
BRIEFING BOOK

THE TECHNOLOGY LEARNING CHALLENGE

A PRESIDENTIAL INITIATIVE

AUGUST 23, 1995

THE TECHNOLOGY LEARNING CHALLENGE

OUTLINE

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TECHNOLOGY LEARNING CHALLENGE EXECUTIVE SUMMARY

The President has an opportunity to lead a revolution in the way the American Education system works. Technology has achieved enormous productivity gains throughout the economy and technology has helped employees in sophisticated businesses and the Department of Defense keep pace with rapid technological advances. But these benefits have largely bypassed the nation's schools -- in part because they lack resources but primarily because schools are not managed in a way that encourages technical innovations. Parents, teachers, students, and community leaders familiar with the technical changes occurring in all other parts of the economy (including home entertainment and home computer systems) are anxious for change. The business community and universities are anxious to help -- and have been willing to provide resources. The President can focus this effort and catalyze a rapid and enthusiastic response with a series of focused challenges to schools, businesses, and communities which we know will be met with enthusiastic responses. These challenges can be backed by a series of focused federal actions that can be taken within current legislative authority and within existing budgets. These actions are outlined in the Box below and explained in more detail in the attached briefing book.

Presidential Leadership Challenges:

1. Challenge the business community to join the **Tech Corps**.
2. Award the first round of **Challenge Grants**, and issue the challenge for the next round.
3. Kick-off and challenge students to join the new **National Technology Honor Society**.

Issue Executive Orders to:

1. Streamline the process of getting excess or surplus government computing and networking equipment into the schools.
2. Make Federal education technology resources easily and widely available.
3. Make use of existing government resources to connect schools to the information infrastructure.
4. Allow government workers to use flextime to volunteer in schools.
5. Improve coordination and relevance of government R&D in educational technology.
6. Encourage all federal education and training programs to incorporate technology extensively.
7. Create objects for a virtual museum and library from the Smithsonian, National Archives, and the National Park Service and the technology agencies (NASA, NOAA, NIST).

This memo presents a set of actions which the President can take, without legislation, to lead us into the future of education and offers a potential Presidential event for announcement of these actions. The background information includes the status of technology in the classroom [Tab A] (and for comparison, in the workplace[Tab B]), economic arguments [Tab C], a representative list of ongoing administration [Tab D] and private sector [Tab E] activities, our government/private sector partnerships [Tab F], and details on the recommended presidential challenges [Tab G] and executive actions [Tab H]. A glossary of technology is included as well [Tab I].

I. WHY IS THIS ISSUE IMPORTANT?

The Problem

We are in the midst of an information and communications revolution that is changing the nature of how we work, how we learn, and how we live. As businesses lean more heavily on telecommunications and electronic technology, American workers must increasingly learn the ways of electronic communications just to carry out their day-to-day responsibilities. Over the past ten years, the number of workers who directly use computers at work has grown from 25% in 1984 to 47% in 1993. There is also evidence to suggest that technological skills are tied to higher wages -- the Department of Labor estimates that in 1993 workers who used a computer at work were paid as much as 23% more than those who didn't. The evidence seems clear that well-educated and skilled workers are prospering in the new technology-driven economy, while those whose skills are out-of-date or out-of-synch with the new economic landscape are being left behind (please see Tab C for more information on these economic issues). As new information technologies are rapidly transforming the way America operates, they are also transforming what our children need to learn. Technological literacy will be as much a part of the 21st century as knowing how to use a telephone is today.

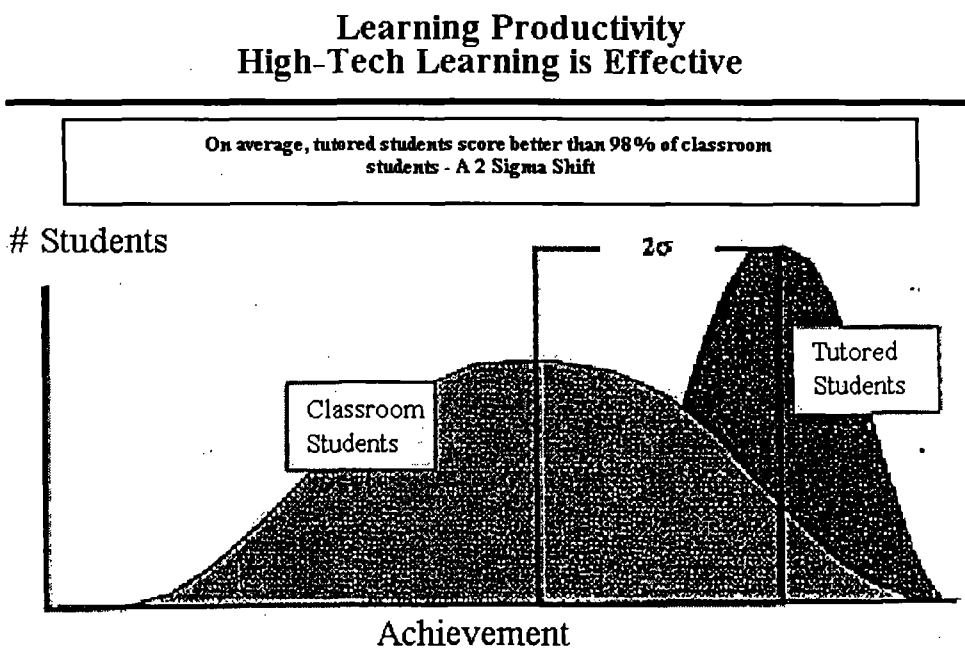
The problem is, when we walk through the doors of most schools today, we enter a timewarp. In an information age society, where technological skills are crucial to economic success, we are using industrial age tools to educate our sons and daughters. In classrooms that should be information and communications hubs for learning, the basic medium of instruction continues to be blackboards and chalk. As of 1994, it is estimated that fewer than 20% of all classrooms even had phones, let alone a connection to the Internet or World Wide Web. Our schools are technologically impoverished in a technologically rich world, and this has serious economic consequences for our nation (Tabs A & B give additional information on the technological disparity between our nation's schools and workplaces). Good jobs in today's economy increasingly require new sets of technological skills that our schools are not teaching. This lack of skills not only keeps thousands of young people from achieving their share of the American Dream, but also has a pronounced drag on the competitiveness of our economy. It is estimated that lack of information literacy costs businesses an estimated \$25 to \$30 billion dollars annually in poor product quality, low productivity, and accidents.

If we want to remain competitive in the next century, our children must be familiar with and proficient in the uses of new communications and information technologies. Additionally, it is increasingly clear that if our young people are to have any chance of competing for high-skill, high-wage jobs in the new global economy, they will have to be technologically literate.

Why We Should Care

If we want to remain competitive in the next century, our children must be familiar with and proficient in the uses of new communications and information technologies. Additionally, it is increasingly clear that if our young people are to have any chance of competing for high-skill, high-wage jobs in the new economy, they will have to possess technological literacy.

A new consensus is emerging about the dynamics of learning: The primary work of learning is done by the learner not the instructor. All students are different, and they learn at their own pace, often in different styles. Learning is genuinely compelling for the student who finds him or herself immersed in multisensory, multimedia environments tailored to their individual learning needs and desires. Learning by doing that involves active interaction and occurs in a meaningful context, rather than through passive listening or watching in the abstract works best. Students taught by individual tutors do better than 98% of students taught in standard "mass production" class room settings (see Figure 1). Emerging technology makes it possible to provide learner-centered contexts for learning tailored to individuals without a prohibitive investment in new materials or increases in instructional staff.



Adapted from: Bloom, B.S. The Two Sigma Problem: The Search for methods of Group Instruction as Effective as One-on-One Tutoring. Educational Researcher, 13, 4-16 1984

Figure 1.

New information technologies will enable learners of all ages to connect with these learning tools -- and with other learners, experts, and tutors -- in schools, workplaces, and homes. Virtual learning communities can be created between coaches, tutors, peers, parents and children, and learners of all ages. They can use these new learning tools at all hours of the night or day, on weekends, throughout the year from any location-- school desktop to kitchen table. The extent of learning and the effectiveness of teaching no longer need be a prisoner of the amount of seat time in a classroom.

What are the Barriers?

The major hurdles to realizing the vision of technologically rich schools delivering learner-centered education to children are:

- **getting up-to-date computers** and other learning technologies into the classroom. While 99% of schools have at least one computer, 80% of those used for instruction in the classroom are considered obsolete and not able to run newly-released software.
- **connecting schools and classrooms** to the Information Infrastructure. Only 5% of classrooms have modems that allow connection to the information superhighway.
- **creating the content and curriculum** which makes effective use of the technologies. Most of the current educational software is not used in schools because it is simply irrelevant for the teachers' overall curriculum goals.
- **training and support for the teachers** in their use of the technologies. The majority of teachers in the classroom today have had no formal training on the use of technology for teaching and learning.

(See Tab A for more detail on these barriers.) Additionally, for technology to truly be integrated into our nation's classrooms, it must go hand-in-hand with comprehensive school-reform efforts. Our current 19th Century model of education cannot successfully support the effective use of technology as a teaching and learning tool. Teachers need the time and permission to experiment with new technologies and share experiences with other teachers. This is a new paradigm and requires outside assistance and ideas. Although these are all barriers, the problem cannot be solved by eliminating any one of them. **They must all be addressed at the same time.**

II. WHAT ARE WE ALREADY DOING?

The Clinton Administration has made an unprecedented commitment to bringing technology into the classroom. As a central element of the President's lifelong learning agenda, the Administration believes that technology can help expand opportunities for American children to improve their skills, maximize their potential, and ready them for the 21st century. (See Tab D for details on the Administration's accomplishments.)

III. WHO IN THE BUSINESS AND EDUCATION COMMUNITY SUPPORTS THESE ACTIONS?

Two years ago, National Coordinating Council on Technology in Education and Training (NCCTET) was formed to address current issues and potential uses of technology to improve education and training (see Tab F). NCCTET members include over 100 national nonprofit membership organizations, state and local groups, individuals, and businesses involved in education and training throughout the U.S. Included in the membership the National Education Association, the Association of Federated Teachers, the Software Publishers' Association, the American Society for Training Development, Regional Bell Telephone Companies, the Interactive Multimedia Association, and the George Lucas Foundation. The purposes of this national coalition are to: facilitate communications with and among stakeholder communities.

IV. THE PRESIDENT'S CHALLENGE TO THE NATION

We should play on the theme of our young, energetic President leading the Nation into the future. He can use the bully pulpit to rally the business community, educators, students, and his own Federal agencies to ensure that we prepare our children to prosper in the information age.

No single stakeholder group can solve this problem alone. As the President has said:

This is something that has to grip the American imagination. Government programs alone can't do it. Educational professionals alone can't do it. There is something for all of us to do.

As outlined below, we propose that the President (joined by the Vice President, Secretary Riley, Secretary Reich, and other Cabinet-level officials from the technology agencies) issue a series of "Challenges to the Nation." He will call for the business community, students, educators, Federal agencies, and other stakeholders to work together to bring 21st century learning technology to the Nation's schools. He will also present a set of executive actions designed to leverage Federal resources to aid schools with the introduction of technology.

Presidential Challenges [Tab G]

- **A Challenge to the Business Community.** The President will join with CEOs of high technology companies to challenge volunteers from the Nation's computing and communications industries to help create the **Tech Corps**. The Tech Corps is a national initiative to organize volunteers from the private sector at the grass roots level to advise and assist schools in the introduction of new technologies for learning in the 21st century.
- **A Challenge to Local Communities.** In March, the Vice President announced the **Technology Learning Challenge Grant Program** which challenged communities of schools, colleges, libraries, museums, and businesses across the country to join together to transform factory era schools into information age learning centers. Over 500 community consortia responded to this challenge, at least one from every state in the nation. The President [along with the Vice President] will present the teams of educators, industry partners, and community leaders who have been selected to receive Challenge Grants. The President will issue the challenge for the second round of Challenge Grant competition.
- **The Challenge to Students.** The National Association of Secondary School Principals (NASSP), with the endorsement of the President's Science and Technology Advisor, is establishing a **National Technology Honor Society** (to complement the National Honor Society, founded in 1926). The President will challenge students to participate in the NTHS, which will recognize students who use their expertise to help teachers and school administrators apply technology to create new learning environments. These students will work closely with Tech Corps volunteers in their schools.

Executive Actions [Tab H]

1. **Direct GSA to streamline the process of getting excess or surplus government computing and networking equipment into the schools.** Present an action plan for transfer of surplus government computer equipment to schools. Existing executive order 12821 should be broadened beyond science and math education and the definition of equipment modified to include networking hardware as well as computers. *Action: Revise and Implement Executive Order.*
2. **Direct Federal Agencies to make Federal education technology resources easily and widely available.** *Action: Executive Order.*
 - a) Create a new on-line web guide to federal resources in education and training technology. The President and Vice President unveiled a "U.S. Business Advisor" web site at the White House Small Business Conference, which serves as a single point of entry for businesses to access government information

electronically. A similar service for the educational technology community would be well received.

- b) Federal departments and agencies have extensive information that can be made available for educational purposes (e.g., NASA, DoE, DoD).
- 3. **Direct several agencies to make use of existing government resources to connect schools to the information infrastructure.** *Action: Executive Order.*
 - a) Make available 5% of all government computing and networking resources for use by public schools.
 - b) Direct all National Guard Armories to share their Internet access with local schools during the week when it is not in use by the Guard.
 - c) Make excess Federal satellite, radio, and other telecommunications capacity available to public schools.
 - d) Direct NTIA to perform a review of Federal communications spectrum for use by schools and libraries.
- 4. **Direct agencies to allow government workers to use flextime to volunteer in schools.** Permit flexible working hours for government employees which would allow them to volunteer in the schools (this allows government to answer the Tech Corps challenge). *Action: Executive Order.*
- 5. **Direct agencies to coordinate government R&D in educational technology.** Formally announce and establish the Interagency Learning Technology Office, a reinventing government initiative to focus education and training R&D projects which are now scattered across many agencies. *Action: Executive Order.*
- 6. **Direct all federal education and training programs to incorporate technology extensively** (including: Title I, Eisenhower Professional Development Program, Head Start, Tech Act Amendments of 1994/Rehabilitation Act of 1973, etc.). In particular, direct these programs to:
 - a) increase both the supply of high-quality learning tools and the demand for these products in the education and training sector;
 - b) expand the delivery of federally-funded technical assistance on technology to include as many federal programs as possible;
 - c) provide technical expertise and training on technology matters to federal program staff;
 - d) where appropriate, expand the use of telecommunications technologies, including electronic networks, video conferencing, and distance learning, to support both learning activities and program operations; and
 - e) address research, development, and evaluation needs identified by federal programs and distribute and publicize the results.

Action: Executive Order.

7. **Direct agencies to work together to create objects for a virtual museum and library from the Federal holdings.** Report on the national digitization initiative, a collaboration between the Library of Congress, the Smithsonian, and the National Archives to digitize the Federal holdings and make them available for educational use.

Action: Announce Initiative.

More to add here

Clinton Presidential Records Digital Records Marker

This is not a presidential record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

This marker identifies the place of a tabbed divider. Given our digitization capabilities, we are sometimes unable to adequately scan such dividers. The title from the original document is indicated below.

A

Divider Title: _____

Status of Technology Use in the Schools

By the year 2000, 60% of the new jobs will require skills possessed by only 22% of the incoming workforce.

Evident by the heavy investments in information technology training for their employees, businesses have realized the importance of investing in information technologies for gaining competitive advantage. However, the ultimate responsibilities lie with the schools to educate our future workforce. Our nation's schools have not been able to invest the resources to provide every student with the technological training needed for 21st century workplace. Use of technology in the schools has fallen far behind that of the business community. The goal is to bridge this gap between businesses and schools to enhance the competitiveness of our future workforce.

- Almost two-thirds of the nation's public schools report that they do not have access to the Internet, and only 3 % of instructional rooms (classrooms, labs, and media centers) are connected
- Schools in the U.S. have an average of one computer for every twelve students
- While 41 % of teachers have a TV in their classroom, only one in eight has a telephone and less than 1 % have access to voicemail
- A majority of teachers report feeling inadequately trained to use technology resources
- Despite the importance of technology in teacher education, it is not central to the teacher preparation experience in most U.S. colleges of education today
- Low-income groups and rural areas tend to have less access to information technology at home and in public schools and libraries
- Approximately one-third of American households have computers, but computer ownership is highly correlated to family income and education

Barriers to the Use of Technology in the Classroom

There are four principal barriers to the effective use of technology in our nation's classrooms:

- **Getting Up-to-Date Computers and other Information Technologies into the Classroom.** At this point in time, the problem schools face in this area is not only in bringing computers into the schools, but instead is in bringing relevant, up-to-date computer and other information technologies into the classroom. Over the past decade, schools have made a concerted effort to purchase computers for student use. In 1992, it is estimated that 99% of schools had at least one computer. Unfortunately, as of 1992 80% of all computers used for instruction in the classroom were considered "obsolete" -- most new software being designed today cannot run on these machines. Additionally, schools lack many of the basic "hardware" items that would allow them to access the information revolution that is sweeping the private sector. Where schools do have access to these current technologies, much of the time they are not located in the classrooms, but rather in school media centers or in "learning labs" where they are accessed by students at infrequent intervals. Additionally, the best hardware is in the schools that can afford it most, leaving a wide gap between information haves and have-nots. The poorest schools are often left behind. When computer skills make the difference in whether or not a person makes a living wage, this computer gap is critical.
- **Connecting Schools and Classrooms to the Information Highway.** Schools are lacking two types of connections that are vital to their joining the information revolution: First, they must be connected externally to the outside world, either by cable wire, phone wire, or satellite; Secondly, classrooms must be connected to each other so that students and teachers can share information and communicate with each other. Both types of connections are critical -- it is not enough to do only one. The vast majority of classrooms lack the infrastructure to either. For example, only 5% of all classrooms have modems that would allow them to make sufficient connections to the information superhighway. As of 1994, GAO estimates that fewer than 30% of all schools have the basic electrical wiring that is considered even "somewhat sufficient" for computers and other communications technology, and only 23% have telephone or cable lines that would allow them to communicate with the outside world. Breaking down the classroom walls and opening up our children's minds to the outside world is fundamental to ensuring our children's future in a competitive global job market.
- **Shortage of Meaningful Content.** Most of the "educational" computer software that is currently being produced in this country does not get used in schools because it is simply irrelevant to the teacher's overall curriculum goals. At best, commercially available software deals with a narrow slice of a given curriculum, if anything at all. Teachers see this sort of narrow instructional software that does not match their curriculum as a distraction that is not central to their basic curricular goals.

Furthermore, the software that is developed for schools is too often "drill and kill" software -- nothing more than an electronic version of flash cards. Educators need to encourage software developers to create materials that are compatible with overall curriculum goals. They must also become more involved in working with software developers to develop such materials. Parents know how technology can engage children with video games. If only we could engage video game makers with education. Until educators and software developers do a better job of communicating with one another, the education software market will continue to lag behind other forms of software development -- in 1993, the retail sales of the violent video game "Mortal Kombat" were \$275 million, over \$125 million more than sales for all home educational software (sales of software for schools is even lower).

- **Teacher Training and Support.** When teachers aren't excited and comfortable with technology in the classroom, neither are students. The vast majority of teachers in the classroom today have had no formal training on the use of technology as a teaching and learning tool. Many rarely come into contact with technology at all during their daily work routine and rarely have extra time to learn the technology themselves. Schools of Education continue to ignore or downplay the importance of technology in training teachers, and therefore new teachers coming out of these schools are often no more technologically-literate than teachers already in the workplace. When technology is introduced into a school, teacher training tends to be a low priority -- overall, districts spend less than 15% of their technology budgets on training teachers, and most of that focuses on the mechanics of operating equipment rather than on integrating technology into the curriculum or selecting appropriate software. Follow-up training and technical support is almost non-existent, with only 6% of elementary and 3% of secondary schools providing a full-time, school-level computer coordinator for technical support. It is no wonder, then, that many teachers are resistant to the introduction of information technologies into their classrooms.

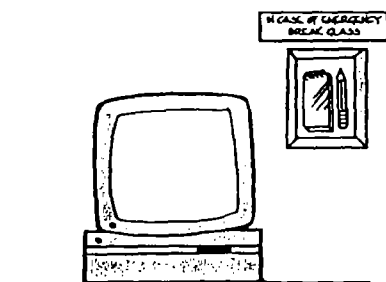
Additionally, an issue that runs through all four of these barriers is the **Need for True School Reform**. In order for technology to truly take hold in our nation's classrooms, it must go hand-in-hand with comprehensive school-reform efforts. Our current 19th Century model of education cannot successfully support the effective use of technology as a teaching and learning tool. Teachers need the time and permission to experiment with new technologies and share experiences with other teachers. Existing standardized measurements of student achievement do not reflect what has been learned with technology. Schools must have plans for the integration of technology into the classroom. Without making a serious effort to link technology and school reform, many school districts have seen their investments in technology literally sit on the shelf or gather dust in the corner of classrooms.

TABLE 1-2: Teaching and Technology: Current Barriers

Teacher time

Teachers need time to:

- Experiment with new technologies.
- Share experiences with other teachers.
- Plan and debug lessons using new methods that incorporate technologies.
- Attend workshops or training sessions.

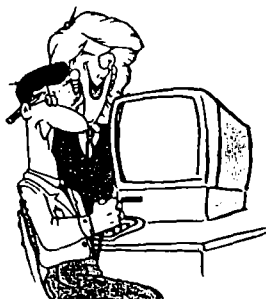
Access and costs

In addition to limited hardware and software, other factors affect access:

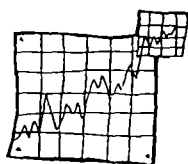
- Costs are high for purchasing, connecting, and training to use technologies.
- Technologies may not be located in or near the classroom.
- Hardware in schools today is old (50 percent of computers in schools are 8-bit machines) and cannot handle many newer applications.
- New or additional wiring or phone lines are necessary for telecommunications networks.

Vision or rationale for technology use

- Schools must have plans, and teachers a clear understanding of curricular uses of technology.
- It is difficult to keep up with the rapid rate of technology development and changing messages of best use.
- Teachers lack models showing the value of technology for their own professional use.

Training and support

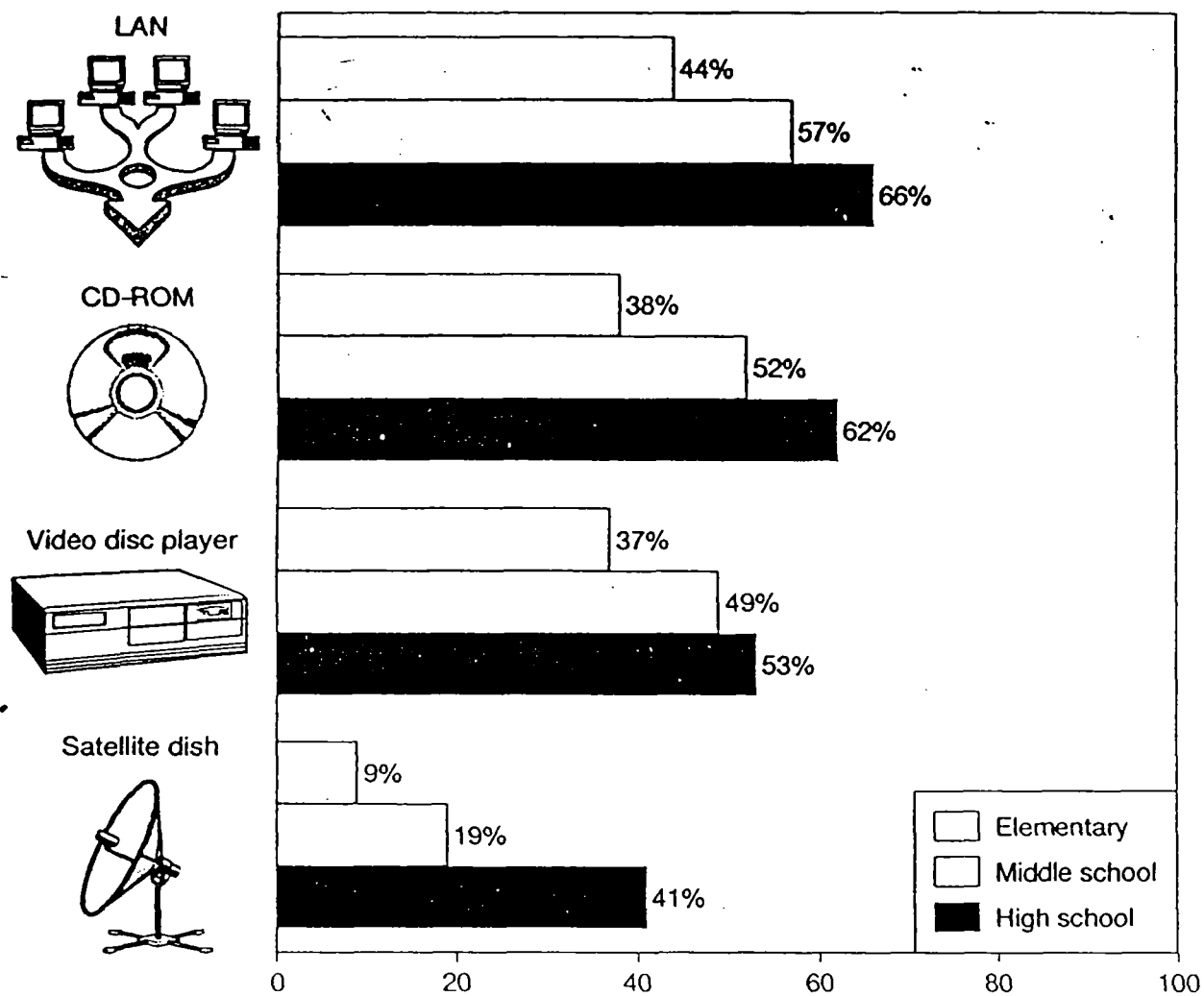
- Overall, districts spend less than 15 percent of their technology budgets on training, but they spend 55 percent of the budget on hardware and 30 percent on software.
- Technology training today focuses primarily on the mechanics of operating equipment, not on integrating technology into the curriculum or selecting appropriate software.
- Only 6 percent of elementary and 3 percent of secondary schools have a full-time, school-level computer coordinator for technical support.

Current assessment practices

- Existing standardized measurements of student achievement may not reflect what has been learned with technology.
- Teachers are held immediately accountable for changes that take time to show results.

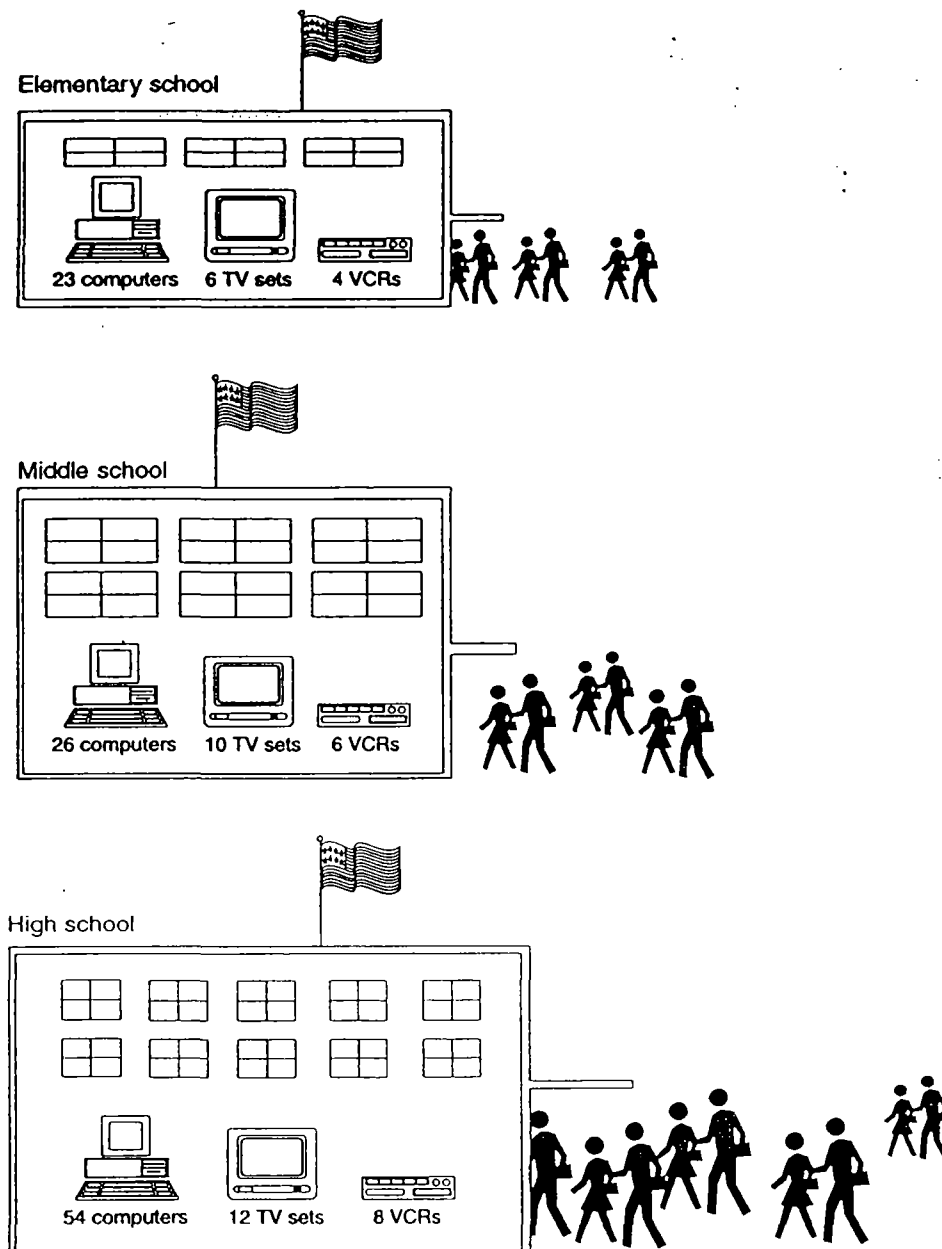
SOURCE: Office of Technology Assessment, 1995.

FIGURE 3-4: Percentage of Public Schools Owning Specific Technologies, 1993



SOURCE: Market Data Retrieval, *Education and Technology, 1993: A Survey of the K-12 Market* (Shelton, CT: 1993).

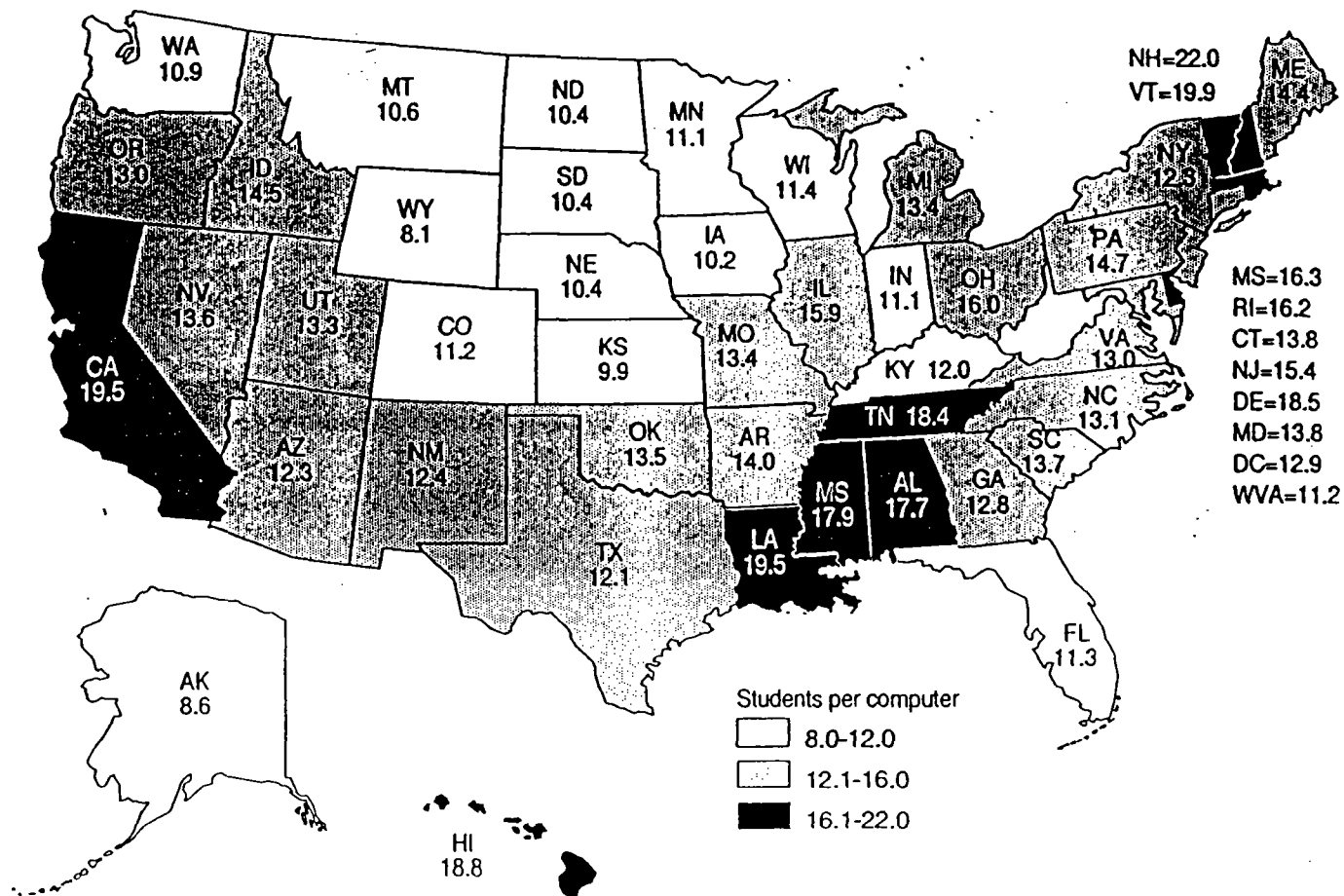
FIGURE 3-2: Installed Base of Computer and Video Technologies in Typical Schools, 1991-92



NOTE: Figures given are medians. Computer data from 1992, video from 1991.

SOURCES: R.E. Anderson (ed.), *Computers in American Schools 1992: An Overview* (Minneapolis, MN: University of Minnesota, 1993). A.L. Russell and T.R. Curtin (eds.), *Study of School Uses of Televisions and Video: 1990-91 School Year* (Arlington, VA: Corporation for Public Broadcasting, 1993).

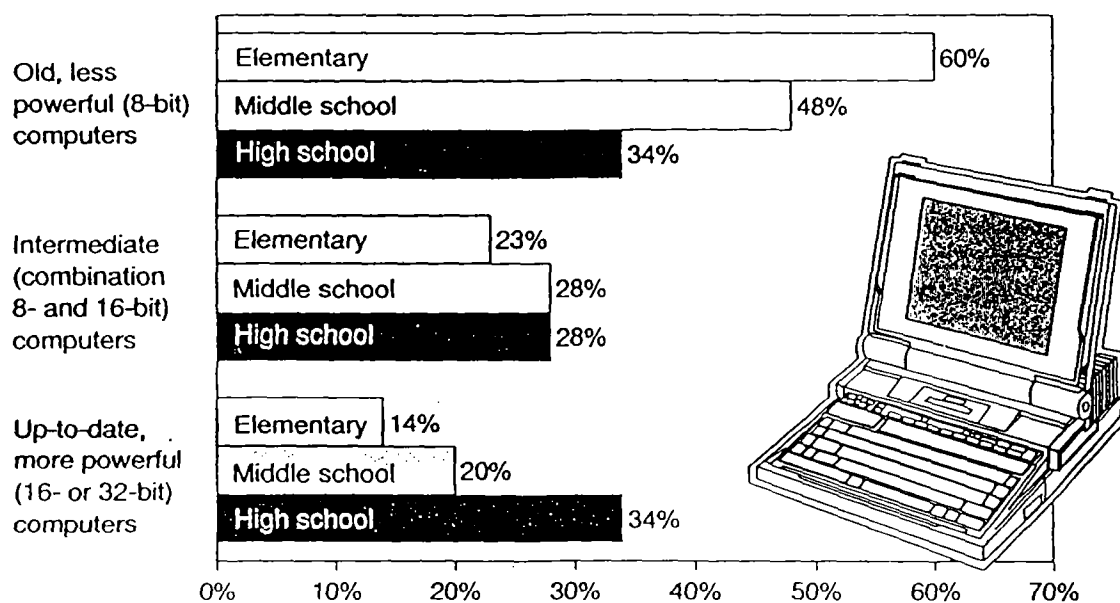
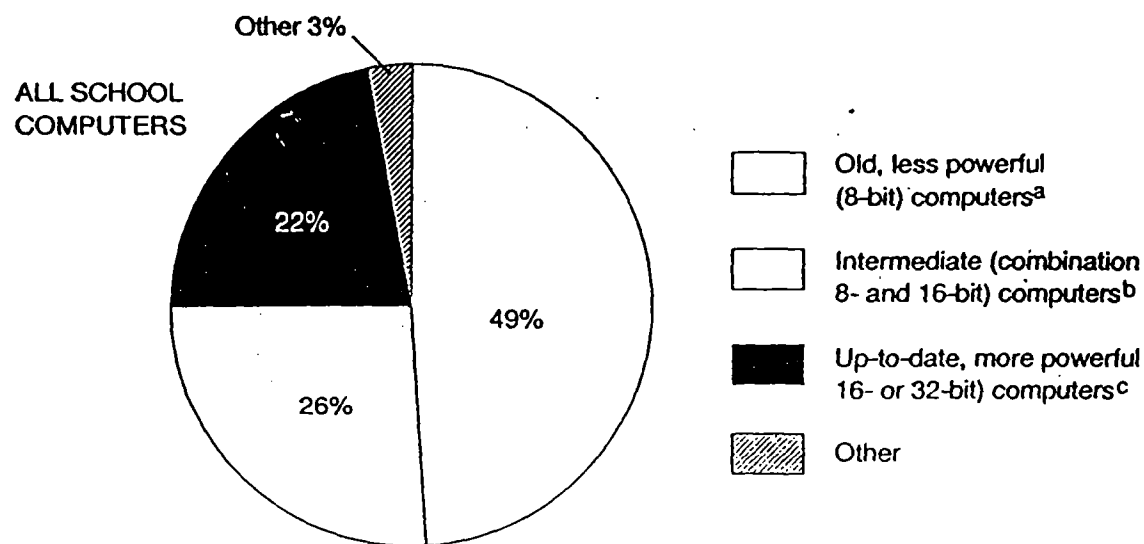
FIGURE 3-5: Average Number of Students per Computer by State, 1994



NOTE: Students per computer is a measure of how many students have to share a computer. Smaller numbers (e.g., 8.0) mean that fewer students have to share a computer.

SOURCE: Quality Education Data, *Technology in Public Schools, 1993-94* (Denver, CO: 1994)

FIGURE 3-3: Inventory of School Computers by Age/Power of Computers, 1992



^a Includes primarily Apple II+, IIc, and IIe.

^b Includes the Apple IIgs and IBM XT8088.

^c Includes the Mac 6800, Mac II, Mac LC, AT 80286, 386, and 486.

SOURCE: R.E. Anderson (ed.), *Computers in American Schools 1992: An Overview* (Minneapolis, MN: University of Minnesota, 1993).

TABLE 3-1: Average Student-Computer Ratios in 1992 by Computer Density, School Control, School Size, and Percent Minorities

	Elementary	Middle	High School
Computer density^a			
Lowest 20%	34.5	35.5	31.4
Middle 60%	15.8	14.0	10.4
Highest 20%	7.2	5.4	3.7
School control			
Private	20.5	18.2	15.2
Public	17.5	15.1	11.9
School size^b			
Small	15.9	14.4	11.5
Large	22.5	24.3	17.1
Percent minorities			
0-3%	16.7	14.0	12.5
4-24%	18.6	16.2	12.5
25-100%	18.7	18.3	12.4

^a Schools were divided into three groups based on the computers per capita. "Highest 20%" refers to the 20% of schools that have the most computers per capita, "Lowest 20%" refers to the 20% of schools with the fewest number of computers per capita.

^b The dividing point between small and large schools was at an enrollment of 500 students at the elementary level, 700 students at the middle school level, and 1100 students at the high school level.

SOURCE: R.E. Anderson (ed.), *Computers in American Schools 1992: An Overview*, (Minneapolis, MN: University of Minnesota, 1993), table 2.3, p. 17.

Education and the National Information Infrastructure

This document was prepared by the Council for Educational Development and Research (CEDaR) for the NCC-TET Forum on education and the NII, March 20, 1995.

One of the most important issues facing Congress is to work with business, education, and the states to enable the nation's schools to better prepare students for a technological workforce and to ensure that education has a place on the National Information Infrastructure. This summary and accompanying documents provide background and important information to share with policy and decision makers who are concerned about education and the information infrastructure.

1. Why is technology and telecommunications important for education?

A review of current research and evaluation findings from studies (1993) has determined that the integration of technology and telecommunications into education...

- Improves attitude and confidence—especially for 'at-risk' students.
- Provides instructional opportunities otherwise not available.
- Increases and expands learning opportunities.
- Increases mastery of vocational and work force skills.
- Significantly improves student problem solving skills
- Improves writing skills as a result of using telecommunications.

Another review of technology and reform conducted by the Council for Educational Development and Research (1995) concludes that for technology to be effectively applied in schools...

- Schools should not support a technology design that does not empower learning.
- Schools must connect technology to powerful learning designs.
- Schools must, from the outset, plan on connecting their technologies to the NII

2. To what extent is telecommunications access a priority for education?

The NCC-TET, representing a consensus of over 85 national professional education, business, and trade associations, developed 19 requirements for

education and the National Information Infrastructure (1994), which are summarized as follows.

Access Requirements

- Ensure that all learners have affordable and equitable access to the NII.
- Ensure that the NII is accessible in a variety of learning environments.
- Develop a variety of sustained public and private partnerships and funding.
- Make public and private information resources available.

Application Requirements

- Coordinate NII-related education activities conducted by Federal departments and agencies.
- Develop and disseminate NII guidelines for education.
- Identify and disseminate effective education and training applications.
- Integrate applications of the NII into education reform.
- Develop quality education and training applications.
- Conduct research on the education applications.
- Promote professional development and technical assistance.
- Support on-going evaluation of the effectiveness and impact of the NII.

Technical Requirements

- Emphasize interactive, broadband transmission of interactive voice, video, and data.
- Provide seamless interconnection among networks.
- Guide the development of voluntary standards to promote interoperability.
- Ensure that the NII is easy to use.
- Develop "navigation" systems for locating resources on the NII.
- Support user collaboration.
- Create adequate security measures for network resources.

3. What is the current reality regarding access and use of technology in schools?

Recent surveys show that we are developing a nation of education 'haves' and 'have nots' with respect to educational access and use of the information highway.

The National Center for Education Statistics (1995) reports the following:

- Overall, 35 % of public schools have access to the Internet but only 3 % of all instructional rooms (classrooms, labs and media centers) in public schools are connected to the Internet.

- Funding is the major barrier most often cited in the acquisition or use of advanced telecommunications in public schools.
- Seventy-five percent of public schools have computers with some type of telecommunication capabilities (i.e., local area networks or wide area networks).
- Smaller schools with enrollments of less than 300 are less likely to be on the Internet than schools with larger enrollment sizes. Only 30% of small schools reported having Internet access, while 58% of schools with enrollments of 1,000 or more reported having Internet access.

An American Electronics Association (1995) survey concludes:

- The NII in schools would benefit curriculum content, increase computer skills for students, increase student motivation, provide greater opportunities for students for independent investigation and research, and increase access to information for educators.
- The NII would equalize opportunities for economically disadvantaged and disabled students.
- In order for the NII to be successfully implemented in schools, sufficient funds and equipment, adequate training of educators on the availability and use of information technologies, and inexpensive access to telecommunications is *essential*.

4. What can the federal government do to help ensure that teachers and learners can access and benefit from the information highway?

To some extent the Federal role in supporting technology in education has already been defined and recently put in statute with the Goals 2000 and the Improving Americas Schools Act (IASA). This legislation established:

- National policy and planning leadership with the U.S. Office of Educational Technology
- National educational technology R & D partnerships between business and education through the recently announced "Challenge Grants"
- Regional staff development and assistance for effective technology integration
- Grants for the local, planned application of technology to support teaching and learning

- Distance learning programs, instructional video development, and others

These programs were authorized and funded for FY 1995. However, the proposed rescissions may eliminate the opportunity for these programs to be implemented and would cut other programs with already established effectiveness.

Rather than rescinding the already minimal appropriation for educational technology, Congress should increase appropriations to the amounts authorized. Furthermore Congress should introduce and support telecommunications policies and legislation that provide incentives and special consideration for including education as one of the most critical components of the NII.

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- Advanced Telecommunications in U.S. Public Schools, K-12.* National Center for Education Statistics (1995)
- Networks for Goals 2000 Reform: Bringing the Internet to K-12 Schools,* Southwest Educational Development Laboratory (SEDL)
- Report on the Effectiveness of Technology in schools, 1990-1994,* Software Publishers Association (1994)
- Towards Linking Both Sides of the Desk.* The American Electronic Association and the Center for Telecommunications Management, University of Southern California (1995)
- Plugging In: Choosing and Using Educational Technology.* Council for Educational Development and Research (1995)
- Summary of Current Research and Evaluation Findings on Technology in Education.* Far West Laboratory (1993)

For additional information regarding the studies and other telecommunications research and policy research, contact John Cradler at Far West Laboratory for Educational Research at 415-565-3016 or send requests to jcradle@fwl.org

The Information Highway is Bypassing America's Schools

FCC Chair Reed Hundt recently stated:

there are thousands of buildings in this country with millions of people in them who have no telephones, no cable television and no reasonable prospect of broad band services. They're called schools.

One of the most important issues facing Congress and the Administration is how to work with business, education, and the states to enable the nation's schools to better prepare students for a technological workforce and ensure that education has a place on the National Information Infrastructure.

Many other leaders of this country are making similar observations about the nation's schools. The Speaker of the House, Newt Gingrich, recently stated that all students should have access to the internet and that all persons should possess a laptop computer.

What does research show about technology and telecommunications and its benefits to education?

A review of current from studies by Far West Laboratory (1993) determines that the planned integration of technology and telecommunications into education:

- Improves student academic performance and increases the preparation of students for most careers and vocations.
- Significantly improves student problem-solving skills.
- Improves attitude and confidence—especially for 'at-risk' students.
- Provides vast instructional opportunities otherwise not available.
- Reduces the cost of effective education when carefully planned and integrated with high standards.

What do current studies find about access and use of technology in U.S. schools?

Access: Recent studies by Quality Education Data, Inc., and the National Center for Education Statistics (NCES) report:

- Almost none of the nation's public schools meet the research-based optimum of five students per computer with the average district having one computer for every 12 students.

- The more ethnically diverse a school's population with the lowest wealth, the least access to personal computers.
- QED estimates that an investment of approximately \$400 million would bring the bottom 10% of districts and their students up to the national average of students per computer.
- Overall, 35% of public schools have access to the Internet but only 3% of instructional rooms in public schools are connected to the Internet.
- Smaller schools with enrollments of less than 300 are less likely to be on the Internet

Training: A study by the Office of Technology Assessment recently found:

- A majority of teachers feel inadequately trained to use technology resources.
- Districts spend far less on teacher training than on hardware and software.

Funding: Recent studies by NCES and the American Electronics Association conclude:

- Funding is the major barrier in the acquisition or use of technology in public schools.
- In order for the NII to be successfully implemented, sufficient funds and equipment, adequate training of educators and inexpensive access to telecommunications is essential.

References

- The National Information Infrastructure: Requirements for Education and Training.* National Coordinating Committee on Technology in Education and Training (1994)
- Advanced Telecommunications in U.S. Public Schools, K-12.* National Center for Education Statistics (1995)
- Report on the Effectiveness of Technology in schools, 1990-1994,* Software Publishers Association (1994)
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- Teachers and Technology: Making the Connection.* Congressional Office of Technology Assessment (1995)
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B

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Technology in the Workplace

If the automobile and airplane business had developed like the computer business, a Rolls Royce would cost \$2.75 and run for 3 million miles on one gallon of gas. And a Boeing 767 would cost just \$500 and circle the globe on five gallons of gas.

- Tom Forrester, The Information Technology Revolution

Welcome to the technology revolution. Maybe you are already a frequent flyer on the burgeoning "information superhighway," or maybe you are a hesitant observer, marveling from afar at the myriad of new technologies that have recently hit the marketplace. Whatever your perspective, hang on, the ride has just begun. The technology revolution is opening up new doors of opportunity and challenges for all of us.

Over the last several decades, Americans have witnessed the evolutionary stages of what many have referred to as a new industrial revolution. Like the previous industrial revolution of the 19th century, dramatic technological advances are driving the current changes. This time the technology drivers are computers, electronics, and telecommunications. For advances in these industries, and the combination of these technologies, have changed forever the face of American workplaces.

The year 1991 represents a milestone in this new industrial revolution: for the first time, companies spent more money on computing and telecommunications equipment than on industrial, mining, farming, and construction equipment (Stewart, 1994). By 1993, 47 percent of American workers were using computers at work, compared to only 25 percent in 1984.

Developments in the computer industry clearly illustrate technological changes that characterize the new industrial revolution. The capabilities of silicon-chip technology, the "brains" of all computer systems, are doubling almost every 2 years. In 1986, the most powerful desktop computer work station had a speed of only 2 MIPS (millions of instructions per second). One year later, in 1987, there was a 4-MIPS work station, in 1988 an 8-MIPS work station, in 1991 a 64-MIPS work station, and in 1992 a 128-MIPS machine. Projections indicate that 1000-MIPS desktop work stations are just around the corner (Tapscott and Caston, 1993).

Even as computer technology has advanced, the relative price of hardware has declined by half every 2 to 3 years since the 1950s (Brynjolfsson, 1993). An equivalent personal computer for \$3,500 in 1991 would cost \$1,500 today (Kirkpatrick, 1994). If the price of food had declined at the same rate as the price of computing power, an average 10 minutes of labor would buy a year's worth of groceries (Brynjolfsson, 1993).

Not surprisingly, many workers today have more computing power sitting on their desks than entire corporations possessed only 25 years ago. Such gains, combined with similar advances in the electronics and telecommunications industries, mean that the way work is performed

today in offices and stores, factories and warehouses, is very different than only a few years ago.

Twenty-five years ago, office communication was restricted to telephone and postage, not fax and e-mail. Conferences had to be conducted in person, not by telephone, computer, or video. Information was stored in vertical file cabinets, numbers were crunched on adding machines, copying was done by mimeograph, documents were written on typewriters, and schedules and calendars were kept by hand. Today's new technologies have changed all this forever, and experts predict that one day soon, every office desk will hold a combination laser printer, scanner, fax, and low-volume copier (Saffo, 1993).

Twenty-five years ago, machine-tool product designs were made on blueprint and hand delivered from engineering design to factory production. When a blueprint called for a 7/8-inch cut in a metal piece, a skilled craftsman physically moved the piece 7/8 of an inch to make the cut using a milling machine. Today, workers can design the piece using the graphical interface of computer-aided design software, and then program a computer numerically controlled machine to automatically produce the piece using computer-aided manufacturing. Computer-integrated manufacturing processes will make design and manufacturing increasingly seamless in the future.

Twenty-five years from now, "cyberspace" may play a more defining role for workplaces than factory or office space. As networking technologies such as the Internet and satellite communications increasingly provide unparalleled opportunities for collaborative work, workplaces are becoming less characterized by physical features than interpersonal connections. Virtual companies, short-lived business ventures made possible by technological links between highly skilled workers, are not futuristic visions but 20th-century realities (Davidow and Malone, 1992).

Today's new technologies present a wealth of opportunities for both workers and organizations, but a growing body of research and anecdotal evidence suggests that some organizations are achieving a higher rate of success from new technologies than others. Technology success, it appears, may depend less on MIPS and memory and other technology features, than it does on effective technology utilization.

For many American workers, the changes engendered by the technology revolution have created new worlds of opportunity.

The forces unleashed by technology must be mastered, not merely buffered. As increasingly capable machines join ever more Americans at the workplace--join them both as co-workers and as competitors--the payoff to education and training has soared, and the penalty for lacking skills has stiffened

- Robert B. Reich, Secretary of Labor

For some workers, new technology has enlarged their job roles.

Take for example, Herman Willoughby, a truck driver with Ryder System, Inc. As a contract deliverer for Xerox Corporation, Willoughby's responsibilities also include installing copiers, training new users, and providing customer service (Grossman, 1993). Willoughby is becoming the norm, rather than the exception, as the technology that truck drivers must be familiar with goes well beyond carburetors and crank shafts. Drivers from M.S. Carriers fax bills directly from their truck cabs; drivers for U.S. Express, Inc., update deliveries using laptop computers; and drivers from Roadway Services, UPS, and Federal Express use laser scanners to transmit bar-code information back to a central computer (Grossman, 1993). For all these employees, driving a service truck is only a very small part of their daily tasks.

For many workers, new technology is creating new job opportunities.

Today's new technologies are spurring a host of new job opportunities in industries that barely even existed only 25 years ago. The growth of computer specialist jobs illustrates the new opportunities created by emerging technologies. Between 1983 and 1993, the number of computer scientists and analysts employed in the United States grew by 179 percent, and the number of computer programmers grew by 30 percent. Not surprisingly, workers with advanced technical skills face a bright job future. The Bureau of Labor Statistics predicts that the number of jobs for technicians will grow 37 percent between 1990 and 2005.

For many workers, new technology is increasing their wages.

Auto mechanics skilled in computer diagnostics today can expect to earn salaries ranging from \$30,000 to \$75,000 a year. Based on Current Population Survey results between 1984 and 1989, workers who use a computer on the job earn 10 to 15 percent higher pay (Krueger, 1993). Research by the Center for Economic Studies of the U.S. Census Bureau indicates that in manufacturing settings, wages increase with the adoption of technology, regardless of plant size. Data from 10,000 U.S. manufacturing plants indicated that average hourly wages paid by plants adopting advanced technologies ranged from \$8.63 at plants using no technologies, to \$11.84 at plants using six or more advanced technologies. A 1987 survey by the Southern Technology Council supports the positive effects of technology on wages. Of 104 Southern manufacturing plants surveyed, 65 percent indicated that they had increased wages with automation, while 33 percent indicated that wages held at the same level with the introduction of factory automation (Rosenfeld, 1992).

For many workers, new technology is creating flexible working arrangements.

More than 60 percent of the 32 million American households with a PC have an office where one or more family members use their computers for take-home work or other income-generating activities (BIS Strategic Decisions, as cited in Kirkpatrick, 1994). Computers and other new technologies make telecommuting and other types of flexible work arrangements increasingly feasible. When workers have the choice to work at or close to home, and they have equal access to the rights and opportunities afforded to other employees, telecommuting

can be a very positive experience. It can improve work and family relationships by providing employees with the dual benefits of working full time while remaining in close contact with their families. Companies also report positive benefits from telecommuting. Storage Tek of Boulder, CO, reported a 144 percent increase in productivity among its telecommuting employees, while Pacific Bell found that telecommuting produced \$400,000 in office-space savings (Weiss, 1994).

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DRAFT

BUSINESS EQUIPMENT AND INFORMATION-PROCESSING EQUIPMENT IN THE CURRENT ECONOMIC EXPANSION

The current expansion has been led by business investment in equipment, and much of this strength has been concentrated in computers and other information processing equipment.

- *Equipment investment as a share of GDP is at a high level.*

In nominal terms, investment in equipment accounted for 8.2 percent of total GDP in the first half of this year. Except for one year, 1979, that share was higher than for any year in the postwar period.

Real (inflation-adjusted) GDP is currently measured by a fixed-weighted series, with the weights used to combine components of GDP based on relative prices of the year 1987. By that measure, investment in equipment in the first half of this year was 10.8 percent of real GDP, higher by far than in any year in the postwar period. Because the 1987 weights are out of date, this measure overstates the equipment share.

- *Compared to past recoveries, equipment investment has been strong.*

Using conventional measures of real investment, growth of equipment investment has far outpaced the average of the four prior expansions, excluding the short-lived 1980 recovery. (chart 1, left-hand panel)

The 1987-dollar measure probably exaggerates growth of outlays for equipment in the current expansion, as the 1987 weights have become increasingly out of date. Late this year, the Commerce Department will substitute a chain-weighted measure as the featured measure of real output in which weights shift over time and so do not become out of date. By this chain-weighted measure, growth of investment in equipment during the current expansion has also outpaced the average of prior expansions, even though growth of total real GDP during this expansion has lagged well behind the average for past expansions. (chart 1, right-hand panel)

- *Equipment investment has made a hefty contribution to economic growth.*

The overall expansion and growth of business investment in equipment did not begin to pick up speed until 1992. From the first quarter of 1992 through the second quarter of this year, real GDP measured in 1987 dollar terms, grew at an annual rate of 3.4 percent. Of that overall real growth, business investment in equipment accounted

for more than two-fifths, or 1.5 percentage point. The chain-weighted real output measures are not additive, but some rough calculations indicate that investment in equipment was the driving force for overall growth as measured by the chain-weighted series as well. [Update to beginning of 1993.]

- ***Computers and communication equipment have been especially robust.***

Among components of real equipment investment, the strongest performers have been computers and communications equipment, which have surged upward in recent years (chart 2). From the beginning of 1993 through the second quarter of this year, real investment in computers has jumped by an annual rate of 36 percent, rising by 60 percent in 1993 alone. Over the same span, outlays for communications equipment increased by an annual rate of 24 percent.

- ***Computers and communication equipment accounted for much of the growth in equipment spending.***

From the beginning of 1993 to the second quarter of this year, business purchases of computers represented nearly one-half of the growth in real equipment spending and communications equipment nearly one-fifth. (chart 3)

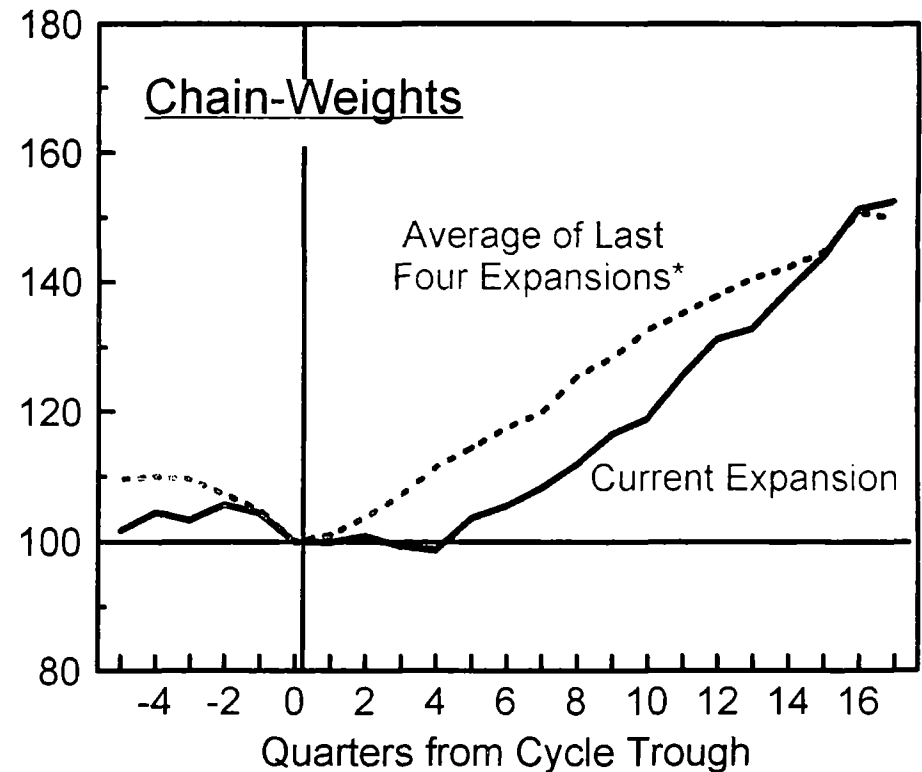
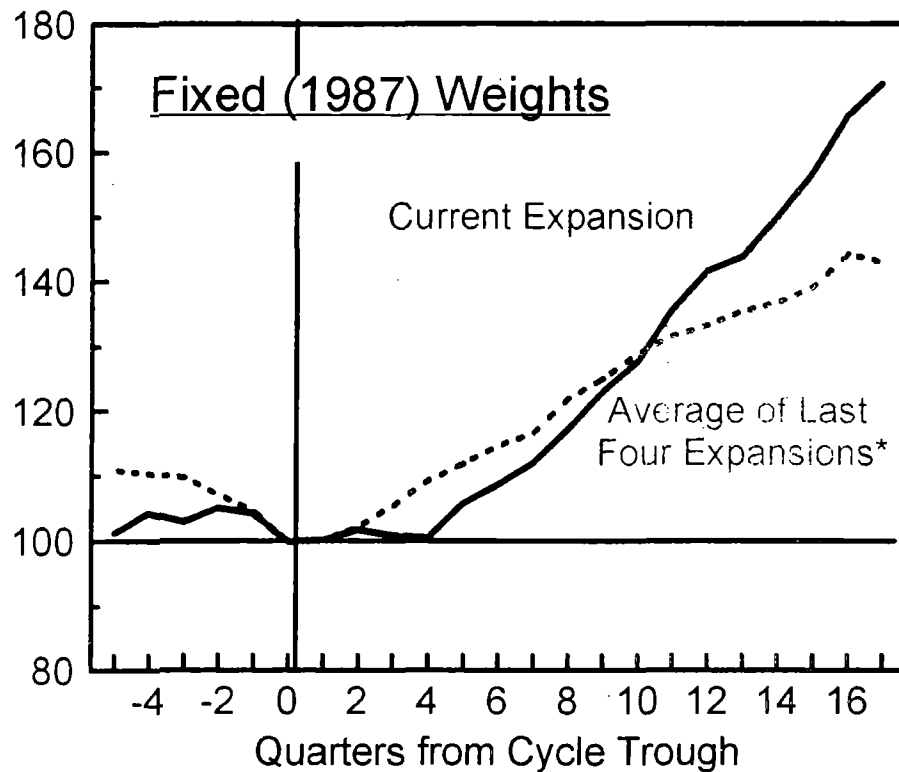
- ***Rapid increases in information-technology investment should boost productivity in many workplaces, although the impact may not be dramatic for overall productivity growth.***

- Information technology is just one of many factors affecting productivity growth in the economy as a whole.
- Benefits of the new technologies may show up with a lag as workers move up the learning curve.
- Despite rapid growth in recent years, the outstanding capital stock of information processing equipment is still dwarfed by stocks of more conventional capital.
- Rapid investment in information processing equipment is not a completely new phenomenon. Growth was also exceptionally rapid during the expansions of the late 1970's and the early 1980's, albeit from smaller bases.

Chart 1

REAL EQUIPMENT INVESTMENT HAS BEEN STRONG IN THIS EXPANSION

(Index, Trough Quarter = 100)

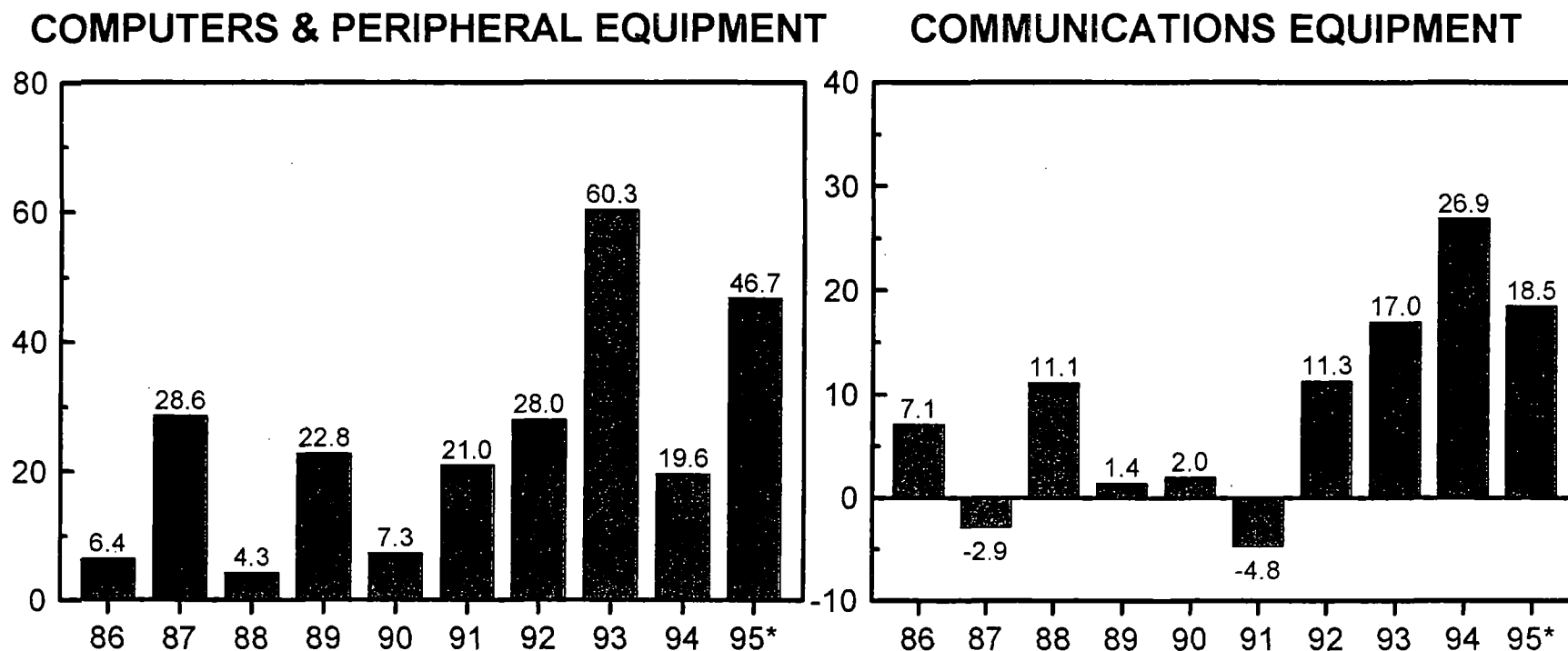


*Average of expansions since 1960 except 1980.

Chart 2

REAL SPENDING FOR HIGH-TECHNOLOGY EQUIPMENT SURGED SINCE LATE 1992

(Percent Change, Fourth Quarter to Fourth Quarter)

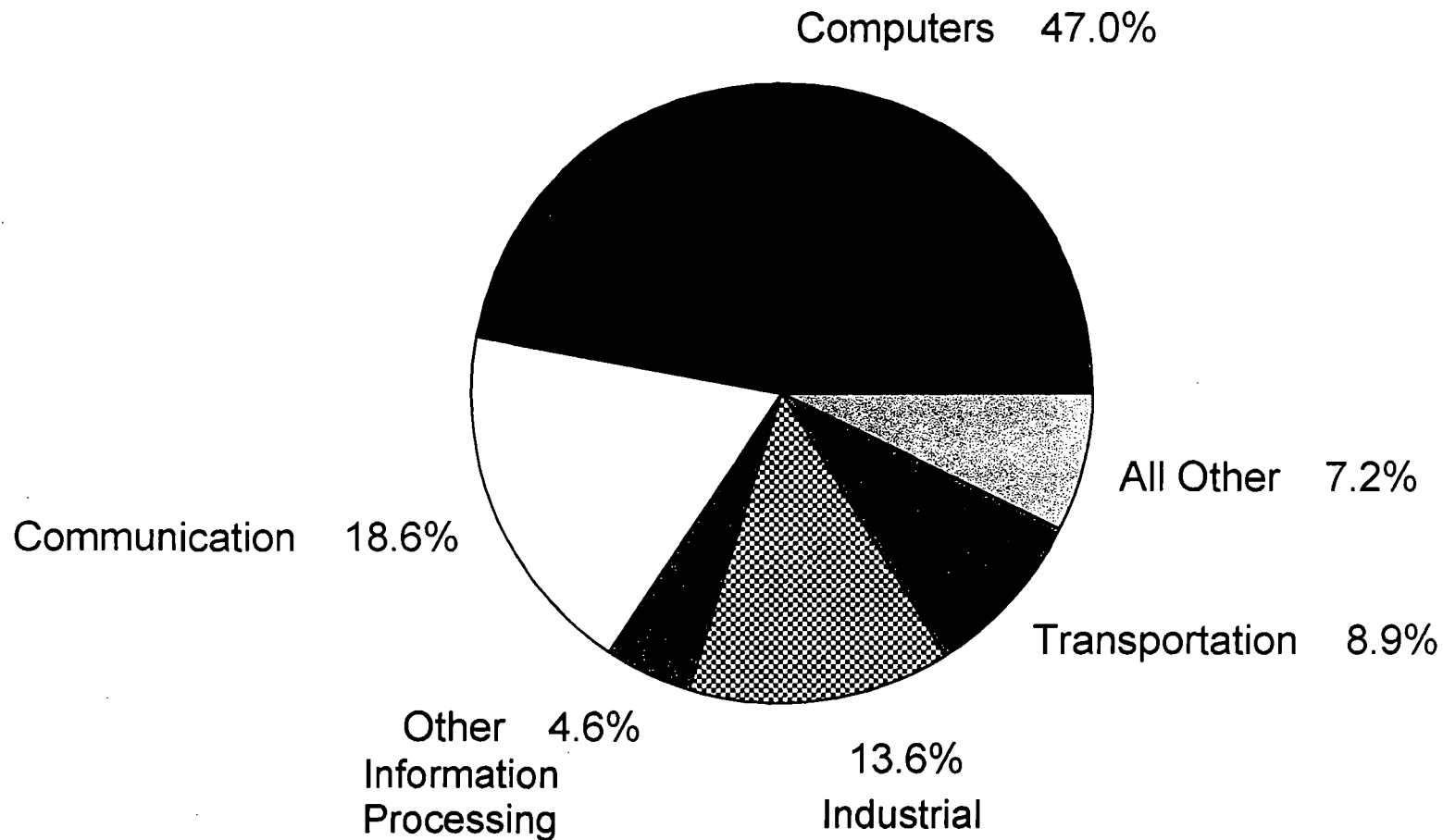


*First half of year at an annual rate
Note: Based on 1987-dollar figures.

Chart 3

**HIGH-TECHNOLOGY GOODS LEAD GROWTH
IN REAL EQUIPMENT SPENDING**

(Composition of Growth, 1993-QI to 1995-QII)





Learning and Change

OSTP

Investments

- Americans will spend \$506 billion on education in the 1994-1995 school year
- That is an average of \$5,900 for each child in public education
- Education is the biggest information-based industry in the U.S.
 - Ten times bigger than long distance revenues
 - Ten times the annual receipts of motion picture industry
- In 1993-1994, schools spent only \$40-\$45 per student (across all students) on information technology



Learning Technology

Cost Effectiveness Advantage



- Cost per unit of processing power is down 10,000 times since 1980 -- while the cost of a unit of instruction has doubled
- At \$250, Nintendo video game players have more computing power than a \$14M super-computer did in 1983
- Since 1980, education's labor productivity has declined by half -- while typical labor productivity e.g., telephone industry, has doubled

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Administration Accomplishments in Education and Technology

"I believe in my heart that by the turn of the century, and in many, many places well before then, it will be possible for children in every classroom to plug into digital libraries, to plug into the Library of Congress, to explore a whole new universe of knowledge at his or her own pace driven by his or her own curiosity. We're determined to make these advantages for American students available all over our country."

Vice President Al Gore, April 8, 1994

The Clinton Administration has made an unprecedented commitment to bringing technology into the classroom. As a central element of the President's lifelong learning agenda, the Administration believes that technology can help expand opportunities for American children to improve their skills, maximize their potential, and ready them for the 21st century workforce.

Goals 2000. When President Clinton signed Goals 2000, he made educational technology a priority by requiring states to develop technology plans as part of their educational reform plans. So far, each of the 48 states participating in the program have developed a technology plan. These plans address the role of technology and standards, assessment, teacher preparation, professional development, parent involvement and system management.

Technology Learning Challenge. The Clinton Administration has initiated a "Technology Learning Challenge," to challenge communities to form partnerships of local school systems, students, colleges, universities and private businesses to develop creative new ways to use technology for learning. Each grant focuses on integrating innovative learning technologies into curriculum and leverages federal dollars to establish local consortia of communities committed to school reform and technology integration. The Administration expects to award 19 grants for FY 95.

Connecting classrooms. Connecting schools is so important that the President and Vice President have made a connecting every classroom, library, hospital and hospital clinic to the National Information Infrastructure by the year 2000 a national priority. The Clinton Administration is working actively with Congress, the states, local governments, private industry, public interest groups and the public groups themselves to achieve this goal.

Grants to schools through TIAP. In 1994, the Clinton Administration created the TIAP program which makes grants to public institutions to speed up the flow of information through the application of advanced communications technology. Through federal support and investment, TIAP has accelerated the pace of connecting public institutions and has stimulated private sector investment. This program has enabled the federal government to leverage \$24.4 million in federal funds to provide a total of \$64.4 million in cutting-edge demonstration projects for public institutions. The program is so successful that there are 200 times more applications than there are grants.

AskERIC Program. In order to reach out to the teachers across the country, the Clinton Administration created the AskERIC service, which stands for the Educational Resources Information Clearing House Service. Educators are able to send questions through e-mail to askERIC, and receive a response within 48 hours. Educators can ask about lesson plans, educational techniques information on GOALS 2000 and so on. Every week 200 new questions come in, and the information that ERIC has made available on-line, such as sample lesson plans and answers to frequently asked questions is accessed more than 15,000 times a week.

Star Schools Program. The Star School's distance learning projects have helped to improve instruction in mathematics, science and foreign languages, literacy skills and vocational education. These distance learning projects serve underserved populations through partnerships that develop, construct, acquire, maintain and operate telecommunications audio and visual facilities and equipment, develop and acquire educational and instructional programming, and obtain technical assistance for the use of such facilities and instructional programming. More than one million students and their teachers in 50 states and territories participate in this program.

Assessing School Connectivity. The first national survey of schools access to broad band telecommunications and the Internet was completed in the Fall of 1994. A second national survey will be conducted in October, 1995 and will document the progress being made to link schools and classrooms.

Improving rural education and health care. The Administration's commitment to ensuring the wide dissemination of information has worked through the Rural Utilities Service Distance Learning and Medical Link (DLML) Grant Program, to improving education and health care for rural residents throughout the Nation. The program has already given hundreds of students attending rural schools in 28 states access to previously unavailable courses.

Teaching computer science skills. The Clinton Administration has worked through the Department of Energy's Computer Science Education Project (CSEP) to develop educational materials, including experimental syllabus for teaching interdisciplinary computational science. This information is available

on the Internet and is also disseminated through training workshops for educators.

Regional Technology Consortia Grant Program. The Clinton Administration initiated the Regional Technology Consortia Grant Program authorizing \$10 million in FY 95. Six consortia of technical assistance providers will be funded to help state, local educational agencies, teachers, administrators and others to integrate advanced technologies into K-12 grade classrooms, library media centers and other educational settings (including adult literacy centers). Consortia will establish and conduct regional activities that address professional development, technical assistance, and information resource dissemination to promote the effective use of technology in education.

National Plan for Technology in Education. Education Secretary Riley will submit a National Plan for Technology in Education to Congress in October. The report is the effort of hundreds of educators, citizens and industry leaders in seven regional forums, two national conferences and a on-line discussion over the Internet.

AmeriCorps Aids Technology Use in Classrooms. The Clinton Administration created AmeriCorps to enable young people to earn money for education by serving their communities through teaching, caring for the sick and making the streets safer. Already 20,000 Americans are serving in AmeriCorps. Currently AmeriCorps members are involved in several programs that promote the use of computer technology in schools. For example, the Fostering Reform Through Service and Technology project (Project FIRST), an AmeriCorps grantee, focuses on improving students performance through the use of technology.

Rural telecommunications infrastructure. The Rural Utilities Service (RUS) administers grants and loan programs to assist rural and remote communities with the development of their communications infrastructure, including schools. Additionally, fifty-two K-12 school systems will be provided two-way interactive video services.

Department of Defense Technology. The Clinton Administration has made major efforts to transfer the technological advancements made at the Department of Defense to the rest of the federal government, to schools and to the private sector. The Administration realizes the value of resources developed for training the world's largest workforce in technology, such as distance learning, computer simulation and training at the Department of Defense.

Cover Sheet Only
Plan is in draft
@ DoEd and OSTP

Connecting Classrooms, Computers, & Communities:

Teaching & Learning in the Digital Age

An Action Plan for Education Technology

U.S. Department of Education
September 1995

NATIONAL SCIENCE & TECHNOLOGY COUNCIL



**Committee on
Education & Training**

STRATEGIC PLANNING DOCUMENT

1995

**NATIONAL SCIENCE & TECHNOLOGY COUNCIL
1995 STRATEGIC PLANNING DOCUMENTS**

Fundamental Science

International Science, Engineering, & Technology

Health, Safety, & Food

Environment & Natural Resources

Education & Training

Information & Communication

Civilian Industrial Technology

Transportation R&D

National Security

THE WHITE HOUSE
WASHINGTON

March 10, 1995

Dear Colleague:

I am pleased to introduce the National Science and Technology Council (NSTC) 1995 Strategic Planning Documents. This document is one of nine Plans that reflect a concerted effort by each of the nine NSTC Committees, over the course of their first year, to articulate the goals, objectives, milestones, and metrics for the Federal R&D system. The Strategic Planning Documents provide a new and unique vehicle for discussing the appropriate focus of federal research efforts as well as planning for future endeavors. The public release of these documents reflects our continuing commitment to improve the Federal S&T enterprise.

It should be noted, however, that these Plans are not an end unto themselves, but rather a means to achieve national goals. Each Plan differs in approach and detail, just as each Committee has a different history, composition, and perspective; however, each Plan is central to the NSTC activities and all will be refined over time.

Since strategic planning is a continuing, evolving task, we know that we will periodically reassess and revise these documents. They must be viewed as snapshots of a dynamic, evolving process.

I hope that these materials, both individually and collectively, will form a useful foundation for a continuing dialogue within -- and beyond -- the Federal S&T enterprise.

Sincerely,



John H. Gibbons
Assistant to the President
for
Science and Technology



UNITED STATES DEPARTMENT OF EDUCATION

January 24, 1995

THE DEPUTY SECRETARY

Honorable John H. Gibbons
Assistant to the President
for Science and Technology
The White House
Washington, DC 20500

Dear Dr. Gibbons:

It is my pleasure to transmit to you the Committee on Education and Training's Strategic Implementation Plan for Fiscal Years 1995 to 1999. This Plan carries out the Committee's charter for interagency coordination of research and development in education and training; promoting the use of technology to enhance lifelong learning; and promoting excellence in science, mathematics, and engineering education at all levels.

The Plan incorporates the efforts of our two subcommittees—Excellence in Science, Mathematics, and Engineering Education and Research and Development in Education and Training—as well as the Strategic Plan Working Group and the Budget Working Group. The National Education Goals as delineated in the Goals 2000: Educate America Act, the National Science Goals from Science in the National Interest, and the Administration's National Information Infrastructure Agenda for Action provide guiding principles for the Committee's efforts.

I believe that the Federal Government can help all Americans—at home, at school, and at the workplace—make the transition to the Information Age in four ways: by focusing attention on access to technology; by setting a common vision for the future; by providing information, research, and assistance; and by promoting partnerships that will link them with high-tech private sector agencies and organizations.

Special thanks are due to Luther Williams, Co-Vice Chair and Chair of the Excellence in Science, Mathematics, and Engineering Education Subcommittee; Sharon Robinson and Louis Finch, Co-Chairs of the Research and Development Subcommittee; Thomas Glynn, Co-Vice Chair; Frank Owens and K. Jane Coulter, Co-Chairs of the Strategic Plan Working Group; Stephen Leeds, Chair of the Budget Working Group; Laura Johns, Executive Secretary; and Linda Roberts, Special Adviser on Technology. We also appreciate and recognize the participation and support of all of the represented Federal agencies.

Sincerely yours,

Madeleine M. Kunin

National Science and Technology Council

Committee on Education and Training

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John Gibbons, Assistant to the President for Science and Technology

Angela Phillips Diaz, Executive Secretary

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Alden Johansen, U.S. Department of Transportation

Assistant to the Chair

Cecilia Fletcher, U.S. Department of Commerce

National Science and Technology Council

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EXECUTIVE SUMMARY

The most important measure of success for the National Science and Technology Council (NSTC) will be its ability to make improvements in the lives of Americans. Few enterprises touch the lives of as many people as do those concerned with education and training. High-quality education and training benefit the individual whose knowledge and skills are upgraded, the business seeking a competitive edge, and the Nation in achieving overall productivity and increasing competitiveness in the global marketplace. It is essential that all Americans have access to the education and training they need and that the teaching and learning enterprise itself becomes a high-performance activity.

In recognition of the importance of education and training -- and of the necessity of bringing to bear the talent and coordinated resources of all the Federal agencies to create productive and successful education and training enterprises that support the lifelong learning needs of all Americans -- the NSTC created the Committee on Education and Training (CET).

COMMITTEE ON EDUCATION AND TRAINING (CET)

The CET was established to advise and assist the NSTC in coordinating and increasing the effectiveness and productivity of Federal efforts in education and training. Its purpose is to:

- Coordinate Federal research and development in education and training;
- Promote the use of technology to enhance lifelong learning; and
- Promote excellence in science, mathematics, and engineering education at all levels.

CET VISION

To coordinate and focus Federal efforts in education and training so that they become a powerful force in helping Americans meet the challenges of the 21st century.

CET PLAN

The CET has developed its Strategic/Implementation Plan to guide Federal efforts in education and training in accord with principles established by the National Education Goals as delineated in the "Goals 2000: Educate America Act," the National Science Goals as expressed in "Science in the National Interest," and the National Information Infrastructure Agenda for Action. The Plan provides a framework for making cross-agency policy, programmatic, and budgetary decisions, and for assessing the impact of these decisions. This framework centers on the vision and goals of the two subcommittees the CET has formed to meet its responsibilities. The two subcommittees are: The newly formed Subcommittee on Research and Development in Education and Training, and the Subcommittee on Excellence in Science, Mathematics and Engineering Education, continuing work started in 1990. Their visions, goals, objectives, and activities are outlined in this Plan.

RESEARCH AND DEVELOPMENT IN EDUCATION AND TRAINING

The vision for research and development in education and training is:

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs.

GOALS

The goals for research and development are to:

1. Provide National leadership in guiding education and training in its evolution toward the 21st century;

2. Develop a research and development agenda for achieving the National Education Goals by the end of the decade;
3. Promote increased resources for research and development in education and training; and
4. Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques.

OBJECTIVES

- Identifying and exploring areas of research and development that significantly improve learning;
- Coordinating the design and implementation of evaluations to assess the effectiveness of new education and training technologies and techniques;
- Identifying, demonstrating, and implementing exemplary models of cost-effective education and training;
- Making information on learning, research, and existing tools and techniques widely available; and
- Enhancing collaboration through interagency, intergovernmental, and industry partnerships that increase learning productivity for all Americans.

ACTIVITIES

Activities of research and development are organized around four focus areas:

- Demonstrating innovative technology and networking applications;
- Developing new models for evaluating learning and learning productivity;
- Developing high-quality, affordable learning tools and environments; and
- Promoting research on learning and cognitive processes.

EXCELLENCE IN SCIENCE, MATHEMATICS, AND ENGINEERING EDUCATION

The vision for excellence in science, mathematics, and engineering education is:

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

GOALS

The goals for excellence in science, mathematics, and engineering education are:

1. By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters, including science and mathematics;
2. 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;
3. By the year 2000, United States students will be the first in the world in mathematics and science achievement;

OBJECTIVES AND ACTIVITIES

4. By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
5. Produce the finest scientists and engineers for the 21st century.

Objectives and activities for excellence in science, mathematics, and engineering education are organized around the following eight focus areas:

- Encouraging science as a core requirement for grades K-16;
- Promoting systemic reform of K-12 standards-based science, mathematics, technology, and engineering education;
- Promoting a competent and contemporary undergraduate science, mathematics and engineering enterprise for a diverse student population;
- Promoting graduate and postdoctoral science and engineering education/training commensurate with human resource requirements;
- Promoting a competent, contemporary, and diverse scientific and technical work force;
- Focusing interagency programming on science and mathematics supported by technological education to ensure work force competency in a rapidly changing economy;
- Promoting Federal efforts to enhance public understanding of science and apply technology to lifelong learning; and
- Promoting efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.

BENEFITS

The Federal Government as both a customer and partner of the Nation's work force has a direct stake in the quality of education and training in America. In assuming its leadership role, the Federal Government is highlighting national challenges, mobilizing national support, and building partnerships involving Federal, State, and local governments, business and industry, professional associations and community-based organizations that will meet the challenges of the next century.

This Plan addresses the entire spectrum of education and training -- from preschool activities through higher education, workplace training, and lifelong learning. Its infusion of new education and training capabilities that are now available from advances in learning technologies will ensure an acceleration toward fundamental reform. It will promote private sector interest in increasing the quality and lowering the cost of learning materials. It will provide nationally visible evidence of the value and practicality of learning technology and the essentiality of paradigm shifts needed to ensure learning productivity.

INTRODUCTION

Over a decade ago, America was called "A Nation at Risk"^{*} because American children were poorly educated compared to children in many other countries. This national report declared that America was failing its children and jeopardizing its future.

The report reflected and intensified rising concern at every level of Government, within the business and academic communities, and among parents and local leaders. In the 1980's, the Nation and the Federal Government began to respond to the challenge of changing the course of education. The culmination of that effort was the "Goals 2000: Educate America Act"^{**} -- legislation passed by Congress in 1994 that outlined daring steps to bring about fundamental and permanent change.

In 1993, the President's National Science and Technology Council (NSTC) was created to renew and reshape the science and technology components of the Federal enterprise. Goals, objectives, and priorities were developed collaboratively in an interagency forum with private sector input. The result was a set of policy principles and a set of Federal goals which represent a common framework to guide the Administration's science and technology investments.

Achieving these goals will require an ongoing supply of imaginative scientists and engineers, an educated and trained work force and wide public understanding. Thus NSTC has a major stake in the effort to revitalize education and training in America as well as the assignment to mobilize the talent and resources of most, if not all, of the Federal agencies as part of this effort. To this end, it created the Committee on Education and Training (CET), with broader scope and responsibility than the previous committee which addressed education at the Federal level -- the Committee on Education and Human Resources (CEHR) -- and with a larger roster of member agencies and departments.

COMMITTEE ON EDUCATION AND TRAINING (CET)

Comprised of many Federal member agencies and departments, the CET utilizes the interagency process to coordinate Federal education and training programs and education research and development efforts using the common set of Federal policy principles, goals, priorities, and evaluation criteria.

^{*} National Commission on Excellence in Education. *A Nation At Risk: The Imperative for Educational Reform*. Washington, D.C.: U.S. Department of Education, 1983.

^{**} Public Law 103-227. (March 31, 1994)

CET CHARTER

The CET advises and assists the NSTC to increase the overall effectiveness and productivity of Federal efforts in education and training through attention to research and development efforts and related policies that cut across agency boundaries. The CET provides a formal mechanism for interagency coordination of programs that:

- 1) Support research and development in education and training;
- 2) Promote the use of technology to enhance lifelong learning; and
- 3) Promote excellence in science, mathematics, and engineering education at all levels.

The CET is chartered to:

- Promote collaboration and partnerships among CET agencies, State and local governments, and with private entities;
- Develop a balanced and comprehensive research and development program;
- Establish a structure to improve the way the Federal Government plans and coordinates education research and development; and
- Develop education budget crosscuts across agencies as well as priorities for education and training policy for all relevant Federal agencies.

Two subcommittees were formed to meet these responsibilities: 1) The Subcommittee on Research and Development in Education and Training, formed in 1994; and 2) the Subcommittee on Excellence in Science, Mathematics, and Engineering Education, with its roots going back to efforts started in 1990.

CET VISION

To coordinate and focus Federal efforts in education and training so that they become a powerful force in helping Americans meet the challenges of the 21st century by:

- *Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs; and*

- *Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.*

CET STRATEGY

The CET has developed this Strategic/Implementation Plan to guide the Federal effort in research and development in education and training, and in promoting excellence in science, mathematics, engineering, and technology education. By following this plan, Federal agencies can work as an integrated, coordinated team focused on a multiyear approach for managing and guiding efforts in accordance with the policy principles and goals previously set forth. The CET Plan provides a framework within which policy, programmatic, and budgetary decisions can be made and assessed.

The CET strategy is intended to address the entire education continuum -- elementary and secondary education, undergraduate and graduate education, public understanding of science, work force training, and lifelong learning. It supports the "Goals 2000: Educate America Act" legislation, "Science in the National Interest," and the NSTC emphasis on research and development in education technologies and learning productivity.

This Plan requires maintaining the integrity and strength of each program. They are interdependent, and each plays a critical role in meeting the relevant national education goals as well as working to ensure America's future economic and technological competitiveness by making today's education and training relevant to tomorrow's workplace.

**Only the educated are free.
Epictetus**

STRATEGIC/IMPLEMENTATION PLAN FY 1995-1999

RESEARCH AND DEVELOPMENT IN EDUCATION AND TRAINING

STRATEGY

The Nation is experiencing a scientific and technological revolution of unprecedented proportions. Its benefits depend upon our capacity to meet the education and training challenges it presents.

OPPORTUNITIES

Fortunately, this revolution also provides the means to meet these challenges. New research in the areas of learning and teaching point to ways to improve curriculum and pedagogy.

THE VISION

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs.

This vision sees new environments for lifelong learning that use technology to support new models of learning and teaching for learners of all ages and conditions. These learning environments extend beyond the confines of classroom walls to include the home, the community (e.g., museums, libraries, community centers), and the workplace. They reach beyond the traditional school-age population. They will aggressively support learning of complex content and complex approaches to problem solving.

As a Nation, we are devoting limited resources to achieve this learning productivity vision. Funding for research and development in education and training comprises only 0.025% of education and training activity. While workplaces and workers are taking advantage of our latest technological advances, education and training lag farther and farther behind. We believe that a significant increase in our current level of Federal investment in education and training research and development is required.

GOALS

1. Provide National leadership in guiding education and training in its evolution toward the 21st century;
2. Develop a research and development agenda for achieving the National Education Goals by the end of the decade;

3. Promote increased resources for research and development in education and training; and
4. Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques.

OBJECTIVES

- Identify and explore areas of research and development that significantly improve learning beyond our current capabilities;
- Coordinate the design and implementation of evaluations to assess the effectiveness of new education and training technologies and techniques in a variety of settings;
- Identify, demonstrate, and implement exemplary models of cost-effective education and training;
- Make information on learning research and existing tools and techniques widely available; and
- Enhance collaboration through interagency, intergovernmental, and industry partnerships that increase learning productivity for all Americans.

FOCUS AREAS IN PRIORITY ORDER

DEMONSTRATIONS OF INNOVATIVE TECHNOLOGY AND NETWORKING APPLICATIONS

Demonstrations of how hardware, software, and the National Information Infrastructure can be used for advanced instructional systems.

NEW MODELS FOR EVALUATING LEARNING AND LEARNING PRODUCTIVITY

Research and technology that lead to a richer set of assessment tools to measure learning productivity.

DEVELOPMENT OF HIGH-QUALITY, AFFORDABLE LEARNING TOOLS AND ENVIRONMENTS

Development of tools that make use of technology to increase the productivity of learning in all fields, by all people. These tools may be used in a variety of settings, including schools, workplaces, and homes.

RESEARCH ON LEARNING AND COGNITIVE PROCESSES

Research that can improve understanding of the learning process and how technology can best support the learning process.

INTERNATIONAL DIMENSION

It is our intention to initiate, maintain, and increase contacts with the international community to coordinate distance learning and technology-based instructional activities leading to technical standards for increasing the availability and portability of education and training materials.

IMPLEMENTATION

ONGOING EFFORTS

The Research and Development Subcommittee has coordinated a budget cross-cut across Federal agencies to determine the relative distribution of resources by Focus Area. The results of the budget assessment indicate that while the Federal Government has made substantial investments in learning research and tool development, programs to transition the products of research and development to the public and private sector have been underfunded. As a result, the CET has placed a high priority on facilitating national demonstrations and evaluations of learning technologies and the development of better evaluative tools and techniques. Research on learning and cognition and development of new learning tools and environments will be focused on the support of technology demonstrations and other technology transfer.

NEW EFFORTS

Most of the work in the area of research and development in education and training falls within the scope of new efforts. The NSTC has dramatically expanded the scope and emphasis of this area, and as a result, the majority of work being done is in programmatic planning, definition and development.

Specific milestones and performance measures will depend upon the completion of the planning phases for each initiative. All planning is aimed at implementing operational phases by the end of the First Quarter of FY 1998.

The Research and Development Subcommittee will work closely with industry to improve communication and cooperation and to rapidly commercialize research and development products wherever possible. In general, the Federal agencies will focus on areas which are high risk or require complex experimental design and independent evaluation. The National Coordinating Council for Technology in Education and Training will serve as a key industry interface for the CET.

The Research and Development Subcommittee will also coordinate plans and initiatives with State and local communities. These projects will be designed with the input and participation of teachers, parents, workers, and business and community leaders in order to ensure that their needs and concerns are addressed.

The CET has created an interagency technology initiative to ensure that the goals and objectives of the Plan are fully coordinated across Federal agencies and to serve as a focal point for communication with State and local governments and industry. The initiative will:

- Draw upon the knowledge and expertise within each of the agencies as well as the public and private sectors;
- Coordinate plans, programs, and budgets for collaborative efforts; and
- Widely disseminate information on education and training related to research, development, and demonstrations.

FOCUS AREAS SUB ELEMENTS

DEMONSTRATIONS OF INNOVATIVE TECHNOLOGY AND NETWORKING APPLICATIONS

1.1 Education and training for disadvantaged youth and youth with disabilities

Demonstrations of new approaches for young people with disabilities, academic or economic disadvantages, or limited English language proficiency to improve their access to education and training and the effectiveness of the education and training they receive.

1.2 Promotion of effective school-to-work transitions

Demonstrations of new approaches that ease the transition of students from school to the workplace and that decrease the time it takes for them to fully participate as effective members of the work force.

1.3 Models and road maps for technology use to ensure that learners and instructors are capable of using educational technology

Demonstrations of (a) new approaches that increase the efficiency and effectiveness with which technology is transferred to instructional institutions, (b) procedures that help prepare learners and instructors use instructional technology effectively, or (c) changes within institutions that help ensure effective use of instructional technology.

1.4 Professional development of teachers and instructors

Demonstrations of programs of instruction that increase the ability of teachers and instructors to prepare and provide effective instruction.

1.5 Manufacturing education and training

Demonstrations of new approaches that increase the efficiency and effectiveness with which students can be prepared to enter the manufacturing work force and the efficiency and effectiveness with which they can maintain their skills or acquire new skills to continue participating in the manufacturing sector.

1.6 Linkages among all levels of education, the private sector, and local communities

Demonstrations of new approaches that integrate all public and private instructional resources available within local communities, increase their accessibility to all members of the community, focus them on providing local solutions to local problems, and increase the viability of the communities.

1.7 Systemic education reform, institutional change, and overcoming barriers to the use of technologies for advanced modes of education and training

Demonstrations of new approaches that enhance the cost-effectiveness of instructional institutions, help integrate and encourage effective use of technology in their activities, and help them devise new organizational forms that enhance their productivity.

NEW MODELS FOR EVALUATING LEARNING AND LEARNING PRODUCTIVITY

2.1 Learning productivity

Research, development, and assessment of models and measures that establish relationships between the effective accomplishment of instructional objectives and useful descriptions and measures of the productivity of schools and other instructional programs and institutions. This category relates the effectiveness of instruction to definitions of the productivity of schools and training institutions.

2.2 Impact of learning productivity on institutional viability

Research, development, and assessment to determine how improvements in the effectiveness of education, such as school restructuring and the effectiveness of training, affect the viability, productivity, or well-being of the institutions (e.g., organizations, businesses, communities, countries) that provide them. This category includes school and organizational structuring and restructuring.

2.3 New assessment tools

Research, development, and assessment to design, implement, and use technology-based capabilities, such as those found in computer-based instruction, interactive videodisk instruction, and instructional simulation, to assess learning progress, simultaneous learner assessment and instruction, instruction based on simulation, learner self-assessment tools, learning tailored to individual needs, and standards-based learning.

DEVELOPMENT OF HIGH-QUALITY, AFFORDABLE LEARNING TOOLS AND ENVIRONMENTS

3.1 Materials development

Research, development, and assessment to determine how best to design and implement tools for producing or "authoring" technology-based instructional materials, reusing and modifying existing technology-based materials when they conform with national standards, developing "just-in-time, just-enough" instruction, developing instruction embedded in operational equipment, developing interactive multimedia instruction, and constructing simulated environments for instruction. This element also includes development of technical standards for the production of all technology-based materials.

3.2 Personalized teaching and learning capabilities

Research, development, and assessment of technology-based capabilities that learners need to manage their instructional progress in school and lifelong learning settings. These capabilities range from technology-based learner's advisors through instructional management capabilities, to intelligent technology-based tutors.

3.3 Collaborative problem solving

Research, development, and assessment to design and implement learning environments that focus on collaborative efforts among students or workers and stimulate teamwork to solve problems posed in a learning environment. This category includes uses of technology to facilitate collaborative learning.

3.4 Access to shared or distributed resources and expertise

Research, development, and assessment to guide learners to sources of information they need and to make these sources of information accessible to all learners. These sources include digital libraries, human subject matter experts, and mentors.

3.5 Integration of technology-based instruction

Research, development, and assessment to help ensure that teachers and instructors can successfully incorporate technology into their existing instruction, that technology-based learning tools meet both local and national standards, and that today's instructional institutions and workplaces realize the benefits of new instructional technology as quickly as possible.

RESEARCH ON LEARNING AND COGNITIVE PROCESSES

4.1 New learning paradigms

Research and development to improve our understanding of how people learn and of the mechanisms and processes through which instruction can and does affect learning. This category includes basic research on cognition, learning, and memory and on how they are affected by instruction.

4.2 Effecting change in teaching and training

Research and development on ways to effect change in our current

institutions for teaching, training, and lifelong learning. This category includes efforts to determine (a) the roles that teachers, students, and lifelong learners should play to increase the effectiveness of learning and (b) ways to incorporate these roles in instructional institutions and workplaces.

4.3 Curriculum structuring and restructuring

Research and development on the design of a standards-based curriculum and programs of instruction. This category of research and development includes efforts to design and structure a curriculum so that it takes advantage of technology-based capabilities for administrative management, information handling, and the tailoring of instruction to each individual's needs, interests, abilities, and learning style.

4.4 Special needs

Research and development to identify the unique instructional challenges faced by learners in special populations, to assess their ability to respond to these challenges, and to exploit the capabilities offered by technology-based instruction. These populations include learners who must overcome disabilities, academic or economic disadvantages, limited English language proficiency, or other difficulties to take advantage of instructional opportunities and participate fully in the work force.

4.5 Cognitive task analysis

Research and development to determine the cognitive processes that underlie the skill and knowledge requirements needed to accomplish real-world tasks. This activity includes research to better understand the evolving content needs of growth-oriented knowledge industries and the cognitive tasks that individuals must possess to meet these needs.

**Education costs money,
but then, so does ignorance.
Sir Claus Moser**

EXCELLENCE IN SCIENCE, MATHEMATICS, AND ENGINEERING EDUCATION

STRATEGY

Mathematics, science, engineering, and technology education are central to the education process and have a profound effect on our Nation's economic competitiveness and on the quality of life of its citizens. A citizenry well educated in the sciences, mathematics, and technology is thus essential to the civic and economic health and well-being of the Nation.

OPPORTUNITIES

THE VISION

The Vision that draws the Federal agencies together working in partnership with State and local educators and industry to promote excellence in science, mathematics, engineering, and technology is thus one which aims at:

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

GOALS

The Goals that sustain this Vision are woven together with many of those found in "Goals 2000: Educate America Act," and the recent report, "Science in the National Interest." Through the combined and collaborative efforts of the Federal agencies working under the CET, much progress can be made in making these visions come true.

1. By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters, including science and mathematics.
2. 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.
3. By the year 2000, U. S. students will be first in the world in mathematics and science achievement.

4. By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
5. Produce the finest scientists and engineers for the 21st century.

OBJECTIVES

These Goals will be pursued through a set of more specific objectives:

1. Encourage science as a core requirement for grades K-16.
2. Promote systemic reform of K-12 standards-based science, mathematics, technology, and engineering education.
3. Promote a competent and contemporary undergraduate science, mathematics, and engineering enterprise for a diverse student population.
4. Promote graduate and postdoctoral science and engineering education/training commensurate with human resource requirements.
5. Promote a competent, contemporary, and diverse scientific and technical work force.
6. Focus interagency programming on science and mathematics supported by technological education to ensure work force competency in a rapidly changing economy.
7. Promote Federal efforts to enhance public understanding of science and apply technology to lifelong learning.
8. Promote efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.

IMPLEMENTATION

ONGOING EFFORTS

Member agencies of the Excellence in Science, Mathematics, and Engineering Education Subcommittee initiated and continued many programs starting with the FY 1992 budgetary process.

1. SYSTEMIC REFORM AND STANDARDS-BASED EDUCATION

1.1 Systemic Reform in Urban and Rural Areas

During 1993-1994 the National Science Foundation gave grants to 24 States and Puerto Rico through its Statewide Systemic Initiatives, made awards to nine urban areas under its Urban Systemic Initiatives to initiate planning for systemic reform, and awarded two development grants and four planning grants in rural areas. These initiatives support comprehensive educational reform by bringing together State and local education leaders, businesses, parents, and other community leaders for the planning and implementation processes.

1.2 Standards-Based Education

Collaborations have been formed among CET agencies, including the National Science Foundation, the Department of Education, the National Aeronautics and Space Administration, and the Department of Health and Human Services, to provide funding to support the development of standards-based curriculum frameworks which would challenge the students. By the end of 1995, the National Academy of Sciences is to complete and distribute standards for teaching science, science curriculum development, and assessment.

2. TEACHER ENHANCEMENT ACTIVITIES AND REFORM OF TEACHER CERTIFICATION REQUIREMENTS

The CET agencies have also concentrated on teacher enhancement activities. CET agencies provided more than 160,000 teachers in FY 1993 and FY 1994 with intensive, multiple-week professional development designed to expose them to new content as well as improve their pedagogical skills. The programs are designed to provide participants with a unique opportunity to explore new dimensions of learning and teaching mathematics and science. Further, these efforts are tied to challenging standards and will help ensure that teachers are prepared to teach their students to the standards.

3. DISSEMINATION

In FY 1992, CET Federal agencies participated in a comprehensive inventory of Federally sponsored education and training programs. Results of the inventory have been published in "A Guidebook to Excellence," which is available on-line and in hard copy. This

publication is updated annually and describes individual programs and partnership opportunities grouped by agency and by region, and includes points of contact for education efforts which are Federally sponsored.

The CET member agencies also sponsor a publication entitled "A Resource Guide to Selected Undergraduate Programs of 10 Federal Agencies."

4. ASSESSMENT

CET member agencies are funding the identification or development of models and tools for the assessment of the effectiveness of teaching techniques, tools, and the efficiency of student learning. Some programs are focused on the development of models for the assessment of student progress relative to the mathematics and science standards. Completion of these assessment tools is expected in 1996.

Programs have been initiated to develop realistic and widely applicable measures to identify successful programs and exemplary products for use by agencies in directing their own efforts.

5. PUBLIC UNDERSTANDING OF SCIENCE

Several programs have been created to provide better access to and dissemination of the vast knowledge base that exists within the laboratories and facilities of member agencies. Technology has enabled agencies to make scientists readily available to assist with classroom experiments, experts to answer questions, and better access to supercomputers and satellite information. Interactive distributed education environments are being demonstrated around the world and government and private companies have been enlisted to assist in developing this new classroom environment. These experiments in information dissemination and distributed education are part of planning for facilitating the process of lifelong learning.

NEW AND ENHANCED EFFORTS

In addition to the continuation of ongoing programs, many are being enhanced, and a number of new programs are being introduced.

FOCUS AREAS

SCIENCE AS A CORE REQUIREMENT FOR GRADES K-16

1.1 Milestone for Development of Science as a Core Requirement

- Starting in FY 1996, CET will have in place a coordinated strategy for the development of science as a core requirement for grades K-16.

SYSTEMIC REFORM OF K-12 STANDARDS-BASED SCIENCE, MATHEMATICS, AND ENGINEERING EDUCATION

2.1 Milestones for Elementary and Secondary Organizational and Systemic Reform

- In FY 1995, CET agencies will make additional grant awards under Goals 2000 to assist States and local areas in planning systemic educational change.
- In FY 1995, CET agencies will make available to all States information learned from the statewide systemic initiatives.
- In FY 1995 and FY 1996, systemic educational reform efforts will be expanded in up to twenty-five urban and six major rural areas where large numbers of ethnic/racial and economically disadvantaged populations are located.
- In FY 1996, CET will continue to conduct distance learning and distributed education.

2.2 Milestones for Elementary and Secondary Teacher Preparation and Enhancement

- Starting in FY 1995, all science and mathematics funds under the National Eisenhower Program will support consortia of institutions of higher education, State education agencies, and local school districts in order to align preservice teacher preparation and licensure provisions with new world-class mathematics and science standards. In addition, funds from the State Eisenhower Program will support intensive, high-quality teacher professional development.
- In FY 1995, the Subcommittee will develop a Federal plan to create research scientist-teacher partnerships and, in FY 1996, will pilot a program involving 2 to 5 States for teacher-researcher partnerships,

including government, academia, and industry with appropriate incentives.

- In 1995, at least 20 major K-8 system-wide teacher enhancement projects will be funded and instructional materials databases will be on-line, providing information on supported curriculum and materials for teachers, administrators, and parents, etc.
- In FY 1995, the Evaluation Working Group will conduct an evaluation of the quality of teacher enhancement activities in Federal laboratories. The evaluation will become part of the overall assessment of Federal laboratories' capabilities to conduct teacher enhancement activities.
- By 1996, CET agencies will have 15 teacher education collaboratives in place, impacting 213,000 undergraduate students and engaging 8,000 faculty, and 7,000 master teachers.
- By FY 1999, 600,000 teachers -- with special emphasis on teachers from and of underrepresented groups and those at the elementary level -- will receive intensive disciplinary and pedagogical professional development through Federal agency teacher enhancement programs.
- By FY 2000, 25 consortia are projected to be in place, providing an estimated one-half of new elementary and secondary mathematics and science teachers with new, more effective, intellectually and pedagogically appropriate modes of pre-service teacher instruction, and one-third of all science and mathematics teachers will graduate from schools participating in consortia-sponsored programs.

2.3 Milestones for Elementary and Secondary Standards and Assessments

- In FY 1995, a plan will be implemented on the Federal role in facilitating the adoption of the science standards through the research and education communities.
- Beginning in FY 1995, CET agencies will continue to provide support and incentives for implementation at the State and local level of challenging standards in mathematics and science education, such as those developed by National Council of Teachers of Mathematics and the National Academy of Sciences.

- In FY 1995-1999, through the National Assessment of Educational Progress, the Department of Education will continue conducting national and State-by-State assessments, on a regular basis, that measure progress toward the National Education Goals.
- By FY 1998, agencies will provide support to enable completion of model assessments for use by States, districts, teachers, and others to measure the performance of individual students against world-class mathematics and science standards.
- By FY 1999, CET agencies will support the development of measures, definition of samples, and administration of two sets of international assessments of student performance in mathematics and science.

2.4 Milestones for Elementary and Secondary Instructional Resources

- Beginning in FY 1995, CET agencies will ensure that all materials developed with Federal support conform to challenging State or National standards such as the evolving National Academy of Sciences science standards and the National Council of Teachers of Mathematics standards for mathematics.
- By FY 1996, the National Science Foundation will ensure the development of a comprehensive set of mathematics curriculum models for elementary through secondary levels and, by FY 1997, will have supported the development of a comprehensive set of science curriculum models which will be available for the elementary through secondary levels.
- CET agencies will continue to contribute to a process for review and revision of science and mathematics standards and frameworks.

COMPETENT AND CONTEMPORARY UNDERGRADUATE SCIENCE, MATHEMATICS, AND ENGINEERING ENTERPRISE FOR A DIVERSE STUDENT POPULATION

3.1 Milestones for Undergraduate Instructional Resources

- In FY 1995, CET agencies will continue an inventory of their currently available technical education and training programs to develop goals, priorities, and strategies specifically for technical education and training.

- In FY 1995, CET agencies will begin to provide support in associate degree granting institutions for at least five centers of excellence in instructional programs in advanced technology fields.
- By FY 1996, the materials and instructional approaches developed through programs supported by CET agencies to revitalize science, mathematics, engineering, and technology education at colleges and universities will benefit at least one-third of the students enrolled in lower-division studies.
- By FY 1999, the materials and instructional approaches developed through programs supported by CET agencies to revitalize science, mathematics, engineering, and technology education at colleges and universities will benefit at least two-thirds of the students enrolled in lower-division studies.

3.2 Milestones for Undergraduate Faculty Preparation and Enhancement

- By FY 1996, CET agencies, in partnership with industrial organizations, will provide faculty enhancement activities for at least 16,000 undergraduate faculty involved in teaching science, mathematics, engineering, and technology.
- In FY 1995, CET agencies will sponsor seminars in different regions of the United States to help science, mathematics, engineering, and technology faculty and administrators in associate degree-granting institutions become involved with Federal programs and be aware of awards that have been made to 2- to 4-year institutions in collaboration with secondary schools and 4-year institutions.
- By FY 2000, CET agencies and industrial partners will provide faculty enhancement for at least 50,000 science, mathematics, engineering, and technology faculty members at both 2- and 4-year institutions.

3.3 Milestones for Undergraduate Student Incentives

- By FY 1997, CET agencies will have in place mechanisms to encourage research experience incentives for undergraduate students in Federal research grant awards.

GRADUATE AND POSTDOCTORAL SCIENCE AND ENGINEERING EDUCATION/TRAINING COMMENSURATE WITH HUMAN RESOURCE REQUIREMENTS

4.1 Milestones for Graduate Education and Instructional Resources

- In FY 1995, CET agencies will continue, through graduate research awards to institutions, to target student support both into selected discipline areas of critical national need and into experimental approaches to predoctoral education.
- Beginning in FY 1995, CET agencies will design and implement special initiatives to promote sorely needed articulation between undergraduate and graduate education programs.
- Starting in FY 1995, CET agencies will encourage universities to broaden the structure and focus of their graduate degree programs to ensure the competitiveness of their Ph.D. students in the market place and the competency of the U.S. scientific work force overall.

4.2 Milestones for Graduate Faculty Preparation and Enhancement

- Starting in FY 1995, CET agencies will provide teaching preparation for graduate students in science, mathematics, engineering, and technology fields.

4.3 Milestones for Graduate Student Incentives

- In FY 1995, CET agencies will inventory agency-sponsored programs targeted to underrepresented groups in graduate education.
- Beginning in FY 1995, Federal agencies should expand financial and other types of incentives to attract outstanding U.S. citizens and permanent residents to graduate programs in the fields of science, mathematics, engineering, or technology in which greater participation is required to meet national needs.
- By FY 1997, CET agencies will improve the quality, timeliness, comprehensiveness, and availability of national data on graduate education programs that they maintain.

COMPETENT, CONTEMPORARY, AND DIVERSE SCIENTIFIC AND TECHNICAL WORK FORCE

5.1 Milestones to Increase Diversity

- In FY 1995, the first Presidential Awards for individuals and institutions with outstanding records in mentoring students from underrepresented groups will be initiated.
- In FY 1995, the Federal member agencies will develop a plan for incorporating an evaluation criterion related to increasing participation by underrepresented groups.
- Starting in FY 1996, CET will have in place and implement a coordinated strategy designed to foster increased participation of underrepresented groups.

SCIENCE AND MATHEMATICS SUPPORTED BY TECHNOLOGICAL EDUCATION TO ENSURE WORK FORCE COMPETENCY IN A RAPIDLY CHANGING ECONOMY

6.1 Milestones for Technological Education

- BY 1995, CET agencies will further efforts to increase technological education capabilities by supporting three centers of excellence in instructional programs in advanced-technology fields at associate degree-granting institutions and supporting the development of high technology learning centers.
- By FY 1996, Federal laboratories will conduct specialized technical apprenticeship programs reaching a minimum of 3,000 participants, including high school and community college graduates and displaced workers.

FEDERAL EFFORTS TO ENHANCE PUBLIC UNDERSTANDING OF SCIENCE AND APPLY TECHNOLOGY TO LIFELONG LEARNING

7.1 Milestones for Public Understanding of Science and Technology

- In FY 1995, CET will develop and adopt a "vision" for all Federally funded public understanding of science programs, and in FY 1996, will consider recommendations developed for a multidimensional

national assessment of public understanding of science and determine whether such an assessment is feasible as well as produce and disseminate a resource guide of Federal public understanding of science resources and activities.

- In FY 1995, CET will convene conferences to address issues, such as alternative sets of standards for public understanding of science and public science literacy, identify data needs, and propose effective education strategies with a special emphasis on reaching underserved populations.
- By FY 1999, CET agencies will expand their support for public understanding of science programs targeted at decision-makers to significantly increase their understanding of science and public understanding of science-related issues.
- In FY 1995, CET will complete a descriptive inventory of agency public understanding of science programs.

DETERMINING THE EFFECTIVENESS OF FEDERAL INVESTMENTS IN SCIENCE, MATHEMATICS, AND ENGINEERING EDUCATION AND TRAINING PROGRAMS

8.1 Milestones for Evaluation and Dissemination

- In FY 1995, the Dissemination and Evaluation Working Group will conduct an evaluation of the quality of teacher enhancement activities in Federal laboratories. The evaluation will become a part of the overall assessment of Federal laboratories' capabilities to conduct teacher enhancement activities.
- In FY 1995, CET will develop and disseminate an inventory of model articulation programs that bridge the transition between secondary schools and 2- and 4-year institutions, between 2-year and 4-year institutions, and between undergraduate and graduate schools.
- In FY 1995, a program of research and study will determine the link between Federal resource allocation for mathematics and science education, including amounts dedicated to teacher preparation and enhancement, and long-term changes in student achievement in pertinent disciplines.

- By FY 1998, each agency will complete its first cycle of program evaluations and will disseminate the results.

**Human history becomes more and more a
race between education and catastrophe.
H. G. Wells**

**GOALS 2000:
EDUCATE AMERICA ACT
NATIONAL EDUCATION GOALS**

- 1. School Readiness**
- 2. School Completion**
- 3. Student Achievement and Citizenship**
- 4. Teacher Education and Professional Development**
- 5. Mathematics and Science**
- 6. Adult Literacy and Lifelong Learning**
- 7. Safe, Disciplined, and Alcohol- and Drug-free Schools**
- 8. Parental Participation**

^{*} Public Law 103-227. (March 31, 1994)

NATIONAL SCIENCE GOALS*

- 1. Maintain Leadership Across the Frontiers of Scientific Knowledge**
- 2. Enhance Connections Between Fundamental Research and National Goals**
- 3. Stimulate Partnerships that Promote Investments in Fundamental Science and Engineering and Effective Use of Physical, Human, and Financial Resources**
- 4. Produce the Finest Scientists and Engineers for the 21st Century**
- 5. Raise the Scientific and Technological Literacy of All Americans**

* Executive Office of the President. Office of Science and Technology Policy. *Science in the National Interest*. Washington, D.C. August, 1994.

**COMMITTEE ON EDUCATION
AND TRAINING**

To coordinate and focus Federal efforts in education and training so that they become a powerful force in the task of helping Americans meet the challenges of the 21st century.

**RESEARCH AND DEVELOPMENT IN EDUCATION
AND TRAINING**

VISION:

Ensuring all Americans access to quality education and training tailored to their individual learning and workplace needs.

GOALS:

- Provide National leadership in guiding education and training in its evolution toward the 21st century.
- Develop a research and development agenda for achieving the National Education Goals by the end of the decade.
- Promote increased resources for research and development in education and training.
- Promote partnerships for demonstrating and deploying cost-effective learning technologies and techniques.

FOCUS AREAS:

- Demonstrating innovative technology and networking applications.
- Developing new models for evaluating learning and learning productivity.
- Developing quality, affordable learning tools and environments.
- Promoting research on learning and cognitive processes.

**EXCELLENCE IN SCIENCE, MATHEMATICS, AND
ENGINEERING EDUCATION**

VISION:

Achieving an American performance in science, mathematics, engineering, and technology in the classroom and the workplace that is second to none.

GOALS:

- By the year 2000, all students will leave grades 4, 8, and 12 having demonstrated competency over challenging subject matters including science and mathematics.
- 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.
- By the year 2000, United States students will be first in the world in mathematics and science achievement.
- By the year 2000, every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.
- Produce the finest scientists and engineers for the 21st century.

FOCUS AREAS:

- Encouraging science as a core requirement for grades K-16.
- Promoting systemic reform of K-12 standards-based science, mathematics, technology and engineering education.
- Promoting a competent and contemporary undergraduate science, mathematics, and engineering enterprise for a diverse student population.
- Promoting graduate and post doctoral science and engineering education/training commensurate with human resource requirements.
- Promoting a competent, contemporary, and diverse scientific and technical work force.
- Focusing interagency programming on science and mathematics supported by technological education to ensure work force competence in a rapidly changing economy.
- Promoting Federal efforts to enhance public understanding of science and apply technology to lifelong learning.
- Promoting efforts to determine the effectiveness of Federal investments in science, mathematics, engineering, and technology education and training programs.

**Learning Productivity Amounts Tying to the
FY 1996 President's Budget
(Dollars in Millions)**

<u>Agency</u>	<u>FY 1995 Enacted</u>	<u>FY 1996 Proposed</u>
Department of Defense	\$144.0	\$130.6
Department of Health and Human Services	57.2	60.5
Department of Energy	1.9	1.9
National Aeronautics & Space Administration	3.9	4.2
National Science Foundation	27.0	30.0
Department of Commerce	6.9	7.2
Department of Transportation	1.0	2.0
Department of Education	86.0	97.0
Smithsonian Institution	<u>0.0</u>	<u>2.0</u>
Department Totals	\$327.9	\$335.4

CET 1996 Request

(Dollars in Millions)

<u>Agency</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Change 96/95</u>
Department of Agriculture	\$18	\$20	\$33	\$12
Pre K-12	\$1	\$0	\$0	(\$0)
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	14	16	28	12
Graduate	4	4	4	1
Public Understanding of Science	0	0	0	0
Department of Commerce	\$8	\$10	\$10	\$0
Pre K-12	0	0	0	0
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	0	0	0	0
Graduate	8	10	10	0
Public Understanding of Science	0	0	0	0
Department of Defense	\$539	\$552	\$566	\$14
Pre K-12	26	27	29	2
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	145	149	154	5
Graduate	369	376	383	7
Public Understanding of Science	0	0	0	0
Department of Education	\$525	\$368	\$427	\$59
Pre K-12	333	95	64	(31)
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	10	12	10	(2)
Graduate	27	27	27	0
Public Understanding of Science	154	233	325	92
Department of Energy	\$0	\$0	\$0	\$0
Pre K-12	0	0	0	0
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	0	0	0	0
Graduate	0	0	0	0
Public Understanding of Science	0	0	0	0
Department of Transportation	\$530	\$575	\$625	\$50
Pre K-12	530	575	625	50
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	0	0	0	0
Graduate	0	0	0	0
Public Understanding of Science	0	0	0	0

CET 1996 Request

(Dollars in Millions)

<u>Agency</u>	<u>FY 1994</u>	<u>FY 1995</u>	<u>FY 1996</u>	<u>Change 96/95</u>
Department of Health and Human Services	\$712	\$737	\$746	\$10
Pre K-12	21	20	20	1
Undergraduate 2-year	6	6	6	0
Undergraduate 4-year	31	36	36	0
Graduate	449	462	468	6
Public Understanding of Science	205	213	216	3
Department of Interior	\$43	\$45	\$45	\$2
Pre K-12	24	23	23	0
Undergraduate 2-year	0	0	0	2
Undergraduate 4-year	7	7	9	0
Graduate	12	12	12	0
Public Understanding of Science	43	45	45	0
Environmental Protection Agency	\$0	\$0	\$0	\$0
Pre K-12	0	0	0	0
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	0	0	0	0
Graduate	0	0	0	0
Public Understanding of Science	0	0	0	0
National Aeronautics & Space Administration	\$103	\$115	\$118	\$4
Pre K-12	25	32	33	1
Undergraduate 2-year	2	2	3	1
Undergraduate 4-year	35	39	40	1
Graduate	41	42	43	1
Public Understanding of Science	0	0	0	0
National Science Foundation	\$583	\$619	\$615	(\$4)
Pre K-12	321	337	333	(4)
Undergraduate 2-year	22	27	27	(0)
Undergraduate 4-year	145	151	151	(0)
Graduate	88	97	96	(0)
Public Understanding of Science	7	7	7	0
Smithsonian Institution	\$10	\$11	\$11	\$1
Pre K-12	2	2	2	0
Undergraduate 2-year	0	0	0	0
Undergraduate 4-year	0	0	1	1
Graduate	1	1	1	0
Public Understanding of Science	7	8	8	0
Department Totals	\$3,073	\$3,051	\$3,195	\$147

**NATIONAL SCIENCE AND
TECHNOLOGY COUNCIL**

**COMMITTEE ON
EDUCATION AND
TRAINING**

**STRATEGIC/IMPLEMENTATION PLAN
FY 1995 - 1999**

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Sample List of Business Partnerships Supporting Technology in Learning

Ameritech

Indianapolis Public School teachers and students are using a 21st Century interactive distance learning network of more than 600 miles of fiber optics to provide interactive distance learning, video-conferencing and television programming to more than 93 locations.

Apple Computer, Inc.

Apple has sponsored the Apple Classrooms of Tomorrow (ACOT) Projects throughout the US. The program promotes use of technology in the learning process. Apple has been highly visible in supporting K-12 technology learning and staff development programs. In addition, the company has been one of the key sponsors of the PBS "Ready to Learn" program.

Bell Atlantic

Bell Atlantic bid on a Maryland state government plan to bring two way audio/video distance learning to all state public high schools, community colleges and four year state colleges. Bell Atlantic won the bidding process, then made a contribution toward the non-network plan elements, such as classroom equipment.

Autodesk

Autodesk has been strong supporter of technology in education, and adopted a high school in San Rafael to infuse technology and networking into learning process. The Autodesk Foundation focuses on promoting technology in education.

Boeing Company

Boeing has been a strong supporter of education reform and use of technology in the reform process. The company has underwritten seminars with National School Boards Association, and has supported local school efforts in Washington, Kansas, and Pennsylvania.

Buddy System

Lilly Endowment, Ameritech Foundation, and GTE provide computers, modems, and access lines to more than 6,000 fourth, fifth and sixth graders throughout Indiana. Students can use computers to access on-line services, communicate with each other and with their teachers.

Disney Corporation

Disney has promoted technology in schools and has begun building the "Celebration School" in Orlando.

Eastman Kodak

Kodak is investing R & D in digital imaging for developing and tracking student profiles. The company is participating in education reform initiatives, and using its expertise in imaging to create student profiles and assessment portfolios. Pilot projects are underway in New York, California, Florida.

GTE

GTE and University of Texas Southwestern Medical Center at Dallas are partners in a program which allows thousands of North Texas school children to visit laboratories at the school and interact with renowned researchers. Schools are also being connected with interactive video links. GTE also sponsors a "hands on" summer research experience at GTE Laboratories for United Negro College Fund professors and students who work side by side for four weeks with GTE scientists and engineers. The GTE Foundation provides financial awards for more than 100 two member teams of math and science teachers under its "Growth Initiatives for Teachers". The program includes a one week seminar to visit GTE facilities. It has supported teachers in 32 states with more than \$5 million.

Hawaii Software Service Center

Hawaii's Department of Education in partnership with the State's Department of Business Economic Development and Tourism and the High Technology Development Corporation are promoting technology in the schools. MIDAS (Multimedia Industry Development for Academic Software) Project is a result of business-education partnership that places greater emphasis on technology as a vital part of the infrastructure in education.

Ingenius

Fifth graders at Mountain View Elementary School in Colorado learn about timely current events news in a format that is designed for students by using the new cable-computer delivered multimedia program "What on Earth".

Intel Corporation

Intel has donated the land to a K-5 school in Chandler, Arizona and has played an integral part in the design and development of the school, which focuses on Math, Science and Technology. Additionally, the company gave a \$1 million technology grant to the Smart Valley Schools in California. The company also produced Journey Inside, a science fiction IMAX movie which explains how the microprocessor works. The film focuses on children in grades 6-8 and is designed to excite interest in math and science. The film and learning kit is free of charge to schools nationwide.

IntelliTools

This software company is participating with third graders in Berkeley, California to use technology with students with disabilities in language arts activities. Project is supported by a Small Business Innovation Research Grant from NIH and by IntelliTools.

Pacific Bell

Pacific Bell's Education First Project has committed more than \$125 million over the next three years to provide ISDN access for internet and video teleconferencing to all California's K-12 schools, public libraries, private schools, and community colleges. Deployment involves more than 10,000 school sites. The project also includes staff development support, computer donations, and business partnerships.

Rochester Project

A collaboration of businesses and non-profits and government enable new uses of interactive media through driving the development of interactive multimedia application in education, health and human services in the Finger Lakes Region of New York.

SBC Communications

Over the next four years, SBC Communications will invest at least \$275 million a year in Missouri. In addition, SBC will earmark at least \$35 million of this investment a year to create a fiber optic network in every community it serves and incorporate distance learning and telemedicine applications into the 75 accredited schools and hospitals across the state.

Silicon Graphics

SGI is participating with the EPA and Saginaw Valley State University in a program called Earth Vision. Earth Vision is a professional development and educational program for high school teachers and students. The program trains teachers and students to conduct environmental research using computational science, and establishes environmental research and computer science programs at high schools.

Sunburst Communications

In Amarillo, Texas the company has given a grant to develop district-wide interest in multimedia approach to science teaching with the Voyage of the MIMI.

US West

Nebraska State Department of Education and US West are partnering on a project called Nebraska Greenhouse. Six Nebraska schools are participating in the deployment of state of the art Internet access. The project is designed to nurture education technology.

Utah Community of Interest Network (COIN)

US West is working with the State of Utah to create a statewide electronic network to give both rural and urban residents access to distance learning, telemedicine, home banking, and video conferencing.

World School

Bell Atlantic-West Virginia is providing the staff development, software, mid-level provider fees and some network equipment to connect at high speed a minimum of five PCs to the Internet in every public school in its service area in West Virginia. The project will use the existing West Virginia Educational Information System to route the new services. The \$10 million project should be completed by the end of 1997.

Educational Initiatives in Telecommunications

A+ Network. In Kansas, SBC Communications has three clusters of schools, referred to as the A+ Network, using interactive video for distance learning. These sites are served by an analog system that provides simultaneous interactive video with up to four remote sites and one live classroom. The configuration of the teacher/classroom arrangement can be controlled via the network.

Ameritech Advanced Video Services Network. Indianapolis Public School teachers and students are using a 21st-century communications tool in today's classrooms -- an interactive distance learning network. The system, designed by Ameritech, uses more than 600 miles of fiber optics to provide interactive distance learning, video-conferencing and television programming to more than 93 locations. The locations include grade schools, junior high schools, high schools and selected administrative buildings in the IPS system.

Ameritech Exploration Network. A contribution of a \$282,000 fiber optic network from Ameritech will allow the Indianapolis Zoo to reach as many students in one week as it now can in one year. The two-way interactive network will allow students to take an "electronic field trip" to the zoo and go behind the scenes to see how the zoo operates.

Ameritech Learning Village. Ameritech pledged \$2.6 million over a two-year period to support this regional initiative, which involves 50 schools. Using computers connected to telephone lines, students will be able to interact with other students and databases, develop problem-solving skills, and collaborate on projects. Teachers and administrators will be linked to one another and have access to more than 500 projects and lessons organized by grade level and subject. The project concludes in June of 1995.

Blacksburg Electronic Village. Using Bell Atlantic network technology, the town of Blacksburg, Virginia is connected Virginia Tech and a host of municipal services. Subscribers on the Blacksburg Electronic Village (BEV) have access to e-mail and can review town council agendas, historical information, council meeting minutes and university databases on line. As of January, 1995, BEV had 1,200 subscribers on-line.

Boulder Computer Consortium Trial Network. This Boulder trial connects supercomputers at the University of Colorado, the National Center for Atmospheric Research, the National Oceanic and Atmospheric Administration, the laboratories of the National Telecommunications and Information Administration and the National Institute of Standards and Technology. Also participating are universities, libraries and several high-tech firms. This high-speed interconnection provided by U S WEST allows these different organizations to work on complex problems quickly.

Buddy System. In partnership with the Lilly Endowment, the Ameritech Foundation, Ameritech Indiana and GTE provide computers, modems and access lines to more than 6,000 fourth-, fifth- and sixth-graders throughout Indiana. Students can use computers to access on-line services, communicate with each other and with their teachers. A 1990

evaluation showed that 90 percent of educators agreed that student work was more creative and of higher quality because of the computers, and 40% of the Project's parents increased contact with teachers about their children's education.

Computer Literacy Program. Ameritech Ohio supports two computer literacy programs in Ohio schools. The first, at John Adams high school in Cleveland, focuses on computer literacy and learning innovation and motivation. The second program provides the Columbus Public Schools with computer hardware, enabling each school's lab to be internally networked for improved instruction and efficiency and laying the groundwork for merging the administrative and academic computer networks.

Distance Learning. An Ameritech interactive video pilot project connects the Illinois Math and Science Academy in Aurora, Ill., the nation's only three-year public, residential high school, and Walter H. Dyett Middle School, a Chicago public school utilizing multidisciplinary studies and team teaching. The network is used for faculty partnering to develop customized curriculum at Dyett and to permit Dyett students to take customized courses from selected teachers at the Academy. A goal of the program is to enable the Academy to expand its recruiting outreach into the Chicago public schools.

High Schools That Work. BellSouth helped fund the addition of a work-based learning component for the "High Schools That Work" network of schools. The Southern Regional Education Board, a part of the Southern Governors convention, runs the project.

Homework Hotline. Ameritech Indiana's Partners in Education team and the Lew Wallace Elementary School faculty developed this service to enable teachers and parents to communicate after hours. The teacher can record messages listing homework assignments and any other pertinent information, while students and parents can leave messages with the teacher. Ameritech Wisconsin provides funding for 15 Homework Hotline or parent information line programs at various schools throughout that state. Ameritech Ohio is funding a trial of the "Education Hot Line" involving 19 intermediate schools in the Cleveland public school system.

Illinois River Project. Ameritech Illinois supports this telecommunications-based education program, currently in use by 87 Illinois schools. Students collect scientific data on various Illinois rivers and then communicate via modem with each other and with a central database at Southern Illinois University-Edwardsville, the project coordinating site.

Institute for Science and Technology. Bell Atlantic, in conjunction with the American Association for the Advancement of Science, the world's largest scientific organization, has sponsored courses in advanced technology for educators. Between 1989 and 1993, 140 middle-school teachers from throughout the mid-Atlantic region participated in Institute programs. Topics have included fiber optics, robotics, the environment and communications networks. Scientists, engineers, and Bell Atlantic employees work with

the teachers to develop innovative lessons and stimulating extra-curricular activities for the students. Through these teachers, the Institute has reached more than 40,000 students.

Lake County Science, Math and Technology Project. This project enables students at more than 30 schools in Lake County, Illinois to learn how to use and share computer information by participating in simulated space missions. The initiative, which involves the entire school community and curriculum, is supported Ameritech Illinois and coordinated by the Lake County Business Industry Education Consortium.

Luminet. Two national telecommunications leaders have joined together in an initiative to extend the reach of teaching and learning and provide the community of Winona, Minnesota with access to the information superhighway. Working in partnership, U S WEST and Sprint have established a fiber optic ring around this Minnesota community to provide distance learning, access to government information, telemedicine, access to the Internet and other services.

Maryland Distance Learning Program. Bell Atlantic bid on a Maryland state government plan to bring two way audio/video distance learning to all state public high schools, community colleges and four year state colleges. Other sites, such as museums and public aquariums, could be added to the network in the future. Bell Atlantic won the bidding process, then made a contribution toward the non-network plan elements, such as classroom equipment.

Minnesota Distance Learning. Mid-Minnesota Telecommunications Consortium (MidTec) is Minnesota's largest post-secondary distance learning system. Mid-Tec leases 400 miles of fiber optic lines from U S WEST to interconnect seven central Minnesota technical colleges. The system delivers 80 to 100 hours of classes per week and is also used for a variety of community meetings.

Missouri Interactive Telecommunications Education (MIT-E). The mid-Missouri cluster is a dedicated multipoint service between Methodist College in Fayette and Pilot Grove, Bunceton, New Franklin, Slater and Glasgow high schools. Mid-Missouri Telephone and SBC Communications have combined to provide classroom equipment and line lease costs for a T1 quad-split system which utilizes both fiber optic and full T1 copper telephone lines as the transmission medium.

Missouri Telecommunications. Over the next four years, SBC Communications will invest at least \$275 million a year in Missouri. In addition, SBC Communications will earmark at least \$35 million of this investment a year to create a fiber optic network in every community it serves and to incorporate distance learning and telemedicine applications into as many of the 75 accredited schools or hospitals across the state as possible. The focus will be broadband video services. SBC Communications will also create at least five Telecommunity Center locations -- interactive video information centers -- before 1999.

Nebraska Greenhouse. Through a partnership between the Nebraska state Department of Education and U S WEST, six Nebraska schools are participating in the deployment of state-of-the-art Internet access. Called the "Nebraska Greenhouse," the project is designed to nurture education technology. U S WEST funding will help these schools assess their training and technology needs and then fill those needs to nurture new education technology.

The Network for Education and Research in Oregon (NERO). In early 1995, U S WEST began a technical trial of a multimedia network that allows five far-flung campuses in Oregon to strengthen their education and research programs by working together more closely. The ultimate vision of NERO is a desktop-to-desktop voice, video and data network that brings student, faculty and industry partners together for these projects, research and learning experiences.

North Carolina Information Highway. BellSouth in partnership with CT&T (a subsidiary of Sprint) and GTE announced support for the North Carolina Information Highway (NCIH) in July of 1993. BellSouth estimated it will be spending about \$70 million over the next 10 years for its share of the NCIH.

North Dakota Distance Learning. The Greater Richland Education And Technology (GREAT) consortium is made up of six K-12 school districts in rural, southeastern North Dakota that include interactive distance learning classrooms at five high schools and one vocational school. Using U S WEST services, distance learning has increased the electives available for students from 25 to 50% and has allowed these schools to offer an expanded curriculum.

Northeast Arkansas Rural Educational Consortium. In Arkansas, a video teleconference system, called the Northeast Arkansas Rural Educational Consortium, has been established between Arkansas State University and the Ozarka Technical College in Melbourne, Arkansas. Using SBC Communications technology, nurses will be trained in Melbourne via two-way interactive video. Currently, five classes are available through the network. In addition, the university will bring another remote learning site on-line at ASU's branch campus in White County, Arkansas.

Northern Wisconsin Education Communications System is a distance learning network that covers 10,000 square miles and is a joint effort of Ameritech, GTE North and numerous other independent telephone companies.

Opportunity Indiana. Ameritech is developing what could soon become the world's largest distance-learning network. The network will link a potential 1,700 schools, 500 major government centers and 100 hospitals in the state with two-way, interactive video as part of the company's "Opportunity Indiana" regulatory reform plan. Ameritech is investing approximately \$120 million in infrastructure over the next six years to extend advanced communications centers in its Indiana service territory. In addition, Ameritech is contributing \$30 million to an independent non-profit corporation, the Corporation for

Educational Communications (CEC), which will provide grants for equipment and training for schools to take advantage of interactive communications.

Professional Development. Two schools for teachers at Auburn University in Alabama developed a program for helping teachers stay abreast of changing technology and furnishing them with tutors to help them write and implement technology-based lesson plans for students. BellSouth is funding this project in the amount of \$150,000 over three years.

Project Enable is a program funded by the Ameritech Foundation. Administered by Ameritech's Indianapolis Partners in Education Team, the program provides take-home computers and establishes an e-mail network for both teachers and students at Lew Wallace Elementary School in Indianapolis and exposes the students to topic discussions, interactive simulations and other applications. Teachers use computers to manage their day-to-day administrative duties, and students can check out portable personal computers through the library lending program.

Project Explore is a home and school-based multimedia learning approach in Union City, N.J. that supports student project research, report composition, group collaboration, and parent involvement. Halfway through the project's 2-year plan, the students, teachers, administrators and parents are very pleased with the improved academic performance, better attendance and lower drop-out rate they attribute to the project. Bell Atlantic provided the hardware for the project that allows students to have access to an extensive CD-ROM library, the Internet, a Lotus Notes Network, and to e-mail.

Regional Education Technology Cooperative. BellSouth administered the formation of the technology cooperative to enable schools from different districts or states to work together toward common goals. Funding for the first two years is \$150,000.

Rural Mountain Distance Learning. Red Rocks Community College in Denver installed a compressed video distance learning system connecting its Denver campus with high schools in Baily, Blackhawk and Idaho Springs. Using U S WEST technology, the Colorado Technological Education Association of Colleges, Communities and High Schools (TEACH) allows Red Rocks to conduct numerous seminars and training courses overcoming the barriers of weather and distance to expand educational access in mountain communities.

Rural Programs. Ameritech's program in Ohio's Appalachian region is showing how distance learning can bring quality education to underprivileged students in underfunded, rural school districts. The link between the schools and Ohio University also provides economical, efficient training for elementary school teachers. The distance learning trials in Ohio's Appalachian Region end in June 1995. The Columbiana County trial is now permanent, involving 11 high schools and two branches of Kent State University.

Ameritech's network in Michigan's Eastern Upper Peninsula brings a range of courses to 11 school districts spread over 3,800 square miles. An Ameritech interactive video pilot

project in central Illinois connects Illinois Central College in Peoria with two high schools -- Peoria Notre Dame and Delavan. Selected high school students take college courses, and the two high schools share selected classes.

SkillLink. An Ameritech interactive video pilot project connects Lewis and Clark Community College in southwestern Illinois to two nearby manufacturers -- Shell Oil and the Olin Corp. -- permitting Shell and Olin employees to take college courses or customized worker training classes from the college without leaving the work site.

Teacher Preparation and Assessment Strategies. BellSouth is underwriting a collaborative project by the College of Charleston and the University of New Orleans which are joining forces to examine how well teachers' training programs are preparing new teachers to teach in restructured schools. BellSouth has agreed to fund a total of \$200,00 over a two-year period.

TeachLink. An Ameritech interactive video pilot project northwest of Chicago has been used to permit three community colleges to "share" nearly 100 classes that could not be sustained by enrollment at any one site. The colleges involved are Waubensee Valley, Elgin and McHenry County.

TeleParent is a partnership between Ameritech, Parent Power (a program of the Indiana Humanities Council) and WRTV Channel 6, Indianapolis, to provide voice mail to schools in order to increase parental involvement. The program began as a trial with 13 schools in the Indianapolis area. It was so successful that the partnership is now working to provide voice mail to schools throughout Marion County.

Texas Video Demonstration Project. Scheduled to run from July, 1994 through December, 1995, SBC Communications has implemented a broadband fiber service trial as part of the Texas regulatory reform. Distance learning as well as telemedicine and remote arraignment will be the focal point of the trial. A two-way interactive video signal will allow up to four simultaneous, broadcast quality pictures to be viewed on one monitor at each participating location. Each school site will also be provided with a PC, which will have multi-media capabilities. Participants in the program include: Rice University, Houston ISD, South Texas ISD,

Two-Way Distance Learning. Bell Atlantic provides the two-way video network serving K-12 schools with distance learning in at least 100 schools in the Bell Atlantic region. Several additional counties that are committed to distance learning are awaiting funding to allow them to proceed.

Utah Community of Interest Network (COIN). U S WEST is working with the State of Utah to create a state-wide electronic network to give both rural and urban residents access to distance learning, telemedicine, home banking, video conferencing and other services. Virtually every state and local government and education site will have access to the information superhighway.

Voice Messaging In School. Through U S WEST, three elementary schools in Phoenix are testing voice messaging service as a communication channel between the school and parents. Teachers are able to send personalized messages to individual parents.

World School. Bell Atlantic-West Virginia is providing the staff development, software, mid-level provider fees and some network equipment to connect at high speed a minimum of five PCs to the Internet in every public school in its service area in West Virginia. The project will use the existing West Virginia Educational Information System (WVEIS) to route the new services. The \$10 million project should be completed by the end of 1997.

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GOVERNMENT/PRIVATE SECTOR PARTNERSHIPS

National Coordinating Council on Technology for Education and Training (NCCTET)

Two years ago, NCCTET was formed to address current issues and potential uses of technology to improve education and training. NCCTET members include national nonprofit membership organizations, state and local groups, individuals, and businesses involved in education and training throughout the U.S. The purposes of this national coalition are to: facilitate communications with and among stakeholder communities; develop awareness of educational technologies through a variety of activities such as presentations, workshops, and symposia; and to arrive at consensus on “what works” and “what actions” should be initiated to facilitate development or adoption of needed educational technologies for use in education and training programs throughout the country.

NCCTET issued a report in March 1994 on National Information Infrastructure Requirements for Education and Training, which presented the consensus of its more than 75 education and technology associations and private sector members. The Council also worked to ensure passage of the Snowe-Rockefeller amendment to the Telecommunications Act of 1995, which provides for affordable access for schools and libraries to telecommunications services.

Telecommunications Industry

There are a number of initiatives in educational technology being launched by the telecom industry (including Ameritech, U S West, BellSouth, Bell Atlantic, and SBC Communications). These are primarily focused on distance learning and uses of the National Information Infrastructure, but they also span the spectrum from training teachers to setting up “hot lines” for students to providing computing and communications hardware. Examples are included in the Appendix.

III. NCC-TET Participant Categories:

Members. Membership in NCC-TET is open to national, non-profit education and training membership associations, foundations, and/or societies who are interested in "supporting uses of technology in education and training programs throughout the United States." Member representatives participate fully in all NCC-TET meetings and other activities; and, may hold elective office, serve on NCC-TET committees, and participate in NCC-TET organizational decision-making.

Observers. This category of participation is available to Federal Government Agencies, Congressional offices, and State and local non-profit education and training institutions and organizations interested in national education and training technology issues. Observer representatives participate fully in NCC-TET policy discussions, informational meetings and other NCC-TET activities as guests of the Committee but may not hold elective office or participate in NCC-TET organizational decision-making.

Patrons. This category of participation is open to members of the private sector community who provide substantial "tax deductible" or "in-kind" contributions (e.g., on loan executives) to support NCC-TET educational technology awareness activities. Patrons receive all NCC-TET materials and are invited to participate in all NCC-TET meetings.

IV. FORUM-TET: Information about national technology in education and training issues and NCC-TET activities is available electronically in America Online's Learning and Reference Area under the heading "FORUM ON TECHNOLOGY IN EDUCATION AND TRAINING." Contributions to this national policy FORUM are invited and should be forwarded to: ISTEUSA2@aol.com

V. Council Officers [1994-95]:

*Drew Allbritten, Co-Chair
Brenda Kempster, Co-Chair
Frank Withrow, Co-Chair
Dennis Bybee, Secretary
Cheryl Williams, Treasurer*

VI. Administration: NCC-TET is ADMINISTRATIVELY supported by the International Society for Technology in Education (ISTE) under its 501(c)(3) non-profit, professional education association charter.

*NCC-TET
c/o ISTE USA National Office
P. O. Box 4437
Alexandria, VA 22303
Phone: (703) 351-5243
FAX: (703) 351-5254
Email: ISTEUSA1@aol.com*

*National Coordinating
Council On ---*

TECHNOLOGY in EDUCATION and TRAINING [NCC-TET]

IS A NATIONAL COALITION ADDRESSING CURRENT ISSUES AND POTENTIAL USES OF TECHNOLOGY TO IMPROVE EDUCATION AND TRAINING.

INCLUDES NATIONAL, NON-PROFIT MEMBERSHIP ASSOCIATIONS, STATE AND LOCAL GROUPS, INDIVIDUAL PARTICIPANTS, AND BUSINESSES INVOLVED IN EDUCATION AND TRAINING THROUGHOUT THE UNITED STATES.

PURPOSES ARE TO:

- FACILITATE COMMUNICATIONS AMONG AND WITHIN STAKEHOLDER COMMUNITIES;
- DEVELOP AWARENESS OF EDUCATIONAL TECHNOLOGIES THROUGH A VARIETY OF ACTIVITIES SUCH AS PRESENTATIONS, WORKSHOPS, AND SYMPOSIA; AND TO
- ARRIVE AT CONSENSUS ON "WHAT WORKS" AND "WHAT ACTIONS" SHOULD BE INITIATED TO FACILITATE DEVELOPMENT OR ADOPTION OF NEEDED EDUCATIONAL TECHNOLOGIES FOR USE IN EDUCATION AND TRAINING PROGRAMS THROUGHOUT THE UNITED STATES.

STEERING COMMITTEE:

NCC/FORUM ACTIVITIES ARE
GUIDED BY A PARTICIPANTS' STEERING
COMMITTEE PRESENTLY INCLUDING:

American Association of Adult and
Continuing Education
American Educational Research Association
American Federation of Teachers
American Library Association
American Society for Training
and Development
ARTSEdge
Association for Computing Machinery
Association for Educational
Communications and Technology
Association for Supervision
And Curriculum Development
Association for the Advancement
of Computing in Education
Cable In The Classroom
Consortium for School Networking
Council for Educational Development
and Research
Council of Chief State
School Officers
EDUCOM
Far West Laboratory
IBM Foundation
Information Infrastructure
Clearinghouse
Inst. for Simulation and Training
International Communications
Industries Association
International Society for
Technology in Education
KIDSNET
Lightspan Partnership
National Association of
Secondary School Principals
National Council for Accreditation
of Teacher Education
National Council of Teachers
of English
National Education Association
National Foundation for the
Improvement of Education
National School Boards Association
Organizations Concerned about
Rural Education
Pacific Telesis
Public Broadcasting Service
Society for Applied Learning
Technology
Software Publishers Association
The Mecklenburger Group
The National PTA
Triangle Coalition for Science and
Technology Education

Council Organization

I. Governance: NCC-TET activities are managed by an Executive Board of elected/appointed officers and committee chairs. The Executive Board includes:

NCC-TET Co-chairs. There are three co-chairs who are elected by the Steering Committee to represent formal education, adult education and training, and business communities involved in NCC-TET activities. Co-chairs must be members of the Steering Committee and will serve 2-year terms of office. Co-chair responsibilities include attending and "co-chairing" Executive Board and Steering Committee meetings and managing NCC-TET projects as approved by the Executive Board and/or Steering Committee.

Secretary. The secretary of the NCC-TET is appointed by the organization administratively supporting NCC-TET activities with the approval of the Steering Committee. Secretarial duties include membership management, preparation and reporting on NCC-TET meetings, NCC-TET financial accounting, and such other administrative activities as may be required in the conduct of NCC-TET activities.

Treasurer. The treasurer of the NCC-TET is elected by the Steering Committee for a 2-year term from among the members of the Steering Committee. Treasurer duties include oversight for and reporting on uses of NCC-TET funds.

Committee Chairs. Chair(s) of NCC-TET committees are appointed or reappointed annually by the Steering Committee; must be members of the Steering Committee; and, in addition to chairing committee activities, committee chair(s) serve as members of the Executive Board during their tenure as committee chair(s).

II. Committees:

Policy Committee. The purpose(s) of this committee are to address issues of "what works" and "what actions" should be initiated to facilitate development or adoption of needed educational technologies for use in education and training programs throughout the United States. Members include volunteers from among NCC-TET member organizations and others appointed by the committee chair(s).

Communications and Networking Committee. The purpose(s) of this committee are to facilitate communications among and within stakeholder communities and to develop awareness of educational technologies through a variety of activities such as presentations, workshops, and symposia. Members include volunteers from among NCC-TET member organizations and others appointed by the committee chair(s).

Legislative Committee. The purpose(s) of this committee are to monitor and analyze Federal Legislation relating to uses of technology in education and training programs in America. Members include volunteers from among NCC-TET member organizations and others appointed by the committee chair(s).

National Coordinating Committee on Technology in Education and Training (NCC-TET)

Members:

American Association of Adult and Continuing Education
American Association of Community Colleges
American Association of School Librarians
American Association for the Advancement of Science
American Educational Research Association
American Federation of Teachers
American Library Association
American Society for Training and Development
American Vocational Association
Association of American Publishers
Association for Computing Machinery
Association for Educational Communications and Technology
Association for Education and Rehabilitation
Association for Supervision & Curriculum Development
Association for the Advancement of Computing in Education
Benton Foundation
Black College Satellite Network
Broadcast Education Association
Cable In The Classroom
Council of 100
Council for Educational Development and Research
Council of Great City Schools
Consortium for School Networking
Council of Chief State School Officers
EDUCOM
George Lucas Foundation
George Washington University
IBM Foundation
Information Infrastructure Clearinghouse
Institute for Research on Learning
Institute for Simulation & Training
Interactive Multimedia Association
International Communications Industries Association
International Society for Technology in Education
KIDSNET
Learning through Media Coalition
National Alliance of Black School Educators
National Arts Education Information Network
National Association of Secondary School Principals
National Association of Elementary School Principals

National Association of State Boards of Education
National Association of State Directors, VoTech Education
National Catholic Educational Association
National Center on Education and the Economy
National Council for Accreditation of Teacher Education
National Council for Social Studies
National Council of Teachers of English
National Council of Teachers of Mathematics
National Education Association
National Foundation for the Improvement of Education
National Home Study Council
National School Boards Association
National Security Industrial Association
National Technological University
Office of U.S. Representative William F. Goodling
Offices of U.S. Senator Edward M. Kennedy, Jeff Bingaman, and Thad Cochran
Organizations Concerned about Rural Education
Private Sector Council
Public Broadcasting Service Online
Public Broadcasting Service
Quality Education Data
Regional Bell Telephone Companies
Society for Applied Learning and Technology
Software Publishers Association
Technology Student Association
The Mecklenburger Group
The National PTA
Triangle Coalition for Science and Technology Education
U.S. Distance Learning Association

Observers:

Advanced Research Projects Agency
California State University System
Fairfax County Schools
National Aeronautics and Space Administration
National Education Goals Panel
National Oceanic and Atmospheric Administration
National Science Foundation
Office of Educational Research and Improvement, U.S. Department of Education
Office of Science and Technology Policy, Executive Office of the President
Office of Technology Assessment, U.S. Congress
Office of the Deputy Secretary, U.S. Department of Education
Office of the Director, Federal Communications Commission
U.S. Air Force (Human Resources Division)
U.S. Army Research Institute

The National Information Infrastructure: Requirements For Education and Training



*Prepared by the National Coordinating Committee on
Technology in Education and Training (NCC-TET)*

March 25, 1994

Executive Summary

Access Requirements

1. Ensure that all Americans have affordable access to the NII.
2. Ensure that the NII is accessible in a variety of learning environments.
3. Develop a variety of sustained public and private partnerships and funding mechanisms to support education and training uses of the NII.
4. Make public and private information resources available to schools, institutions of higher education, training institutions, libraries, and arts and cultural institutions.

Education and Training Application Requirements

5. Coordinate NII-related education and training activities conducted by federal departments and agencies.
6. Develop and disseminate NII guidelines for education and training applications.
7. Identify and disseminate effective education and training applications of the NII.
8. Integrate applications of NII and related technologies into education reform plans.
9. Develop quality education and training applications for the NII.
10. Conduct research on the education and training applications of current and emerging technologies.
11. Promote training, professional development, and technical assistance for educators as an integral part of the development of the NII.
12. Support ongoing evaluation of the effectiveness and impact of the NII to inform policy makers and educators.

Technical Requirements

13. Emphasize interactive, broadband transmission of voice, video, and data for education and training.
14. Provide seamless interconnection among all relevant information networks and services.
15. Guide the development of voluntary standards that promote interoperability.
16. Ensure that the NII is easy to use.
17. Develop comprehensive directories of information resources and "navigation" systems for locating these resources.
18. Support user collaboration.
19. Create adequate measures to protect the security of resources on the network.

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Disclaimer: This position paper has been prepared and is being distributed in order to facilitate understanding of education and training requirements that must be addressed in the development of America's National Information Infrastructure. It represents a consensus of opinions held by representatives of national professional education, training, and trade associations participating in the NCC-TET collaboration and does not necessarily imply endorsement by organizational participants in the Committee process or government personnel who attended meetings of the Committee.

Introduction

The National Coordinating Committee for Technology in Education and Training (NCC-TET) has developed the requirements discussed below to ensure that the National Information Infrastructure (NII) provides expanded opportunities for education and training. National organizations representing education, training, government, defense, business, arts and cultural institutions, and libraries have contributed to the development of these requirements. They are intended as guidelines to be used by the Administration, Congress, state agencies, national and state organizations, and other education and training stakeholders to help shape future policy and legislation.

This is a time of unparalleled change in the United States. The growing integration of the global economy is placing enormous stress on our labor force requirements and education and training systems. In the aggregate, jobs of the future will be more complex and demand much more of employees. Lifelong learning will eventually become commonplace. This means that the education and training communities must accommodate an enormously diverse community of learners in a wide variety of contexts. The NII has a preeminent role to play in meeting the emerging needs of our society. As one commentator notes:

The promising vision of an advanced telecommunications infrastructure lies not only in its potential to help public and private institutions to prosper and survive, but also in its capacity to improve social, educational, and economic services for the vast majority of the nation's citizens.
(Sheekey 1993)

The education and training communities need an NII that allows interactive communication among teachers, students, and parents and meets the complex and diverse information needs of teachers and students. The NII must be able to support learning across a whole range of users and contexts while overcoming the barriers of time and distance. The NII must support attainment of the National Education Goals.

The requirements are grouped into three areas: access requirements, education and training application requirements, and technical requirements.

Access Requirements

Requirement 1. Ensure that all Americans have affordable access to the NII.

Rationale: Accessing the best and most recent information to do a job or perform a task must become a cultural norm by the end of the century. It is especially critical that schools develop this capacity. As Vice President Gore noted during his January visit to Los Angeles, "When it comes to ensuring universal service, our schools are the most impoverished institutions in society."

Almost 90 percent of K-12 classrooms lack even basic access to telephone service (Princeton Survey Research Associates 1993). When classrooms do have phone lines, schools are typically charged at the corporate rate for telephone service. Schools have not been the beneficiaries of the universal service policies that resulted in the delivery of basic service at affordable rates for most American homes.

An interim goal of providing at least one connection to every school building and educational site in the nation can be achieved almost immediately. The goal of connecting every home and classroom to the NII should be set for the year 2000. Populations (e.g., rural and poor populations) which have traditionally been underserved must have special attention paid to them with respect to both network access and information resources relevant to their needs.

Requirement 2. Ensure that the NII is accessible in a variety of learning environments.

Rationale: The applications on the NII should extend into homes and workplaces as well as schools, institutions of higher education, libraries, and arts and cultural institutions. The vision of the NII is one in which learning occurs in a variety of environments throughout the course of one's life. The NII should make it possible for individuals to gain access to the resources they need when and where they want access. The principle of "learning on demand" should guide the design of all NII-related education and training programs funded by the federal government.

Requirement 3. Develop a variety of sustained public and private partnerships and funding mechanisms to support education and training uses of the NII.

Rationale: It is clear that if our education system is to have universal access to a broadband NII, its use must be adequately subsidized in some fashion. Schools and other public service organizations would pay rates subsidized by private organizations using the network or tap into other revenue sources.

This may require a change in existing universal service arrangements. Currently, corporate users subsidize residential users. A revised model might require educational telecommunications to be subsidized by corporate users. We would, however, have to revise existing subsidy formulas to make them compatible with growing competition in the local loop. Future arrangements should require all telecommunications providers to contribute to universal service funds.

At the present time, rural schools usually pay more for access to information services because the nodes of information service providers are not located in local calling regions. *Universal service* must mean that all schools have affordable access to all information services, including high bandwidth resources.

To solve equipment and training problems, the federal and state governments could establish technology funds that could be used to help poorer districts defray the costs of purchasing the equipment or providing the training needed to use the network. Necessary requirements would

not only include the time online, but also the tools and materials (computers, modems, scanners, video cameras, ordinary cameras, VCRs, software applications, and printers, for example) that would be necessary to take full advantage of such an infrastructure. In the absence of outside funding, some districts would be far more able to use the resources of the NII than other districts.

State and federal funding is appropriate for education and training applications of the NII in a number of areas. These include planning grants, applications research and development, information clearinghouse activities for model programs, technical assistance programs, and training-related activities (in the development of materials, for instance).

Both state and federal governments should consider various forms of tax relief for producers to create software and programs and telecommunications providers to supply access, services, and equipment. Alternative sources of funding might be pursued. In an open, competitive telecommunications environment, schools could form statewide or even regional cooperatives with state and local governments and universities for purchasing telecommunications services. Their aggregate purchasing power would ensure that they received services at the lowest possible cost. Savings from such arrangements would be earmarked for special trust funds designed to allow districts to purchase services and equipment.

Another possibility includes renting (rather than auctioning off) the rights to new allocations of the electromagnetic spectrum to telecommunications companies. Revenues from such rental fees could result in billions of dollars to ready our educational institutions for the next century. Yet another alternative funding source could be a check-off box on telephone bills that allows rate payers to make donations to educational telecommunications projects.

Requirement 4. Make public and private information resources available to schools, institutions of higher education, training institutions, libraries, and arts and cultural institutions.

Rationale: The NII should include the information resources developed and maintained by both public and private sources. Educators and students are already using a wide variety of these resources. Teachers and students are now accessing data from the Jet Propulsion Laboratory- NASA space mission. Others are using the Internet to communicate with researchers or to search the catalogues of distant libraries. In California, teachers use software and video clearinghouses to select programs that align with state curriculum frameworks as well as national education goals and performance standards.



International Society for Technology in Education

Education and Training Application Requirements

Requirement 5. Coordinate NII-related education and training activities conducted by federal departments and agencies.

Rationale: Many federal agencies and departments participate in grant programs and other activities that support the use of telecommunications in all disciplines. They include the Departments of Education, Defense, Agriculture, Energy, and Commerce (through the National Telecommunications Information Administration); the Advanced Research Projects Agency; and the National Science Foundation.

It is vital that adequate means be established for federal agencies to share information and coordinate planning, implementation, and evaluation of applications of the NII for the education and training communities. A national interagency council or task force could be established, for example.

Most federal educational telecommunications programs predate the formation of policy discussions and telecommunications industry changes that anticipate the NII. As a result, existing federal programs must be reshaped to prepare for radically new kinds of technology-based education and training environments.

Requirement 6. Develop and disseminate NII guidelines for education and training applications.

Rationale: The federal government has a legitimate and important role in the promulgation of national standards. National standards could serve a number of important functions within the NII context. Instructional standards would ensure that education and training applications of the NII help us attain the National Education Goals. To promote a teaching profession experienced in the effective use of technology, national teacher certification standards and credentialing requirements should be expanded to include applications of educational technology. Applications standards would work to maintain the quality of individual applications and facilitate their development. Standards should be developed with the ongoing advice of key stakeholders in the education and training communities.

Requirement 7. Identify and disseminate effective education and training applications of the NII.

Rationale: Effective educational technology and telecommunications applications should be developed, identified, and disseminated. An identification and dissemination process should be established and coordinated among the Regional Education Laboratories, the Department of Energy Laboratories, the National Science Foundation, and Department of Education programs. Existing dissemination systems such as the Eisenhower National Clearinghouse, ERIC, and the National Diffusion Network should be incorporated into this process.

Requirement 8. Integrate applications of NII and related technologies into education reform plans.

Rationale: One of the core components of the Goals 2000 initiative is that all states will develop comprehensive educational plans in support of the attainment of the National Education Goals. The NII (as it develops) and related technologies can be key supports for education reform. Serious

consideration should be given to educational technology in plans under development at the national, state, and local levels.

Careful planning is a prerequisite for the effective application of teaching and telecommunications in education and training. The national education reform agenda must ensure that states have the incentives and direction to develop technology and NII application plans. Plans should 1) involve education stakeholders in their design; 2) be guided by education and training needs of learners; 3) specify clear objectives related to national and local education goals; and 4) incorporate technology applications and practices that have been tested for their educational benefits.

Requirement 9. Develop quality education and training applications for the NII.

Rationale: The development of quality software and video programming is critical to the successful implementation of the NII in education and training contexts. Educational software and programming should support the National Education Goals and curriculum standards. Software developers and video producers should have financial incentives available such as tax incentives, low interest loans, and seed money to encourage development of products for the educational and training markets. As a condition of receiving incentives, software developers should be required to consult with experienced curriculum developers and practicing educators on the design and testing of programs. The educational technology application guidelines suggested above should be applied to this process. Ongoing dialogue between educators and industry will result in software that is well-suited to education and training needs for both learners and educators. To ensure that new technologies and applications address the needs of diverse and special needs populations, testing of software and programming should be conducted across socioeconomic, racial, ethnic, and gender lines.

Requirement 10. Conduct research on the education and training applications of current and emerging technologies.

Rationale: Educators need access to research findings for guidance in the selection of hardware and educational software. In numerous instances, school districts have made major technology purchases without reliable information about the educational benefits of these resources. Further research is needed to guide the development of new software and to determine the ability of existing technologies to meet the challenges found in education and training environments. Grants should be given for the study of what works under what circumstances for specific populations. Research findings should be made available to all educators over the network.

Requirement 11. Promote training, professional development, and technical assistance for educators as an integral part of the development of the NII.

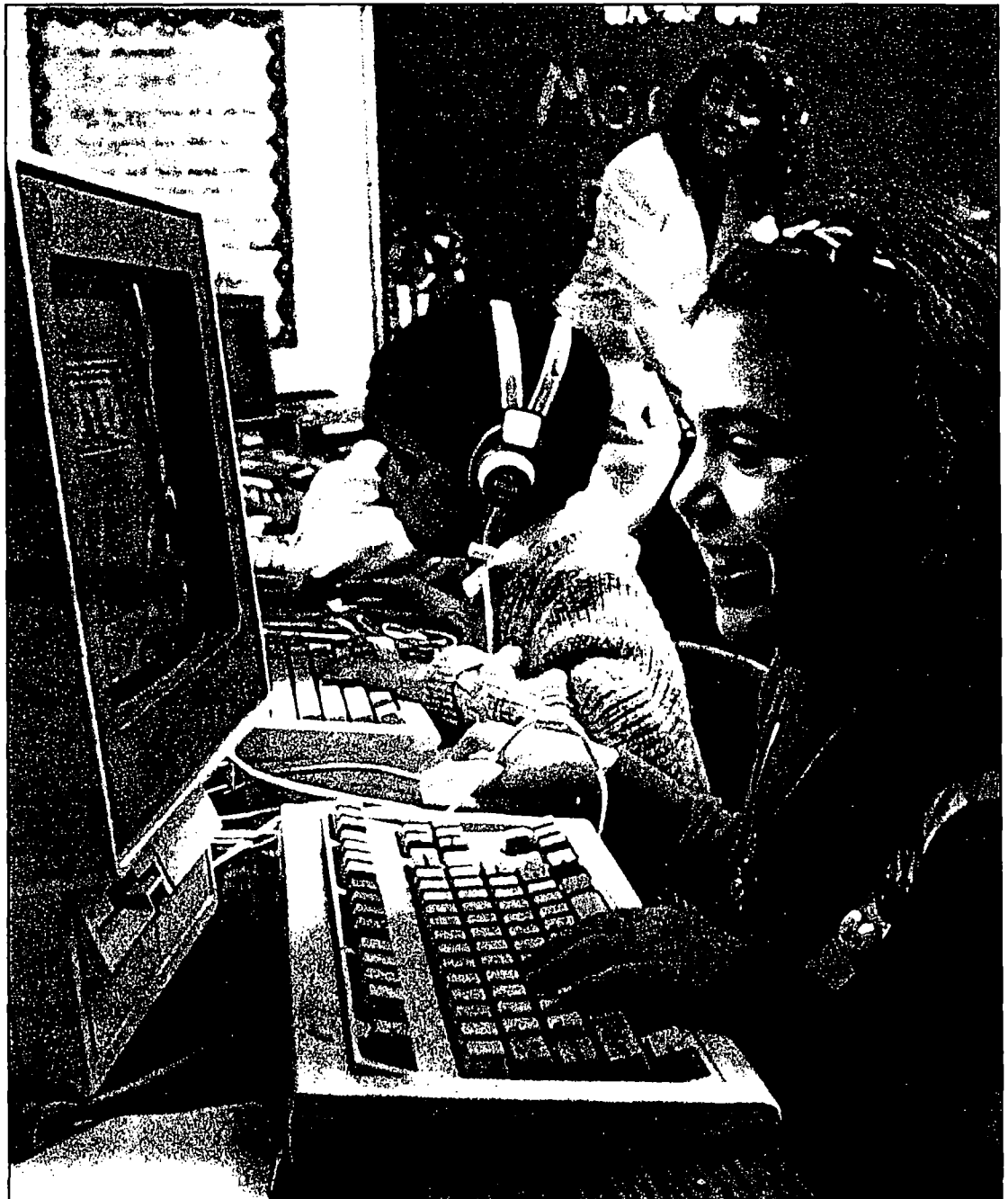
Rationale: Staff development, training, and follow-up assistance is a prerequisite for effective and sustained applications of technology and telecommunications. Educators need opportunities to acquire the skills necessary to use telecommunications and other technologies effectively. Teacher training must not only be provided for equipment and software operation, but also for teaching strategies that incorporate the use of a variety of technologies.

Consideration should be given to the enormous training challenge represented by the NII. The skills and knowledge of people using the NII should be considered as important as its hardware and software. Funding for both the training of educators and the development of training materials should be provided.

Requirement 12. Support ongoing evaluation of the effectiveness and impact of the NII to inform policy makers and educators.

Rationale: Ongoing evaluations should inform stakeholders about access, adherence to standards, levels of use, and the impact of the NII on teaching and learning. The results of evaluation should be used to guide program improvements and to inform decision makers about the benefits and barriers of the NII in relation to education.

The continual improvement of educational and training applications on the NII depends upon ongoing evaluation. Evaluative criteria should be developed for the identification of promising practices and programs. These criteria should be used to evaluate educational and training applications of the NII in a wide range of diverse racial, cultural, and geographic environments.



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Technical Requirements

Requirement 13. Emphasize interactive, broadband transmission of voice, video, and data for education and training.

Rationale: The need for a broadband NII is extensively promoted for entertainment and commercial use, but not addressed as a critical need for education and training. Increasingly, educators are seeing the need to provide learning experiences in multiple media. A broadband network could be used to beneficial effect by delivering multimedia materials online to students at their workstations to support diverse learning styles.

Communication is currently limited to text and data in most instances. Interactive video will open new dimensions in the learning process that are not possible with voice and data transmission alone. However, broadband systems will be necessary to permit the use of interactive video in education. The ability to transmit voice, video, and data with relative ease across networks will extend teaching and learning beyond traditional school walls, opening the classroom to the world outside.

Requirement 14. Provide seamless interconnection among all relevant information networks and services.

Rationale: There are 71 satellite education networks worldwide. Roughly 60 networks are located in the United States alone (Hansell 1992). On the training side, the U.S. Army's Teletraining Network (TNET) uses digitized, compressed video to present 67 distributed training courses to over 30 sites. The Army Logistics Management College (ALMAC) has a Satellite Education Program (S.E.P.) delivering 20 distributed training courses to 79 sites (Redding and Fletcher, in press). Online services and electronic forums used by educators exist on a variety of electronic networks.

Existing resources could be leveraged much more effectively if education and training networks were interconnected and instructional programming were available across networks. The NII must become a seamless network of networks that links learners to information and communication. The barriers caused by incompatible technologies and isolated networks must be eliminated. New communication protocols and continued technological innovation should permit the easy exchange of information among diverse networks in a variety of media

Requirement 15. Guide the development of voluntary standards that promote interoperability.

Rationale: Standards that promote interoperability allow devices to connect easily with one another and permit software and hardware to be used in and exchanged across a variety of telecommunications and hardware environments. This lowers the cost of user training as well as hardware and software. Ultimately, this will lower hardware and software costs, create a robust market for education-related products, support equity of access, and eliminate one of the major barriers to the use of networking technologies.

Requirement 16. Ensure that the NII is easy to use.

Rationale: Research and development is needed to assure that user interfaces for education and training applications are designed to be easy to use and are as consistent as possible across computer platforms, individual databases, and information services. Today, the rich resources and networks of the Internet are a province of the few. In the general teaching population, only one-fifth of teachers are familiar with the Internet and only 4% have access to it (Princeton Survey Research Associates 1993). Over one-third of the K-12 teachers using telecommunications who were surveyed by the Center for Technology in Education did not even know if they had access to the Internet (Honey and Henriquez 1993). Teachers who do have Internet access report that complicated procedures are one of the major barriers to using it and engaging their colleagues in use of the network.

If the NII is to become truly universal and indispensable to our citizenry, it should be as easy to use as most household appliances. In this vision, the user takes center stage. "Knowbots," an idea first proposed by Robert Kahn, represents one of the most promising research directions at the present time. After being given a simple command in English, "the knowbot would 'travel' over the network, enter several computers it knows to contain this information, search around each using its syntax and conventions, combine the gleanings from these data stores into a single response, and translate it into a format understood by the user's computer" (Dertouzos 1991).

In this way, the enormous complexity of such a system is hidden from the user and the ease of use allows the user to build rapport with it. In the K-12 and training environments, many educators continue to experience considerable anxiety around computers and other electronic devices. An information and electronic service resource driven by friendly "electronic agents" would help to overcome this significant problem.

Requirement 17. Develop comprehensive directories of information resources and "navigation" systems for locating these resources.

Rationale: In part, resources and services appear fragmented because there is no comprehensive directory of available information over electronic networks. Users often are forced to resort to chance discoveries and word of mouth to locate relevant information sources. Better methods of organizing the many pieces of the information available to users are needed. A truly easy system of searching and accessing information on the network must be developed. Until this happens, the NII must have people available to serve as network guides.

Requirement 18. Support user collaboration.

Rationale: Since a premium will be placed on collaboration in the training and educational organizations of the future, the infrastructure's ability to support collaboration among users is a vital requirement. Contemporary efforts to encourage collaboration using electronic media are distinguished by several factors: collaboration in multiple modes and media, ease of use, easy retrieval and forwarding of sessions, and accessibility in the work environment (Brittan 1992).

A comprehensive directory is only the first step in addressing this need. People-to-people communication is open-ended, consists of a wide variety of data types (voice, text, images, graphics, animation, video, spreadsheets, documents, and gestures), and takes place in multiple contexts (Felde 1992).

Beyond establishing and terminating sessions, the NII must be able to maintain records of past sessions. After a session has occurred, it should be saved in the network in a form that allows the user to retrieve a record of interactions. The retrieval system should use subject or content references as

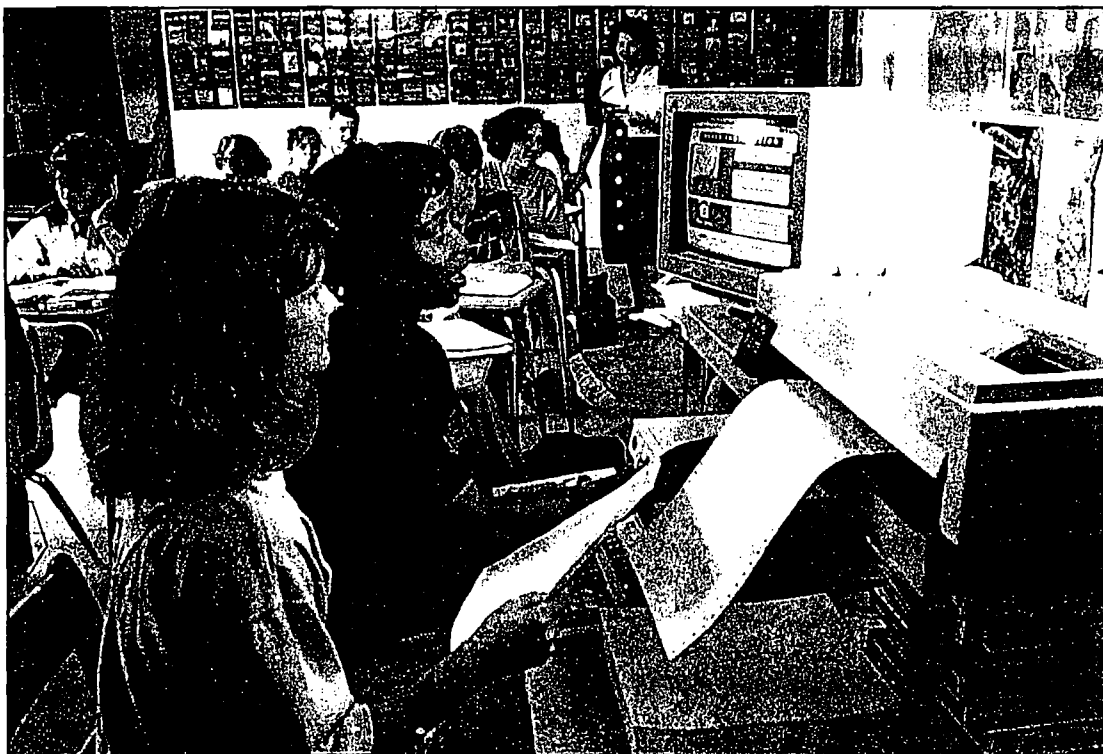
well as session references. For example, a user should be able to request the "record of the March 12 training on interpreting statistics." Moreover, it should also be easy to configure user groups. If several classes of students at geographically dispersed locations (or groups of individual students for that matter) wish to pursue a subject of common interest, it should be easy for them to arrange to work together online, share resources, and easily interact with a variety of connecting technologies. In other words, it should be easy to create collaborative learning communities.

Requirement 19. Create adequate measures to protect the security of resources on the network.

Rationale: The NII should have security systems adequate to protect the privacy of individuals, the confidentiality of documents, and intellectual property rights. The rights of privacy and confidentiality are cornerstones of our society. The NII will carry information that is sensitive to individuals and organizations. Government, business, and education must work together to guarantee the security of this information.

The NII should also have security systems capable of safeguarding intellectual property rights. This gives an incentive to software and video producers to develop and disseminate their works over the NII. The protection of intellectual property rights should be accomplished in a manner which safeguards the rights of right holders, provides them with appropriate and timely compensation, and allows protected information to flow over the network. Systems adopted to protect intellectual property should rely on the copyright law which permits the "fair use" of accessed over the network under some circumstances.

A balance must be created between the need for security and the need for open and free access to information on the network. Different levels of security should be established to allow material with varying degrees of sensitivity to be transmitted in the most effective manner.



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Acknowledgments

While it is impossible to fully credit all of the individuals and organizations who contributed to the preparation of this position paper, the Committee would like to acknowledge the following individuals who made the work possible:

Principal Authors

John Yrchik, National Education Association

John Cradler, Council for Educational Development and Research

NCC-TET Executive Officers

Co-chairs: Drew Allbritten, American Association for Adult and Continuing Education

Brenda Kempster, Regional Bell Telephone Companies

Frank Withrow, Council of Chief State School Officers

Secretary: Dennis Bybee, International Society for Technology in Education

Treasurer: Cheryl Williams, National School Boards Association

NCC-TET Sub-Committee on National Policy Issues

Co-chairs: John Cradler, Council for Educational Development and Research

Ed Schroer, American Society for Training and Development

Members: Geri Andersen-Nielsen, National Education Goals Panel

Bill Graves, EDUCOM

Sue Kamp, Software Publishers Association

Tom Koerner, National Association of Secondary School Principals

Keith Krueger, Organizations Concerned about Rural Education

Julie Medin, Institute for Simulation and Training

Jim Mecklenburger, The Mecklenburger Group

Robert Seidel, U.S. Army Research Institute

Scott Stoner, Alliance for Arts Education

Boyce Williams, National Council for Accreditation of Teacher Education

John Yrchik, National Education Association

Reviewers

Kathleen Barfield, California Department of Education

Greg Dumas, Telebit Corporation

Carol Edwards, National Foundation for the Improvement of Education

Lynn Fontana, National Council for Social Studies

Kim Igoe, American Association of Museums

Karen Jaffe, KIDSNET

Cindy Johanson, Public Broadcasting System

John J. Mahlmann, Music Educators National Conference

C. Dianne Martin, George Washington University

Denis Newman, Bolt, Beranek, and Newman, Inc.

Ruth Perlin, National Gallery of Art

Mabel Phifer, Black College Satellite Network

Paula Reinman, Pacific Telesis

Ilene Rosenthal, Curriculum Television Corporation

Carol Sterling, American Council on the Arts

Michael Sullivan, Southwest Educational Development Laboratory

Bonnie Tenebaum, Enterprise Integration Technologies

Marty Tenebaum, Enterprise Integration Technologies

Mark Traphagen, Software Publishers Association

Lauren Williams, Triangle Coalition for Science and Technology Education

William Wright, National Council of Teachers of English

National Coordinating Committee on Technology in Education and Training (NCC-TET)

Members:

American Association of Adult and Continuing Education
American Association of Community Colleges
American Association of School Librarians
American Association for the Advancement of Science
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Interactive Multimedia Association
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KIDSNET
Learning through Media Coalition
National Alliance of Black School Educators
National Arts Education Information Network
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 Office of U.S. Representative William F. Goodling
 Offices of U.S. Senator Edward M. Kennedy, Jeff Bingaman, and Thad Cochran
 Organizations Concerned about Rural Education
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 Regional Bell Telephone Companies
 Society for Applied Learning and Technology
 Software Publishers Association
 Technology Student Association
 The Mecklenburger Group
 The National PTA
 Triangle Coalition for Science and Technology Education
 U.S. Distance Learning Association

Observers:

Advanced Research Projects Agency
 California State University System
 Fairfax County Schools
 National Aeronautics and Space Administration
 National Education Goals Panel
 National Oceanic and Atmospheric Administration
 National Science Foundation
 Office of Educational Research and Improvement, U.S. Department of Education
 Office of Science and Technology Policy, Executive Office of the President
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Comments

The Committee invites comments and suggestions as to how these requirements might be achieved through independent and collective activities of public and private education and training stakeholders—locally, in states, and nationally.

Please mail suggestions to:

NCC-TET, P. O. Box 4437, Alexandria, VA 22303

or send via electronic mail to:

NCCTET-COMMENTS@EDUCOM.EDU

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TECH CORPS

Vision:

A national, non-profit organization of technology volunteers dedicated to helping improve K-12 education at the grass roots.

Mission:

The mission of Tech Corps is to recruit, place, and support volunteers from the technology community who advise and assist schools in the introduction and integration of new technologies into the educational system. Volunteers provide assistance with local planning, technical support and advice, staff training, mentoring, and classroom interactions. The organization utilizes the abilities of skilled individuals and groups across the country in an effort to prepare students, teachers, and schools for the 21st century.

Mode of Operation:

Tech Corps is a volunteer organization. It is funded principally through corporate sponsorships. It has a small headquarters staff to set the Tech Corps mission and agenda, establish and maintain the culture, provide national media liaison, and ensure quality. The broader organization is based on a bottom-up philosophy and draws on the expertise and enthusiasm of technology-literate members of local communities.

Activities:

Tech Corps volunteers work with the teachers and school administrators in their local communities. They do whatever is necessary to promote the effective use of computing and communications technologies in K-12 education. Thus, their tasks may range from getting local contractors to upgrade the electrical wiring in a school, to installing a local area network, to providing assistance in obtaining computing hardware and networking services, to finding a volunteer systems administrator, to helping with the development of a school's World Wide Web home page, to providing assistance with the development of teaching materials, to mentoring students, teachers, or administrators in the uses of computing and communications technologies. Since the determining factors are local needs, a wide variety of tasks are conceivable.

Draft: 13 August 1995

Tech Corps Rollout:

MAY 95	Begin Tech Corps incorporation and tax exemption
JUNE 95	Tech Corps prototype in six states; Obtain corporate and laboratory assistance in building Tech Corps computing and communications infrastructure
AUGUST 95	Tech Corps home page and mirror sites on the Internet in experimental mode; Refine Tech Corps definition, based on feedback from prototype
SEPTEMBER 95	Presidential announcement of Tech Corps and call for organizers; Initial Tech Corps media release and announcement of Charterers' Conference; Public debut of Tech Corps home page; Pointer from White House home page activated
OCTOBER 95	Charterers' Conference held in Washington, DC
NOVEMBER 95	Tech Corps call to businesses at Comdex (possibly by Vice President); Home page focus shifts to recruiting business participants
JANUARY 96	Tech Corps media release and call for participation by school districts; Home page focus shifts to recruiting school districts
APRIL 96	Tech Corps media release and call for participation by volunteers; Home page focus shifts to recruiting individual volunteers
SEPTEMBER 96	Tech Corps operational

WHY TECH CORPS CAN PULL ALL THE PIECES TOGETHER

What is It?

The **Tech Corps** will recruit, place, and support volunteers from the technology community to advise and assist schools with the introduction and integration of new technologies into the educational system. Volunteers will provide assistance with local planning, technical support and advice, staff training, mentoring, and classroom interactions. The organization will use the abilities of skilled individuals and groups across the country in an effort to prepare students, teachers, and schools for the 21st century.

What will Be the Benefit to Schools?

There is tremendous energy in our schools to move toward more effective implementation of technology. But the reality is that the available resources are slim. The Tech Corps seeks to provide the human resources that can support and enhance the school's local technology efforts.

The Tech Corps offers schools qualified, enthusiastic individuals who are willing to share their technical talents and experiences with the schools in a **volunteer** capacity. The "people power" being offered has the potential for offsetting significant expenses which the schools might incur if they sought outside assistance with these projects. In addition, community awareness of and interest in the schools will increase through the involvement and commitment of local citizens who might not otherwise have reason to participate in school activities.

What Will Be the Benefit to the Volunteers?

All too often, individuals wish to volunteer but do not know where or how. The Tech Corps offers a vehicle for volunteering for those individuals who would like to share their time and talents with their local schools. Through the Tech Corps, individuals have the opportunity to give something back to their community and to have a positive impact on kids, schools, and education in their state.

While working with a specific school district, Tech Corps Volunteers will also be part of a larger organization that is having impact on education state- and nation-wide. Volunteers will meet with others throughout the state at state-wide Tech Corps events, learn about projects in other school districts across the nation through the Tech Corps web site, and feel part of **an organization that is making a difference.**

CHALLENGE GRANTS FOR TECHNOLOGY IN EDUCATION

The Challenge Grants for Technology in Education are designed to build alliances between educators, the private sector, and others to develop a new generation of interactive learning tools. These five-year grants will support partnerships that include at least one school district and other organizations seeking to meet educational goals through the use of technology -- particularly in underserved and urban areas.

The first Challenge Grant competition is currently underway, and 505 applications were received by the June 2, 1995 deadline. Such a large number of applications indicates that the "Challenge" to local school districts, companies, universities, and other organizations to work together to develop new educational solutions involving technology has been very successful. Notable in these applications is strong participation from the private sector, universities, and non-profit organizations:

- Two-thirds of proposals have one or more private companies as partners, with one-third being telecommunications companies.
- More than half of the proposing agencies partner with institutions of higher learning (for a total of 900 colleges and universities).
- Over 300 libraries, 250 museums, and nearly 1000 non-profits are included as partners.
- Proposals have been received from every state.

Funding for Challenge Grants is \$9.5 million in FY 95. These funds will leverage millions more in private sector support and local community involvement in education. The grants are administered by a team led by Thomas Carroll at the Interagency Learning Technology Office. Approximately 10 grants will be awarded in September.

DRAFT: 8/2/95

NATIONAL TECHNOLOGY HONOR SOCIETY

Purpose. The purpose of the NTHS is to (1) provide an organization through which students can help bring computing and communications knowledge and technology into their schools and (2) recognize and reward students who use their technological expertise to serve their schools.

Function. Members will (1) assist teachers, school administrators, and adult volunteers with integration and use of technology in schools; (2) train teachers, school administrators, classmates, and parents in the use of technology in the schools; (3) participate in mentoring programs with middle/elementary schools; (4) serve as computer system administrators for a class or teacher; and (5) perform other functions which serve the goal of increasing/improving the use of technology in education.

National Sponsor. National Association of Secondary School Principals will manage and guide the NTHS, which will be modeled on the National Honor Society (founded in 1926). NASSP will perform the following functions for the NTHS: create and maintain an organizational structure to support the NTHS on a national level; determine and publish guidelines for local chapters; and publicize the NTHS organization in schools. NASSP will also set NTHS membership selection criteria and define a reward structure.

Potential Faculty Sponsors. Computer science, engineering, tech prep, science, physics, and math teachers; media center managers; other faculty with computing expertise and interest.

Parental Involvement. NTHS can work with the PTA to educate parents on the use computers and the Internet in the schools.

Endorsement. The President's Advisor for Science and Technology, John H. Gibbons, has written NASSP in support of the NTHS concept.

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DRAFT: 7/31/95

EXECUTIVE ORDER #####
INTERAGENCY LEARNING TECHNOLOGY OFFICE

By the authority vested in me as President by the Constitution and the laws of the United States of America, including _____ (Public Law #####), and in order to establish an interagency learning technology office to bring learning technology to bear on the objectives of education, training, and life-long learning, it is hereby ordered as follows:

Section 1. Establishment. There is established the Interagency Learning Technology Office ("the ILTO").

Section 2. Purpose. The purpose of the ILTO is to initiate and support focused collaborations of the technology agencies with the Department of Education to create and demonstrate learning technologies for the 21st century.

Section 3. Functions. (a) The principal functions of the ILTO are, to the extent permitted by law:

- (1) To initiate and support focused interagency collaborations in the research, development, demonstration, assessment, and dissemination of learning technologies across the Federal government.
- (2) To identify and focus the knowledge and expertise on learning technologies that exist within each of the Federal Departments and Agencies.
- (3) To promote and coordinate public-private sector collaboration, investments, and partnerships for improving learning productivity.
- (4) To serve as a single point of access to the best available learning technologies within the Federal government for state and local governments, private companies, and individual Americans.
- (5) To assist Federal agencies with identifying and using technology in major education and training programs.

(b) The ILTO may, at the discretion of its Director and consistent with FACA requirements, convene advisory panels to assist in the performance of its functions.

Section 4. Direction. (a) The Chair of the Executive Board of the ILTO ("the Chair") shall be a senior official of the United States Government, whose oversight of

the ILTO shall be added to his or her existing duties. Assignment to the position of ILTO Chair shall be made by the President of the United States, and the Chair shall serve at the pleasure of the President.

(b) The Executive Board shall be appointed by the National Science and Technology Council.

(c) The Executive Director of the ILTO shall provide day-to-day management of the ILTO and shall be appointed by and will report to the Executive Board.

Section 5. Administration. (a) Professional and support staff of the ILTO shall be assigned to the ILTO by the supported Departments and Agencies. The Department of Defense, the Department of Energy, the Department of Labor, the Central Intelligence Agency, and the National Aeronautics and Space Agency shall detail, on a nonrefundable basis, at least one senior level representative to the ILTO. Additional individuals may also be detailed to the ILTO by the Federal agencies mentioned herein or other agencies as needed. Staff of the ILTO shall:

- (1) serve as the project leaders and principal points of contact for their supporting agency's learning technology demonstration program(s);
- (2) coordinate demonstration proposals and plans with the Office of Science and Technology Policy, the Office of Management and Budget, and other Federal agencies as necessary, as well as with the NSTC Committee on Education and Training;
- (3) draft and staff interagency agreements to implement demonstration projects;
- (4) help focus and coordinate related Federal research and development programs with public and private sector organizations.

(b) Initially, the Department of Education shall provide core administrative and financial support for the ILTO.

(c) The ILTO may receive and make use of additional funding from any Federal agency.

Section 6. Future Modification. If any subsequent Public Law (including, but not limited to, an appropriation of funds for the use of the ILTO) deals with the ILTO, those portions of this Executive Order which are not inconsistent with this Public Law shall remain in force.

8/2/95 -- Modify Section 2, Purpose, to read as follows:

Section 2. Purpose. The purpose of the ILTO is to initiate and support focused collaborations of the technology agencies with the Departments of Education *and Labor* to create and demonstrate learning technologies for the 21st century. *It will also encourage the use of technology in all Federal education and training programs.*

Executive Order 12821 of November 16, 1992

Improving Mathematics and Science Education in Support of the National Education Goals

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the provisions of the Stevenson-Wydler Technology Innovation Act of 1980, as amended (15 U.S.C. 3701, *et seq.*), and the Federal Property and Administrative Services Act of 1949, ch. 288, 63 Stat. 377 (codified as amended in scattered sections of the United States Code), and in order to ensure that Federal departments, agencies, and laboratories assist in mathematics and science education to meet the National Education Goals, it is hereby ordered as follows:

Section 1. Assistance in Mathematics and Science Education. (a) Each executive department and agency (hereinafter referred to as "agency") that: (i) has a scientific mission; (ii) employs significant numbers of scientists, mathematicians, and engineers; or (iii) has a Federal laboratory; as determined by the Committee established by section 2(d) of this order, shall, to the maximum extent permitted by law:

(1) Assist in the mathematics and science education of our Nation's students, teachers, parents, and the public by establishing programs at their agency to provide for training elementary and secondary school teachers to improve their knowledge of mathematics and science. Such programs, to the maximum extent possible, shall involve partnerships with universities, State and local elementary and secondary school authorities, corporations, and community based organizations. These activities shall be coordinated with other relevant Federal teacher training programs (e.g., those administered by the National Science Foundation, the Department of Education, and the Department of Energy). Because of its extensive experience in teacher training programs at its Federal laboratories, the Department of Energy, when requested by other agencies, shall assist in the development of these activities.

(2) Provide brief periods of excused absence for Federal employees to assist in the conduct of mathematics and science education programs, in accordance with guidelines of the Office of Personnel Management.

(b) Develop, within 6 months of the issuance of this order, an implementation plan to fulfill the requirements of this section. The plan shall be consistent with approved agency budget totals. The plan shall be coordinated through the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering, and Technology.

Sec. 2. *Transfer of Education-Related Federal Equipment to Elementary and Secondary Schools.* (a) To the maximum extent permitted by law, all agencies shall give highest preference to elementary and secondary schools in the transfer or donation of education-related Federal equipment. All such transfers to the schools shall be made at the lowest cost permitted by law.

(b) Each agency, to the maximum extent permitted by law, shall:

(1) Identify and transfer excess education-related Federal equipment at that agency that can be transferred to elementary and secondary schools by:

(A) Direct transfer of excess Federal research equipment in accordance with the provisions of subsection 3710(i) of the Stevenson-Wydler Technology Innovation Act of 1980, as amended (15 U.S.C. 3710(i)). The transfer of such excess equipment shall be reported to the General Services Administration (GSA); or

(B) Reporting such excess equipment to the GSA for donation when declared surplus in accordance with the provisions of section 203(j) of the Federal Property and Administrative Services Act of 1949, as amended (40 U.S.C. 484(j));

(2) Allow the elementary and secondary schools sufficient time to select available education-related Federal equipment before it is disposed of elsewhere;

(3) Provide training and technical assistance, where possible, to recipients of education-related Federal equipment to ensure that the equipment will be utilized to its full capability; and

(4) Attempt to provide education-related Federal equipment to those elementary and secondary schools with the greatest need or to the recipients of federally funded mathematics and science projects where the equipment would further enhance the progress of the project.

(c) The GSA shall:

(1) To the maximum extent permitted by law, ensure that elementary and secondary schools are notified of the opportunity to obtain education-related Federal equipment, and, where practical, provide to elementary and secondary schools a current listing of education-related Federal equipment that is available for transfer, and, when requested, provide a current listing of this available equipment to agencies; and

(2) Maintain a record of the education-related Federal equipment provided to elementary and secondary schools pursuant to this order.

(d) There is hereby established a Coordinating Committee on Education-Related Federal Equipment (Committee). The Committee membership shall include, but not be limited to, representatives of the Departments of Defense, Education, Energy, and Health and Human Services, the National Science Foundation, the General Services Administration, and the National Aeronautics and Space Administration.

(1) The Co-chairs of the Committee shall be the Administrator of General Services and the Secretary of Education, or their designees.

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(2) The Committee shall assess the availability of appropriate education-related Federal equipment and mechanisms for expeditious notification and transfer of the equipment to elementary and secondary schools and shall resolve issues that may arise in implementing this order.

(3) The Committee shall inform, as necessary, non-Federal groups (e.g., National Governors Association, State Agencies for Surplus Property, etc.) of issues concerning the transfer of education-related Federal equipment.

(4) The Committee may consult with the Committee on Education and Human Resources of the Federal Coordinating Council for Science, Engineering, and Technology concerning activities outlined in this order, particularly those activities listed in section 1 of this order.

Sec. 3. Definitions. For the purposes of this order:

(a) "Education-related Federal equipment" means excess or surplus personal computers and related peripheral equipment, research equipment, and education-related equipment that is appropriate for use in mathematics and science curricula in elementary and secondary school education.

(b) "Elementary and secondary schools" means individual public or private educational institutions encompassing kindergarten through twelfth grade, as well as public school districts.

(c) "Federal laboratories" has the meaning set forth in the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3710a(d)(2)).

(d) "Research equipment" means excess or surplus Federal property appropriate for mathematics and science education activities at the elementary and secondary education levels, as defined by and in accordance with the regulations of the agency that owns the research equipment.

GEORGE BUSH

THE WHITE HOUSE,

November 16, 1992.

TABLE 2. Federal Delivery Programs Targeted for Expanded Use of Learning Technologies

	HEADPROGRAM START	COMPENSATORY EDUCATION (CHAPTER 1/ TITLE I)	EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM	JOB CORPS	ADULT BASIC EDUCATION AND LITERACY	JOB TRAINING PARTNERSHIP ACT (JTPA)	PERKINS VOCATIONAL AND APPLIED TECHNOLOGY ACT	ONE-STOP CAREER CENTER SYSTEM	REHAB. ACT OF 1973
Overall Purpose	Help prepare pre-school children and their parents for school and life	Improve educational opportunities in high poverty schools	Promote teaching skills of teachers in all academic subjects	Improve employability of disadvantaged youth	Help educate adults over age 16 not enrolled in school	Provide youth and adults with job readiness skills	Promote improved academic and occupational skills	Help integrate career transition information and services into a "re-employment system"	Prepare persons with disabilities for employment
Lead Agency	Department of Health and Human Services	Department of Education	Department of Education	Department of Labor	Department of Education	Department of Labor	Department of Education	Department of Labor	Department of Education
Planned Expenditures	\$3.5 billion for FY '95	\$6.7 billion for FY '95	\$320 million for FY '95	\$1.1 billion for ADP for FY '95	\$254.6 million for FY '95	\$965 million for FY '95	\$956 million for FY '95	\$120 million for FY '95	\$2.1 billion (all programs, FY '95)
Target Population(s)	Low income disadvantaged pre-school children and their parents	Teachers, administrators, and educationally deprived children	Teachers and administrators	Disadvantaged youth seeking to enter the workforce	Educationally deprived adults	At-risk youth, economically disadvantaged and dislocated adults	Vocational-technical education students	All job seekers (especially those seeking re-employment), and all employers	Persons with disabilities at or near work age
Current and/or Potential Uses of Technology Supported by Program	Interactive satellite distance learning program, national electronic bulletin board system	Integrated learning systems, record keeping, testing, and tracking	Networking to promote sharing of instructional materials, instructional videodiscs and software	Computer Managed Instruction (CMI) system supporting record keeping, diagnosis, assignment, testing and tracking	Interactive teleconferencing, dial-in electronic communications	ETA Wide Area Network (WAN) which includes access to Bulletin Boards, E-mail, TTRC, and Internet	Purchase of computers, software, curricula for learning labs	To be identified by local grant recipients	Monitoring Information System, MONLOG, computerized tracking used to target resources for training
Related Technology-Based Activities Supported	Incorporate satellite distance learning as part of training and technical assistance	Technical Assistance Centers, Rural Technical Assistance Centers	Forums for promoting technology		Software development N/A	Satellite transmissions for delivering training to regional offices	Support VocNet, an Internet listserv	Technology-based proposals from grant applicants encouraged	Client Assistance Program Research (CAPAR)
Planned Expansion of Automated Tools	MIS for managing programs	Connection of stand-alone systems to networks, distance learning, high quality software	Development and maintenance of networks at state and local levels	ADP System, educational software packages usable with LANs	Linking electronic networks	Expanded use of Internet for information dissemination	Distance learning tools, simulation software, intelligent tutoring systems	Expand use of Training Technology Resource Center (TTRC)	Internet access
Method of Distribution	Grants to public or private nonprofit agencies	Formula grants to counties/school districts contingent upon state approval of applications	Formula grants to states	Operations of 100+ residential centers	Formula grants to states	Formula grants to states	Formula grants to states	Competitive grants	Formula grants to states

APPENDIX B

RELEVANT FEDERAL EDUCATION PROGRAMS

This section begins with a summary for selected federal training and education programs that use or have the potential to use technology-based learning technologies. Each program is summarized under three broad sections; namely:

- Program overview
- The role of technology
- Implementation plan

Programs described in this appendix are divided into two groups. The first contains the following framework programs:

- 2000: Educate America Act
- School-To-Work Opportunities Act
- Technology-Related Assistance for Individuals with Disabilities Act

The second group contains the following delivery programs:

- Head Start
- Compensatory Education (Chapter 1/Title I)
- Eisenhower Professional Development
- Job Corps
- Adult Basic Education and Literacy Programs
- Job Training Partnership Act (JTPA)
- Perkins Vocational and Applied Technology Act
- One-Stop Career Center System
- Rehabilitation Act of 1973

GOALS 2000: EDUCATE AMERICA

Purpose of the Program

The Goals 2000: Educate America Act is the Federal government's framework for education reform. It is designed to provide resources to states and communities to develop and implement comprehensive education reforms aimed at helping all students reach high academic and occupational skill standards. Specifically, it targets K-12 academic and vocational students. Key provisions include the statutory establishment of eight national education goals, national education reform leadership, support for state and local content standards and assessment standards used to measure educational progress, support for parental involvement in education, and the formation of the National Education Standards Improvement Council (NESIC) and the National Skill Standards Board. The legislation also creates an Office of Educational Technology within the Department of Education with responsibility for providing national leadership in using technology to improve learning.

The Role of Technology

Statutory Provisions

Title II of Goals 2000 creates an Office of Educational Technology within the Department of Education. This office is charged with providing national leadership and with the development of a long-range plan for technology in education.

Title III of Goals 2000 provides grants to states to develop comprehensive education improvement plans. A minimum of \$75,000 is set aside for each state to ensure that the use of technology is integrated into this plan. Section 317 of the act defines the requirements of this technology component in detail. Once a state or territory's improvement plan has been approved by the Secretary, a state is eligible for more substantial grants for implementation. It is expected that in many states, a portion of federal implementation funding will support technology infrastructure and other technology components.

Title III also requires states that receive technology planning funds to establish a technology panel with broad-based representation.

Technologies relevant to Goals 2000 include computer hardware, electronic networks (especially local area networks in schools and connections to the Internet for instructors and students), instructional software and other applications, distance learning programs, expanded use of telecommunications equipment such as modems and voicemail systems, video and video production equipment, and the development of digital libraries and file servers that provide distributed access to school and community information.

Implementation Plan

FY 1994 Planning Grants and FY 1995 Implementation Grants

- The Office of Educational Technology in the Department reviews each application for technology planning funds, and if necessary provides comments on the state's proposal. Over 30 state applications have already been reviewed.
- The Office of Educational Technology is providing assistance to states in developing the technology component of their Goals 2000 state improvement plans. A conference bringing state network directors, telecommunications regulators, and private sector representatives was held on September 23-25, 1994, in Austin, Texas. Another conference is planned for March, 1995. Assistance to individual states is being provided upon request.
- The states' education improvement plans will be submitted to the Department in spring, 1995. If approved, significant implementation funding will be available. The Office of Educational Technology will participate in the development of criteria for evaluating these state plans.

Content and Assessment Standards

- The Office of Educational Technology will encourage national, state, and local standards development projects to integrate technology into these model standards.

SCHOOL-TO-WORK OPPORTUNITIES

Purpose of the Program

The School-to-Work Opportunities Act (STW) creates school-to-work opportunities systems throughout the country for all youth, both in school and dropouts. This is accomplished through seed capital grants to states and local partnerships coupled with technical assistance.

Such systems must: (1) be part of comprehensive school reform, (2) integrate Goals 2000 and further national education goals, (3) integrate academic and occupational training, (4) integrate school-based and work-based learning, and (5) provide performance-based opportunities for all students.

STW helps youth acquire knowledge, skills, abilities, and labor market information needed to make a smooth and effective transition from school to career-oriented work and to further education and training. In doing so, it requires that every school-to-work system contain three core elements: (1) School-based Learning, (2) Work-based Learning, and (3) Connecting Activities.

Role of Technology in the Program

Being conversant with technology is a necessary precondition to developing high skills, that in turn, leads to high wages. Technology can link schoolroom and workplace geographically; and in subject matter content. It can provide innovative, self-paced curriculum/instruction as well as creative and valid means for measuring performance against industry skills standards. Students can be assisted in working with labor market information in order to identify possible career choices by the 11th grade. The availability and distribution of work-based learning opportunities, industry mentors, and other connecting activities as defined by the Act can be managed by technology.

The most relevant technology applications for the STW program would be networking capabilities, including an MIS system for management and performance evaluation and real time labor market information, and self-paced content modules for students. Many of the newest technology applications that are useful in other disciplines can also impact School-to-Work programs. For example:

°Personal Computers: Students need these to retrieve data, communicate, and learn key programs used at home or in the workplace.

°Electronic mail: Provides access to research databases and special periodicals as well as the possibility of working on projects with students across the world.

°Interactive videodiscs: Can store and retrieve massive amounts of information in the form of video, sound, and text providing high quality lessons in diverse occupational areas.

°Intelligent Tutoring Systems: Students can get unlimited practice on a variety of topics, from a medical technique to brake repair, and can move ahead to more complex materials when prepared. This tool is also useful as an assessment technique.

°Simulation Software: Design students, through the use of software such as AutoCAD, can create a drawing without ever touching a pencil. DOD has been a leader in the development of such software with applications in everything from construction technology to jet engine repair. The spinoff possibilities are legion.

°Distance Learning Tools: Increases the possibility of equal access to a quality education

for all students, especially in rural areas where resources are limited for certain programs.

Implementation Plan

- Promote, encourage, and "incent" the use of learning technology in subsequent state and local solicitations for grant awards. (Eight states, 15 localities, and approximately 21 urban/rural high poverty areas are already in the process of receiving implementation grants, with more to be solicited and awarded in FY 95 and beyond.)
- Focus technical assistance and research more heavily on the application of learning technologies. One mechanism would be for someone with experience and expertise in technology from another federal program (e.g., Defense, Energy, Commerce's NIST program) or a loaned Executive to join the School-to-Work implementation team.
- Innovative use/application of technology is encouraged in state and local school-to-work partnerships. It is an allowable cost under the published Solicitations for Grant Award. Technical assistance funds earmarked under the Act's "National Activities" should be used to explore the use of learning technologies or designated for research and evaluation. The program's Governing Board should adopt a technology emphasis for these funds in FY 1996 and beyond.

COMPENSATORY EDUCATION (CHAPTER 1/TITLE 1)

Purpose of the Program

Chapter 1/Title I provides about \$6.7 billion annually to local educational agencies (LEAs) to improve the educational opportunities of children in high poverty schools by helping those children acquire the knowledge and skills contained in state content standards and to meet state performance standards developed for all children.

As the largest federal program for elementary and secondary education, Chapter 1/Title I targets those students attending schools having high concentrations of children (ages 5 - 17) from low-income families. Supporting the use of technology, the target audience enlarges to include teachers and administrators who operate the technology either to teach the students, administer Chapter 1/Title I programs, or communicate with each other about various aspects of their Chapter 1/Title I programs. A local educational agency may use funds under Chapter 1/Title I schoolwide programs provision in combination with other federal, state, and local funds, in order to upgrade the entire educational program in a high poverty school. These projects enrich the academic program for the child and for the whole school. It is estimated that 5 percent, or \$425 million, of Chapter 1/Title I funds went to support school purchases of computer equipment, hardware, and software for the 1993-94 school year.

The Role of Technology

Technology is now a central part of the way Chapter 1/Title I funds are used. The Chapter 1 Technical Assistance Centers (TACs) and Rural TACs provide assistance to state administrators and practitioners on the use of technology, including the use of distance learning. The Chapter 1/Title I TACs and Compensatory Education Program monitoring staff are aware of some technology applications and provide assistance, where appropriate and requested, to state and local jurisdictions on the use of this technology. However, dollars spent for technology typically support computer laboratories in schools that provide only limited access to resources and are primarily used to operate software that drills students on basic skills. Typically, these schools are not electronically linked, e.g., via Internet, to resources outside the school.

The use of technologies that focus on a higher Chapter 1/Title I's mission could be advanced by the use of technologies that focus on teaching higher order/complex thinking skills and reading comprehension, aligned with challenging content standards. Information systems that allow practitioners to communicate with each other, store relevant data on promising practices, Chapter 1/Title I distinguished programs, and the application of distance learning technology should also promote the program's goals.

Technology applications funded by other federal programs that are implemented in Chapter 1/Title I programs should be readily accessed. Such examples would include the National Dissemination Network, Star Schools program, as well as programs from other Federal agencies -in particular, the National Science Foundation, the U.S. Department of Labor, and the National Aeronautics and Space Administration.

In the past, Chapter 1/Title I has sponsored annual national and periodic regional conferences, although that has been superseded in 1994 by an overall Office of Elementary and Secondary Education (OESE)-sponsored conference.

Implementation Plan

Many opportunities exist for increasing the integration of learning technologies within Chapter 1/Title I. Action steps include:

Promoting High-Quality Software Development

Chapter 1/Title I will collaborate with the Office of Education Technology to sponsor a software forum bringing together buyers and sellers who affect the marketplace, including State and local jurisdictions, vendors, and associations involved with educational technology. Issues to be addressed include:

- guidelines and resources for acquisition and effective use of technology;
- linking technology developments to content standards and new goals for higher order thinking skills of Chapter 1/Title I participants and determining how technology will effect content standards;
- requirements, procedures, and systems for training teaching staff how to integrate technology with curriculum and teaching; and
- procedures for state educational areas (SEAs) and LEAs to consolidate technology purchases for the purposes of lowering costs and increasing the impact on student achievement gains.

Fostering Research and Assessment

The Planning and Evaluation Service should conduct studies and prepare ideabooks that assess the effectiveness of technology for LEA use, identify barriers to the effective use of technology by SEAs and LEAs, and identify strategies for encouraging the effective use of technology in the classroom.

A research agenda to identify and measure variables influencing the use of technology with at-risk students and in high poverty schools will be developed through collaboration with the Office of Educational Research and Improvement and the Center for Research on the Education of Students Placed At Risk (CRESPAR).

Provide Information and Assistance

To help overcome practitioners' reluctance to use and integrate learning technologies, Chapter 1/Title I should disseminate information about programs that effectively use technology and use National Diffusion Network funding to support competitive learning technologies demonstration projects. A compendium of recognized project descriptions should be distributed that includes information about projects that demonstrate the effective use of technology in the Chapter 1 Recognition Program. The Chapter 1/Title I program will also sponsor technology presentations at the OESE integrated conference in December 1994.

Technical assistance should be given to SEAs and LEAs for planning and technology acquisition, uses of technology, assessments of technology, research finding; and uses of technology included in teacher training.

Compensatory Education Program (CEP) staff should develop a technology training plan for its staff, deliver the training, and integrate technology T/A strategies into monitoring procedures. The comprehensive regional technical assistance centers will develop contract specifications for comprehensive centers to provide technical assistance in technology, and also specifications of how TACs will work with Regional Technology Consortia. These centers will supply technology representatives to the proposal review team.

The Internet should be used to identify sources with promising educational technology applications in instruction and management tools, such as the Council of Great City Schools National Urban Learning Network, the Coalition of Essential Schools, the EPIE State Consortium for Improvement. Technology packages (e.g., technology products, assessments, assessment procedures, acquisition strategies) will be developed and installed on Internet.

**THE TECHNOLOGY-RELATED ASSISTANCE
FOR INDIVIDUALS WITH DISABILITIES ACT
(Public Law 100-407)**

Purpose of the Program

The goal of the Technology-Related Assistance for Individuals with Disabilities Act (Tech Act) is to bring about fundamental systems change in the availability of assistive technology for Americans with disabilities. This is achieved by development of model programs for the delivery of assistive technology to individuals with disabilities and advocacy conducted in a consumer responsive manner. Policies and practices that impede the acquisition of necessary devices are vigorously challenged. The program provides funding to projects in 55 U.S. States and territories.

Implementation Plan

A proposed goal has been established for the Office of Special Education and Rehabilitative Services (OSERS) in the Department of Education, in which the Tech Act is administered, to increase access to technology for people with disabilities. Strategies are to be developed after objectives have been approved by the OSERS components. The current operating concepts for this goal are that access to technology can mean two very different things; namely that,

- the availability of technology for use, i.e., physical access to technological devices, and
- the useability of technology if available, i.e., accessibility of technological devices.

Each of these concepts are of equal importance and will be identified and addressed by the associated strategies for the following objectives:

- Improve the capability of OSERS to conduct research on new solutions to the problems of access to technologies by people with disabilities.
- Support access for persons with disabilities to the National Information Infrastructure at school, on the job, and at home.
- Promote opportunities for people with disabilities to participate in telecommuting and lifelong distance learning in school and in the workplace.
- Provide strong collaborative support for the use of accessible technology in the implementation of all federal education and training programs.
- Increase the access to technology by persons with disabilities undergoing vocational rehabilitation.

HEAD START

Purpose of the Program

Head Start provides services to low income preschool-aged children and their families to help prepare for life and for school. The program currently serves about 720,000 children. In addition to a developmentally appropriate curriculum for the education component, the program provides health and nutrition services, social services, and support for parent involvement. Some programs receive additional funding for more intensive employability, literacy services, and substance abuse prevention services to parents.

Head Start is a community-based program sponsored by about 1400 grantees and 600 sub-grantees (who may be public or private non-profit agencies). Head Start targets economically disadvantaged preschool children and their parents. Classroom teachers, teacher assistants, and parent classroom volunteers are also target audiences for technical initiatives. Funding (\$3.5 billion for FY 1995) is provided directly from Federal Regional offices to the grantees without state involvement.

The funding guidance issued to Head Start grantees permits the use of base grant funds, discretionary grant funds, and quality improvement funds for the purchase of program (and management) hardware, software, as well as to support staff training through satellite distance learning approaches.

Role of Technology

Learning technologies are being used as a teaching device in the classroom. A number of programs have used computers in the classroom, including participation in a demonstration project funded in part by hardware contributions by IBM.

An interactive satellite distance learning program for Head Start staff and parent volunteers in remote areas has been successfully developed and implemented in 39 states, 22 Indian Reservations, Alaskan villages, the Pacific Territories, Puerto Rico, and the Virgin Islands. The program, now in its fourth year of funding, has proven very effective in providing the training needed for staff to achieve the Child Development Associate (CDA) credential in rural areas, and to earn college credits applicable to degree programs.

A national electronic bulletin board system (BBS) is currently in use as a resource for developing technology demonstration programs and then disseminating results.

Head Start uses learning technologies to advance educational opportunities for parents. Grantees use a variety of applications in teaching literacy, providing job skills development training, GED preparation, and parenting skills.

Head Start funds three demonstration programs to explore the use of assistive technology to meet the needs of children with disabilities. It announces the availability of demonstration Federal funds in the Federal Register and awards them on a competitive basis. Results are disseminated through publications, and through the network of training and technical assistance contractors, through national meetings such as the annual training conference of the National Head Start Association, and other means.

Implementation Plan

During the remainder of this fiscal year and next, Head Start expects to promote the use of technology in the following ways:

- ° To institutionalize the satellite distance learning project for training classroom staff and parent volunteers.

This project has already demonstrated the effectiveness of satellite distance learning in providing needed high quality training to Head Start teaching staff in remote, geographically isolated areas.

If the project becomes self sufficient based upon direct payment for the training by grantees (out of training and technical assistance funds in their base grants), the Head Start Bureau expects to pilot the use of this kind of technology for other priority training needs within Head Start programs across the country.

- ° To incorporate satellite distance learning as part of the Head Start training and technical assistance (t/ta) system. The current Head Start t/ta is being reviewed to determine what changes need to be made in its capacity and structure in order to better support grantees. It is expected that satellite distance learning will be an integral part of the new system.

EISENHOWER PROFESSIONAL DEVELOPMENT PROGRAM

Purpose of the Program

The Dwight D. Eisenhower Professional Development Program (Title II) is designed to ensure that teachers have access to sustained and intensive high-quality professional development that is aligned to state content standards and state student performance standards. This quality professional development will be supported by state and local educational agencies (SEAs and LEAs), state agencies of higher education (SAHEs), and nonprofit organizations through activities in the core academic subjects. Funding for this program will provide \$320 million to the states to support activities implemented by SEAs, LEAs, SAHEs institutions of higher education (IHEs), and nonprofit organizations.

The primary target group for Title II includes teachers and, where appropriate administrators, other staff, and pupil services personnel.

Role of Technology

In recent years, many technology programs related to mathematics and science content have been implemented with Eisenhower funds. These programs included state-sponsored conferences with an emphasis on technology and inservice activities which promoted the use of computers in the classroom. In states with a strong focus on technology, students and teachers can utilize video discs and networking capabilities to enhance knowledge in the mathematics and science content areas. This use of technology will continue to be encouraged as a part of professional development activities in the other content areas.

States requesting funding under the Eisenhower Program will be required to submit plans and applications that will include descriptions of how technology will be used to improve professional development. This may be in the form of:

- Developing and maintaining networking capabilities for all teachers with colleagues in their content area;
- Fostering distance learning technology and applications, especially in rural areas; and
- Expanding the use of other federal funding sources, specifically, Title VI (formerly Chapter II) funds as they relate to technology and professional development.

Implementation Plan

- Include a learning technologies component as part of the regional teams's function to answer specific questions from states as they begin and continue planning for the integration of technology.
- Utilize the integrated site review team process to discuss the importance of learning technologies within the federal programs funded within each state.
- Provide guidance on computer purchases as a part supplemental information issued from the program office.
- Encourage states to use all federal sources for the acquisition of necessary technology equipment.
- Use conferences as a forum for promoting technology integration such as sponsoring a software conference focused on learning technologies tools that help teachers.
- Expand the use of learning technologies to all academic content areas by encouraging increased attendance of teachers and administrators at educational conferences sponsored by professional organizations which promote the use of technology within all content areas.
- Promote the use of Satellite Town Meetings to provide on-site instruction or sponsor discussions related to professional development in the core academic subjects.
- Conduct a formal study of the use of technology by LEAs, as it relates to teacher training activities. The study should include the amount of funds being spent on teacher training related to educational technology, an assessment of the effectiveness of teacher training, and possibly student outcomes as a result of teachers receiving training in technology in technology-related professional development activities.
- Incorporate a section of technology-related questions into the revised state annual performance report forms and as part of the program on-site monitoring instrument.

JOB CORPS

Purpose of the Program

Job Corps is a major national training and employment program administered by the Department of Labor to address the multiple barriers to employment faced by disadvantaged youth throughout the United States. A distinguishing aspect of the program is its residential component which enables Job Corps to provide a comprehensive array of services in one setting 24 hour a day, seven days a week. Approximately 90% of its students are residential, with the remainder commuting to the centers daily.

Enrollment in Job Corps is open to individuals aged 16 through 25. The program is open-entry, open-exit, and individually-paced to allow students to progress at their full potential. Each Job Corps site provides a full array of services including: entry diagnostic testing of reading and math levels, work experience programs, health care, occupational exploration programs, comprehensive basic education program, community service through volunteer and vocational skills training programs, and post-program placement and support.

During the past five years Job Corps has made a concerted effort to take advantage of advances in technology in the areas of student records, student pay, and instructional management. Over the next two to five years the CMI System (described below) will become a component of a larger Job Corps Automated Data Processing (ADP) System. The new ADP system will facilitate interconnectivity between the existing Job Corps data systems, including the Student Pay and Allotment Management Information System (SPAMIS), and new systems, including a standard local MIS, a Scheduler, and other program components.

Role of Technology

During the past two years, an innovative Computer Managed Instruction (CMI) system has begun to be phased into all Job Corps education programs. The CMI system is designed to automate many of the tasks that instructors and administrators have traditionally found to be tedious and time consuming. By eliminating manual records and assisting with the scoring and recording of assignments, the system frees instructors to spend more time with students in individual and small group instruction. The immediate acceptance of the system by students and teachers is a strong indicator of the further benefits to be gained by implementing learning technologies more fully into the delivery of training services by the Job Corps.

Currently, the CMI Systems provides automated instructional management for basic reading, graded reading, math, GED, writing/thinking skills, and the world of work. Planned expansion for content areas include the Vocational curricula, Social Skills Training, Student Orientation, and Student Progress Evaluation.

The CMI system enables Job Corps to offer a comprehensive, integrated education approach that allows teachers to assign instructional materials based on individual student needs. By means of computer-managed diagnosis, assignment, testing and tracking, the new Job Corps Education Program links the best conventional materials and audio-visuals with computer-assisted instruction, in a technologically advanced and individually responsive educational system.

Not only have the CMI System terminals in the classroom served to motivate students, they have also increased the students' responsibility for their academic training. Being able to logically think their way through the system by selecting menu options and choosing prompts to update their progress, students increase their computer literacy and acquire valuable workplace skills.

FY '95 funds have been set aside by Job Corps to pilot educational software packages in a Local Area Network environment. While several packages have been contemplated for review, DoD's *Fundamental Skills Training* (FST) stands out as a superior package of materials. A preliminary examination of this material indicates that this "Intelligent Tutoring System" could serve as an excellent supplemental package for Job Corps' education program. Job Corps plans to pilot these materials in FY '95, if arrangements can be made to obtain software support within its existing budget parameters.

Implementation Plan

Based on the earlier success of the introduction of the CMI system and the potential use of DoD developed learning technologies, Job Corps should: include the potential use of learning technology in all Job Corps classrooms, shops, dormitories, and offices as a part of all future procurement; and enter into a regular dialogue with DoD to review their training materials for adoption into Job Corps curricula. The general education, technical training, and workplace skills learning technology developed by DoD may have the potential to greatly enhance the interpersonal and teamwork skills, thinking skills, and basic academic skills presently taught in the Job Corps Curricula.

Job Corps should organize a three year demonstration project on the effectiveness of transferring DoD developed learning technologies into the Job Corps program. Three years would be needed to identify and modify existing DoD software for Job Corps use, implement the application at up to three pilot centers equipped with trained staff to utilize a fully integrated training delivery system, and evaluate its impact on Job Corps students. In order for a valid pilot to be conducted, up to \$2.5 million a year from sources other than the Job Corps budget would be needed. Subject to availability of funds, pilot centers could begin participation in early 1996.

Specific Applications

Job Corps has identified a number of specific learning technologies programs which demonstrate potential for application to the Job Corps training program. These programs, identified below, could greatly enhance vocational training program in two ways. First, particular programs have been identified that could serve to assist national policy makers to more effectively match vocational training offerings with regional job market conditions. Secondly, DoD has developed several automated authoring systems that offer Job Corps trainers the capability to more economically and efficiently plan lessons and author their own software.

What follows are descriptions of specific programs that have been identified as offering a potential application to Job Corps.

Fundamental Skills Training (FST): The FST is an adaptive, computer-based training system that provides diagnostic, individualized instruction to students. The Department of Defense's Armstrong Laboratory developed this program to improve 9th grade critical thinking skills in mathematics, reading/writing, and science. Its Word Problem Solving tutor focuses on teaching students to analyze word problems and write correct equations. In addition, its reading/writing and science programs help students and instructors analytically approach these areas. The programs use state-of-the-art color graphics and can be adapted to students performing at different competency levels.

Intelligent Computer-assisted Training Testbed: A program designed to provide a proof of concept and demonstration of how this can be achieved by developing, testing, and demonstrating prototype software tool, called authoring shells in the field. ICATT could allow Job Corps instructors and curricula developers to economically author their own training software. At the

very least, the program may allow the Job Corps training community to develop a comprehensive criterion referenced test bank which could be used throughout its system.

Virtual Environment Based Intelligent Tutoring System Authoring Tools: Software will allow instructional designers and subject matter experts with little or no computer experience to develop, deliver, and maintain programs that use virtual environments to train students how to perform a variety of tasks. If proven cost effective, this technology could allow Job Corps centers in remote areas to offer training not available from either local institutions or employers. Such programs might also provide training at centers without the purchase of costly training equipment.

Training Impact Decision System and Intelligent Instructional Design Tools: Programs developed to support tools that simplify the design and development of high quality learning systems. Such programs could provide Job Corps training specialists with tools to design new training programs and the ability to quickly and effectively up-date them.

Training Efficiency and Effectiveness Methodology: A management information system that is designed for training managers and course personnel. The program could allow Job Corps professionals to compare the amount of time spent in training on a task with the field recommended training emphasis for that task. This could allow instructors to provide a more balanced and employer driven training program.

ADULT BASIC EDUCATION AND LITERACY PROGRAMS

The Purpose of the Program

The purpose of the Adult Basic Education and Literacy programs is to provide basic educational opportunities for adults over the age of 16, not currently enrolled in school, who lack a high school diploma or the basic skills to function effectively in the workplace and in their daily lives. Courses of instruction include Adult Basic Education (ABE), Adult Secondary Education (ASE), and English as a Second Language (ESL). Within this cohort of adult learners, adults with disabilities and those enrolled in the ESL program are particular target groups with regards to technology use. The 1994-95 Program Year budget for the Basic Grants to States Program totals \$254.6 million.

The Role of Technology

Integrating learning technologies into this program can help adult learners in many ways. It can help stretch federal, state, and local dollars to expand program resources, improve program quality, and reach larger numbers of adult learners. It can assist adults with disabilities, reach learners outside of classrooms, help learners use time more efficiently, raise interest and sustain motivation. Learning technologies can also promote individualized instruction, provide access to information tools, improve curriculum, enhance assessment and evaluation, and serve as a magnet for fund raising and business contributions.

The most relevant technology applications to improving adult basic education and literacy programs include computer-based technologies, telecommunications technologies, and consumer electronic devices.

Certain sections of the Adult Education Act (AEA), as amended by the National Literacy Act (P.L. 102-73) of 1991, facilitate the use of technology. These sections are the following:

- ° **Experimental Demonstration Projects and Teacher Training**

Of the funds allotted to a State under section 313 for each fiscal year, not less than 15 percent are to be used for special projects that involve the use of innovative methods, systems, materials, or programs which may have national significance or will be of special value in promoting effective programs. This would include projects that are introducing or expanding the use of educational technology into adult education and literacy instruction. Of these funds, at least two-thirds must be used for teacher training. This could include preservice and inservice instruction concerning the use of technology in adult education and literacy programs. [Sec. 353]

- ° **Purchase of Hardware and Software**

Up to 10 percent of the grant funds received under the program of State Literacy Resource Centers can be used to purchase computer hardware or software. [Sec. 356(f)]

◦ **Workplace Literacy**

Grants awarded under this program may include the establishment, as appropriate, of technology-based learning environments, such as computer-based learning centers. [Sec. 371(c)(2)(E)]

◦ **Instructor Training and Technical Assistance**

Funds provided to each state under the program of State Literacy Resource Centers are authorized to conduct activities to provide training and technical assistance to literacy instructors in selecting and making the most effective use of state-of-the-art methodologies, instructional materials, and technologies such as computer assisted instruction, video tapes, interactive systems, and data link systems. [Sec. 356(d)(7)(A)]

◦ **Research in the Use of Technology in Literacy Programs**

The National Institute for Literacy, authorized under the National Literacy Act of 1991, is empowered to conduct basic and applied research and demonstrations on literacy. The Institute studies the best methods for assisting adults and families to acquire literacy skills, including the use of technology. It also evaluates the use of technology and other studies which will increase the literacy knowledge base use, but not duplicate the work of other research services, and build on the efforts of such other research services... [Sec. 384(B)(iv),(vii)]

◦ **State Advisory Council on Adult Education and Literacy**

Each State advisory council is to advise the Governor, the State education agency, and other state agencies concerning the improvement of the quality of literacy training programs in the state by supporting, among other areas, technology-based learning. [Sec. 332(f)(2)(C)]

Implementation Plan

Reauthorization of the Adult Basic Education Act is an opportunity to expand and highlight technology provisions intended to serve more adults, to improve the quality of program services, to increase staff inservice, and to strengthen program evaluation.

This issue involves examining: 1) the impact of current federal and state requirements concerning matching and/or supplanting of funds on the use of technology; 2) mechanisms available to leverage federal dollars with funding from other federal agencies and from state, local and private sectors to promote the use of technology; 3) creation of clear policies supporting the expanded use of technology; and 4) authorization for collaborative efforts with other ED programs and with other federal programs and agencies.

Technology was included in the Federal Register Notice of September 20, 1994, which invites comments on issues to be considered during the reauthorization process. Recommendations on alternative ways to use technology more effectively are among the comments being gathered at public reauthorization hearings and at meetings held with the adult service providers.

Currently the Division of Adult Education and Literacy (DAEL) has several initiatives either underway or planned to extend the use of technology in adult programs. These efforts are as follows:

Conferences

Teacher Training Using Interactive Teleconferencing involves collaboration between DAEL, National Center on Adult Literacy (NCAL), the Public Broadcasting Service's Adult Learning Systems unit, and Station WHYY Public Television to design and produce four interactive

teleconferences for adult education and literacy service providers.

This video series is addressing the need for high quality, accessible, innovative, cost-effective professional development while testing and demonstrating the feasibility of distance education for teacher training. The first video teleconference, held on April 28, 1994, and viewed at more than 850 sites, focused on *Technology: New Tools for Adult Literacy*. The December 1994, teleconference discussed strategies to improve math education for adult learners. Workplace literacy is scheduled to be the topic for an April 13, 1995, video teleconference, while family literacy is scheduled for the fall of 1995.

NCAL and DAEL co-sponsored a national invitational software developers conference on October 18 and 19, 1994, to convene federal and state policymakers, local adult education providers, software publishers, and research and development specialists in technology and adult education. Participants explored new approaches to stimulate the development of quality adult education software which sustains motivation, improves curriculum, and uses learning time effectively. A follow-up workshop will be held in January 1995, to consider the progress made since the conference and to refine ideas concerning "next steps."

DAEL will work with the State Literacy Resource Centers, NCAL, and the National Institute on Literacy to combine information about available quality software and to disseminate this information to the adult education community.

Electronic Communication Efforts

DAEL is supporting several activities which pilot the use of technology to help manage complex recordkeeping and accountability requirements for federal programs. The Division of Adult Education and Literacy is using National Adult Education Program funds to develop and implement an electronic state management information system called FASTR which will enable state staff to transmit federally-required reports to the federal staff electronically. In addition, the Division is supporting development and implementation of a local electronic data collection system called AEMIS which will enable local adult programs to transmit student enrollment and other program data to their State offices electronically.

An electronic communication system, called DiAL-IN, which enables the State Adult Education and the State Literacy Resource Center staffs to communicate directly with the federal staff, is also being supported.

Through the "Building Professional Development Partnerships with the Adult Educators" project, DAEL is developing and operating a national network of adult education staff development specialists and practitioners in state departments, universities, and local programs. DAEL's DiAL-IN bulletin board system, which is being enhanced and placed on the Internet, will be a major mechanism of communications for the network. DAEL is also designing and developing an on-line research project to solve problems in the classroom by developing practices to improve instruction and program management. CASAS' on-line action research project initially funded by the National Institute for Literacy will be expanded.

Distance Learning Initiatives

A project to form collaborative partnerships for distance learning is being planned. To support this effort, a paper on distance learning options within the adult education community was commissioned. The distance learning initiative is envisioned to be a competitive award which brings together both public and private sector service providers to expand access to adult literacy instruction.

Distance learning capacity building will be encouraged by strengthening collaborative efforts between DAEL, the Star Schools Program, the State Directors of Adult Education, the Directors of the State Literacy Resource Centers, and local service providers.

Federal Interagency Cooperation

DAEL is working with several federal agencies concerning the collaborative use of learning technologies by the adult education community, to expand the adult education services.

JOB TRAINING PARTNERSHIP ACT (JTPA)

Purpose of the Program

The Job Training Partnership Act, which became effective on October 1, 1983, seeks to move jobless individuals into permanent self-sustaining employment. The Act provides job-training services for economically disadvantaged adults and youth, dislocated workers, and others who face significant employment barriers. It also authorizes federal programs for native Americans, migrant and seasonal farm workers, and veterans.

State and local governments, together with the private sector, have primary responsibility for development, management, and administration of job training programs under JTPA. Governors have approval authority over locally developed plans and are responsible for monitoring program compliance.

Also receiving authorization from JTPA are the Job Corps, the National Commission for Employment Policy; nationally-administered programs of technical assistance; labor-market information; research and evaluation; and pilot and demonstration programs.

Role of Technology

Technology can advance JTPA's mission by contributing to the development of high standards and quality outcomes for adult and out-of-school youth, and by improving the delivery of services. Currently, demonstration projects that use technology include a wide-area network that provides JTPA stakeholders in the Southeastern states, down to the local Service Delivery Areas, with e-mail and other electronic services. Another project is converting a Technical Assistance Guide into an electronic format that is suitable for use as a tutorial for front line staff at their work stations.

Recently, a major revision to the collection of participant information was implemented. The new system represents a major step forward in the use of automated technology to relieve some of the reporting burden faced by the states.

Implementation Plan

°JTPA should identify innovative applications of learning technology currently used by local implementers for youth and adults and disseminate these promising programs.

°JTPA should develop proactive means to encourage local implementers to employ the use learning technologies.

- JTPA should actively explore distance learning options.

◦The JTPA system from the National Office down to the local implementers should be able to electronically communicate peer to peer to share experience and advice, program information, and promising practices that often are not available in formal documentation.

CARL D. PERKINS VOCATIONAL AND APPLIED TECHNOLOGY ACT

Purpose of the Program

The purpose of the Carl D. Perkins Vocational and Applied Technology Education Act is:

to make the United States more competitive in the world economy by developing more fully the academic and occupational skills of all segments of the population. This purpose will principally be achieved through concentrating resources on improving educational programs leading to academic and occupational skill competencies needed to work in a technologically advanced society. (20 U.S.C. 2301, § 2)

The Carl D. Perkins Act is administered primarily through a Basic Grant program which funds states and localities with formula grants that are used to improve the quality of vocational education programs for students of all ages.

The Perkins Act also funds tech-prep education, tribally controlled postsecondary vocational institutions, state councils of vocational education, and national programs including demonstrations, research and data systems.

The Act contains equity provisions to ensure that students who are members of "special populations" are provided full access to programs and the supplemental services they need to succeed. Members of "special populations" include low-income individuals, low-achieving individuals, individuals with disabilities, individuals of limited English proficiency, individuals in programs designed to eliminate sex bias, and individuals in correctional institutions.

Role of Technology

Technology can advance the mission of the Perkins Act by contributing to the development of high standards and quality outcomes for vocational education programs and by improving the delivery of services.

The 1990 amendments to the Perkins Act contain key provisions which can be better implemented through the use of technology. Learning technologies could be especially helpful in improving the quality of instruction for special populations. In remote areas, distance learning, simulated work environments, and other applications of technology may provide higher quality learning experiences for students.

Many of the newest technology applications that are useful in other disciplines are just as powerful, when adapted, for vocational-technical education. For example:

°Personal Computers: Can be utilized by Vocational-technical students to retrieve data, communicate, and learn key programs used in the workplace (word processing, spreadsheets, databases, and design).

°Electronic mail: Provides access to research databases and special periodicals as well as the possibility of working on projects with students across the world.

°Interactive videodiscs: Can store and retrieve massive amounts of information in the form of video, sound, and text - which all provide high quality lessons in diverse occupational areas.

°Intelligent Tutoring Systems: Provides students with unlimited practice on a variety of topics, from a medical technique to brake repair, and can move ahead to more complex materials when prepared. This tool is also useful as an assessment technique.

°Simulation Software: Allows design students, through the use of software such as AutoCAD, to create a drawing without ever touching a pencil. DOD has been a leader in the development of such software with applications in everything from construction technology to jet engine repair.

°Distance Learning Tools: Increases the possibility of equal access to a quality education for all students, especially in rural areas where resources are limited for some programs.

Perkins' basic state grant funds are used to enhance vocational education. Localities use these funds for purchase of materials (such as computers, software, etc.) as well as professional development and other activities.

Perkins' funds also support a "knowledge-sharing" Dissemination Program that includes VocNet, a listserv on Internet.

Implementation Plan

°Review Perkins' state plans to ascertain whether or how states have addressed educational technology usage.

°Identify a research agenda on the status of educational technology usage in vocational technical education and suggested policy actions.

°Include in the reauthorization proposal for the Perkins Act (FY 96 submission for FY 97 budget proposal) provisions which encourage the use of educational technology in vocational-technical education. The provisions should focus on: 1.) providing learners with the skills needed in a technologically advanced workplace; 2.) increasing the usage of cutting-edge learning tools; and 3) using networks that link learners to new resources.

- ° Research funds for the development and dissemination of educational technologies, professional development, equipment purchases, and best practice demonstration projects should be targeted resources.

°Increase learner access to up-to-date workplace technology through increased linkages with School-to-Work systems and greater partnerships between schools and industry.

°Explore the possibility of using demonstration projects (under existing authority) as models of educational technology usage.

ONE-STOP CAREER CENTER SYSTEM

Purpose of the Program

The purpose of the One-Stop Career Center System (OS) is to help integrate the delivery of career transition information and services into a "reemployment system." There are several paths being used to create this system: 1) implementation grants to states to create statewide systems, 2) planning and development grants to states for the same purpose, 3) grants to local systems to serve as learning labs, 4) grants to state to improve the quality of their labor market information (LMI) systems, and 5) research, development, and operations consortia of states to support the LMI initiatives.

Services to be integrated into the OS include at a minimum the following programs: JTPA Titles II, III (EDWAA); the Employment Service; and Unemployment Insurance. States are encouraged to integrate education (e.g., Carl Perkins, School-to-Work, community colleges) and social service programs (e.g., JOBS) into the OS.

The goal is to provide a seamless system of service delivery to all persons in the labor force, job seekers, and employers.

Role of Technology

There will be four primary uses of visible technology: 1) linking service providers to reduce the need for redundant paperwork/applications, 2) delivery of career and labor market information and information on services, 3) as part of electronic labor exchange systems, and 4) as part of the training to be provided to some job changing or non-job-ready customers. There will also be uses of technology for program evaluation and data gathering that are likely to be invisible to most of the customers.

Learning technologies would be useful in many of the One-Stop centers which will offer basic skills training. Most centers will refer customers to skills training outside the centers (e.g., at community colleges); the extent of learning technology use by those training vendors will be the crucial factor. Because all One-Stop centers will promote customer choice, particularly in the area of training, general promotion of learning technologies will make these "choices" more open to center users.

Management Information Systems (MIS) and case management technology are critical to making the one-stop systems work in most states. Most states will also depend on some form of remote access (e.g., voice response, dial-up modem, Internet, kiosks) to provide access to people who cannot reach the physical centers.

One-Stop envisions using technology to provide customers with career and labor market information, much in a self access form. It also envisions a substantial expansion of the electronic labor exchange function.

Implementation Plan

- Promote, encourage, and "incent" the use of learning technologies in subsequent state and local solicitations for grant awards. Already, the first round of grants to states have been awarded. All six winners of the One-Stop implementation grants proposed the use of technology in the four visible areas. A second round, with 8-10 states is anticipated for award in mid-summer, 1995.
- Promote the use of technology and conduct research on the application of technology through the state consortia and a national clearinghouse.
- Promote the use of technology in future grants by sponsoring a technology fair in conjunction with future bidders conferences. Have the technology fair not only display exhibits but also include formal learning tracks (like formal concurrent workshop tracks).
- Focus technical assistance more heavily on the application of learning and other technologies. One mechanism would be for someone with technology experience and expertise from other federal programs (e.g., Defense, Energy, Commerce's NIST program) or a loaned Executive to join a combined School-to-Work/One-Stop Team.
- Have the local learning labs showcase technology.
- One-Stop is likely to have at least two annual technical assistance/bidders/winner conferences where technology can be displayed and specific tracks can be formed to walk people through them. The goal of these conferences will be to bring together new federal grant recipients and people hoping to get a federal grant with the hopes of influencing these people early in their decision making process.

REHABILITATION ACT OF 1973

Purpose of the Program

Under Title I of the Rehabilitation Act of 1973 as amended (Rehab Act), the goal of the Vocational Rehabilitation (VR) Services Program (approximately \$1.8 Billion) is to meet the "needs of individuals with disabilities so that such individuals may prepare for and engage in gainful employment to the extent of their capabilities."

The Rehabilitation Training program's purpose is to:

- Increase the supply of qualified personnel available for employment in public and private agencies and institutions involved in the vocational rehabilitation, independent living, and supported employment programs for individuals with disabilities, especially those individuals with the most severe disabilities; and
- Maintain and upgrade basic skills and knowledge of personnel employed as providers of vocational, medical, social or psychological rehabilitation services.

The Role of Technology

The following are examples of the role of technology at present:

A Client Assistance Program Assurance Review (CAPAR) system has been developed to monitor compliance with Governors' Assurances submitted to receive funds under Section 112 of the Act. The CAPAR data analysis system has undergone field testing and it will generate a computer print-out of review results and will enable RSA to aggregate regional and national results.

A Monitoring Information System (MIS) has been designed that to enable RSA management to track the status of all formula grant programs in regard to predetermined indicators, such as compliance with Federal law and regulations (SPAR, CRS, CAPAR) and statistical reports regarding service delivery.

MONLOG, a computerized program for tracking the status of monitoring reports sent to the central office by regional offices has been developed and implemented.

Computerized data systems now exist for all primary formula grant programs. Regional office staff have received training and are becoming more proficient in their use. Monitoring data is aggregated and analyzed at the regional and national levels and is used to target resources to areas of identified deficiencies as well as long-term planning for monitoring, technical assistance, needs assessment for special populations, training, and evaluation priorities.

Implementation Plan

A proposed goal has been established in the Office of Special Education and Rehabilitative Services (OSERS) in the Department of Education, in which the Rehab Act is administered, to increase access to technology for people with disabilities. Strategies are to be developed after objectives have been approved by the OSERS components. The current operating concepts for this goal are that access to technology can mean two very different things; namely that,

- the availability of technology for use, i.e., physical access to technological devices, and
- the useability of technology if available, i.e., accessibility of technological devices.

Each of these concepts are of equal importance and will be identified and addressed by the associated strategies for the following objectives:

- Improve the capability of OSERS to conduct research on new solutions to the problems of access to technologies by people with disabilities.
- Support access for persons with disabilities to the National Information Infrastructure at school, on the job, and at home.
- Provide opportunities for people with disabilities to participate in telecommuting and lifelong distance learning in school and in the workplace.
- Provide strong collaborative support for the use of accessible technology in the implementation of all federal education and training programs.
- Increase the access to technology by persons with disabilities undergoing vocational rehabilitation.

Draft Statement of Work

Support to the Environmental Program

DBA Systems, Inc. will provide technical support to The MITRE Corporation in its role as System Integrator for the Environmental Program. The work to be performed, the deliverables, and the schedule are described in the following task descriptions. The work will be performed on a fixed-price basis.

Task 1, Russian System Comparative Analysis

DBA will review the *Environmental Task Force (ETF) Final Report* to develop an understanding of the requirements identified during the ETF, and the U.S. systems that were judged to be valuable by the ETF scientists. DBA will conduct a comparative analysis of the capabilities of U.S. and Russian remote sensing systems and identify Russian systems that are likely to have applicability for environmental research.

The results of this analysis will be documented in a briefing to the government and selected members of MEDEA in Washington, D.C. The briefing will be completed by TBD. Based on the feedback received at this meeting, DBA will prepare a report documenting the results of the analysis. The report will be completed by TBD.

The estimated cost of this task is TBD.

Task 2, Russian-American Environmental Seminar Support

DBA will investigate and review Russian remote sensing archives to assess their applicability to real-world environmental applications. A specific environmental application will be selected to demonstrate the utility of Russian reconnaissance satellite imagery. The results of the analysis will be incorporated into a series of posters for presentation at the Russian-American Environmental Seminar poster session in Washington, D.C. on 16 May 1995. The results of the analysis will also be documented in a short report suitable for inclusion in the proceedings of the seminar. The report will be completed by TBD.

The estimated cost of this task is TBD.

Sole Source Justification

DBA Systems, Inc. is uniquely qualified to perform the work described in Tasks 1 and 2 due to its expertise in satellite remote sensing, and its relationship with and knowledge of pertinent U.S. and Russian government organizations.

Clinton Presidential Records Digital Records Marker

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C Appendix C: Glossary

Analog communication

A communication format in which information is transmitted by modulating a continuous signal, such as a radio wave. Voice and video messages originate in analog form since sound and light are wavelike functions; thus, they must be converted into digital messages in order to communicate along digital communications formats or media.

Anonymous FTP site

A server that allows the public to log on and download files without having an account or a user ID on that server.

Application tools

Computer software that enables the user to manipulate information to create documents or reports.

Archie

A database listing programs and data files available at anonymous FTP sites or Telnet sites on the Internet. See *Veronica*.

ARPAnet

The original experimental U.S. government network that started the Internet. ARPAnet was started in the mid-1960s to connect researchers, and is no longer in existence. ARPA is the Advanced Research Projects Agency, under the Department of Defense, previously named

DARPA (Defense Advanced Research Projects Agency).

Artificial Intelligence

The use of computer processing to simulate intelligent behavior. Current research includes natural language recognition and use, problem solving, selection from alternatives, pattern recognition, generalization based on experience, and analysis of novel situations.

ASCII (American Standard Code for Information Interchange)

Pronounced "as-key," a set of computer characters devised to achieve some measure of compatibility among various computers. Putting a text file in ASCII format reduces it to essential elements—upper- and lower-case letters, numbers, punctuation, and some control characters but no graphics characters or printer codes—and eases the process of sharing it with other computers.

Asynchronous communication

Two-way communication in which there is a time delay between when a message is sent and when it is received. Examples include electronic-mail and voice-mail systems. In contrast, synchronous communication is simultaneous two-way exchange of information—for example, a telephone conversation.

Audiographic conference

A conferencing system that can transmit audio and still-video signals, computer graphics, and text on the same telephone cable or other narrow-band communications channel. Equipment generally includes computers, graphics cables, and speaker phones at both the receiving and delivering ends.

Authoring

The process of building or modifying computer software using a computer program designed for that purpose. Generally, authoring software applications require less technical expertise compared with programming languages.

Backbone

The main communication channel in a network wiring scheme, so called because other communications lines connect to it like ribs connect to the human body's backbone.

Bandwidth

A measure of information-carrying capability. The difference between the lowest and highest signal frequency is expressed in hertz (cycles per second). Wider bandwidths can carry more information.

BITNET (Because It's Time Network)

An international computer network created to connect research institutions and higher education.

Broadband

A flexible, all-purpose, two-way medium that provides the wide bandwidth necessary for both conventional video and high-definition television, and for still-frame displays for information retrieval, catalog shopping, and so on.

Bulletin board service (BBS)

A computer service that is modeled after a community bulletin board. Using a computer, modem, and phone line, individuals connect to a central "host" computer to post or read messages or to upload and download software. Communication is usually asynchronous.

Cable television system (CATV)

A broadband communications system capable of delivering multiple channels of programming from a set of centralized satellite and off-air antennae, usually by coaxial cable, to a community. Many cable television systems combine microwave and fiberoptic technologies.

CAI (Computer-aided instruction)

Instruction that is carried out or supported by computer technology.

CD-ROM (Compact disc-read only memory)

An optical storage system for computers that permits data to be randomly accessed from a disc. With read-only discs, new data cannot be stored nor can the disc be erased for reuse. Other optical storage systems allow users to record or write and rewrite information.

Chat room

An area on a computer network where members "gather" to type in messages in real time. They can receive immediate responses. There are two types of chat rooms—public and private.

Client

A computer workstation that can request and receive services, information, and applications—such as file transfer to other computers, access to a printer, or access to another computer network—from a server on the same computer network.

Coaxial cable

Shielded wire cable that connects communications components. Coaxial cable is commonly used in cable television systems because of its ability to carry multiple video (or other broadband) signals.

Codec

An electronic device that converts analog video signals into a digital format for transmission, and vice versa. The name is an abbreviation for "coder-decoder," or "compressor-decompressor" when compression is also involved.

Compression

Compressing information so that it requires less space to store or transmit. When speech is compressed, for example, pauses are eliminated. Compression is generally expressed as a ratio. For example, an 8-to-1 ratio means that the information requires one-eighth of its original space. The greater the compression ratio, the higher the chance for loss of quality in image, sound, or motion. In compressed video, digital technology is used to encode and compress the signal. Picture quality is generally not as good as full motion; quick movements often appear blurred.

Computer graphics

Representations of information in formats other than text on a computer. Application tools allow users to draw or "paint" original images with a mouse or a graphics tablet.

Conference

In computer networking, refers to an online discussion group focused on a topic.

Connectivity

The degree or level to which one computer can connect to an online service. For example, a lower-level of connectivity to the Internet may support only the exchange of e-mail, while a more advanced level of connectivity may support FTP and Telnet services.

Courseware

A package used for teaching and learning that includes computer or video software and related print materials such as a teacher's guide and student activity books.

Curriculum (pl. curricula)

The courses offered by an educational institution. Most schools have a prescribed curriculum teachers must follow throughout the school year and on which students are tested as the basis for passing a course or getting credit for it.

Cyberspace

Worldwide pool of information stored and transmitted by internetworked computers. William Gibson created the term in his novel *Neuromancer*.

er, where he used it to refer to computers and the society that focuses on them.

Database

A collection of related information, computer databases can include text files, programs, and graphics, that can be searched by key words or other means, and reviewed or downloaded onto another computer.

Digital communications

A communications format used with both electronic and light-based systems that transmits audio, video, and data as bits of information.

Digital video

A format used to store, manipulate, and transmit moving images of bits of information. Codecs are used to convert traditional analog signals into a digital format and back again. Digital video can be compressed for more efficient storage and transmission.

Digitize

To change analog information to a digital format. Once information has been converted to this form, it can be conveniently stored, manipulated, and compressed. It can also be transmitted over a distance with little or no loss in quality. Sound (such as speech or music), still images (such as transparencies), and motion video are commonly converted into digitized form.

Distance learning

Instruction delivered from a distant site, possibly including data, voice, and video transmissions for interactivity.

Distributed network

Network that relies on multiple computers to provide various resources to other computers in the network, rather than making all resources available from a single server. The Internet depends on distributed networking.

Domain

A set of nodes on the Internet whose names share the same last two or three parts. For example, "msu.edu" is the domain name for the network of Michigan State University. Domain names that

end with "edu" are for education organizations; "com" for commercial entities; "net" for networks; and "gov" for governments.

Download

To copy a file, e-mail, or other information from a central computer to a personal computer. See *upload*.

Downlink

An antenna shaped like a dish that receives signals from a satellite. See *uplink*. Often referred to as a satellite dish, terminal, Earth station, or TVRO (television receive-only).

Electronic mail (e-mail)

A computer application for exchanging information over a distance using a modem and a computer. Communication is asynchronous. E-mail typically consists of text and/or graphics; advanced multimedia formats are under development. It can be addressed to an individual, as well as to groups of people.

E-mail address

A specific, locatable, electronic address that designates a person or service at a specific network site. Electronic mail addresses include a user name (which can be a title or function, such as "info"), the symbol "@," and a domain name (e.g., *teacher@school.edu*).

Ethernet

A type of local area network of up to 1,024 nodes (i.e., computers in a network), originated by Xerox Corporation. It specifies the types of wires connecting the network and the format in which information is packaged to travel over those wires. There are three types of Ethernet connections; different Ethernet systems use different software protocol, such as TCP/IP.

Facsimile machine (fax)

A device that converts hard-copy images and text into an electronic form for transmission over telephone lines to a similar device at another location, which then reconverts it back to text and images.

Fiber optic cable

Hair-thin, flexible glass rods that use light signals to transmit information in either analog or digital

formats. Fiber optic cable has much higher capacity than copper or coaxial cable, and is not as subject to interference or noise. Fiber optic cable has the bandwidth to accommodate high-speed, multimedia networking.

File

A file is a body of information (text, graphics, or a program) that can be passed from one computer to another.

File server

The personal computer that provides access to files for all workstations in a local area network.

Flame

To send over a computer network, as through e-mail, a message displaying a derogatory, obscene, or inflammatory attitude.

Flat-panel display

A video or computer screen that is relatively thin, lightweight, and typically used in portable computers.

FreeNet

One of a group of freely accessible servers offering information, e-mail, and access to the Internet over telephone lines.

FTP (File Transfer Protocol)

A standard technique for transferring files among dissimilar computer systems on a network.

A program that transfers files using file transfer protocol. It supports file exchange over the Internet.

Gateway

A dedicated computer that provides a link between dissimilar networks, allowing information to cross between the two.

Gopher

Software that presents in menu form information found all over the Internet. Gopher programs also allow searches on the Internet for hosts, directories, or files based on keywords supplied by the user.

Groupware

A software program that allows the same information to be shared among several computers simultaneously. With some applications, users can see

each other and, from their own computers, add to or edit text and graphics in a single document.

Hardware

The electrical and mechanical equipment used in conjunction with software (programs and files) for computer and telecommunications systems.

Host

The main computer system to which computer users are connected.

Hub

A point of connection to the Internet for users in a particular region.

Hypercard

A software program designed to create multiple pathways for moving through a body of related material, allowing the user to link documents and parts of documents in a nonlinear fashion from a single computer. Words in the displayed document may be linked to other documents or other text in the same document, usually by icons within the document, sometimes called *buttons*. Through Hypercard applications, the user can quickly access linked materials from a variety of media, such as still-motion video from a videodisc linked to a paragraph from a word processor (this type of Hypercard use is often called *hypermedia*).

Icon

A symbol displayed on the computer screen that represents a command or program (e.g., a trash can symbolize the command to delete a document or file).

Information highway/information superhighway
The vast network of interconnected telecommunications systems worldwide.

Interface

A general term used to designate the hardware and associated software needed to enable one device to communicate with another or to enable a person to communicate with computers and related devices. A user interface can be a keyboard, a mouse, commands, icons, or menus that facilitate communication between the user and computer.

Internet

International collection of interconnected electronic networks that support a common set of data communication protocols—Transmission Control Protocol (TCP) and Internet Protocol (IP). Internet evolved from ARPAnet. The National Science Foundation supported wider use of the network through development of NSFnet, expanding and replacing ARPAnet, and through funding for development of regional distribution networks. Many networks in the United States and worldwide are now part of the Internet.

ISDN (Integrated Service Digital Network)

Network that accommodates digital transmission of voice, data, and video over, standard copper telephone lines.

Keyword

A word that leads the user to go directly to a specific area. For example, entering the keyword "LABNET" takes you to the LabNetwork; "NGS," to the National Geographic Society; "Time," to *Time* magazine.

Knowbots

Software programs that act as "knowledge robots" to carry out functions such as searches for desired information, on electronic networks.

"Last mile"

Popular term for the last segment of the connection between a communication provider (e.g., telephone company central office) and the customer (usually residential, but sometimes commercial).

LATA (local access and transport area)

A geographic region ranging from a metropolitan area to a state, created with divestiture of AT&T and used to define service areas for regulated versus unregulated services (e.g., intra-LATA local service versus inter-LATA long-haul services).

Library

The term library, when used with computers, refers to a collection of computer files. A library contains files that can be text, graphics, or programs.

Listserv

A program (text and graphics) that distributes e-mail to users on a computer network who share a common interest and whose ID's are stored together. Any mail sent to a list on the listserv is automatically distributed to everyone on that list.

Local area network (LAN)

A network connecting computers in close proximity. LANs facilitate communication and sharing of information and computer resources (such as printers or storage by the members of a group).

Login/Logon/Logoff

The process of entering and leaving an electronic communications system; access generally requires a user identification code or password (often the user's name).

Mailbox

A file or directory on the end user's host computer that holds the user's e-mail.

Mailing list

A topic-specific alias with multiple mail destinations.

Message board

Message boards (or boards) are where members post messages, reply to messages, and so forth. Boards are organized using folders, which contain messages on a specific theme.

Microwave

High-frequency radio waves used for point-to-point and omnidirectional communication of data, video, and voice.

Modem

A device that allows two computers to communicate over telephone lines. It converts digital computer signals into analog format for transmission. A similar device at the other end converts the analog signal back into a digital format that the computer can understand. Abbreviated form of "modulator-demodulator."

Mosaic

A popular interface that eases navigation of the Internet.

Mouse

A pointing device that connects to a computer. With a mouse, users can control pointer movements on a computer screen by rolling the mouse over a flat surface and clicking a button on the device. The mouse is also commonly used to define and move blocks of text; open or close windows, documents or applications; and draw or paint graphics.

Multimedia

Any combination of video, sound, text, animation, and graphic images in a computer-based environment. Often includes technology such as CD-ROM, videodiscs, videocassette recorders, television, video cameras, and software.

National Research and Education Network (NREN)

Electronic network that eventually will succeed the noncommercial aspects of the Internet in the United States.

Network

A shared communications system that supports digital communication among connected computers.

Newsgroup

A topical discussion group on a network. Individuals submit messages to a newsgroup and read messages that are posted there.

NII (National Information Infrastructure)

The overall electronic information system in development in the United States.

NSFnet

The National Science Foundation Network, a high-speed network of networks linking computers at educational and research institutions. It is made up of several regional networks.

Online

Being actively connected to a network or computer system; usually being able interactively to exchange data, commands, and information.

Optical storage

High-density disk storage that uses a laser to "write" information on the surface. Erasable or rewritable optical storage enables written information

tion to be erased and new information written on the disk.

PC

A personal computer or microcomputer. The Apple Macintosh and the IBM PS/2 are examples of personal computers. Many participants on the Internet use PCs to connect to Internet hosts.

Point-to-point protocol (PPP)

Protocol that enables a computer to use the Internet protocols (TCP/IP). PPP is gaining in popularity over the SLIP alternative.

Protocols

The set of specific communication standards that allow one computer to interact with other computers.

RAM (random access memory)

Computer memory where any location can be read from, or written to, in a random access fashion. A computer's RAM is its main memory where it can store data.

ROM (read only memory)

Once information has been entered into this part of the computer's memory, it can be read as often as required, but cannot be changed by the user.

Router

A device (sometimes a specialized computer) that stores addresses of network hosts and forwards packets of data between networks. For maximum access to the Internet's resources, a local area network needs its own router.

Satellite

See *downlink*.

Scanner

An input device attached to a computer that makes a digital image of a hard-copy document, such as a photograph, scanned picture, graph, map, and other data that are often used in desktop publishing.

Server

A server is a powerful computer on a network that provides a particular service and information to other computers; for instance, a disk server manages a large disk, and a print server manages a printer.

Shareware

Shareware is software that can be shared among users but it is not free. Users purchase this type of computer software through donations to the software developer, usually to fund further research and development of the product line.

Simulation

Software that enables the user to experience a realistic reproduction of an actual situation. Computer-based simulations often involve situations that are very costly or high risk (e.g., flight simulation training for pilots).

"Snail mail"

Paper-based mail, delivered by the U.S. Post Office or other vendor, that cannot compete for speed with electronic networking.

Software

Programming that controls computer, video, or electronic hardware. Software takes many forms, including application tools, operating systems, instructional drills, and games.

Synchronous communication

See *asynchronous communication*.

Sysop (system operator)

A person in charge of a network system or BBS.

TCP/IP

Abbreviation for Transmission Control Protocol/Internet Protocol. TCP/IP is a set of computer commands that dictate how the computers on the Internet will communicate with each other.

Teleconference

Simultaneous visual and/or sound interconnection using telecommunications links that allow individuals in remote locations to see and communicate with each other in a conference arrangement. There are many types of teleconferencing, including videoconferencing, computer conferencing, and audioconferencing.

Telnet

An Internet service that allows users to log on to remote host computers as "guest" users, providing access to the files as if they were actually at the host site.

Terminal

The computer used to connect to a host. The terminal can be a personal computer such as a Macintosh, IBM, or compatible microcomputer.

Touch screen

A device that attaches to a computer screen that allows data to be entered by using a specialized stylus to write on the screen, or by making direct physical contact between the finger and the screen.

Uplink

A satellite dish that transmits signals up to a satellite. These signals are then sent back to Earth to a downlink (receiving) site.

Upload

To copy a file, e-mail, or other information from one's personal computer to a larger computer on a network.

Veronica

A Gopher service that allows you to do a keyword search of Gopher menus. Named after the comic strip character (like *Archie*).

Videoconference

A form of teleconferencing where participants see and hear other participants in remote locations. Video cameras, monitors, codecs, and networks allow synchronous communication between sites.

Videodisc

An optical disc that contains recorded still images, full-motion video, and sounds that can be played back using a Videodisc player through a television monitor. Videodiscs can be used alone or as a part of a computer-based application.

Videotext

A form of multimedia that presents video and text simultaneously on the same screen.

Voice mail

An electronic system for transmitting and storing voice messages, which can be accessed later by the person to whom they are addressed. Voice mail operates asynchronously, like an e-mail system.

Voice recognition

Computer hardware and software systems that recognize spoken words and convert them to digital

signals that can be used for input (often used as an alternative to other input devices, such as a keyboard).

WAIS (Wide Area Information Server)

A protocol that allows users to search and access different types of information on many different computer systems from a single interface. This text-based information retrieval system selects databases from an unlimited pool, without the need for user familiarity with the internal configurations of each, and helps to organize responses on the user's machine despite vast amounts of accumulated data.

Wide area network (WAN)

A computer network in which widely dispersed computers, such as those among several buildings or across a city or state, are interconnected. WANs make use of a variety of transmission media, which can be provided on a leased or dial-up basis.

Window

A part of the computer screen that is given over to a different display from the rest of the screen (e.g., a text window in a graphics screen). It can also be a portion of a file or image currently on the screen, when multiple windows are displayed simultaneously.

Wireless

Voice, data, or video communications without the use of connecting wires. In wireless communications, radio signals make use of microwave towers or satellites. Cellular telephones and pagers are examples of wireless communications.

Workstation

A computer that is intended for individual use, but is generally more powerful (i.e., it has greater memory and speed) than a personal computer. A workstation may also act as a terminal for a central mainframe.

World Wide Web (WWW)

A hypermedia information retrieval system linking a variety of Internet-accessible documents and data files (text and graphics). Often referred to as "the Web."