" classroom environment includes student live interaction with computer simulations between and among remote classroom sites; live class debates between and among students from different school locations; teacher staff development with scholar experts; student articulation between area schools; on-line video transmission of top news stories of the week; and live information on national and international weather. The INET system exposes students to a multitude of learning resources and instructional strategies brought about by the seamless integration and manipulation of multi media. Student results reveal an increase in comprehension, problem

solving, motivation, and positive attitudes. The business partnership between the Hueneme School District and Jones Intercable, Inc. represents a productive merger of business and community interests.

Video Teleconferencing: In 1990, the District expanded its local area telecommunications program by forging a new alliance with the Port Hueneme Division Naval Surface Warfare Center. Their Video Teleconferencing Center is one of 170 plus Department of Defense nationwide conferencing rooms. The Defense Commercial Telecommunications Network is a secure, digital, video conferencing network which allows for full duplex video, audio, and graphic transmissions for all sites involved, with a maximum use of 25 sites at one time. Hueneme School District staff have worked cooperatively with personnel at the Video Teleconferencing Center on various "Coast-to-Coast" events. The "Coast-to-Coast" events link students in the Hueneme School District with public and Department of Defense schools in Georgia, Hawaii, Maine, Mississippi, North Carolina, Pennsylvania, Virginia, and Washington. This project emphasizes an educational "hands-across-the-nation" approach by integrating sound teaching and learning strategies with the medium of real time telecommunicating. The program's first step is for students and teachers across the nation to reach out through a pen pal program, and then a "face-to-face" telecommunication event at the Video Teleconference Center. Through the telecommunications medium, students share families, homes, hobbies, other interests, and life styles. A follow-up telecommunication lesson focuses on a particular curricular area. The program grew from eight sessions with several different locations in the first year to twenty essions with multiple locations in the second. Continued growth with expansion to additional sites in the United States is anticipated in the 1994-95 school year. On several occasions, there has been an actual physical exchange of students and

teacher participants. The impact on student learning and teacher initiative has been immeasurable. (In fact, a teacher from Port Hueneme and a teacher from Virginia who met via "Coast-to-Coast" were recently married!)

The capabilities of the Video Teleconference Center include the ability to video tape incoming and outgoing video and audio signals.   Video tapes of various teaching and curriculum learning activities exchanged between remote sites have become an essential part of the telecommunications lesson. For example, teachers have taped students performing science experiments and then viewed the tape simultaneously with students at the remote location to show how the experiment is conducted.   The video tapes from the school sessions have also been used as a self-evaluation instrument for teachers and students.

Cameras in the Video Teleconference Center are located so that three dimensional objects or photographs may be viewed by the remote location in real time. Teachers have used these cameras to show an abacus in a math project, balloon rockets in a science lesson, and flags and maps for a geography lesson. Students have used these cameras to show pictures of their homes after an earthquake, their school, local geography, and various other subjects. One interesting aspect of the telecommunications program has been its use as a medium to bring together innovative and creative ideas to teachers at remote sites. An outgrowth of the video telecommunications was a joint staff development program between teachers from a K-6 elementary school in Port Hueneme, California and teachers from a K-6 elementary school in Spanway, Washington. The possibilities for improving public school education through this existing network are limitless.

Design for a New Generation of Schools - Connected: Our newest venture brings the expertise of a large corporate phone company, MCI, together with a private company, Pyramid, Inc., and three school districts   Hueneme

School District, Port Hueneme, California, Berryessa School District, San Jose, California and the Savannah-Chatham County Public Schools in Savannah, Georgia. The "Schools - Connected" project is a completely new concept in the delivery of education and services for communities across America. The network proposed for this demonstration project will connect three communities of varying levels of economic and communications resources. The project will demonstrate three components:

- ► Distance Instruction Teleconferencing;
- ▷ Video on Demand; and
- ► Interactive Multi-Media Courses.

Distance Instruction/Teleconferencing will use the local cable networks within the "Schools - Connected" via a T1 network from interexchange carrier MCI, using digital modems. This will allow distance instruction/teleconferencing between the schools and classroom to classroom "real time" activities to take place. Video on demand will be available via dial-up ISDN lines to servers located on the MCI network that will provide video instruction interactively through ISDN communication lines to remote PC computers. Interactive multi-media lessons will be developed on site to be used via CD ROM, and through the video on demand network. Pyramid's fractal technology allows a normal video signal to be digitized and compressed to a very small file size and transported over existing telephone networks, and decompressed at the destination without specialized hardware.

The network will also have a direct T1 and/or ISDN connection into the Internet with a TCP IP (Transmission Control Protocol/Internet Protocol). This connection will allow the "Schools - Connected" maximum use of Internet. The focus of teachers and students on the Internet will be to collaborate through time

and distance or simulated activities with real time oversight. The three school districts connected will model simulation games conducted by the Department of Defense on the Internet using educational simulations instead of battle simulations.

THE HUENEME PUBLIC SCHOOL CURRICULUM

Curriculum is the body of knowledge and skills that are taught in the public schools. By definition, curriculum is an area that can be influenced by information networked technology. The Hueneme curriculum foundation is basic-- reading, writing, speaking, listening, and calculating; thematic--an instructional focus that serves as a central thread or theme and allows for content, subject matter, or disciplines to overlap, to interact, and to be interlocked; thinking-- creativity, decision making, problem solving, visualizing, learning to learn, and reasoning; personal qualities--responsibility, self-esteem, sociability, self-management, and integrity.

Enhanced by multi-media, technology has changed the curriculum from a static representation of knowledge to a dynamic representation, allowing for linear and non-linear curriculum examples. Multi-media technology helps teachers develop creative interactive lessons that present information in all the ways students really think and learn. Curriculum and instructional electronic products enhance the natural learning process. They are designed logically, allowing students easy access to information they need. The ability of multi-media technology to bring information to life is unprecedented. Multi-media technology integrates digital, video, sound, animation, and photographic-quality images with text and graphics to create an intense and engaging learning experience. Technology can deliver each piece of information in its best possible medium for maximum student comprehension.

Accessing knowledge through technology will fundamentally change teacher instructional strategies and will build a new learner; an epistemologist, -- researching the boundaries of knowledge and discovering new knowledge. Complex problems are resolved through student collaboration while working with networked interactive simulations. Students become active learners making decisions through exploration and discovery. Multi-media technologies will provide access to information from all media in one place, allowing students the opportunity to interact continuously with that information. Learning becomes unlimited and traditional organizational barriers no longer impede learning.

The dynamics of building and delivering the electronic curriculum has produced a new learning paradigm and has created a new and exciting role for the classroom teacher as entrepreneur. Teachers, utilizing easy-to-use authoring software and skills developed in Smart Classrooms are bringing the many pieces of a multi-media electronic lesson into one medium--CD ROM. The CD ROM curriculum brings the instructional power of multi-media and the Smart Classroom to any school district, school, or learner with access to an inexpensive CD ROM player. As a corollary, the District has launched the Hueneme Foundation for Educational Technology, a California non-profit benefit corporation, signed a CD ROM production and publishing agreement with Preview Publishing, Inc., and established an alliance with Pyramid, Inc., a company that owns the softvideo license for fractal technology.

The District's model for electronic curriculum development gives teachers opportunities to earn additional income. The contract with Preview Publishing, In guarantees the District funds permitting the teachers to work as entrepreneurs producing electronic curriculum on a sabbatical leave, working for the District as an independent contractor, or during the school year as an hourly employee after

their teaching day is over. Working hand-in-hand with a professional multi-media producer, teachers are developing electronic curriculum that: (1) speaks to the ways students learn; (2) is economical to purchase for home shoppers and by school districts; and (3) has the capability of being accessed by most standard electronic networks.

The District has also established a royalty stream from the sale of the Hueneme curriculum series produced on CD ROM. The royalties will be deposited in the Hueneme Non-Profit Educational Technology Foundation and will be used to compensate teachers for their efforts in product development and to provide District financial support to continue research and development in educational technology. The program is being replicated in school districts in California, Georgia, New Mexico, New York, and Pennsylvania. It is anticipated that the first two programs in the Hueneme series will be released in June of 1995. As this model matures, it will make public schools competitive in the market place and establish a new revenue source for public school districts.

ACHIEVEMENT

The worth of any educational innovation is measured by the impact it has on student achievement. Achievement is defined as increasing individual student knowledge and skills relative to public expectations. The major efforts of the Hueneme School District have focused on increasing the productivity of the system by organizing the learners' environment in a different way. Technology provides an interactive learning environment for individuals and groups and allows the teacher more time to tutor and personalize the process of learning. On its own, multi-media has limited value, but as part of a new approach to learning that places
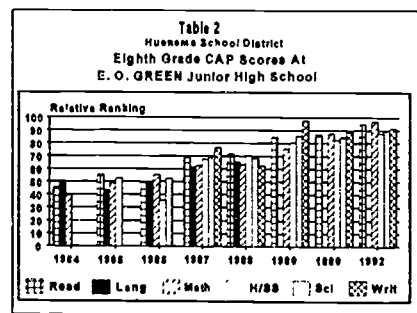
technology at the core of a learner-centered environment, it can be enormously beneficial.

The University of Southern California (USC) conducted an independent four-year study of the District 's development and use of technology over an eight-year period. The results of the study document a marked increase in students' learning abilities, comprehension, motivation, and attitudes. Specifically, both District junior high schools--Blackstock Junior High School and E.O. Green Junior High School exhibited significant increases in student achievement levels between 1984 and 1992 in reading, language, writing, math, history/social studies, and science on the California Assessment Program (CAP) when compared with districts or schools in California with similar demographic characteristics and student populations (Relative Ranking).

In 1992, the last year the CAP test was administered, Hueneme eighth grade students scored at the 90th percentile and above in math, history/social studies, science, and writing. Significantly, Blackstock Junior High School students scored at the 99th percentile in writing. Table 1 and Table 2 present longitudinal CAP
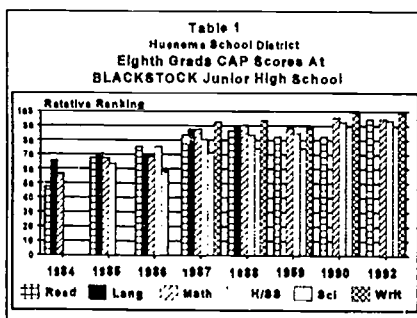
Table 1
Hueneme School District
Eighth Grade CAP Scores At
BLACKSTOCK Junior High School

Relative Ranking

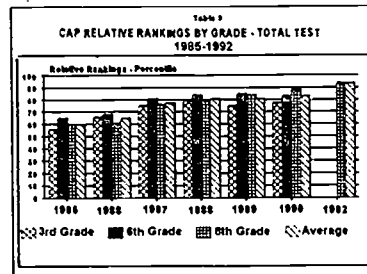1984 1985 1986 1987 1988 1989 1990 1992
Read ▓ Lang Math H/SS Sci Wrt

Relative Rank   Comparisons with districts or schools of similar demographic characteristics and student populations No CAP testing in 1991 and only grade eight in 1992

Table 2
Hueneme School District
Eighth Grade CAP Scores At
E. O. GREEN Junior High School

Relative Ranking

1984 1985 1986 1987 1988 1989 1990 1992
Read ▓ Lang Math H/SS Sci Wrt

Relative Rank   Comparisons with districts or schools of similar demographic characteristics and student populations No CAP testing in 1991 and only grade eight in 1992

Relative Ranking scores at both junior high schools for the eight-year period from 1984 to 1992 that parallels the initiation and growth of educational technology in the District.

Table 3 presents Hueneme School District third, sixth, and eighth grade CAP scores, averaged across all curriculum areas from 1984 to 1992. The data presented in Tables 1-3 demonstrates the power of solid curriculum, effective instructional strategies, and educational technology to significantly improve student achievement. During the period studied, diverse populations of students in the Hueneme School District excelled when compared to the achievement of other students in California from districts and schools

Table 3
CAP RELATIVE RANKINGS BY GRADE - TOTAL TEST
1985-1992

Relative Rank   Comparisons with districts or schools of similar demographic characteristics and student populations. No CAP testing in 1991, and only grade eight tested in 1992

of similar ethnic, language and economic demographic composition.

Of far more significance to the Hueneme School District, however is the relative academic standing of our students when compared to students from ALL public schools and districts in California. When compared with all California eighth grade students, Hueneme students scored 24 scaled points above the state average, with combined score averages exceeding the 65th percentile. Table 4 presents longitudinal comparisons of CAP scaled score averages for Blackstock Junior High School, E.O. Green Junior High School, and the rest of the state from 1984 to 1992.

Table 4
Longitudinal Comparison of CAP Scaled Score Averages For
BLACK&TOCK Jr High, & O GREEN Jr High and State
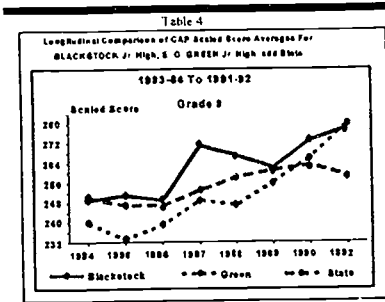
Scaled Scores Ranking when compared with all other districts or
schools in the state of California

District junior high school students were also tested using the Cornell Critical Thinking Test for their ability to think critically in inductive, deductive, assumptive reasoning, and observation/credibility. Hueneme students were compared with seventh and eighth grade students in a school district in upstate New York, and with seventh, eighth, and ninth grade students in

Table 5
Hueneme School District MTS Project
Random Sample Matched Scores Percentile   Rankings for
Cornell Critical Thinking Tests Level X

District

NORM GROUP "XG"	NORM GROUP "XN"
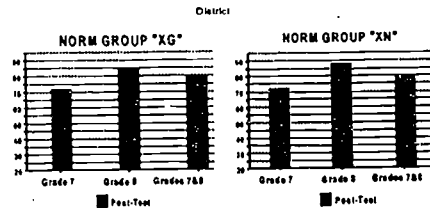
| Norm Group XG | 51 seventh grade students and 50 eighth grade students (Total 101 students) All 7th and 8th grade students in a central school in upstate New York (Mean IQ= 108, N = 100) |
| Norm Group XN | 7th, 8th, and 9th grade students in a large So California city, selected for their representativeness range ability socioeconomic background, and ethnicity) (N = 600) |

a large Southern California district. On the Cornell Critical Thinking Test Hueneme junior high school students scored at and above the 75th percentile, and compared favorably with upstate New York and Southern California students. (Table 5)

The USC study also found that District parents, students, and teachers indicated a strong support and positive attitude toward technology, an increase in student average daily attendance, and a reduction in student discipline problems. One of the most significant findings from the USC study showed a direct statistical relationship between improving student achievement and the increased use of technology.

F inally, the success of the educational program is reflected in the number of visitations made to the District by educators, business people, and political leaders from within the United States and a number of foreign countries. From 1983-84 to 1993-94, visitors included approximately 3,000 educators from 297 California school districts or school related institutions, and 550 educators from 106 school districts outside of the state of California; 300 business and political leaders from around the U.S. (including the Governor of the state of California and the U.S. Secretary of Education); and 49 people from 25 foreign countries.

A s a result of these remarkable accomplishments, the U.S. Department of Education recognized the District as a *National A+ District For Breaking The Mold* in the 1992-93 school year. In 1992-93 the U.S. Department of Education recognized E.O. Green Junior High School as a *National Blue Ribbon School*, with auxiliary awards from the National Science Teachers and the National Math Teachers for their outstanding science and math curriculum. E.O. Green Junior High School was the only secondary school in the U.S. to receive both science and math awards by the Department of Education at the Blue Ribbon School ceremony in Washington, D.C. More recently, Blackstock and E.O. Green Junior High Schools were invited by the California Department of Education to apply for the 1994-95 National Blue Ribbon Schools Secondary Program. The District has also received seven state of California *Distinguished Schools* awards; a California award for excellence in restructuring science; was selected as one of six California *Model Technology Schools Projects;* was granted a *California School Restructuring Grant* by the California Department of Education; and two *Golden Bell* awards for distinguished programs from the California School Boards Association.

T he American public school system has historically been accorded the primary responsibility for providing economically "disadvantaged" students with the

opportunity to achieve and prosper academically, socially, and financially. Thus, the more recent failure of public schools to effect significant academic achievement and related social advancement within populations of "at-risk" students has been viewed by many policymakers as nothing less than a serious threat to national security. The achievement data presented in this report document the power of the Hueneme School District instructional program to dramatically improve the academic achievement of "at-risk" students, providing them with the knowledge and skills to compete and succeed with any segment of society. These data suggest it is possible for America to deliver on her promise of a better life for those who complete a public school education.

CONCLUSION

In the body of this report, I have discussed the initiatives, successes, and challenges faced in our efforts to use telecommunications and related technology to prepare students and teachers to participate fully and successfully in a world of rapid change. District policymakers, the Superintendent and five elected Governing Board members, focused a great deal of human and fiscal effort on technology as one way to reduce the gap between the "haves" and the "have nots." It has been estimated that two-thirds of the money being spent on electronic educational aids in the United States will be spent by affluent families. Such a situation will create even greater educational and economic disparity in our country and continue to reduce the job pool of employees with the basic knowledge and skills required to perform in the information society, unless all public schools take a proactive stance and forcefully pursue a universal and widespread information access program for their students. With the advent of the "Superhighway" and networked technology, lack of direct action now will exacerbate the current gap in educational

opportunities.   What then can I advise Federal policymakers on what should be done to:

1.   Promote K-12 networking as a means to achieving systemwide educational reform on the local, state, or national level;

2.   Ensure that telecommunications technology is wid..!y available; and

3.   Accommodate the unique needs of teachers, students, and libraries in rural areas, for whom the cost of connecting to a national network may be high?

Federal policymakers can:

1.   Encourage multiple solutions. It appears that always and everywhere someone has an agenda--a special fix--or the only solution. There are many topologies and cost curves for a variety of educational approaches. For example, the tendency has been to oversell the functionality of the on-premises piece (e.g., the connections into the school site and the school local area network), and ignore the commercial pathway into the school, and its' costs, assuming that it will be "OK," free and heavily subsidized. I do not believe this is realistic, historically accurate, nor likely to succeed. However, if cooperative industries demonstrate a commitment and willingness to produce multiple solutions that are subject to market forces, real progress can be made.

The Hueneme School District illustrates clearly that much can be done with current technology that is available, feasible, and cost effective. Hueneme's efforts have proven that existing technologies can be utilized immediately and efficiently in schools. Obviously, as new information services come on line that can be accessed simply by clicking a mouse, existing technology will become more widespread in public schools.

2.   Federal subsidies are needed, and should be justified on a need basis to public schools if Congress hopes to achieve widespread access for under-served

school populations. The focus should be at the end-user level, not at the transport
level where it is today. Subsidies are currently being focused on expanding the
content and range of information and services carried on the Internet. Yet, this
effort is to a large extent, irrelevant to the vast majority of public school students,
and indeed citizens at large without access to the end-user hardware and easy to use
software necessary to access this information. In order to provide widespread
information access to all public groups, especially to the "have nots," it is essential
that libraries, community centers, and schools, which have long been places where
people acquire knowledge and develop skills, become locations where all of this
information can be delivered in an equitable and cost effective manner. Congress
should begin to focus subsidies at the end-user point to address this concern.

3.   Invest in stabilizing the educational platform at the "gateway level."
A "Superhighway" without a motor vehicle authority will experience all sorts of
wrong turns, traffic jams, and collisions. State and National Governments should
press for significant progress on standards. The standards should assure that
schools spend wisely and cost effectively on internal capabilities (e.g. media,
speeds/protocols, open architecture, and durable goods), and include responsible
rules of the road for each school that travels the highway.

4.   Interoperability: The Hueneme experience has shown that the
Superhighway is more than a data highway. The Hueneme networks include
information resources, communications networks, information applications, and
human resources. Our pioneering efforts have revealed a major issue that must be
addressed in the private sector, i.e., open interfaces to allow for interoperability
between the existing and future networks. An interface is open if its' specifications
are readily available to all vendors, service providers, and users. Without an open

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interface, interoperability will be difficult to achieve. Congress should lead a public debate that addresses both the public and private sector to insure that users such as school districts will not get caught between the different providers and their efforts to sell their own products and services. Without reservation, I can attest to the fact that our efforts in educational telecommunication networking--from a wide area network to a local area network--have been limited by the difficulties that we have experienced in our attempts at creating open interfaces for our students and teachers.

5.   The Federal Government can serve a leadership role in funding collaborative research and development models between successful public school sites and industry. This should be done on a competitive basis. By example, our plan for "Schools - Connected." A Design for A New Generation of American Schools is being seriously considered for a federal grant by the U.S. Department of Commerce, National Telecommunications and Information Administration.

6.   The Federal Government has a responsibility to encou.age the replication of successful school district student achievement models that have profited from telecommunications networks and technology throughout the United States. Part of what Hueneme has accomplished was possible because of a special grant from the state of California. However, much of what we have learned, specifically in the development of mature educational models that produce significaat student achievement levels, can be replicated with a minimum of funds. Furthei evidence supporting replicability of the Hueneme educational technology model was published by the California Department of Education from a 1993-94 independent evaluation of the Model Technology Schools program. The results

Mr. MARKEY. Our next witness is Connie Stout, the director of the Texas Educational Network TENET project. We welcome you. Please begin.

STATEMENT OF CONNIE STOUT

Ms. STOUT. Thank you.

I am Connie Stout, and since 1987 I have worked in planning, design and implementation of the K through 12 network in our State. Since 1991, when it first began, we have had 35,000 educators use our electronic network, and I must say we have quite a challenge because our districts vary in size from 190,000 students in Houston, Texas, to 7 in Laureles Independent School District.

The success has been based on ubiquitous access, widespread professional development, training and support, affordable cost structure, State leadership and a program that integrates the use of technology to support educational reform initiatives. And I think this is really key: It is because we do nothing within that State for the use of technology unless it is integrated within the curriculum.

To help fund this, we have the technology allotment fund. Our State legislature felt like it was critical if we needed access to the technology there had to be moneys there. We fund $30 per child, and a portion of that State funding is put aside for State-wide funding.

That is how we currently maintain the project, but let me tell you just a couple examples of how it is used. Linda Madson is a teacher at Pease Middle School in San Antonio, Texas. This is a school that has heavily-at-risk children.

Those children made a difference in their environment because they used technology. They worked collaboratively with folks at TERC in Massachusetts as they learned about testing air quality. They found their school was what they called the bad air school. These children then took their report to their school board and, as a result, their school was closed down and their air filtration system completely changed. It was because of the children's involvement.

Also, we have many rural schools. For example, Debra Griffin is a librarian in El Dorado, Texas. El Dorado is the only city in that county. I think there we have some of our phone lines going across barbed wire fences so we have a lot of, you know, resources, but we also have problems.

At-risk use is critical to the technology because many of our teachers, the only place they have to use a computer and modem is from their home, and we really encourage that.

It has also changed the paradigm of our textbooks. Texas is a textbook adoption State. We spend $270 million per year on textbooks, but in Houston Independent School District they are maintaining the Armadillo Gopher, and the children and the professors at the University of Houston have put up Texas history information, and that is an alternative to textbooks.

Also, the linking between the communities is essential. The University of Texas Health Science Center in San Antonio is using TENET to communicate with school teams, the classroom teacher, the school nurses, the dietician for the medical management of children, but we don't have phones in the classrooms. But we need

more than phones and modems. We need robust communication systems that will require a major retrofit of our particular schools, and it is going to require partnerships, partnerships with a broad cross-section of the community.

At the State networking project that Linda mentioned a little earlier, one of the private-sector people who participated there said there is a perception that there is no viable business case in support of education. However, it is in the interest of business to have a work force that is well educated and a work force that can use the information technology, and how are we going to get there from here?

Today, more than 65 percent of the districts in Texas are in the process of networking their schools. We have a connections grant where the State has allowed me to set aside $1.7 million to go directly to schools to fund their own Internet nodes, but we need support, and we need guidance in doing this. Right now, it is very difficult.

That school in West Texas will pay over $1,200 per month just for a lease line, yet an inner city school only has to pay $250 per month. So there is such a disparity there, and we simply cannot let this disparity continue. There have got to be incentives to extend the services.

And, let's face facts. Hooking up Dime Box, Texas, isn't going to change anyone's quarterly report. So we really need to work together.

I would like to refer you in this testimony to "Realizing the Information Future." It is a report from the National Academy of Science, and I participated in that report process. It draws three recommendations for education: leadership in the Department of Education and technical expertise in networking, a collaboration among all the Federal agencies.

And I think the State networking project that Linda alluded to earlier is critical in that, an aggressive research agenda. We have got to know how this impacts student learning, and I think it does dramatically. We have some information, but we need an extended study and a grants program that will leverage the resources that we have. We also need technical support.

The greatest need, as I have looked at these schools, is that we don't have teachers that know how to build these networks, but I would say I don't need to know how to build a car to drive it. And as I look at trying to deploy these systems across the networks, we need some type of tech corps of volunteers or parents nationally as well as locally to help encourage the deployment of these network designs.

I look forward to answering questions.

Mr. MARKEY. We are going to use that line: You don't have to know how to build a car in order to drive it. We are going to take Washington, you can have Texas as your franchise area for that line, and I am going to take it up to Boston. It is a very good line.

[The prepared statement of Connie Stout follows:]

PREPARED STATEMENT OF CONNIE STOUT, DIRECTOR, TEXAS EDUCATION NETWORK

Thank you Chairman Markey, distinguished members of the subcommittee and guests

I am Connie Stout. I am a member of two professional organizations that support educational reform initiatives. I am Chair and a founding member of an organization that hopes to work with education, the private sector, and government to help develop a compromise so that we can achieve universal access for our children. COSN, the Consortium for School Networking, is organized is to advocate access to. and facilitate the evolution of, national and international electronic networks as resources to K-12 educators and students.

Using these interconnected networks, the Consortium will support educational goals by advocating equitable, low-cost, user-friendly access to communications services and information resources, and by stimulating collaborations among K-12 educators and students, post secondary researchers and scholars, and other individuals and groups concerned about K-12 education.

I serve as an Executive Board member of the International Society for Technology in Education (ISTE). The International Society for Technology in Education is a society of educators who share an interest in instructional and administrative applications of technology that enhances the educational enterprise. ISTE has played a critical role in developing technology competencies to be incorporated into preservice education programs for our teachers.

I initially became involved in statewide telecommunication while I was at the Texas Education Agency during which I played a key role in the planning and implementation stages of the Texas Education Network. Currently, I am employed at The University of Texas at Austin as the director of the Texas Education Network (TENET). TENET is an subnetwork of the NSFnet regional network, the Texas Higher Education Network, THEnet. Funded by the Texas Education Agency, TENET is administered and operated by The University of Texas at Austin and serves more than 35,000 K-12 educators across the state. During the past three years we have seen the rapid adoption of information technology in our state because of ubiquitous access. wide-spread professional development and training, affordable cost structures, ministrative leadership, and programs that integrate the use of this technology to support educational initiatives in our state. The integration of TENET into the educational system in Texas has been a dynamic process that required collaboration with a broad cross-section of our community. While TENET has exceeded the expectations of many, we have many issues and many barriers yet to be resolved before the benefits provided by telecommunications technology can reach all our students.

Frequently, I've been asked about who is using TENET. We have completed a recent research study based upon a random sample of TENET educators to see who is using this resource. These folks are experienced educators. The average age was 44.5 years and 51% had more than 15 years of teaching experience. It is noteworthy that 70% have two or more years of telecomputing experience. This study showed they had a mean number of 15.5 logins per month with an average time on-line of 3.5 hours per month. There was also a significant correlation between experience and usage. The correlation indicates that as the network grows and more people get on-line and the demands for these resources increase.

Our educators cite numerous instructional benefits realized through the access to TENET and the information resources. These included the ability to access up-to-the-minute information, news, as well as download materials and ideas for lesson plans. The immediacy of the information, and the fact that they are working with real information, appeals to both teachers and learners. One teacher noted that it became a living breathing subject. TENET helped motivate both teacher and learner. Helen Bell, a librarian in El Paso, noted that TENET makes resources equally available to all her children.

In addition to instructional use, teachers and administrators have used the network for peer-support and professional development activities. They pose questions and receive answers from colleagues across the state and beyond. Teachers consult with each other on ideas for lessons and experiences with particular approaches. Considering how isolated teachers are from each other in classrooms during the school day, it is frequently easier to consult with colleagues via TENET because time and place no longer matter. For teachers in our rural communities, the opportunities provided to exchange ideas with colleagues is a reality for the first time.

Debra Mae Griffin, a librarian and TENET trainer from El Dorado, works in the library at Schleicher CISD. Schleicher CISD is the ONLY school district in El Dorado County. She noted that this technology is an invaluable resource to her community. They are hundreds of miles from the nearest library and the network has enabled her students access to resources they would not have otherwise.

The network technology is playing a key role in reform initiatives in Texas as educators throughout the state are able to participate in on-line discussions. Each school district is required to have a school improvement plan. All districts are re-

quired to integrate their technology plans within their school improvement plan. This closely aligns how technology can support educational reform goals.

It is important to note that TENET is used extensively at-home. Teachers who do not have access to a computer and modem at school have found the after hours use of the network is extremely important. Even if the educators have access to the technology at school, our teachers felt that access to these resources from their homes is essential. Many teachers have taken courses through the Internet. One such course is taught by Dr. Judi Harris. Her students, graduate students at The University of Texas at Austin, meet face-to-face three times during the semester. All other course interaction takes place on-line. The students rated this course the on a scale of 1.0—This is worse than every other course I have taken at the university to 4.0—This is better than every other course I have taken at the university semester. The course has received an average rating of 3.7 for the four semesters. As we are seeking was to restructure teacher education new delivery means will need to be considered for our professional educators.

If we think back to visualize the classroom of the 1880's many of our current practices would fit well. However developing real-world skills and reaching world-class standards requires a major transformation in how our teachers teach and how administrators support those new ways of teaching and learning. New communication systems that connect educator to educators and educators to scientist and researches change the traditional paradigms of hierarchies in schools. These networks will irrevocably alter the way schools do their business. TENET has already altered traditional schooling in Texas. the Armadillo Gopher, supported by the Houston ISD, was developed as an alternative to Texas History textbooks.

Courses are being conducted over many hybrid networks. These communication technologies have the potential to create a quality workforce and enhance productivity through increased and more efficient communication and through opening new avenues of professional development to teachers and administrators in ways not possible under existing top-down models of training.

Collaboratives cross institutional lines and have the potential to closely align communities. One such initiative is between TENET and the South Texas Center for Preventive Genetics (at the University of Texas Health Science Center at San Antonio, Pediatrics Department). This Center has begun developing three projects that use TENET to communicate targeted educational/medical/health information between certain school user groups and higher education institutions, including medical schools. In one such example the South Texas Center for Preventive Genetics has begun development of a pilot project to improve the tracking and long-term care for children with these diseases that receive care at the UTHSC-San Antonio Metabolic Clinic. The project uses TENET to communicate with local school teams (classroom teacher, school nurse, and dietician) in the medical management of these children. Texas children with inherited metabolic diseases that require long-term dietary treatment to avoid mental retardation receive tertiary care at 5 regional Metabolic Clinics. Many families do not have the resources to travel frequently to a regional Metabolic Clinic for necessary care and they are now able to receive the necessary care from their local school. The infrastructure in Texas is an enabler for these children and their families.

Yet, educators cannot take advantage of these resources if they do not have access to it. Access to the network resources through dialup modems is a minimal solution. Only 4% of the nations' classrooms have access to plain old telephone service. Many classrooms lack the necessary electrical wiring.

The lack of an adequate communications infrastructure for our nation's children is criminal. Growth and usage patterns have created a demand to develop local resources.

In order to build such an infrastructure there must be a proactive partnership between government, business, education, and the legislature. The National Science Foundation, the U.S. Department of Education, and the U.S. Department of Commerce awarded a grant to The University of Texas at Austin Computation Center and TENET to bring together a forum of leaders to initiate the National State Networking Project. This forum met in Austin last week. I must add that on one day these leaders were hosted by the parents and faculty at Highland Park Elementary School in the Austin Independent School District.

As a part of the workshop, participants were surveyed as to what they felt were the major barriers to telecommunication. The survey response from a private sector participant stated that a barrier was the "Perception that there is no viable business case in supporting education." However, it is in the interest of business—and all of us—to have a work force that is well educated, a work force that can use information technology.

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At the workshop, Greg Conlon, Commissioner of the California Public Utilities Commission, pointed out that 80% of the high school graduates that came to work for Pacific Telesis could not pass an 8th grade exam. It is imperative that the private sector needs to become a partner so that the people they hire have the necessary background. You pay now or you *really* pay later. We must remember that schools will provide a big market for business and can help stimulate the use of advanced technology in our homes and everywhere in our economies.

A couple of years ago a myth was floating around that the Internet run by the government and was taking business away from the private sector. That is simply not true. More than 65% of the districts in Texas are in various stages of planning to develop their own wide-area network. These networks will provide voice, video and data communication. Every school district in Texas that sets up a node on TENET is buying leased lines, routers, and other services from the private sector. We have just announced a grant program of more than 1.7 million that allows districts to apply for $25,000-50,000 to buy the necessary equipment to establish a network node. As the network becomes more distributed, the demand will grow. For example, a trend now is for school buildings to set up plug-and-play Internet servers. Internet servers so easy that a librarian or teacher can run them. This means that we buy even more leased lines and equipment. As networks become more distributed, the only model that will work. business will see exponential growth. Telebit Corporation, for example, has identified education as one of the fastest-growing markets.

Schools will help parents and others in the community learn the value of new information services. Schools are the center of the community in many of our rural areas and the libraries and local government entities are working together to invest in the necessary infrastructure.

This brings me to the "U" word—and I don't mean UNIX—or The University. Universal service, as it applies to information infrastructure in education, should not mean that big government has to come in and regulate. In fact, most education groups support competition because we see that more areas will be served. However we don't have support and guidance many of our students will be disenfranchised because they live in areas that are remote and there is not incentive to extend services to their areas. But "all" areas won't be served by having more competition. Potentially, students in Dime Box, El Dorado or Canadian, Texas will be passed by. Will market forces lead to broadband connectivity and the means to "use" new technologies in those areas? Probably not. There has to be a mechanism to provide for the rural areas, Indian reservations, and other have-nots of the information age. I spelled out the economic reasons—why it is good for business to connect schools and give them the means to train teachers. But let's face the facts. Hooking up Dime Box, Texas, is not going to cause anybody's quarterly revenue report to shoot up. We must bring these areas to the information infrastructure at rates they can afford because it is the right thing to do. If it means having education and the private sector work out a pooling system that brings access, equity, and training that is what we must do.

We feel that education can help the private sector build new markets for information technology. Texas is doing it now with K-12 connectivity grants.

An educated work force, one that knows how to use new technologies, is important to the private sector and the economy. We all know that.

We can not leave out the rural schools and other underserved groups. We must find a way to bring connectivity and training to the have-nots if this is going to continue to be a strong, well-educated country.

In general, the federal government should provide financial incentives, policy direction, and technical assistance to advance state level capacity for telecommunications in schools.

Public utilities commissions in several states are considering providing public schools with funding derived from telephone company penalties, excess rate charges, and other sources. Recently the legality of a PUC's ability to allocate funds for educational telecommunications and related resources has been questioned. One state. California, has considered legislation that would remove any doubt of PUC authority to allocate funds for educational purposes. For these reasons, the following recommendations are proposed.

1. Legislation should be introduced that would allow PUC authority to earmark funds from various sources to support telecommunications in public educational institutions.

2 Goals 2000 provides funds for states to develop and implement technology plans. The statute included as 317(b)(3) of the Act calls for. the development and implementation of a cost-effective, highspeed, statewide, interoperable, wide-area

communication educational technology system for elementary and secondary schools within the state, particularly for such schools in rural areas.

Therefore, in future legislation the federal policies should strongly encourage all states to incorporate the use of technology and telecommunications within the Goals 2000 plan as a vehicle to increase opportunities for students to learn.

3. It is further recommended that the National Education Goals Panel make recommendations to establish guidelines and national standards for the applications of telecommunications and describe ways technology and telecommunications can support each of the eight National Education Goals.

4. Many states are considering connecting schools electronically. However, it is often reported that once schools are connected they don't have the staff development, technical assistance, and resources to effectively utilize technology. A state PUC may provide the wiring only to encounter the same obstacle of schools' lack of resources. In other cases, a PUC may not provide wiring of schools because of these obstacles.

The federal government should provide incentives by matching grants through the Department of Commerce or the Department of Defense Technology Reinvestment Project. Federal funds would assist with planning and necessary staff development and be a match for school districts to work with phone companies to provide connectivity. These funds could support the development of local volunteer Tech-Corp. These could be volunteers from industry who could provide the necessary technical assistance to their local schools as schools develop infrastructure and support plans.

5. It is well known that once school connectivity and equipment is provided that staff development and technical assistance is needed for effective use of telecommunications. The federal government already funds regional agencies such as the Regional Educational Laboratories, the Department of Energy Laboratories. State Departments of Education and Professional Development Centers.

It is recommended that incentives be provided to these agencies to assist states in the development of telecommunications networking plans in collaboration with other professional education organizations and business and industry.

6. The information highway will not be very useful without the content and resources for teachers to support teaching and learning. Many schools gain connectivity, but teachers do not find needed resources. In some cases libraries are attempting to retrain library personnel to development information resources for the network.

Funding and resources should be allocated in new legislation to support the development of information collection and management systems and to ensure appropriate educational content is available on networks.

7. It is well known that states cannot implement educational technology/telecommunications programs without the involvement of state leadership, including the governor, state legislature, state agencies, business roundtable, chamber of commerce, or others.

New legislation and policies should involve such leadership of business and state agencies to develop, implement, and fund state plans. The federal government should be a model and encourage states to involve all stakeholders

Mr. MARKEY. Our final witness, Dr. Shirley Malcom, is the head of the Directorate for Education and Human Resources Programs. She was recently appointed by President Clinton and confirmed by the Senate as a member of the National Science Board.

We welcome you, Doctor. Whenever you are ready, please begin.

STATEMENT OF SHIRLEY M. MALCOM

Ms. MALCOM. Thank you very much. I am very pleased to have the opportunity to come and add my voice to a plea for a reasoned, rational, systematic incorporation of technology and telecommunications technologies into the educational process and to also plead for the equity of access issues that you have heard coming out of almost every statement that we have had here—that we have had delivered here this morning.

I am here as an individual today drawing on my experience as an advocate for technology and equity and as an involved and concerned parent looking at these issues and also from my job at

AAAS where we have been able to look at the issues and to develop programs to try to address some of these issues.

I am not going to cover the ground that has been covered before by the other witnesses. I want to highlight a few points that have been made.

Let me say from the beginning that in science and mathematics the use of telecommunications technology is a natural part of the way we do our business. And if we are, in fact, going to have educational goals for children that relate to them understanding the nature of science, then they have got to have access to these kinds of technologies. I mean, that is just the bottom line on that.

And we know of a lot of innovative programs, such as the ones that TERC have undertaken from Cambridge, where they have included the science where children can share data not only within their own school but with schools across the Nation and really with schools around the world.

So we know that these kinds of things are possible. We know that they enhance learning. We know that they make a difference in terms of the motivational aspects and in terms of really understanding and learning the nature of science, the way that it is actually done.

I think that there is this other issue that we have to be concerned with, about the availability of technology to teachers in their home settings. And one of the recommendations that I made within my prepared remarks was the need to devise incentive to support K through 12 teachers' purchase and home use of computers and modems, such as through tax credits.

I think we really have got to look at these kinds of issues because, if teachers don't have access to it, they can't use the networks. They certainly can't use them during the day.

I have been concerned, for example, that a lot of computers have been sitting in the schools during the summer. Why aren't they going home with the teachers? Why don't they go home with—even with some of the students who might need that kind of access so that there really is this time for learning and a much stronger education continuum that isn't just 9 to 3:30 but that basically can continue.

I want to add my voice to the support for teacher professional development and think that anything that we are currently funding right now with regard to teacher professional development ought to include a technology component in a natural kind of a way, not as an add-on or a tack-on but as a part of the overall learning goals.

I would also want to support the notion of promoting and supporting an infrastructure for redistribution of usable computers and modems, telecommunications-ready equipment from business and government to teachers, schools, libraries, community centers, housing projects and other nonprofit groups who work with children and youth, especially those from disadvantaged situations.

While some parents can make this kind of technology available at home to their children, I think that we have to look at innovative and creative ways to make this available within those communities that so seriously need them—through libraries, through community centers, through housing projects. Let's put them in the

place where these kids live and provide them some alternatives and some programmatic alternatives to basically hanging out.

And I think that we can do this if we really just are much more creative and much more imaginative. We have got to support better links between the technology rich parts of our society and the technology poor parts of our society, and I think that that is really the bottom line on all of this testimony, and I am here to add my voice in support of that.

Thank you very much.

[The prepared statement of Shirley M. Malcom follows:]

PREPARED STATEMENT OF DR. SHIRLEY M. MALCOM, HEAD, DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES PROGRAMS

I am pleased to have been invited to provide testimony to the Subcommittee on Telecommunications and Finance at its hearing on education, access to telecommunications technology and equity. I believe that these issues are critical to any discussion of education reform. While they are increasingly being discussed, efforts to provide a systematic national response have not yet been developed. And yet the new technologies are changing the options for work and education in fundamental ways.

Walk into any small to medium size office in a business or an association here in the District of Columbia or in almost any other city or town in this country. It's a very different place than it was ten years ago. The people there do their work in very different ways than in the past. Much of this change has been brought about because of powerful new technologies. Telecommunication technology has led the way. I have been personally affected in the way I do my own work. When I return to my office I not only check for telephone messages but also for electronic messages. These may be made up of short notes or complete documents that I have to review. These messages come from people down the hall as well as from other parts of the U.S. and world. Internet links me to colleagues in universities, in other associations and agencies. Besides sending and receiving documents, I can also access databases on-line.

I can check my mail from home or from the road, send files to another computer or to a fax. But I can work this way only with some of the people with whom I interact. I am not able to interact with K-12 teachers and principals, or with staff of the many community-based and youth-serving groups with whom we work using these same tools.

Walk into a school today. And in most cases with the exception of the calendar, bulletin board and books, the school hasn't changed that much in the last 10 years. The elementary schools are likely using the same hardware that they acquired originally. There is no telecommunications capability; it's likely that here is no e-mail to permit teachers to interact, no access to on-line databases, no Internet. In all likelihood there is no phone line, either, outside of that in the office of the principal, (or where they have such personnel) the counselor or nurse. In the high schools there may be a phone in the chemistry lab but more for safety concerns than to be used in instruction.

High School Restructuring: A National Survey, published by Educational Research Service and conducted by Gordon Cawelti, paints a fairly dismal picture regarding the use of technology in our nations' high schools. Responses to the survey on the implementation of reform were received from approximately ⅓ of the more than 10,000 regionally accredited public and private high schools in the United States. These high schools were asked to report on the extent to which they were implementing the five major components of restructuring: curriculum/teaching; school organization; community outreach; monetary incentives; and technology.

Among the various questions posed about the availability of technology were those about use of video instructional materials, use of computers for word-processing applications, in-school use of CD-ROM technology, presence of requirement to demonstrate basic proficiency in use of computers; use of modems to access information from sources outside of the school; presence of multimedia systems and use of distance learning technology or integrated learning system.

Looking specifically at the telecommunications component, about one fourth of the responding schools reported general use of modems, about 35% had partial implementation of this component and another 13% signalled their plans to implement this element next year. According to the survey, suburban schools were most likely to have modems in general use. General use of distance learning was reported by

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almost 19% of schools and another 19% had partial implementation of this component. Distance learning was more likely to be reported by rural schools (26%) than by urban schools (15%).

The potential for use of telecommunications technology by schools is tremendous though not yet realized.

We can outline the many roles that such technology could play: reducing teachers' isolation by connecting them to colleagues both inside and outside of their institutions; expanding their resources through connection with on-line databases or with faculty in higher education institutions; permitting the sharing or pooling of data on projects done jointly with students in other schools, or even in other countries, such as some of the innovative work of the National Geographic KidsNetwork and their partnership with TERC of Cambridge, Massachusetts. At AAAS because of our focus on science, mathematics and technology education we have been particularly drawn to the use of telecommunications technology as a powerful tool for teacher professional development, for providing access to resources and for linking to create learning communities.

A number of our existing projects make use of the new technologies.

At AAAS, we have identified the school media specialist as a key player in providing science and mathematics opportunities for all children. Various projects have sought to disseminate both AAAS-developed resources, as well as research findings that are useful for any school but that particularly seek to enhance the science and mathematics experiences of minorities, girls, and students with disabilities. Currently we are planning a Science Library Resource Board which will include hands-on science and mathematics activities developed by AAAS that are appropriate for use in the library and classroom; excerpts from publications such as Science Books & Films, the premier review journal of print and non-print science resources for all ages. IDEAAS, a sourcebook, which lists science organizations, contacts, and projects across the country, and Proyecto Futuro/Project Future, an activities manual designed for use with bilingual children; an on-line version of the quarterly newsletter Science Education News; and a network of scientists who can conduct hands-on science in schools, discuss careers in science, and assist media specialists and teachers in collection weeding and curriculum development. Existing technology can accommodate the placement of each of these resources on the AAAS Science Library Resource Board thus making them available via the Internet. However, librarians, teachers, students, and others must have the necessary equipment if they are going to become adept at accessing Internet resources. Unfortunately, the newfound wealth of information on the Internet is spawning a negative by-product: the widening gap between the haves and the have-nots in the information age.

Science Linkages in the Community (SLIC) is a new initiative of AAAS that organizes the diverse sectors of a community around science, mathematics, and technology education reform with the goal of improving the current and future prospects of the children of local communities. Currently operating in three pilot sites, Chicago, IL, Rochester, NY, and Rapid City, SD, we have confirmed that access to technology is and will continue to be one of the most onerous of issues. For example, in Rapid City, there is a dropout rate of nearly 75% for Native American students. Our program has endeavored to establish lines of communications between the reservations schools and the Rapid City School District using telecommunications technology. We have breached the problem of equipment acquisition and are on the verge of overcoming that obstacle through business donations. However, we still face the problem of telephone lines and access to "air time."

We have been advocates for technology and equity for many years, authoring papers and articles signalling our concerns about the growing disparities between have and have not communities. (See attached article) about 8 years ago a partnership with the Apple Computer Company allowed us to establish a competitive grants program to support distribution of computers and science and math based software to organizations based in communities, especially to organizations serving female, minority and disabled youth. We provided training and assistance to these groups. A number of these community computer learning centers still exist, providing non-traditional access to technology. Several institutions used these centers to develop more comprehensive programming to support out-of-school education for disadvantaged young people.

From 1989 to 1993, the Bell Atlantic Foundation awarded almost $1.2 million to the American Association for the Advancement of Science (AAAS) for an education program for middle school science and technology teachers in the Bell Atlantic operating region (District of Columbia, Maryland, Pennsylvania, New Jersey, Delaware, Virginia, and West Virginia). In partnership with George Washington University (GWU), AAAS developed a program that increased participant knowledge of robotics, fiber optics, remote sensing, the environment and computer applications as well

as providing effective teaching models that encouraged the use of hands-on, problem-solving activities, cooperative groups, and integration of science and technology in the classroom. Each year, from 1989 to 1992, about 30 teachers attended a two-week summer graduate course at GWU and then applied the new knowledge in their classrooms. Throughout the school year, participants communicated with each other via a telecommunications network, America Online. In addition to a year's subscription to the network, each teacher received a $500 award for technological equipment and/or instructional materials and shared some aspect of the summer program with their school/district/county colleagues at an in-service workshop. Over the four years, a total of 111 teachers participated in the Institute.

In 1992, programs were developed for alumni—a leadership training and satellite institute project as well as a curriculum writing project. Members of the leadership training program wrote a proposal for a local institute for a $20,000 grant from AAAS and Bell Atlantic and matching support from their community. Sites were chosen in Charleston, WV; Pittsburgh, PA; and the Hampton Roads area of Virginia. A total of 51 teachers participated in the three satellite programs developed and staffed by alumni teachers.

A survey of 50 Institute alumni was undertaken to evaluate the effectiveness of the program and its impact on the participants and their schools. About 50% indicate that support from administrators to initiate programs that use technology or purchase new technologies has increased. Thirty-five said that colleagues respected them for their new information and come to them with questions about new technologies and that they now act as resource persons (formal or informal) for their schools and/or districts. Almost all of those surveyed said that they have incorporated elements of the Institute into their classrooms and have increased student use of computers, telecommunication networks, and other instructional media. The fifty teachers surveyed have received almost $285,000 in grants and in-kind gifts from 1990 to 1993. They are using these funds to update technology education laboratories, integrate telecommunications and computer technologies in curriculum, and create multimedia centers.

Project Alliance is a two-year education program (two summers and two academic years) in environmental science and technology for teams of middle grade teachers and administrators from the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. Supported by the National Science Foundation, this project emphasizes the concept of teacher teams—teachers working together and sharing their expertise to develop and teach integrated curricula and then to disseminate to colleagues the process for developing an integrated curriculum and team approach to teaching. Administrators and scientist/engineer partners provide support to the teams.

During the summer programs (four weeks in the first summer and two in the second summer), teachers learn about environmental science through hands-on investigations of real issues, simulations, and field trips. They employ remotely-sensed data, computer probeware, telecommunications, and other computer applications' tools to investigate, analyze, and communicate data about the environment. They develop teaching strategies and produce model activities that link science, mathematics, and technology within the middle grade curricula. In the first school year, they pilot a curriculum unit in their school that integrates environmental science and technology, and in the second, they will implement a dissemination plan. America Online links all participants, scientist/engineer partners, and project staff during the two years of the program. Participants learn how to use the network during their first summer in the program.

The teams are composed of teachers from the same school and consist of at least one science teacher and one computer science, mathematics, or technology education teacher. A teacher from another discipline, e.g., social studies, language arts, may be included. For example, a team from John Paul Jones Middle School in Philadelphia entered the program this summer. On this team is a mathematics teacher, a science teacher, and computer science teacher. They will teach a unit focusing on the Delaware River (literally in their back-yard) and study it from its source in upstate New York to their city. Data gathered in science class will be calculated in math class, and graphed in computer class.

A partnership has been developed with a middle school in New York near the source, and information about the river, the rural and inner-city communities and students will be shared via America Online. The intended outcomes of the project are to increase teachers' knowledge of environmental science, produce curricula that integrates environmental science, mathematics, and technology and improves student learning, foster effective collaboration among teachers, and disseminate the process and the results in such a way that other teachers begin to adopt and/or adapt them successfully.

We cannot achieve the desired incorporation of this technology as a tool for education reform unless there is access to the equipment, to the networks and to the training to support this movement. We must: Devise incentives to support K-12 teachers' purchase and home use of computers and modems such as through tax credits; Promote technology training and networking components as integral to all teacher professional development activities; Promote and support the infrastructure for redistribution of useable computers and modems (telecommunication-ready equipment) from business and government to teachers, schools, libraries, community centers, housing projects, and other non-profit groups working with children and youth, especially in disadvantaged communities; Support public access of the technology beyond schools such as in libraries, museums, malls, community centers, town halls, etc. Support better links between schools and libraries in rural areas with colleges and universities in their region.

There is much to argue in favor of considering free access of telecommunications for schools and libraries as an investment in the human resource base of this country. And if this is not possible a strong case can be made for greatly reduced rates. As telecommunications companies are upgrading their systems they are following the markets, putting services in wealthier suburban areas first. Even where services are provided to nearby schools without charge as the build in occurs, this practice perpetuates the disadvantage of schools in urban and rural districts, putting them further and further behind. Special program options are needed for these service areas so that the disparities do not multiply. Every action taken in this important policy area has multiple implications for equity. These need to be considered as the systems are being designed rather than retrofitted after the design has been effected.

Mr. MARKEY. Thank you, Doctor, very much.

We will now turn to questions from the subcommittee members, and we will recognize the gentleman from California, Mr. Lehman.

Mr. LEHMAN. Thank you, Mr. Chairman.

Again, I want to thank each of the panelists for some very enlightening conversation.

I guess I hear from the school representatives here, the people who work with students and districts, that you need basically three things—one, resources. Obviously, districts always need resources, and no matter how much you have you seem to be short.

Second, some type of structure, and I guess we have a role to play there. Dr. Rescigno, that is what I heard you saying, we need some structure to make sense out of this, that we can put ourselves into or take advantage of the opportunities that are there.

And then, finally, I guess some regulatory incentive to make the connections that you need possible and affordable.

One of the problems I have witnessed is even sometimes we will have the incentives to hook up and maybe even the hardware available—that is great for 6 months. But after that it still has to be paid for, and there is no—very difficult for a district or school to make an ongoing commitment today to do that. Is that a problem you have experienced?

Mr. RESCIGNO. Currently, the market seems to be driving the pathway costs down. America On Line, if you want to get into the Internet, now is about $8 a month from one address.

The issue that we are trying to deal with now is how do we use one address to multiple users, which is a technology issue which we are trying to work through. But I do think that Congress has a role in terms of directing funds, especially to the underserved populations, which they are doing right now with Chapter 1 across the United States.

And if those subsidies could be opened up—for instance, like Chapter 1 dollars today are really restricted to a certain extent and how it is used—if they could be opened up a little bit more so we

could use it for a lot of the technology at the local levels, that would help.

I do not foresee that the pathway cost—and I might be in the minority here, given the market forces, assuming that Congress encourages multiple solutions and assuming that Congress deals with interoperability so that we have open interfaces and we are not dealing with different kinds of technologies. Assuming those things happen, I do not anticipate that public schools will not be able to take care of the pathway costs. I think the biggest issue is the on-premise costs that we have to deal with all the time.

Mr. LEHMAN. The problem that Miss Stout identified was the rural schools, the Dime Box school, costs 10 times what the Dallas school costs. Do you see that changing?

Ms. STOUT. I certainly hope so, and it is really critical to the success of this. But what we are looking at is changing currently the way the school does its business so that they institutionalize the use of communications systems, it is not a separate entity, that they can gain resources.

Let me give you an example. Right now, we are looking at putting many—what we call administrative services over the Internet, over our State network. And so administrative costs really support some of that basic infrastructural cost, and then you can use it for instructional ability within a school. But unless those two are linked together there is no way, and I think we also have to look at alternative delivery systems. I feel like we are using a hybrid approach within our State because whatever works and works well is what we will want.

Mr. LEHMAN. Also, it is easy to see where, if you are building a new school, you can put the infrastructure in from the ground up, but if you have got an old school, we have asbestos problems, leaky roofs, bad wiring, et cetera, so—go ahead.

Ms. STOUT. Right. The thing we did with the State networking project last week, 1 day we met in a school. Now, I don't know how many times there had been national meetings where people came from 50 States to be in a school building all day long, but what we did see were the wires that were hanging from the ceiling are well stapled up, secured, but that is what we have. Of course, now, some of our buildings are not as old, I think, as those you have in Boston, so there are other opportunities.

Mr. LEHMAN. Let me ask you—if anybody here wants to comment on this.

One of the things the bill I introduced does is it seeks to open up some spectrum for the schools. Because we were thinking when we wrote the bill that some of these places with the asbestos problems and everything else, it is just going to be very expensive, prohibitively so to do.

And, you know, we all own the airwaves now. We are allocating them—probably allocating a lot more spectrum than we have around here, at least holding out the promise that it is there. But it seems clear to me that this ought to be a priority if indeed the technologies can match up.

Any of you care to comment on that?

Ms. HARRISON-JONES. I wasn't going to comment. I was going to simply comment on the previous discussion, which has to do with

not so much of the age of a building or whatever. Because I think all school districts have new buildings and old buildings and middle-aged buildings.

The point I want to make is that it is the fragmentation of resources, it is the disparity of access that is a real concern, and it ... the gearing up or the front-loading costs that—we have talked a bit about cost here today, but I think the problem that people have is that there has never been that infusion of the significant amount of resources to get started.

And it means capacity. It means training for staff. It means access to hardware, software, et cetera. That seldom has been in sufficient quantity for any district, regardless of its size, to do.

With all due respect to Miss Roberts who mentioned as a matter of leadership, you know, those of us as superintendents have been darting to and fro after whatever happens to be the latest trend for decades now, and we have got to bring a halt to that. When Sputnik came along, we went in the direction of science. Then when you swing the pendulum another way you go in another way. And each time we leave a major area and then a few years later you must revisit that.

Hopefully, this won't be what will happen this time. That we won't say technology is important, as important as it is, but you also need roofs. You also need teachers. You also need smaller class sizes, and on and on. So we really need to keep all of this in perspective as we look at this issue.

Mr. LEHMAN. If the chairman will indulge me just a couple minutes because I have to go back to my office for a meeting, but did you want to comment on the spectrum issue or not?

Ms. MALCOM. No.

Mr. LEHMAN. I just want to point out I think, in my view, it is a critical element.

The other thing I want to ask is what kind of success are we having with getting businesses to donate computers to schools?

Ms. HARRISON-JONES. Sir, in my testimony, the business community in Boston has been very receptive. But invariably business tends to link up with schools, and we encourage that, partnerships, et cetera, but you tend to get unrelated, incompatible kinds of resources. And it is fine for some purposes, but it does not serve the comprehensiveness of the response that is needed.

So we acknowledge that it is going on in our district ard I am sure in a lot of other districts, but it is not the kind of structured, organized, systematic institutional approach to using technology as a vital part of your curriculum. It is not as an add-on. To some extent, that is sort of like augmenting what you are doing as opposed to having it as an integral part.

Mr. LEHMAN. One of the things developing in the legisl. tion is a national computer bank here where businesses could donate computers and maybe the schools could link up in the manner that suits them.

Mr. RESCIGNO. Congressman, one big problem with the donation program that I see is the software compatibility. As we get into higher speeds, Pentium 90 chips and beyond, the software compatibility becomes very, very important. And if we are going to serve our students with information that is up to date and critical, we

need to make sure that that compatibility is between the existing technology that we have and the software that is being produced.

So it is a wonderful program, but if they throw 8086 technology at us or even 286 technology at us or even Apple IIE technology at us, I think that is a problem.

I do believe, though, that within the next 2 years, as they phase out the low-end technologies with the CPU's, that anything from 486 on if any industry would like to give us any computers that have 486 Intel chips or 8080 chips we would be only too happy to accept them.

Mr. LEHMAN. I am sure. Dr. Malcom.

Ms. MALCOM. On this one I would raise some concerns about a national solution. I think you maybe have to think more regionally.

The reason I say that is that sometimes it is difficult—the reason the business often will give is because there is a partnership and a relationship that can be developed with a system or with a school so that there is the opportunity not only to get their equipment but also their people who are savvy users, and I think that that is really what we want to try to promote.

So maybe a better solution is if we go to a smaller regional approach, if we basically sort and sift, if we build the infrastructure to sort and sift the equipment to find out that it is indeed usable still, that it can support the kind of software that we really need and that we can configure it so that when a gift goes into the school it doesn't go in with a piece from here and a piece from there, whatever, but it goes in as a compatible set.

I mean, I think that there is some kind of front-end smarts that we have to put on this distribution thing. That if there is some— a disk that needs replacing that we can take whatever—the little bit of money that will be required to get that thing up to real use and then take whole sets and put them into institutions so that we can do away with some of the kind of compatibility issues.

Mr. LEHMAN. Thank you very much.

Mr. MARKEY. The gentleman's time has expired.

Mr. Kernan, one of the barriers of access to the kinds of services that you described is the cost of a computer. In your testimony you describe a way to get around this problem by using the television set that exists in most homes. You go on to suggest that the cable or the phone company could provide the box free of charge to the subscriber. Do you anticipate that this box, whether it is free of charge or not, will provide open access to a wide range of services, even those not owned by the network provider?

Mr. KERNAN. As these new interactive television networks are deployed, it is likely that there will be one or two standards very much like there are a couple of general standards in the computer business today. There is the Macintosh standard and the Windows standard.

In interactive television there will probably be two. I don't know what two they will be, but a couple will come to pass.

Those standards are likely to be open standards because program developers are only going to want to build their programming for a box that is in millions of homes, and so the market itself will actually create an open standard, and it will likely be maybe two open standards.

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Mr. MARKEY. But the standards, you think, will be open regardless of whether or not there is Federal or State regulation requiring that?

Mr. KERNAN. I think that the evolution of technology may run ahead of Federal and State regulation and the sort of commercial realities of the fact that program builders, very much like television programmers today, are only going to want to build to the most popular standard. It may even come down to one.

It is very much likely to be like the way the videotape—home videotape industry went from many standards to two to one and the way the computer industry has gone from many standards to two. And, even among the two, one has more than 80 percent of the market.

Mr. MARKEY. And what is the relationship that, as a result, is constructed between the information service provider and the network operator in terms of the control that the network operator might have over the software provider?

Mr. KERNAN. I think network providers are going to have to make their networks open to all software providers, particularly in the education space where it is very important to our Nation that the best education programming be available over the network, and that may not necessarily be the education programming that is provided by the particular network operator.

Mr. MARKEY. OK, well, let's talk about that, then. Let's talk about, you know, a mother and a father who are interested in having their kids get competing educational software or a competing learning channel to that which the cable company or the telephone company want to send into the home because they own that learning channel or that educational software.

What access will the family have to alternative educational software if the telephone company or cable company have a proprietary stake in their own and are rules or laws needed in order to ensure that access for the families to the competing——

For example, if you are not able to cut a deal with the local telephone company, and they cut a deal with another company, and yet you are considered to be the leading educational software in the country but you just weren't willing to sell out 51 percent of your company to that local telephone company in order to get access, what ability will the superintendent of schools in Boston have to then ensure that the parents, the children have access to your software as well?

Mr. KERNAN. I think educators don't realize, superintendents don't realize the market muscle that they actually possess. If in a community there are competing network providers, the school district is in a position to examine the various types of educational programming that are available and either recommend or even specify the types of programming that that school district wants to use in the classroom and also that that school district, through their teachers, suggests that kids use at home.

So it is the market muscle of the school district to say I want this programming available in the school, and I also want it available to the kids at home. School administrators are only just beginning to recognize the muscle that they have.

Mr. MARKEY. You are saying since the primary market is the school and the children at home who go to those schools, if the school superintendent or if the school principal or teacher for an entire department in a school called up the telephone company or the cable company and said, look, I need this, understand, or else I send different instructions to all these teachers and all these families in the school department about how we deal with your other products—you think that could be successful? You think that is a real market power?

Mr. KERNAN. I don't think it is market power that might be exercised in a punitive way. It is more that the school district says, I want this type of programming in the classroom, and I want this type of programming in the home, and I want you to carry it.

Mr. MARKEY. That is a very euphemistic way of saying punitive very nicely, but that is essentially what it would be: I want it or else.

Doctor, you are kind of shaking your head over there. You don't think that kind of power exists?

Mr. RESCIGNO. I appreciate John's comments. I am not sure that, as individuals, we have that kind of power unless we are able——

Mr. MARKEY. Dr. Harrison-Jones does, though. The whole City of Boston—if she wanted to ask NYNEX or Cablevision to provide a certain type of programming and held a series of negotiations and at the end of it, just frustrated, held a press conference, parents standing behind her demanding those kind of concessions from the bottleneck controller of all this information that would help her to provide a better educational environment for her children, you don't think that that would have a tremendous impact on a public-relations-sensitive company?

Mr. RESCIGNO. It would, but it might not have an impact on them making the deal with you. That is the basic issue is the kind of deal they are going to get out of this and the kinds of rewards they are going to get back from it.

Mr. MARKEY. I guess what I am asking you is if then she asks the mayor to bring them in and explain to them, you know, what their relationship with the community might be on a longer term basis if they weren't going to cooperate with the educational objectives and then asked the governor, others to please help us on this issue, this is central to giving skills to children to compete for jobs in the information age, otherwise, our children are going to be left behind, are you saying that a sophisticated superintendent, using all of that leverage——

Mr. RESCIGNO. No, it can be done. I am just saying as an individual. I mean, my school district is only about 8,000 students, OK? We have attempted to do that. I am sure Boston or New York——

Mr. MARKEY. With whom? With whom have you attempted to do it with?

Mr. RESCIGNO. We are doing it currently with MCI. We are doing it currently with Preview Publishing Company.

Mr. MARKEY. Some of these companies aren't receptive?

Mr. RESCIGNO. They are very receptive.

Mr. MARKEY. That is the point.

Mr. RESCIGNO. I recognize the point. All I am suggesting is that is a whole new ball of wax for school superintendents and that

there are many school districts across the United States. And if we did combine together and did push that way, we probably could effect a change. That is all I am suggesting. But, as an individual, it is very difficult.

One of the reasons why I am here is, obviously, because of the successful business ventures we have launched with various companies and how to do it. Certainly, I would say that Boston School District has a heck of a lot more clout than the Hueneme School District simply because of the size of the district.

Mr. MARKEY. Well, on the one hand, yes, but on the other hand, no. I don't know what the demographic breakdown, the income breakdown of your particular district may be. If you are small and poor, perhaps you have got some problems in terms of your leverage. However, if you are a small but extremely wealthy community, then you are in a very strong position because they want to sell HBO. They want to sell long distance. You know, they don't want you upset with them as the local regulatory authority, as the mayor or the cable commission or whatever. They just don't want you upset with them.

All you are asking for, really, is this collateral concession that deals with the future of all the children in the community, and they want to be good corporate citizens. If they understand that they may be in a headline for a month in a row denying access to the schoolchildren to something, that is rudimentary, you know.

As Miss Stout said, it doesn't cost that much, you know, to make these kind of connections. I mean, playing hard ball with these people who have within their control the ability to expedite the process by which these educational tools get within the hands of children.

So what I am saying to you is if you had a national summit in January of the 20 biggest school superintendents and 20 middle-sized and 20 small all in one conference, you all came out with an agenda—this is what we are going to demand by the end of this year, and we urge every one of you across the country to do the same thing—I can tell you that by the July 4 next year you would have your declaration of educational independence, OK, signed in each and every school district, as long as you all banded together.

Mr. RESCIGNO. As long as we all agreed.

Mr. MARKEY. But you would agree. Why wouldn't you agree?

Mr. RESCIGNO. I am not sure. Have you ever been in a meeting of educators and school superintendents?

Mr. MARKEY. As they say—I won't get into it. But what I am saying is that you have an educational process that you have to go through within the educational community, but you have already reached critical mass in terms of the number of school superintendents, the number of principals who now understand the issue.

If you just brought those people together, the ones that didn't come would begin to be questioned locally as to whether or not they got it, you know. You could begin by the end of next year to have citizens groups inside communities questioning whether or not the superintendent should keep his or her job if she is going to let those surrounding her or him to keep these surrounding communities so far behind.

That is what we really need. We need school superintendent jobs to be threatened if they are going to hold on to the status quo. And

we need these people who are going to wait to the end of the line to be the ones to have people beginning to circulate petitions and to organize in a way that says these people don't deserve to be school superintendents in the 1990's and into the 21st Century. They were great for a time. They are not willing to take on these new fights. They are not willing to move on.

So the sooner you call the conference to identify the people who won't come is the sooner the other people's jobs start to get threatened. And once whatever your national bulletin is says superintendent in Wichita fired for resisting these, OK, the message will get sent very quickly. And it is within your own power, your own organization to take this power that Mr. Kernan is talking about and to threaten, in the same way the Congressmen get threatened with movements that go nationally very quickly.

All of a sudden everyone is talking about the same issue. And what I am saying to you is you can telescope the time frame that this becomes one of the top five issues in America to 1 year. That is all it would take as long as there were people in the larger, middle-sized and smaller communities, the leaders who all banded together, held their press conferences, called their conferences, demanded change, you know, came here en masse. You would change the whole structure of the political debate here in Washington and, s a result, across all of the States.

But, right now, you know, everyone has an expert in their own department that knows something about it, but they still consider themselves to be isolated within their own educational community. So what you have to do, in my opinion, is to plug into what this subcommittee wants to do and what Secretary Riley wants to do and others want to do and take that movement, capitalize upon it and then use that leverage with the telephone companies, with the table companies, et cetera, and isolate the school administrators who are hide bound and resistant to change and are going to deny educational opportunities that are indispensable to getting jobs in the 21st century to the schoolchildren.

Yes?

Ms. HARRISON-JONES. I don't know about in this area. I don't know many students who are resistant to coming into the 21st century or using whatever leverage they are capable of using. I think the idea, however, of focusing and using many networks, national networks, to perhaps more directly synchronize or put in sync our local initiatives in with the national movement, is a, I think, a direction that is certainly worthy of pursuing.

But my colleague over here to the right is not too different I don't think from most of the superintendents. They are putting their necks on the line each day to attempt to certainly advocate for what the students need in the school systems and working with the local establishments and whatever establishment might prove to be responsive or indeed resistant.

So many of us are functioning not only as superintendents of our local districts but providing leadership with some of the major national organizations, ASA, ASCD, NAFSI and so on. So I have been taking copious notes, and certainly we are going to remember that we got encouragement from sources here as we pursue these suggestions.

Mr. MARKEY. Well, and I appreciate your blanket endorsement of all school superintendents across the country, but that is not my experience with them. And, as a matter of fact, I know too many school superintendents personally that resist this agenda, in my own little world, my own little life that I live in that great suburban Boston area. And I know many school headmasters and I know many school teachers and I know many others that look at this computer revolution as though, you know, it is alien to, arriving in their life.

Well, you know, of course, I don't know anything about computers, says the school superintendent. Of course, I don't know anything about software says the—you know.

So what I am saying to you is that is all fine and dandy and you can kind of use that as a justification for assigning one person on their staff to kind of work on all these issues. But let's not kid ourselves that the mayors or the school superintendents across the country understand all these issues or care about them and make them their top priority issue. They are in—they are basically taking emergencies as they come along on a weekly basis, and they are working on those things.

What I am saying to you is that the long-term emergency never does quite get the attention, never does quite get the headline. And that is that these kids aren't going to have the skills in the year 2002 to get a job. You know, they won't know how to use it. They won't know how to walk in and even apply for the jobs that we are creating.

And in a post-NAFTA, post-GATT world, where we are letting the low-end jobs go in order to compete for the high-end jobs, if you haven't given all of the kids high-end job skills, there won't be any low-end jobs because part of all these treaties give them away.

So unless people focus upon this as an emergency condition today to give the kids next year and the year after the skills they need when they are 17, 18, 19, 20, there aren't going to be any jobs to use that use your hands. We are giving them away. And that is all part of this GATT, NAFTA signings that are going to be taking place.

And my great concern is that we haven't fully advertised this to the educators, that we are accelerating the demise of low-end jobs for kids that don't have skills. And we are going to create this Grand Canyon where kids are walking around without skills that relate to the jobs that are being created, growing frustration, larger numbers of them without any opportunity, declining Federal budgets for the public works jobs or whatever that could give them something to do. And unless they are qualified to get into the private sector, we are going to have a mess on our hands. And I just don't think that they relate it as much to this, OK?

We do 2 weeks on midnight basketball, $50 million for the whole country, and the whole country has a debate about midnight basketball. You know, midnight basketball, $50 million, 2 weeks of the United States Congress, and every person in America has a view on it.

And this subject, you know, should be a national, you know, conference almost every month with people saying how can we get it all done by the end of next year or 2 years from now and how can

we force every CEO of every major telecommunications company into a room so you can confront them, you can be dealing with them on that basis.

Mr. KERNAN. Mr. Chairman, there is an interesting technique that even a local school superintendent can use to exercise their market clout. In many of these communities it is likely that there will be competing wire line operators, the cable company and the telephone company. They are really out to provide video on demand and home shopping and all kinds of other entertainment and information-related services to the home.

But if the local school superintendent says I am going to choose one of you to carry my education programming, the one who happens to be able to provide the most service, the best service to my school district—this is in any town—the best service to my school district, I am going to give you the education programming and therefore I am going to give you all the children in town, it is nearly certain that that wire line operator will also get their subscribers to take the entertainment programming for their children, the telephony, the home shopping.

So the local school superintendent, by just saying you take the education, that wire line provider wins everything else. It is a remarkable ability to deliver subscribers in bulk.

Mr. RESCIGNO. Can I—just one remark.

Mr. MARKEY. Yes, sir.

Mr. RESCIGNO. I agree with you. I think that most of the superintendents across the United States are not dealing with technology. I agree with that. I know that is the case in California, OK? But I also think that this is part of our evolution. These superintendents will grow old like I will and ultimately retire, and that this evolution will continue to take place.

I also agree with what John is saying, because we are actually doing that.

But I want to take that one step further for public schools. I want to make some money out of that. If we are going to offer them our intellectual property, I want some money coming back, outside of what the taxpayers are doing.

And we do have some programs that will allow us to bring money back into the school district which will go back into research and development for the use of technology with students and also to give bonuses to teachers that worked on that kind of technology. To me, that is an aggressive way to pursue this thing. But I really feel badly that you feel that badly about the leadership that you have been exposed to in the public schools, because there are some great leaders. And I grant you there are some superintendents that I wouldn't hire.

Mr. MARKEY. There was a conference in Boston on education and computers about 3 months ago that I addressed. About 1,500, 2,000 of these people came into Boston from across the country, teachers, headmasters. When I finished speaking, I was surrounded by teachers all telling me how they were the only one and I am still battling my headmaster, I am battling my superintendent, thank you so much, you know.

And there you had one teacher in one school, and everyone else is still battling her as she is trying to move the whole school, you

know. There is another headmaster over here, and he is the only one in his whole district, ￵nd there is another one over here.

And they are all gathered in one big conference. And at least it has reached critical mass where there is 1,500 of them. That is 1,500 out of maybe 300,000 in the whole country saying, this is my passion. We have got to change this system.

The kids aren't getting the skills they need for an information age. If you are not digitally literate, if you don't know what it is, if you can't crack this digital code, you are not going to have a job.

In my own district, the kids are going to be working at Fidelity. They are going to be working at Lotus. They are going to be working at hundreds of other locations where you have got to have these fundamental skills. They are not that difficult to get if you are training them from an early enough age. But if you don't have them, there is no jobs. Those are the jobs.

We are going to be doing the heavy lifting in Taiwan. We are going to be doing the heavy lifting, you know, in Costa Rica, you know. We are going to be servicing that out of our area. The kids just won't have the plants. There won't be the jobs to go and get the work.

So all I am saying to you is that I don't want to sound, you know, critical, because there are clear people of leadership within this movement across the country. They are here today. But, as you can imagine, the only witnesses we get at our hearings are the good people. They don't send in bad people.

What I am saying to you is—you know, we don't have a group of people saying I don't understand it at all. I am not going to do it. They don't come in.

You ask an association please send someone in to testify, of course they are going to send in the most concerned people.

What I am saying to you is we have to find a way of galvanizing the vast majority, unfortunately, of people out there who are still unaware of the real employment limitations that are going to be placed on all these children, unless they gain access to it both in the school and at home.

You know, I was in—in my hometown of Malden, which is kind of a blue collar community, and if you talk to the middle school kids, which I did about 4 months ago, you ask them to raise their hand, how many of you have computers at home, and like 35 percent of the kids raise their hands. How many of you would like to have computers at home? Every kid in the class raises their hands.

Now, what an incredible advantage. They have a few—they have a limited number of computers in the school. They have to scrap for the time in the course of the day. All the kids want to use them. But the kids, the 35 percent at home, what an advantage, you know, in every single subject all day long, because they, through their parents and not that expensively but expensive enough that in a blue collar community it is harder for all the parents to afford it

Well, that is going to be the great gap that exists as the years go by. It is just access to it.

So when I am growing up in Malden, I can take my books home and if my father works for the Hood Milk Company and the other kid's father is a lawyer, I just I had my books and stuff I can

compete with that kid. I can be a Congressman. I can be a doctor, a lawyer, an Indian chief. But I can put in the extra 2 or 3 hours to catch up, you know.

What does the kid do now at home unless there is a plan to give them the extra time, the extra, you know, capacity if they are interested? And the school closes down at 3:30. Get out of here. You know, we are locking the doors, says the janitor. Get out of this place. I am going home myself. You know, you can't stay here.

How do we—you know, how do we move people to a point where every kid in the class, because every parent, because the superintendent recommended it, has bought this 200 buck, you know, computer? And it is at home. It is on line. It is plugging back into the school, and the school is plugged into the Library of Congress. And the software is there, and the school committee has moved over 10 percent of the budget over to software that you send the kids home with homework which is software that plugs back in.

They are solving their geometry problems together, six of them, on line together, very inexpensively, a penny a minute, to solve the problems, play on it at home.

How quickly do you move to that vision of what the school system should look like to compete for the jobs that America is trying to target?

Because that is the other side of the story. All these big business guys are saying, you know, vote for GATT, you know, which is basically give up all your low-end jobs, vote for NAFTA, give up all your low-end jobs. It is great for competitiveness. And it is. But it is not necessarily good for young people in America who don't have the skills now to compete for these jobs that we are going to be competing for, we are going to be creating on the other end.

And unless there is a real clarion call that goes out that telescopes the time frame, that kneecaps the obstructionist, that gets them out of the way very soon, you are writing off 3, 4, 5, 6, 7, 8, years of children.

You will get to it eventually, yes, OK. It could be a gradual process. It is inexorable. It is inevitable. But you will write off 1 million children the first year, then 2, then 3, then 4, then 5, then 6. They will be out in the streets the rest of their lives without these skills. You won't have the control of them once they hit 16, 17, 18, 19, right?

So that is the dilemma that we have. And meanwhile, we are going to pour 1 million, 2 million, 5 million more guns a year into the very same street corners, right? And they will have access to those technologies when they are 10 and 11 and 12 and 13. That is the competing technology that they are going to have access to at those very ages.

So what is the mother to do, you know? What are you giving them? What is the competition? What does the mother have at home to say, no, do this, plugs in, simple computer, 200 bucks, into the school, school has the software. This is very interesting stuff, too, not dull, whatever. It is stuff Mr. Kernan or others have put together that is really fun. It is meant to be educational and interesting and will help you get a job.

Otherwise, every one of them sees this gun, this handgun, you know, and they are cheap, you know. They are 50 bucks, 60 bucks.

What is that? You can work at McDonald's for 3 days and earn 60 bucks. Now you are empowered with the technology. It makes you a somebody.

What is the other technology, you know, that the mother is using with the teacher to compete for this kid's brain, you know, at that early age? Otherwise, you got this Grand Canyon and no jobs for them, either, OK. They will be 15, 16; guess what? That plant closed down and that plant closed down, and no one's lifting anything and, you know, no one's carrying anything, and it is all gone.

And there is another headline saying—you know, here are the headlines in the newspapers. You know, this company lays off 5,000 lifting things, 200 companies hire 300 people apiece to be doing software programming, and guess what, the unemployment rate dropped. But there is more kids without jobs who come from this, you know, this particular area because they don't have the skills to compete.

And so you can—you know, you can try to delay it by a year or 2, that the plant closes down that lifts, you know, that people lift things, but it is less expensive to do it in Mexico or Costa Rica. It is going to go. And it is inevitable.

And if you haven't anticipated it that community now has a disaster on its hands because the community has lost all those plants. The kids don't have the skills. They are going to be walking the streets for the rest of their lives. They have had access to handguns since they were 10 or 12. The only thing they know how to do now is the angle as to how you are going to make a living, and the community is shocked.

Because now we are going to have headlines in the 6 o'clock news or the 11 o'clock news, that is when they start covering these kids, when they are on 16 and they are on the 6 o'clock news.

But you need the crisis meeting today, right? Not in 3, 4, 5 or 6, years. Because it is inevitable. We are accelerating the process. These huge headlines on GATT today are the most relevant headlines to the school superintendents. This is their big threat, more than anything else. GATT and NAFTA are your big threat.

And it is going to be devastating to the low-end kids, the bottom one-third, who are just going to be left behind in this economy because they don't have the skills.

Because we are going to have an increase in jobs. We are going to export all the stuff that Mr. Kernan and others are going to be making, but the question is are we going to have the low-end people with the skills to be able to get the jobs at his company and thousands of others that we are going to be creating across the country?

And I am just afraid that, you know, that the conference that I went to where teachers are thanking me, because they are the only one in their school system, you know, they are the software advocate, you know, in the whole town, it is a lonely crusade for them.

And we just need some way where we replace kind of a national crises about, you know, the need to have metal detectors getting into schools, you know what I mean, to have another competing technology arriving simultaneously and twice, ten times as much money being spent on it immediately, you know. Because that is the only way you are going to have a counterbalance really quickly.

But when the Malden school superintendent wants me to help him get money for metal detectors, you know, then something is seriously awry with the system.

I go off on these things, but it is—to tell you the :ruth, it is a great frustration to me that you could have a 2-week debate in August of 1994 on $50 million for midnight basketball, and you can have a telecommunications bill collapse that was going to require every school and every classroom in America, for millions of children to be plugged in and to have the Library of Congress and everything, and no one is even talking about it, you know.

Because that is what the kids really need. That is what millions of kids really need. Not just $50 million for midnight basketball, to just come and go, but for something that is long term.

Ms. HARRISON-JONES. You are reading that speech.

Mr. MARKEY. Yes. No, I believe it.

Ms. HARRISON-JONES. I am simply saying we are all here looking like we are bobbing for apples or something, because I don't think any of us—I think we all are just as frustrated as you and wonder about national priorities.

Mr. MARKEY. I am venting my real diatribe. I am going to be venting, you know. And I just—I just can't believe that—what a country, you know. So it is just——

And don't expect the big business guys to come in and say, oh, it is a mandate for technologies in schools. They want barriers taken down so they can export products to other countries.

But my concern is that the jobs be here in America, that we are the ones exporting these products. Where are the workers to create these products that we are going to export once we put down the barriers and what is going to be the racial and economic composition of those? That is what is lacking in this whole discussion. And it is kind of sad.

OK. Mr. Kernan, in your testimony I found it interesting that, as you explained Lightspan's efforts to increase access to educational tools, you mentioned that children stand to benefit from enhanced telecommunications technologies because on-line technologies allow and indeed encourage access to educational materials from the home.

You also make mention of the ongoing battle parents are forced to wage ag: inst a Nintendo or video game factor. In developing educational software for children, do you find that a majority of your efforts go towards tying—or trying to find creative and interesting software capable of capturing kids' attention?

Mr. KERNAN. Historically, education software has been characterized by a sort of 95 percent education, 5 percent entertainment, interest potential. If you really want to compete with Nintendo and with entertainment television, you have got to beat them at their own game. And so the secret is to have—to start out with real curriculum objectives, but then you have got to go get the people from Hollywood and the people that make the video games and have them add their potential.

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mal, within a 5-year period. So without—and also, in doing that, looking at potential resources from not only general funds but from external forms of support.

As you know, in the Boston area, we have established quite a network of support from the business community, just negotiated the third Boston compact, where there is now a commitment, we have got the commitment from the business community as well as a commitment from the teachers' organization.

We just negotiated the 3-year contract where our teachers—there has never been any reluctance on the part of teachers with regard to embracing it, except for persons who felt that they weren't comfortable.

So that is why we are saying the training. You are not going to turn on a computer if you never had any experience or exposure to it. You can buy it. It will sit there and gather dust. So we see the training piece, the community appreciation. And you know our community will have to develop an appreciation because there are people who still see technology as simply play. It is regarded as something that children play with, and they are games that you play as opposed to this being a valid instructional utilitarian tool, if you will.

It is not a panacea. It will not replace teachers. I think we are past that. I don't think any of our teachers are worried any more that technology will replace them. But it will certainly assist them.

So a long way of answering your question is that I don't have a definitive dollar amount now, but we do know that it will require something other than the traditional forms of funding in order to see it happen.

Mr. MARKEY. Dr. Malcom, do you have any ideas about how we solve this funding question for cities?

Ms. MALCOM. As a matter of fact, this issue came up in my own home county. It is not very far from here. And they solved it in a quite interesting way. And that is that the parents basically rejected the notion of the budget mark that they were given, went en masse to the school board meetings, then went en masse to the county council meetings, and we got additional moneys up and above the mark in order to capitalize over time to deal with the technology equity issue.

See, I am one of these people who believes that we have to create a demand for change. And I think that we have got to get our communities concerned enough and mad enough that some of the priority setting that goes on, absent any attention to what is happening to the real needs of the schools, can turn around.

That means that we have to not only talk to parents about the technology, but we have to show them the technology and let them handle the technology and see what it is capable of doing for their children. Maybe setting up some units in the mall so as the people come through they can have a chance to play with it and work with it. And then basically a campaign that says why aren't the—why isn't this technology in our schools?

So that people can come to understand what they are dealing with here. They are dealing with choices that are being made about how funds are being expended.

We talk about the big companies and about the revenue opportunities. The companies don't have a problem laying cable. They don't have a problem putting in the fiber-optics. Because they see that has an investment.

Well, I would like to think that if we do this for our children, that that is an investment, too. It is an investment in the human capital of the country, that we have to realize that we may—it may be necessary to delay gratification or to delay the immediate revenues in order to socialize the next generation to the use of this technology and to give them the tools and the interest that it will take for them to then start really making money down the line because they have people who know how to do things. Plus they have basically been socialized to the fact that this technology is a powerful tool that is available to them, and then they will start to incorporate it into the normal flow of their lives.

So my initial response is that we have got to get much more public pressure on these issues so that there can be a demand for different priority setting, number one.

But that isn't all of it, you know. In the meantime, there is the reality that next year's budget, hey, I mean that is not even up for grabs any more.

So we have got to look for multiple kinds of solutions that can play out. And that would include things such as encouraging the donation of equipment, and then with a smart distribution system we can fix it up and then distribute it in ways that aren't haphazard. That is thinking about the nature of what the school wants to do with it and bringing in sets of things.

I think that it is—that it is going to be important if we can get the technology into some public use places, not only for making it available to the parents so they can see what is possible with this, but also to look at kind of the immediate dealing with the more immediate term solutions. We have got to treat this like any other capital expense and realize that we just can't keep forcing it out of operating budgets.

Mr. MARKEY. What do you think, Ms. Stout? What should we do to get the funding that is going to be necessary?

Ms. STOUT. What we did—looking back at what we looked at in Texas, we saw there was a real need. And then once that need was created then we could move forward to find those dollars to help, you know, with our needs.

But looking back at what Dr. Malcom said, there has to be this demand come from the parents. And it is not just the superintendents that can create this. It is the entire district.

Our superintendents nationally are only in a district for 3 years. But we need a national campaign where people understand the full benefits and what is going on here, that we are disenfranchising these children.

The other thing, we have to look at the structure of the school. You know, you realize, what is the reward system? The superintendents are there because those students pass certain tests. And we really don't start teaching in our State until October, after the TAAS tests are through. And so it is a real complex situation that we are looking at.

I really feel that there will be mon... that can be redirected, re-used. We have to reallocate and rethink how we are using the technology. But it can be created.

Mr. MARKEY. Dr. Harrison, what is the reaction of children to these technologies?

Ms. HARRISON-JONES. Oh, just overwhelmingly responsive. Try as you may, I don't know anything right now that is comparable to the response that children give to a combination of an excellent teacher with technology. The combination has to be there, because they will get bored of one thing. But with it used properly, motivation really is never the problem.

It is sort of self-directing, too. That is why they can be used at home. They will do that homework at home via that mechanism when they won't use it with pencil and paper and a textbook.

Mr. MARKEY. I was at a Rotary Club meeting about a month ago, and I was speaking about this to the Rotarians and how important it is to get into every school. And one of the businessmen stood up and said, but what about the poorer kids and the slower kids? I mean, we would still needs jobs for them where they will be lifting things. They won't be able do this, will they? And what do you say to them?

Ms. HARRISON-JONES. The poorer children need it more than anyone else. Before you came in, I also mentioned some examples of how we are using it in Boston and how, unfortunately not consistently, of where a visually handicapped young man, how special needs students, where teachers are facing such a wide range, instructional range, in a single classroom, technology can help them meet those differing ability levels, these different learning styles, the need for bilingual education. Through technology you could cut down tremendously on the cost of manual labor, really, with some additional technology.

Just to touch up here, we really do need a national—locally, we need the support of State and national agreement, if you will, that this is a priority. We can do it, but it is a lot easier and you do it faster when you—when the Nation is speaking of one accord.

And that is what I think we—I know I came to say today. Let's not any longer say technology is good for Malden or Newton or Boston or for Austin. It is good for education. It is an integral part of education. It is a tool just as we use other things. Make it a normal, natural thing.

And it really bothers me that we have to spend so much of our energies demanding it, petitioning and trying to coerce people into adequately responding to the needs of children and their education. That is not the way superintendents and teachers and principals should be using their time. We should be spending it trying to figure out how best to provide educational services and not trying to convince everybody in the world that what is normal and natural and has to be, has to be. I know we have to do it until things change, but it is such a waste of human energy to have this happen.

Mr. MARKEY. You should just thank God you don't have to deal with the United States Senate, okay? No matter what you think about any other institution you have to deal with, they have just

indiscriminately killed every important bill that we for the last 2 years have been trying to work on.

You know, each 2-year period is central. It is critical. You lose a generation of kids every 2 or 3 years that you haven't got a program in place. And it is just so frustrating that, you know, midnight basketball can replace, as a discussion, you know.

We deal with the symptoms, you know. When are we going to deal with all the kids that are now out there at midnight? What about the 5-, the 6-, the 9-year-old that, if you got to them earlier, you can avoid having to have these ridiculous situations about 11-year-olds killing others and midnight basketball. But that seems to capture the media's imagination and unfortunately——

Ms. HARRISON-JONES. Congressman, I think you feel like many superintendents feel at a school board meeting when we propose a budget that has in it technology, computers or whatever, distance learning, and it gets shot down for a metal detector. So we understand the frustration.

Mr. MARKEY. If what I feel like is what a school superintendent feels like, I don't want to be a school superintendent. Because I am now 6 days into it, and if this is a permanent condition, which I am afraid it is, okay, in dealing with the Senate, then—it is just—it is very frustrating. These are tremendous opportunities that we should be enacting on a bipartisan, nonideological basis. But sometimes we wind up thinking that the Republicans are the opponents. but the Senate is the enemy. You know what I am saying? And how do we get around this crazy system of filibusters, of narrow, you know, points of objection that kill broad policies that could really help advance policy discussions?

There is only 10 minutes left to go, so I will have to leave in 5 minutes. What I would like to do is ask each one of you if you could give me a 1-minute summation of what it is that you want us to remember as we are moving on through all of these issues.

We will begin with you, Ms. Stout, if we could. Just a 1-minute summation. How should we be viewing these issues?

Ms. STOUT. I think, you know, if we can take it back to the Congress and the legislation to come back with this demand for our children to move ahead and create the infrastructure nationally that can develop this. This is not an easy situation, because you have to look at the schools. They are not easy as well.

And we have many constituents to deal with within our districts or within our local States. So we have got to have that demand. We have got to work hand in hand with the private sector as we develop these things because we want to be sure we want to see those tools enter our classrooms.

Mr. MARKEY. Thank you. Dr. Malcom.

Ms. MALCOM. I guess the take-home message that I want to leave is that we need to start with those kids who have the greatest needs. All of the problems of getting technology into education, they are there for everyone, and we do need a reasonable and national solution. But the kids who are at the bottom right now need this a lot sooner than everyone else. And I think that we have to—if we have got to do triage, then we have to look at that as really the best place to invest first.

Mr. MARKEY. Thank you. Dr. Rescigno.

Mr. RESCIGNO. I think if I leave you with one message, is that the difference that this country has when you compare it with other countries, is the fact that we deal with confidence, and we deal with optimism. And I think as a public official, I think that is one of the issues that we consistently work with every day of our lives.

And I think if Congress can do anything, I think Congress—the most important thing that Congress can do is lead a national debate on this, with Congressman Markey driving that issue, the whole issue of telecommunication and educating our young children.

But I don't think we should ever lose sight of the fact that this country was built upon the strength of our public schools and will continue to be built upon that strength. And I think telecommunications will play a role and I think all of us here will play an active role in that. And we support your efforts in terms of what you are trying to do.

Mr. MARKEY. Thank you, Doctor. Mr. Kernan.

Mr. KERNAN. Two suggestions. First of all, bring H.R. 3636 back again in the next term. It created a very fair situation where network providers and other telecommunications providers were able to compete, and the education enterprise turned out to be a very desirable partner for any of those competitors.

And my second suggestion is that senior education administrators should study these issues and understand the remarkable competitive clout they have.

Mr. MARKEY. Thank you. And Dr. Harrison-Jones.

Ms. HARRISON-JONES. Well, mine would echo much of what has been said, and my purpose for being here is certainly to articulate from this particular superintendent's point of view. And I think I expressed the opinion of many of my colleagues that we do have a vision for education that does include technology. We see, however, our capabilities as linked to your support, your ability to be of help in terms of meeting this tremendous capital need.

I would agree with Mr. Kernan. I would like—would hope that we could somehow resurrect this legislation and would like to know just to what extent educators throughout the country can be helpful in regard to doing that. And perhaps I can talk to you one on one in regard to how we best do that.

Because, ultimately, we cannot allow this to end at this point. The need has never been greater than now, and we are willing to assume a leadership and will continue to put our necks out on the line in order to make this vital resource available to our students.

Mr. MARKEY. OK. Thank you very much.

Ensuring learning links into every classroom and onto every desk is absolutely essential for the children of America in a post-NAFTA, post-GATT global economy world which is about to unfold. And it is absolutely essential as a Nation that we give opportunities to every child to gain those skills which HERE they are going to need and we give the parents the tools they are going to need, and the teachers, to provide those skills to children.

I want to encourage each of you to continue your good works. This Subcommittee on Telecommunications is going to continue to

work very hard to press this message on the Congress, because they need education as well, unfortunately, as does the American public, with regard to how central this is to ensuring that both the social and economic progress that our society is going to make in the next generation is inextricably entwined to the access children have to these technologies so they can feel empowered in this modern economy.

Or else we risk reaping the whirlwind of a disenchanted and disenfranchised segment of our population that will pay 20-fold greater prices in terms of the catastrophes of the cities and towns of our country.

We thank you all very much.

[Whereupon, at 12:26 p.m., the hearing was adjourned.]

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