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ABSTRACT

Originally prepared for two conferences co-sponsored by the Office of Educational Research and Improvement in the spring of 1990, the eight papers in this collection focus on the concerns of policymakers and critical issues associated with the application of new telecommunications technologies for improving elementary and secondary education. Papers 1-5 were commissioned for the 1990 State Technology Leadership Conference, which was conducted by the Council of Chief State School Officers in Minneapolis, Minnesota: (1) "Technology and Students at Risk of School Failure" (David W. Hornbeck); (2) "Advanced Technologies Innovations and Applications for Distance Learning" (Suzanne G. Douglas and Louis Bransford); (3) "Policies for Educational Technology: A National, State, and Local Agenda" (Richard T. Hezel); (4) "Telecommunications and Restructuring: Supporting Change or Creating It" (Saul Rockman); and (5) "Using Technology To Support Professional Development for Teachers and Administrators" (Judson Hixson and Beau Fly Jones). Papers 6-8 resulted from a Workshop on Education and Telecommunications Technologies co-sponsored by the Annenberg School of Communications' Washington Program: (6) "The Mass Learnpike: Educational Telecommunications Comes to the Commonwealth" (Inabeth Miller); (7) "A Depiction of Distance Education" (Donald C. Holznagel); and (8) "Telecommunications: The Critical Resource for Achieving National Educational Goals" (Arthur D. Sheekey and Suzanne G. Douglas). A list of participants for the Annenberg/OERI workshop is included. (DB)

Education Policy and Telecommunications Technologies

U.S. Department of Education
Office of Educational Research and Improvement

IR

Education Policy and Telecommunications Technologies

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Introduction

This report consists of eight papers that were prepared for two conferences co-sponsored by the Office of Educational Research and Improvement (OERI) in the Spring of 1990. The first five papers were commissioned for the "1990 State Technology Leadership Conference" conducted by the Council of Chief State School Officers in Minneapolis, Minnesota. Each provides an overview, an analysis of issues, and recommendations. The remaining three papers resulted from a workshop on "Education and Telecommunications Technologies" at the Annenberg School of Communications' Washington Program.

All papers are directed at concerns of policy makers and focus on critical issues and problems associated with the application of new and advanced telecommunications technologies for improving elementary and secondary education. The authors are knowledgeable experts who draw upon recent research and policy studies, as well as their own personal experiences in adopting and adapting instructional technologies. Federal, state and local policy makers should find these papers especially useful in planning for the inevitable integration of schools and telecommunications networks, and in identifying critical issues associated with the application, management, financing and governance of these alternative educational delivery systems.

(1) Technology and Students at Risk of School Failure

David W. Hornbeck begins his paper with a description of the overall decline in the condition of poor children: economic, non-academic, demographic and academic performances. He then describes several practical ways of using technology, and claims: "we have the means and the know-how" to use computers to teach basic skills. Hornbeck observes that many "technologies are available and they work," and, ' vhen no satisfactory alternative is available," they can do a satisfactory job. His five recommendations for making use of technology to help improve the performance and progress of at-risk youths are: monitoring student performance, providing tracking and records of students, identifying indicators of at-risk students, relieving teachers of administrative burdens, and tracking individualized student objectives.

(2) Advanced Technology Innovations and Applications

Suzanne G. Douglas and Louis Bransford provide an historical perspective as well as up-to-date description of the technologies which constitute the facilities necessary for offering "distance learning." Transmission technologies, including, satellites, fiber optics, and cables are now interdependent and readily connected to low-cost reception technologies, which most schools can afford. The authors provide descriptions of hardware systems, including interactive audio and video technologies, that lay persons should find understandable. Douglas and Bransford emphasize systematic planning, early involvement of teachers and the importance of a broad vision for applications of available telecommunications technologies for transforming the nation's educational system.

(3) Policies for Educational Technology: A National, State, and Local Agenda

Based on research supported by the Annenberg/ CPB projects, Richard T. Hezel urged states to develop policies to ensure the equitable distribution of education and public service programs offered by telecommunications. Hezel says planning at the state level should be centralized and that states now have a host of planning models from which to choose. Planning for a statewide or regional network should begin with a thorough needs assessment. States are urged to form new partnerships and consortia, but governors and legislatures should recognize the need for designating one agency with governance authority for educational telecommunications. Other issues addressed by Hezel include: management, program resources, staffing, and training and evaluation.

(4) Telecommunications and Restructuring: Supporting Change or Creating it

Citing a quote from Bela Banathy, Saul Rockman reminds us that "the current crisis in education is not a crisis of performance, it is a crisis of vision." He provides an exceptionally good and brief historical perspective on educational tec ology, reminding readers that few if any of the technology demonstration projects of the '60s and '70s succeeded in changing the structure of schools or the delivery of instruction. Rockman cautions policy makers against "technohype," which he describes as the repeated efforts by advocates and commercial vendors to sell technology as "the solution" for all or most educational problems. Rockman suggests two options: to view educational technology as tools to augment the existing system, or to recognize the full capacity of telecommunications and interactive technologies "to create restructuring," and in the process, transform the entire system. Clearly, Rockman favors using technology to change the fundamental way in which teachers teach and students learn.

(5) Using Technology to Support Professional Development for Teachers and Administrators: Implications or State-Level Policy and Planning

The authors, Judson Hixson and Beau Fly Jones draw upon their knowledge and experience in working with schools and systems throughout the mid-west region of the nation. Their framework for changing and improving school learning is based on five strategic issues: (1) a recognition that schools and teachers need to make use of a wide variety of instructional resources, including those available from technology-based programs; (2) a recognition that the design and delivery of instructional programs must reflect changing demographics and needs of individual students; (3) the need for a revised curricula and more realistic assessment mechanisms; (4) an alteration of the classroom environment to foster more personalized and collaborative learning; and (5) the need to ensure linkages among formal schools, work places, and the wider community. Technology, they claim, could empower the teachers to communicate with students in schools, and with other agencies, organizations and individuals beyond school settings.

(6) The Mass Learnpike: Educational Telecommunications Comes to the Commonwealth

The "Mass Learnpike," a distance learning network involving the use of 50 downlinks and some 400 schools, was launched by the Massachusetts legislation in 1990 at a time when the state of Massachusetts was experiencing serious declines in revenues. Inabeth Miller, the new Executive Director of the Massachusetts Corporation for Educational Telecommunications (MCET), describes how a new statewide consortium got underway and how it quickly progressed. She explains "the value in developing a positive mythology in a organization" through the metaphor of the "Mass Turnpike." Miller agrees with Hezel's recommendation to initiate a statewide plan by identifying common needs and interests. And, the critical importance of building coalitions of prospective constituents—in this case local schools and teachers. Ms. Miller identifies the practical and political processes, the contacts necessary for building a new telecommunications infrastructure, and how it can be designed to complement both educational needs and political interests.

(7) A Depiction of Distance Education

This paper was prepared by Donald C. Holznagel for educators in the Northwest region of the nation who have begun assessing problems and issues associated with technology-delivered educational programs in and across state boundaries. Some of the distance education programs identified by Holznagel have been operating successfully for more than five years. He explains how the Northwest region is already using instructional programs originating in other parts of the nation.

The author attributes much of the progress to rural interests and to the availability of low-cost transmission systems (i.e., satellite networks). To progress further, he suggests the establishment of a regional clearinghouse, a mechanism for regional coordination, technical assistance research and evaluation all of which could be assigned to Regional Education Laboratories.

(8) Telecommunications: The Critical Resource for Achieving National Educational Goals

The final paper includes an overview summary of issues identified as part of a workshop conducted by the Office of Educational Research and Improvement in conjunction with the Annenberg School of Communications' Washington Program

and the Public Service Satellite Consortium. More than twenty experts participated in the workshop in an effort to identify and discuss critical policy issues relating to the application of telecommunications technologies and education.

In writing this paper the authors wanted to provide a context to understanding the need to change policies and institutional arrangements associated with formal education and the domestic telecommunications infrastructure. Both may be outmoded. The opportunity, according to the authors and expert consultants, is in matching the interests and resources of educators addressing national educational goals with those responsible for planning and developing public and private telecommunications networks.

Telecommunications technologies, which combine fiber optics, microwave, cable television, satellite linkages and a host of newer and low-cost interactive and transmission devices, have already transformed other sectors and many institutions in this nation. We should expect technologies to have a similar effect on schools and the delivery of education-related services in the not-too-distant future. Educators need to participate in the planning and development of these communications resources, and attend to communications policies and regulations to ensure they complement, rather than hinder, the efforts of teachers and the mission of schools.

Contributors

Louis Bransford is President of the Public Service Satellite Consortium (ASSC), an international nonprofit membership organization whose purpose is to facilitate the application of telecommunications technology for public service. Dr. Bransford has written numerous articles on telecommunications-related topics, and directs policy seminars and technical services for several national organizations and Federal agencies. He was a professor of education at the University of New Mexico, where he directed the Chicano Studies Program and the College Enrichment Program.

Suzanne G. Douglas is the Director of Information and Research for the Public Service Satellite Consortium (PSSC). She coordinates and supervises all internal and external research activities, which includes marketing research and feasibility studies for the use of satellite fixed and transportable uplinks and services. Ms. Douglas has worked for the Academy for Educational Development and has authored and edited several publications dealing with distance education, communications satellites and telecommunications policy issues.

Richard Hezel is the president of Hezel Associates, a communications planning and research company in Syracuse, NY. Formerly, he was on the faculty at Syracuse University. He serves as a consultant to the Office of Technology Assessment and to the Corporation for Public Broadcasting. Dr. Hezel has consulted on several state-level telecommunications initiatives, and has written a number of publications on the governance of state telecommunications networks serving education. In 1990, Hezel prepared a report for the Annenberg/ CPB Project, Statewide Planning Telecommunications for Education.

Donald Holznagel is Director of the Technology Program at the Northwest Regional Educational Laboratory. He has worked for information on microcomputer applications in education. As Director of the Technology Program, he is now responsible for most of the projects in NWREL dealing directly with computers, video or other technologies in instruction or school administration. From 1970 to 1979, he was Manager of Instructional Systems and Manager of Student-Related Systems at TIES, a computer cooperative of 55 school directs in Minnesota. He holds degrees from Eastern Oregon College, and has completed graduate studies at Stanford University, State University of New York, and the University of Oregon.

Inabeth Miller is the Executive Director of the Massachusetts Corporation for Educational Telecommunications, which has received direct support from the state legislature to build a state-wide educational network. MCET plans to serve classrooms through a combination of satellite receive stations and cable. Dr. Miller was formerly the Director of Outreach and Technology for the Boston Museum of Science. As Director of MCET, Miller oversees the construction and operation of the Massachusetts Distance Learning Network. In 1990, MCET received a Star Schools grant in the amount of $4.9 million.

Judson L. Hixson is a Program Director for the North Central Regional Educational Laboratory, with responsibilities for a variety of projects in the area of preservice educational profession development, and educational applications of technology. Mr. Hixson has authored a number of significant papers on education, co-authored several major research papers on education, and has served as a consultant to several national organizations, colleges and school districts. He has also taught at all levels of education, and has direct experience in multimedia productions, television and radio broadcasting.

Beau Fly Jones is a Program Director of Institutional Collaboration and Development for the North Central Regional Educational Laboratory, with responsibilities associated with a variety of research, development and dissemination projects. In 1990, Dr. Jones coordinated a series of video teleconferences conducted by the Public Broadcasting Service, and she has established several educational networks involving individuals affiliated with schools and colleges. She has also served as Special Projects Coordinator for the

Chicago Public Schools and in this capacity, was a main collaborator for the development of instructional materials in several areas, particularly social studies and reading.

Arthur D. Sheekey is a senior education program analyst in the Office of Information Services, Office of Educational Research and Improvement (ED). He has served as Director of the Education Information Resources Division and Director of the Higher Education Division in the Office of Research. Dr. Sheekey has also held positions in the U.S. Office of Education, Department of Health, Education and Welfare and OMB. This year, as a Science and Technology fellow, he is working with the office of the Chairman of the FCC on hearings focusing on "Networks of the Future."

David Hornbeck is a partner at the Washington, D.C. law firm, Hogan & Hartson. He served as the State Superintendent of Schools for the State of Maryland between 1976-1988 and previously was Executive Deputy Secretary of Education for the State of Pennsylvania. Mr. Hornbeck has degrees in theology and law and, presently serves as a principal consultant to several major national and state-level efforts to reform and restructure public elementary and secondary education. He is Chairman of the Board of Trustees for the Carnegie Foundation for the Advancement of Teaching, and on the board of several other national organizations and private foundations.

Saul Rockman is a consultant on educational technology for corporations, state and federal agencies, and educational organizations. He was manager of education research at Apple Computer with responsibility for analyzing and disseminating research on the impact of technology in education.

Mr. Rockman was director of technology programs at the Far West Regional Educational Laboratory in San Francisco, California. He conducted research on teacher training programs in technology, analyzed technology resources in social studies, developed distance education projects for rural schools and conducted technology policy research in Arizona, California, Nevada and Utah. Before moving to San Francisco, Rockman was director of research at the Agency for Instructional Technology in Bloomington, Indiana.

Technology and Students at Risk of School Failure

by David W. Hornbeck

I will set the context for this paper before turning to the direct utility of technology in meeting the needs of America's children and youth at risk of school failure.

I refer the reader to facts in three areas: non-academic conditions of children and youth; economic and related demographic conditions; and academic achievement.

The non-academic conditions of children and youth include the following: the United States ranks twentieth in infant mortality today; more than one in five children are poor; nearly one in two black children are poor; 25 percent of sexually active teenagers contract a sexually transmitted disease; forty teenage females give birth to their third child daily; in general, seven million youth, ages 10–17, are at serious risk of pregnancy, alcohol or drug abuse, or poor school performance.

The economic and related demographic conditions include the following: between 1947 and 1973, the average income in the United States more than doubled; between 1973 and 1986, the average income declined by almost $300; in 1985, of 20- to 24-year-old males, less than 45 percent earned enough to support a family of three above the poverty line; of young black males, the percentage was less than 25 percent; only 2 of every 10 new workforce entrants in this decade will be native born white males; by 2000, there will be fewer than three people working for every U.S. retiree; well over one-half of the new jobs being created require *more* than a high school education.

The academic facts include the following: in most international studies of math and science performance the United States is at or near the bottom; only 12 percent of 17-year-olds can arrange six ordinary fractions in order of their size; 5 percent of 17-year-olds are able to write a good letter; 44 percent of whites, 20 percent of Hispanics and 8 percent of blacks can correctly determine the change due from the purchase of a two-item restaurant meal.

In recounting these facts, I have not sought to be exhaustive. I note them, however, to point out several serious problems we are facing as a nation.

Our survival as an economic power in the international marketplace is at issue. We have fewer youth overall and a greater proportion are from groups with whom the schools have historically failed. New jobs require higher skill levels than most of our students are exhibiting upon graduation.

In addition to our competitive disadvantage, but growing out of the same conditions, is the threat we are experiencing to our democratic institutions. The rich are getting richer; the poor, poorer. In addition, this sharper class division is also characterized by the wealthier being disproportionately white and English-speaking and the poor being disproportionately people of color whose first language is often not English.

These facts have resulted in two other phenomena which serve as a backdrop directly related to technology and at-risk students.

The first is that corporate America is becoming increasingly involved in the policy and politics of elementary and secondary education. The Committee on Economic Development was the first major corporate player. They were joined by the National Alliance of Business. Most recently, the Business Roundtable, which is composed of the nation's 200 largest corporations, has recognized their vital interest in American public education. Each corporation has "adopted" a state where they will concentrate strong effort. Moreover, they have declared that the effort will be of at least 10 years' duration.

The second phenomenon, and the last context-setting reference point I wish to offer, is the growing attention to setting and achieving certain high level academic achievement objectives. In January, the President set six ambitious goals and on February 25, the Governors adopted those far-reaching goals. The goals include, among others,

being number one in the world by 2000 in math and science *and* having a graduation rate of 90 percent or more. In March, the Kentucky legislature enacted the most aggressive and far-reaching education legislation in memory. They identified six goals for their schools. Their goals not only include math, science, social studies and English but, more significantly, emphasize such things as thinking and problem solving skills and mental abilities to assure the integration of knowledge. Kentucky, however, went further. The state is building a new set of assessment strategies that are performance-based. It has adopted a system of rewards and sanctions that will have an impact on the schools' staffs and on the schools' success or failure in increasing the proportion of successful students in a school. The President, the Governors, and now a state legislature have made decisions that address the future.

These five factors (non-academic conditions, economic and demographic facts, present academic performance, the policy/political clout of corporate America, and the new emphasis on measurable outcomes reflecting high expectations) pose an unprecedented challenge for American elementary/secondary education. For the first time in our history, we must improve the level of student achievement significantly *and simultaneously.* We must reach those higher levels of achievement with a much greater proportion of our students, including those who are black, limited English-speaking, the poor and the disabled.

Academic success or failure depends increasingly on the manipulation of information—its receipt, its generation, and our ability to relate diverse bits of information.

Information, of course, has become so central to our existence that it has come to be regarded as a product, as a commodity. AT&T, IBM, and other giants of industry sell it, buy it and enable others to do likewise. A significant portion of our economy rests on the basis of such commodity trading. It is also central within our wide reaching and expanding data bases. Scientific and technical information is, of course, crucial to our national security. In the last generation, information has come to be considered as necessary an element of production as land, labor, and capital.

The ability to access and process information has become a necessary skill to function effectively as citizens and consumers. Also as political participation depends on our access to and understanding of information. Relationships to government are more complex whether in applying for AFDC payments or filling out income tax forms. The need to evaluate and make more sophisticated choices is daily reality. Even one's ability to comprehend and act on individual rights and responsibilities is dependent on the explosion of information which has many roots in our technological world and which will be, at least in part, controlled by technology.

There are numerous ways technology, and I initially refer to the computer, can assist. There are generic contributions of computer technology which are not limited to any particular application. One might fairly summarize those generic characteristics within the framework of empowering the student. The computer motivates. It is non-judgmental. It will inform a student of success or failure without saying by word or deed that the student is good or bad. The computer individualizes learning, permitting mastery at one's own pace. In most instances, the learner has far more autonomy than in many other teacher directed settings. The computer gives prompt feedback. And good software makes the computer, at least potentially, remarkably imaginative. Such generic qualities allow the learner more often to be in charge. This is a quality missing in the lives of many students, especially those who are at-risk, due to environmental, physical, mental or language disabilities.

Having summarized the generic contribution of learning through technology, let me make two observations about learning facilitated by technology. We do not need many courses in computer literacy (translate keyboard skills) or programming. For a time both comprised what too many thought of when the call for technology in the classroom was sounded. In one sense, I suppose it was not surprising. With the dearth of good software, there were not many alternatives. While software is still not of the necessary quality or quantity, fewer school people are putting whole schools of students through eight weeks of familiarity with the keyboard. It is increasingly recognized that the computer will be used by most as the telephone, television, and automobile is—to accomplish other objectives without being able to either build or fix one.

Let's turn then to more specific contributions computers can make. First, it is clear that the basic skills of students can be enhanced. In a presentation to the U.S. Senate Committee on Labor and Human Resources in 1987, Robert Taggart, relying on work done by himself, Gordon Berlin, and Andrew Green, identified ten elements that

research prescribes to teach basic skills effectively. They include:

- individualized, self-paced instruction;
- competency-based, open-entry/open-exit approaches;
- use of multiple media and methods, including computers;
- self-directed learning promoting learner efficacy;
- frequent feedback and positive reinforcement;
- accountability of teachers and learners;
- efficient management to maximize time on task;
- individual attention and one-on-one instruction;
- supportive services and learning environments; and
- linkages to work, training, and other activities.

Computers clearly must play a central role in such efforts. Taggart also notes that there are models presently working in a wide array of settings. One, in which he has particular confidence, is the Comprehensive Competencies Program. It is in place in hundreds of secondary and vocational schools, colleges, community based organizations, correctional facilities, job training programs, union halls, and private sector worksites in at least 35 states and Canada. He notes that the CCP learning centers have been described as the "high tech equivalents of traditional one-room schoolhouses." While the data on CCP is very persuasive, I am not attempting to serve as a salesperson for CCP. Nevertheless, there is a great deal of data, which to my satisfaction, demonstrates we have the means and know-how to deal with the basic skills of most, if not every, at-risk teenager and adult in this nation with the computer as a major tool.

At a different level, but still in the basic skills arena, is IBM's "Writing to Read" program. An evaluation conducted by the Educational Testing Service concluded that it works. Children read better and they write better. It works with black and white, male and female, and poor students and rich students. It works with five- and six-year-olds. In a number of instances, where poor children are involved, such as Greenville, North Carolina, the results are quite dramatic. Moreover, it begins to move us into the realm of developing thinking skills, not just rote learning, since it emphasizes writing. That is a theme to which I will return.

Finally, on the basic skills front, I direct your attention to the potential contribution made by authoring systems, such as the one developed in the continuing education program at Johns Hopkins University.

My point in identifying the Comprehensive Competencies Programs, "Writing to Read", and the Hopkins authoring system is not to say those are the only approaches to using technology to enhance basic skills. They are not necessarily even the best. My point is to emphasize that in the basic skills context, whether one wants technology-based strategies for youngsters who are older or those in kindergarten, or if one wants to design one's own, they are available and they work.

At the same time we do not want to fall into the all-too-typical trap of thinking of technology only in the drill and practice of basic skills context. If our thinking were limited in that way it would be easy for drill and practice to become somewhat the same kind of limiting use of technology that teaching keyboard skills and programming was until recently.

We need to think increasingly of computers as tools to enable the mass of students, including at-risk students, to think critically or analytically, to solve problems, to draw inferences. We have long been successful in providing environments in which some students learn to think. But never in the history of human kind have we succeeded in having the skills of critical thought become normative for the masses of students. Moreover, never before has it been necessary that we achieve that goal in order to maintain competitiveness in the international marketplace.

The computer can help all students to be more productive. Word processing is a particularly good and readily available example. It assists in writing. Writing is the skill that schools have sought to teach on a mass basis which is most closely connected to thinking. Word processing can help writing be even more closely connected to thinking since it helps overcome some of the mechanical impediments to writing. It can solve problems of penmanship; we find that students will write longer, more complex thoughts and sentences; they will revise and edit and, thus, think through better ways to say what they are thinking; even spelling and punctuation can be reduced as a barrier. I am not suggesting that we eliminate attention to the mechanics of good written expression. I am saying that we have the means to place those mechanics in the appropriate relationship to good thinking/ good writing. Such a capacity is a particular advantage to many who are disabled or at-risk.

There are, of course, other ways technology can contribute to thinking. Simulation is one. Consider the number of permutations of a science experiment

that are possible with a computer but would be impossible in a science laboratory using consumable supplies. In a mathematics class, consider plotting a graph with hundreds of points—possible with a computer—rather than the handful available if it is necessary to calculate them manually. There are so many more examples. The challenge to which I will return later is to assure such liberating power to the poor student and the limited English proficient student as well as to the wealthier, suburban student.

Shifting to another perspective, technology for disabled students can make the difference between a life of dependency, of existence under the proverbial staircase or, alternatively, life in the mainstream, in competitive employment, with a family, a social existence and all the good things to which all human beings aspire.

The visual display of voice output can be used to assist the deaf student to monitor his or her speech output. Major applications for technology with blind or vision impaired students are generating large print on a screen, printing braille and converting printed text to speech output.

Those who have difficulty speaking or writing are assisted by synthetic speech output and word processing with adaptive keyboards which, for example, help them take notes in school. Young people with specific learning disabilities frequently have significant difficulty in writing or spelling or organizing their thoughts or time. Remembering, organizing, editing, and spelling can all be assisted with word processing.

Students who are temporarily or permanently homebound can "keep up" through the magic of electronics. For example, in one local area network school in Maryland, the school decided not to use the laboratory concept with 30 machines in a single room. Instead, they placed six machines in each of five areas of the school—mathematics, science, social studies, English, and far down at the end of one corridor, where few others traveled, in the special education section of the school. According to the testimony of the special education teacher, that electronic connection to what those disabled children think of as the real world has made a world of difference.

There are increasing sources of support and information about the ways technology can help the disabled. There are two with which I am most familiar. One is the work of the National Cristina Foundation (NCF); the other, the Center for Technology in Human Disabilities. The Chairman of NCF, a New York businessman, recognized that we are enroute to the corporate obsolescence of eight-bit computers. At the same time, for many school applications, there are years of life left. He donated 2,500 Apple PCs to the Maryland State Department of Education to demonstrate the potential uses for disabled youngsters. He believes within ten years corporate America will cease to use between 8 and 10 million eight-bit machines. The NCF/Maryland effort has identified the uses to which they can be put. Just as methodically, NCF intends to make that information available across the nation and internationally. The work has also led NCF to recognize that many of the applications are useful with non-disabled at-risk students as they are with those who are disabled.

The NCF initiative is also related to the National Center for Technology in Human Disabilities in which Johns Hopkins University and the Maryland State Department of Education are partners. It is an unusual collaboration of the private and public sectors in which the founders brought together more than a dozen projects worth over $3 million in the technology/disabled arena. The project involves youngsters birth to twenty-one, adults in vocational rehabilitation, youth and adults who are severely handicapped, and outreach beyond the nation's borders, particularly in Latin America, the People's Republic of China, and Ireland.

The segment of our population growing most is that of limited English proficient students. Between 1978 and 1982 the overall 9- to 14-year-old student population declined by 6.2 percent. Their limited English proficient (LEP) counterparts increased by 10.3 percent. Another way of putting the numbers in perspective is to note that while Spanish is the language most often spoken by these youngsters, there are more than 100 language/language subsets spoken by public school students.

> Computers can sometimes provide instruction when no satisfactory alternative is available.

Computer assisted instruction (CAI) can speed up certain learning; it provides greatest improvement for the lowest achieving students. Motivation is enhanced. Patience is a hallmark of the computer. Interactive devices provide students with a sense of control. Students can fail without embarrassment. All of those qualities can be helpful to the LEP student. There is evidence that CAI programs like "Writing to Read" which are designed generally to help young children with language, are effective not only with youngsters whose first language is English, but LEP student as well.

According to a March 1987 Congressional Office of Technology Assessment report there are a number of developments affecting LEP students which are encouraging. For example, Seattle reports increased achievement with the Vietnamese, Cambodian, and Laotian bilingual software they developed. It is focused on U.S. history and reading comprehension. In San Diego, software in Spanish has proven useful. We already know that word processing packages and other devices used to enhance writing skills can be particularly useful. One can add to that the fact that low-cost chips are available which add dual language character generation, making Spanish and English writing possible.

Other potentially good contributions that are reported include digitized speech and audio devices. These can include native language speech output as part of an instructional program managed through a microcomputer. Also, dual audio tracks in video discs can be helpful as they permit instruction of any subject in English and in the native language.

There are clearly other technologies, and technologies with more than one component that can help meet different objectives at different times. Straight video-instructional television is one. Maryland uses it extensively and with a variety of audiences related to the topic of at-risk student. One national award winner is "Constancia's Choice," directed to migrant youngsters. The message focuses drop-out prevention. Another of a different variety is a multiple segment series that Maryland developed to train special education teachers. The series is now used in more than 30 states and was dubbed into Chinese for use in the People's Republic of China. A third is a parent education series starring Greg Morris. The target audience is the teenage potential parent.

Another basic way to use technology that is growing in importance is distance learning. Utah, Texas, and Oklahoma have been big producers. The Federal Star Schools program administered by the U.S. Department of Education has provided great impetus to the movement. The benefits to wide-open, sparsely settled spaces are obvious. Recently the Kentucky legislature passed legislation that contemplates reaching the poor and rural schools in that state for both in-service training for teachers and advanced and other low enrollment courses for students. In fact, this feature is only one of a $200 million six-year program designed to reach all Kentucky students using all modes of technology. This effort could have a major impact on at-risk students.

But distance learning is not applicable only in sparsely populated settings. Using cable rather than satellite in densely populated central Maryland, students in diverse high schools have first rate courses not otherwise possible. The courses include very advanced foreign language, science and math courses without the prohibitively high costs of both personnel and transportation. Again, the issue is whether poor school systems where poor students are concentrated have the advantage of such initiatives that enhance the learning opportunities of participating students.

Another technology that can be a powerful tool is the videodisc. Work that is being done at the Technology Learning Center at Vanderbilt is an excellent example. With a particular commitment to at-risk students, they are developing a series of videodiscs with computer connections, including a strong hypercard component, that early evidence indicates contributes significantly to thinking skills.

Finally, in the list of instructionally related uses of technology in connection with at-risk students, I wish to mention one other. That is the use of technology in connection with staff development. One example is a very major and potentially productive project of the Agency for Instructional Technology that is presently in prospectus form. It is a multi-part video series focused on instructional practices that work with at-risk elementary school students. A second stage, presently on the drawing board, is a followup interactive videodisc series on the same subject matter. Staff development is becoming more and more important as teachers are being asked to reach higher levels of achievement with many more students of a more diverse background; they are being asked to accomplish new things with techniques they've never seen or used. Video, and especially interactive video, will likely prove to be a major tool in accomplishing the task.

I turn from the direct way in which schools can be assisted in meeting their instructional responsibilities to at-risk children and youth via technology to a different powerful contribution of technology. To summarize the point I wish to make, technology can produce, manage and assist in the analysis of information about the students and their performance. This can help in planning school system, school, and student instructional programs. This capacity can also help generate resources from legislative bodies, who are sometime skeptical of needs, but insist on accountability, by helping to organize the data for which they look.

Opportunities for the Application of Technology to Manage Education

There are at least five ways one can think about contributions in this arena. First, student data bases, demographically organized, can produce powerful policy-relevant information unattainable in any other practical way. Let me illustrate in a national context. For the first time in the nation's history, there is openness to developing comparable state data about student performance. In 1991, with math at the 8th-grade level, using a National Assessment of Educational Progress test, comparable data will be collected from nearly 40 states. If a proper demographic analysis is done—wealth, race, gender, parental education, as well as state/school systems resource analysis, we will have the ability to know what we are doing and where and how we should do things differently and more effectively. If one knows, based on comparable data, that another state, or better yet, a school system in another state, is producing better results with impoverished, Hispanic 15-year-olds, the potential for replicating "what works" could be increased substantially. Change will occur because one will decide to do the right thing, or the front pages of the newspaper will force a positive response. Either way, at-risk youngsters will be the winners.

As a final word on that notion, states need not wait for the nation to generate student data concerning performance-sensitive indicators analyzed within appropriate demographic cells. Most states will have the breadth of students to do the same thing internally. It is not easy; there will be political risks; it will generate controversy; decisions about which indicators and which population profile characteristics to use are complex. But the means of generation, collection and analysis are at hand. If one has the courage, and will commit the necessary resources, such knowledge will enrich a state's ability to serve its students, especially its at-risk students. I emphasize that as states become more focused on outcomes, they should not only develop the data base to know the outcomes but they need to collect the elements that will encourage analysis for performance improvements.

A second way to use technology to produce, use or manage information to help at-risk youth is in tracking youth on a national, state or school system basis. The most outstanding example I know of is the migrant tracking system through which an individual student's progress and needs can be followed. This can greatly facilitate instructional program planning for that student as he or she moves from, for example, Florida to Texas to Maryland. Similarly, with the tremendous movement of youngsters within our cities, moving in many instances several times per year, a sophisticated mechanism for tracking the students could be very helpful. As states (such as Kentucky has done recently) enact laws linking outcomes with rewards and sanctions and use the school's performance as the unit of measurement, knowing where students are will be of great help. A third, related alternative could involve young people who for any number of reasons are in institutions, in foster homes or in some other or a series of other settings. Designed properly, one could program for and track such youngsters relatively easily.

A third use of technology in this general arena involves the identification of indicators of at-riskness—poor grades, truancy, persistent tardiness, behavioral problems leading to various levels of disciplinary measures. These factors can be used singly and/or in concert to identify for special attention students who cross certain identified cumulative thresholds. Most educators care about kids and want them to succeed. At the same time, with the educator's range of responsibilities, it is difficult to always be aware of when a student is in trouble. Technology can help solve that problem relatively easily. In this context, one should ensure, however, that the ability to identify students needing help does not increase labeling or pull-out programs for at-risk youth.

A fourth use is to solve for administrators and teachers a host of administrative problems—tracking student progress, keeping records, producing reports. To the extent those sorts of items can be made more routine through technology, time can be freed for more instructionally related purposes.

Finally, technology can help greatly in organizing and tracking learning objectives for individual students, related instructional strategies, class lesson plans which account for individual attention, and evaluative data which can be cumulative and cumulatively analyzed. One way in which Maryland effectively employed technology for disabled children related to the state requirement that IEPs affirmatively account for the 232 competencies which comprise Maryland's K-12 competency based program in reading, writing, mathematics, world of work, citizenship, fine arts, and survival skills. It is one thing to establish standards and raise expectations, it is another to help students achieve them. These efforts related to IEPs helped contribute to significant achievement

gains by disabled youngsters on competency tests required for graduation.

There are several final issues requiring attention if technology is to fulfill its promise in fact, not just in theory.

I will mention four and treat two additional ones a bit more fully. First, good teacher training is crucial; second, we need to systematically disseminate information about the kinds of things discussed in this paper; third, evaluation and research about technology's impact on at-risk youth should be increased; fourth, school systems and states must be far more purposeful in their objectives and strategies to harness technology for young people in need.

There are two final critical factors. The first is the issue of access. The poor are disproportionately represented among at-risk youth. It is hardly profound to note that poor students are more concentrated in less wealthy school systems. Impoverished school systems do not have the necessary resources available to the rich. I use my experience in Maryland to illustrate, not because its system is particularly diverse in available resources (in a national context it does well), but because I know the statistics. The wealthiest system spends $2,500 more per child than the poorest. If one thinks of a typical classroom of 30 children that means one class has $75,000 more in resources than the other. It's not difficult to determine which has more of everything including access to technology.

The major solution is, of course, that the public, corporate America, educational leaders, and elected officials will recognize the need and demonstrate the resolve, intelligence and courage that is required to provide the resources.

Too often at-risk youngsters are treated in schools only to drill and practice opportunities while the others are engaged in thinking skill activities. That's a mistake. It is also an issue of access. At other times computers are used only in courses with prerequisites like math and science. Too often the at-risk child will not have, for example, the algebra prerequisite. At-risk youth will not have as much non-class computer time. The at-risk student is less likely to have a computer at home than a wealthier counterpart and more likely to be in a school where for reasons of economy, the school is closed in mid-afternoon. There are multiple ways schools must consider the access question. But it is a threshold question.

Finally, a word about software. It's better than it used to be, but it's not particularly good. The single biggest reason it has not gotten better faster is that few firms and developers have discovered a way to make money producing educational software. The problem is compounded for sub-sets of youngsters like LEP students where the market for some items is even thinner.

If there is an answer to the several software issues, it lies in part in creating market power. We need a consortium sufficiently broad-based and cohesive enough so as to produce sufficient users to enable us to drive unit costs down. We must shape content and determine development priorities in line with school and student needs. We also need the power to address some important special needs like those of LEP students.

The challenges we face are extraordinary. The stakes are high. Commitment, imagination, will, courage, and resources, in that order, are necessary for our success. We must succeed with at-risk students as well as others. Technology can help us do that.

Advanced Technologies: Innovations and Applications for Distance Learning

by
Suzanne G. Douglas and Louis A. Bransford

Introduction

Despite the repeated calls for change in today's educational system, and the increased use of electronic alternatives for delivering instructional material to students and teachers, most educators would agree that the basic goals of education remain the same. This was reinforced in a recent study by the National Association of Secondary School Principals that cited the primary goal of education as teaching students how to read, write and compute, with fostering good human relations and problem-solving ranking second and third.[1] Methods may vary but the basic tenets of education remain the same.

However, it is becoming increasingly clear that these goals are still out of reach for many. Nationally, two-thirds of all employers consulted assessed their current pool of entry-level applicants as being insufficiently prepared, and a large percentage of high school graduates require remediation in reading, writing and mathematics skills when they enter college.[2]

The overwhelming mandate to deliver more course offerings and more educational resources combined with stagnant budgets has led many school districts to turn to electronic alternatives for expanding educational opportunities. These alternatives include stand-alone courses taught at a distance through video or audio technology, interactive computer conferencing or videodisc, as well as a myriad of support materials for courses taught on-site in a more traditional manner.

The eagerness with which many school districts have embraced electronic learning materials is evident in the popularity of the U.S. Department of Education's Star Schools Program, Whittle Communications' Channel One venture and the TI-IN Network. One key to the success of these enterprises has been the provision of satellite and classroom hardware in addition to the programs. This one-stop shopping is especially attractive because schools often have a difficult time justifying expenditures for satellite dishes and the accompanying equipment, when textbook budgets and teachers' salaries are feeling pinched.

Fortunately, more and more educators are becoming familiar with advanced technologies and their potential for expanding students' horizons. As teachers start to view telecommunications technology as just another dimension of the school library, and become comfortable with its presence in the classroom, the doors will be opened for a number of new technologies with potential for educational applications. Satellite companies such as Hughes Communications and GTE Spacenet are already anticipating this company providing everything from satellite time to dishes to programming. EDUSAT, a Department of Defense effort to develop a shared use network, is equally ambitious. In the near future, technologies such as direct broadcast satellites (DBS) could result in schools that have seven or eight inexpensive ($300) flat antennas mounted on the roof and aimed at different satellites for a variety of programming services.

There is a significant role that telecommunications can play in alleviating some of the current crisis in education. Its success, however, will depend not only on technology, but on a number of human factors—the producers of the material, the reliability of the hardware, the support of the school administration, and most of all, the teachers that use it.

Historical Perspective on Electronic Distance Learning

In a conventional sense, distance learning through extension programs or correspondence courses has been around for more than 100 years. Instructional radio, most notably in Latin America in the 1950s

and '60s demonstrated the benefits of electronic distance learning in rural or remote regions. The use of television in distance learning can be traced to the '60s, when many public television and commercial stations, usually in cooperation with a local school district or college, would offer courses of study to the community at large and to schools in the broadcast coverage area.

Public Broadcasting and ITFS

The early efforts using telecommunications to deliver instructional programs that emanated from public television stations were virtually all one-way broadcasts, lacking one of the critical ingredients for distance learning, namely live interaction.

The perceived need for broader access to educational television programming was instrumental in the 1963 set-aside of special frequencies dubbed Instructional Television Fixed Service (ITFS), which still serve as a program distribution alternative in many schools. Although ITFS is a relatively low-cost one-way distribution system, ITFS channels are saturated in many parts of the country, particularly in metropolitan areas. Educators considering an ITFS system may find it difficult to secure a license, as most have been allocated to higher education institutions, PBS stations or commercial Multipoint Distribution Service (MDS) operators. However, for school systems concerned with retaining local autonomy, the attraction of ITFS is its inherently local nature—reception is limited to line-of-sight and 20 miles.[3]

The ATS Era

More than 20 years ago, the first of the Applications Technology Satellite (ATS) series was put to use for transmission of a continuing education course for teachers offered by the University of Alaska. In the mid-1970s, ATS-6 opened up new options for video distance learning. Since then, educational television via satellite has become a big business, with a number of states establishing statewide networks for bringing programs into the schools.

Transmission Systems

A variety of technologies either currently in use or planned for the near future will enable schools to pick and choose the most appropriate and cost-efficient route for distance learning programs. In today's distance learning environment, satellites are a viable, but certainly not exclusive option for schools that need telecommunications linkages to information resource centers or program providers.

Satellites

The past 20 years have firmly established communications satellites as a commonplace technology. NASA is currently experimenting with next-generation satellite technology, which could ultimately result in more distribution alternatives at lower cost.

Mobile satellite technology promises a flexible program distribution alternative, not necessarily from a moving vehicle perspective, but from the transportability advantages it provides. With mobile telecommunications technology, one could theoretically originate from any location for subsequent distribution in virtually any educational network. Such capabililty could give new meaning to the traditional "itinerant teacher."

Direct broadcast satellites (DBS) provide another opportunity for schools to access educational programming at bargain basement prices. Although true DBS has been in the development stage for more than eight years, the industry is now approaching the operational phase. The technology behind DBS involves a very high-powered satellite operating in the upper end of the Ku bandwidth, combined with small, low-powered receive terminals.

With satellite dishes that are priced in the $300–400 range, DBS provides an affordable alternative to the $2,500 and up that schools must now spend to acquire satellite reception capability. The flat 2'x2' antenna design may be the most practical choice for K–12. Although these dishes are not steerable, and must therefore be aimed toward one program provider only, their low cost and ease of installation make DBS a technology that can be expanded and adapted as needed by schools unable to make large up-front cash commitments.

Cellular

Cellular technology will also offer an alternative to promote two-way interaction among rural schools. Low cost, receive-only satellite earth stations have opened up many previously unavailable program services for rural America, but the technology does not allow the student to talk back to the television. A cellular system with a base unit located in proximity to several rural schools provides a mechanism for interaction that only requires the classroom to have a hand-held wireless phone. Such a system would also facilitate school-to-home communication in geographically isolated communities with limited phone service. Instead of sending a note home, the teacher could send a

phone. This opportunity to strengthen home-school-community linkages in a relatively inexpensive way should not be overlooked.

Fiber Optics

Fiber optic technology has also made significant inroads into the distance learning domain, and it is anticipated that as fiber connections become more ubiquitous, schools will be able to use these electronic "super highways" for transmission of two-way video, two-way audio programs, the "Cadillac model" of distance learning.

Minnesota has long been a fan of fiber optic technology for distance learning. Beginning early in the last decade, school systems in Minnesota were turning to fiber to link schools in individual districts for sharing teachers. More recently, the Little Crow Telemedia Network began narrowcasting to eight schools over a fiber optic network. The two-way interactive network involves three phone companies installing more than 80 miles of fiber cable. Currently the network offers 12 courses to more than 190 students, as well as in-service training, staff development and community-oriented educational opportunities.[4]

Opt In America has made waves recently with its call for a "two-way fiber optic cable running to and from every American home, office, school and institution." [5] Opt In's dream would result in a futuristic scenario where teachers could access a multitude of sources for information, education and entertainment, through two-way high definition video and lightning-fast digital data transmission.

Cable

Cable companies have long provided an option for schools seeking televised educational material. The Learning Channel, formerly the Appalachian Community Service Network, has been a leader for almost 20 years in the educational television arena. Originally founded as part of the ATS experiments by the Appalachian Regional Commission, The Learning Channel has operated as a private, for-profit organization for 10 years, and boasts 20 million subscribers across the country.

With the increasing market for cable-delivered educational video material, several newcomers are getting involved. The Discovery Channel, Turner Broadcasting and the Cable Alliance for Education are all evidence that distance learning is a hot topic, and it's anticipated that as cable/satellite or cable/fiber hybrids proliferate, the program producers will respond to market demands and the number of companies offering services will expand. In addition, more communities are striking deals with the local cable company to wire schools for free as part of the franchise agreement.

Hybrids

Although the recent history of electronic distance learning is often identified with satellites, the proliferation of alternative technologies is changing the landscape radically. Conventional wisdom dictates that, rather than claim that one technology demonstrates clear superiority over another, technologies will in the future tend to merge and blend to provide a custom solution for individual schools and situations.

Not only does this trend allow greater flexibility, but interconnecting technological systems often provide more powerful tools for the classroom. A classic example is the telephone line combined with the satellite receive dish for two-way voice interaction. The fact that both hardware and software are moving toward digital technology will also facilitate the merger of transmission systems.

Public Switched Telecommunications Network

The increased role that telephone companies are striving to play in finding solutions to the education crisis will encourage hybrid systems, with the phone company providing the critical "final mile" to homes and school buildings. The public switched network may become less of a telephone network and more of a general purpose broadband conduit for all types of traffic, including voice, video and data. For schools, this may mean that they no longer have to construct their own systems for delivering education to remote locations.

An example is "Links to Learning," a project launched in 26 Connecticut towns and cities by the local telephone company, Southern New England Telecommunications Corporation (SNET). The program uses the public switched telecommunications network to build bridges between urban, suburban and rural schools. Elements of the program include "Data Link," which uses the phone company's switched network to connect personal computers to research databases and and wire news services; "Voice Link," which facilitates teacher-parent communications by providing the teacher a way to inform parents of weekly homework assignments, book reports, field trips, test and report card dates, and other important information; and "Video Link," which provides two-way live audio and

video communications through fiber portions of the SNET network.

Advanced Hardware Technologies

A variety of technological tools have found their way into the classroom as part of distance learning programs. The transmission systems discussed above are used primarily to deliver three types of communication: video, audio and data.

Video

Video, whether it's on tape or live, has been the predominant distance learning technology in recent years. With the proliferation of both satellite and terrestrial delivery mechanisms, video will continue to play a major role. Indeed, one outcome of both federal (Star Schools) and state (statewide networks) efforts in facilitating distance learning has been the acquisition of hardware to schools for the reception of video programming.

The major advances in video technology affecting distance learning in the near future will be development of High Definition Television (HDTV) and video compression techniques. HDTV, although considered technological overkill for many types of teaching, could be very useful in science courses like physics and biology, as well as some electives, like art history. The clarity of picture and sound through higher resolution techniques and digital technology, will, by the early 21st century, be commonplace in entertainment as well as educational broadcasting.

Video compression, where the video signal is digitized for transmission over narrower bandwidths, has made significant in-roads into business teleconferencing both in this country and particularly in Europe. With the recent regulatory agreement on compression standards, video compression will fit the bill when high resolution imagery is superfluous, such as in straight lecture situations. Its lower transmission cost will make it an extremely attractive alternative for distance educators in the near future.

The implications of these advances in video technology involve primarily budgetary and long-range planning considerations. With the standardization of these new technologies, schools can start making decisions on acquiring equipment that will transcend the usual three- to five-year obsolescence cycle.

Audio/Audiographic/Data

Although public opinion dictates that today's television-oriented youth will respond most readily to instructional material presented in a video format, advances in audio, audiographic and computer technologies must not be overlooked. Audioconferencing bridges that incorporate full duplex, all-digital technology allow very natural voice interaction at a fraction of the cost of video.

Audiographic options have graduated beyond traditional slow scan technology, and courses can now be taught with simultaneous voice and visual contact using one phone line. Sophisticated key pads provide quick, computer-tallied responses from a variety of sites, so that teachers have immediate feedback as to whether they're getting their point across. Local area networks offer increased options for linking classrooms and sharing resources.

The success of the Technical Education Research Centers (TERC), one of the Star Schools funding recipients, demonstrates the efficacy of using computers in schools for hands-on science and mathematics experiments. Cooperating centers are universities, museums, school districts and other educational resource centers, which support local teachers and assist them in implementing research projects.

The make-or-break factor in using audio or audiographic technology in the K-12 classroom is teacher training. Because these technologies require a little more effort from the student than just watching television, the teacher must be prepared to bridge that gap with appropriate printed materials and tight lesson plans. Opportunities for training must be scheduled, and accompanying credit would make them more attractive for teachers who may be less than enthusiastic.

Advanced Software Technologies

Although there is a multitude of new software packages and programs on the market each year, two of the most exciting and promising technological breakthroughs for distance learning purposes are hypertext and interactive videodisc.

Hypertext

Hypertext is a computerized information organizing principle that enables the user to access a multidimensional array of resources through a unique concept linking process. Hypermedia is an expansion of this technology that allows a dynamic linking of "documents" of various formats—sound, graphics, video and text.[6] Thus, a student or teacher researching a particular novel could access contemporary literature, music, art and historical

data to form a complete picture of the various influences that led to the development of the novel's literary style and content.

Interactive Videodisc

Another manifestation of the tremendous power of today's computer technology is evident in the interactive videodisc. The term "interactive videodisc" can refer simply to the actual disc as a storage device, but in this context, we are referring to interactive videodisc's capability as a learning tool. Interactive videodisc can provide a wide range of informational resources, from a simple, self-directed learning plan to complex, hypertext-like databases of visual and audio information. Well-designed interactive video lessons enable learners to interact with the material by forcing them to interrupt, identify, sequence and select from alternative actions. Learners can repeat sections where they need more practice, or experiment to discover the consequences of various decisions made along the way.[7]

These two technologies are illustrative of the changes now taking place in the world of educational resources that will change the way teachers teach and learners learn. Teachers will be able to design and monitor individualized learning plans for students, regardless of proximity. With the proper equipment available, students could interact from home, or access the wider resources of the community. Again, as with other innovations in applied learning technology, teacher training and experience are essential to the success of the medium.

Service Providers

Statewide Networks

One of the ongoing debates in distance education involves questions of local, state and national control. Many communities can point with pride to localized distance education programs, where a limited number of schools or districts are connected to share teachers and resources, and questions of curriculum coordination, accreditation and certification never arise.

However, local solutions are not likely to effect the magnitude of change needed to reverse the nationwide downward trend in high school graduate capabilities over the past few years. States increasingly have taken the initiative to implement telecommunications networks linking schools and resource centers throughout the state. Oklahoma, South Carolina, Kentucky, Missouri, and Iowa are just a few examples of states that have dealt with the telecommunications infrastructure in different ways. South Carolina's system is a hybrid mixture of microwave, satellite and cable. Kentucky and Missouri are using VSAT earth stations to link schools via satellite. Iowa is planning to install a fiber backbone to link local ITFS stations.

The technological advances described above will mean even more choices for state educators in planning for distance learning. In particular, schools should be looking to local telecommunications service providers for commitments to link schools in exchange for permission to add capacity. The Bell Operating Companies' (BOCs') willingness to provide specialized services to the schools as the cost of doing business in a community could make them powerful new partners for educational institutions. In addition, the agreements entered into as a part of the local cable franchise should not be overlooked as an opportunity to wire schools to provide programming services.

At the present, the restrictions placed on the BOCs as a result of the 1984 AT&T Consent Decree regarding provision of information services may hamper the BOCs' ability to offer the advanced services needed for distance learning. Easing restrictions in the future may allow telephone companies to provide video transport services to schools or they may even be able to own the content as well. The current legislative debate over cable/telco cross-ownership, changes in the Cable Act and the AT&T Modified Final Judgment will determine what video services phone companies can provide.

New Private Initiatives

Recent proposals by telecommunications carriers and satellite companies to become the all-inclusive provider of distance education indicate the seriousness with which they view the education community's role in national telecommunications planning. Hughes Aircraft Company has recently proposed the development of the Hughes Public Education System—a total package aimed at disadvantaged K-5 students that would include satellite time, ground and classroom equipment (receive terminals, advanced television receivers and video recording equipment), teacher training, as well as the development and delivery of a series of new educational television productions targeted at at-risk students. GTE Spacenet is also working on an initiative to provide educational services to K-12 schools, and a number of Regional Bell Operating Companies have proposed a variety of

joint ventures with school systems to provide network services.

These initiatives could provide certain opportunities for educators, but must be approached with a certain amount of caution as well. In the case of proposals like Hughes, where the company would provide the educational content as well, there will be a need to develop new policies and mechanisms to ensure quality control, state concurrence and local appropriateness.

Human Factors

Without a doubt, innovations in telecommuncations technology have had a noticeable impact on students, teachers and school administrators in the last decade, and from all indications the decade of the '90s promises even more exciting challenges and opportunities.

The use of technology in the schools, however, is not without its drawbacks. Michael Schrage, who writes the "Innovation" column for the *Los Angeles Times* commented recently that, "In the real world, technology isn't just a medium of information but a medium for relationships. Information matters, but it's the relationships—the formal and informal networks of people—that really govern how the organization runs and how value is created." [8] Some students and teachers may find that it's more convenient, more comfortable and more productive to interact with a machine than with each other. Ultimately, the dynamics of human or personal interaction, one of the cornerstones of education, could be diminishing. What will not change is the need for guidance and motivation that only a teacher can provide.

The results of the 1988 National Asssessment of Educational Progress may also reflect on the influence of technology in the schools.[9] The report revealed that students did not demonstrate advances in thinking critically or communicating ideas. This ability is predicated on human interaction: questioning, challenging, probing, clarifying, reinforcement, smiles, proximity. The inherent nature of telecommunications inhibits face-to-face human interaction. Vicarious interaction may satisfy many distance learning authorities, but it doesn't necessarily stimulate spontaneous, critical and creative thinking. Perhaps with more sophisticated techniques using artificial intelligence, machine interaction will compete favorably with the human factor, but for the foreseeable future educational policymakers should recognize that the success of distance learning, be it video-, audio- or computer-driven, is built on interaction that will depend heavily on the professional skills and competence of the instructor.

Conclusion

The President and the nation's 50 governors have declared a set of ambitious goals for education, for the year 2000. Technology, used in a way that exploits its strengths and minimizes its weaknesses, can be of tremendous help in reaching these goals.

However, the critical first step in planning for advanced technologies is the development of a vision of how schools will look by the year 2000, what the teacher's role will be, and how technology can be used for certain functions in order to provide more free time for other human-intensive activities, particularly in the lower grades.

Technology in schools is not new, and the history of its use some experts would claim, records more failures than successes. As education decision makers make the leap to the next level of exciting new technologies, they need to ensure that teachers, administrators, parents and children make the leap with them. In planning for technology, educators must address concrete issues like partnerships, network options, financing and training, but they must also convey a broader vision of how technology will transform education in a positive way to achieve the ambitious goals established at Charlottesville last fall.

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Policies for Educational Technology: A National, State, and Local Agenda

by Richard T. Hezel

Introduction

This paper is based on research undertaken by the author during the last three years on the issue of educational telecommunications policies. Some of the impetus for the research came from the Annenberg/CPB Project, which has supported a biennial report on statewide planning for educational technology.

Since 1987, Hezel Associates has studied how each of the 50 states is or is not coordinating the planning of technology, especially the use of telecommunications for education and related activities (Hezel, 1987, 1990). In the studies, telecommunications activities of state departments of education and higher education, boards of regents, boards of vocational and technical education, state departments of telecommunications, and schools, colleges and universities that have formed pockets of technology within states were all documented. To some extent, consortial work of educators with departments of economic development, commerce, corrections, health, and social services have also been noted.

This paper is also based on contract work with the Office of Technology Assessment for its recent report, Linking for Learning (U.S. Congress, OTA, 1989), as well as planning work undertaken for education agency clients in various states.

In the fall (1988) Council of Chief State School Officers State Technology Leadership Conference at Charlotte, the considerable efforts of many attendees resulted in the development of a report and recommendation of policy issues that required the attention of the Chiefs and other key people who influence national and state telecommunications policies (Council of Chief State School Officers, 1988). This presentation has also incorporated and expanded on some of the ideas that emanated from that meeting as well as many other ideas that have originated from educational technology representatives in the states.

Technology and Telecommunications

Throughout the paper reference is made to "technology" and "telecommunications systems." The reader should understand technology as the broader term, which encompasses the use of electronic systems, like computing, telephone, and television for the delivery of educational programming and administrative support. Telecommunications refers to a delivery system, such as broadcast, telephone lines, fiber optics, microwave, and satellite, for transmitting programs from one location to another.

Why Develop Technology Polices?

Policy allows a consistent treatment of a commonly recurring issue or question. Statements of policy are the standards, established with deliberation, for making decisions. Whether policy is established through legislation, regulation, or some form of published paper, policy is the codification of how decisions are made. Policy is important for state educational technology development because of the expense involved in implementing technology. Since school technologies must be installed incrementally, policy assures equitable distribution of technology, and it assures a means of deciding how distribution will be made and under what conditions decisions are made.

The need for a consistent method of treating the development of technology has been apparent for at least the last several years. Some states, like Virginia and Utah, have been relatively advanced in the development of statewide educational policy concomitant with the statewide development of technology. Other states have utilized technology readily and quickly, but they have failed to articulate policy to guide technology development and uses.

It is only when policy is considered before and during the implementation of technology that a system for making principled judgments about the appropriate uses and the growth of technology can emerge. Then, technology policy can assist in making recurring decisions about technology and other issues of public importance. As a result of clearly stated policies, states can avoid making arbitrary decisions that lead to inequities.

There are many other practical reasons for policy development. Hansen (1987), for example, points out that saving small schools through distance education requires an acceptable rationale and some policy development.

The California legislature in 1989, as an example of policy development, passed a law establishing a state distance learning policy. The law formed the Educational Technology Local Assistance Program to award grants to teachers, local school districts, and other educational organizations. The law also required the California Postsecondary Education Commission (CPEC) to develop a state policy on the use of distance learning technology in education. The policy is required to enhance the coordination of distance learning networks and provide incentives to build partnerships that further distance learning as a cost-effective means to address resource equity and quality issues in education.

Setting the Agenda for Policy Discussion

The need for leadership in promoting and guiding the development of educational technology and policy has been readily apparent across the states for some time. Where no clearly articulated statewide educational technology policy exists, planning is haphazard and technologies are implemented haphazardly. Where technology planning is guided by policy, the likelihood of reducing costs and obtaining funding is enhanced.

Policy leadership may arise predominantly at the local level, at the state level, or at the national level from, for example, the U.S. Department of Education, from a federation of interested individuals, or from a central organization such as the National Governors Association (NGA) or the Council of Chief State School Officers (CCSSO). There is evidence that statewide telecommunications planning has been on the ascendancy during the last three years, but a debate rages in some states over whether planning should be local in nature to meet specific needs of local schools or regional to capture economies of scale in technology purchases. The ideal may prove to be to develop a body of general technology policy and funding at the federal level, with a central core of policy and technology planning at the state level, to guide local technology decisions and implementation.

Identifying the Major Policy Issues

The policy issues have changed over the last several years, but most of the issues that surfaced in earlier technology policy discussions have not been resolved. Many of the issues are treated in the report on statewide telecommunications coordination for Anne .berg/CPB (Hezel, 1990), and some of the issues are discussed in the OTA report, *Linking for Learning* (U.S. Congress, OTA, 1989). The major telecommunications policy issues, for example, are interconnected, and they must be treated in context with one another. The issues are separated below for conceptual clarity.

Strategies of Planning

The quality of technology systems depends, in part, on which organization provides leadership for planning. (Cf. Hezel, 1987, 1990, for a description of alternative structures for telecommunications planning.) The planning models are diverse, and each has its strengths and weaknesses. There is evidence of a growing desire to adopt planning models from states that have exhibited the greatest success in their distance learning systems.

It is also evident that the success of any technology intended for classroom use is substantially dependent on the involvement of teachers in the planning. Most states are including teacher representatives in the planning process. No planning should be undertaken without teacher participation.

Of equal importance with the locus of planning are the goals established for the system and their clear articulation. The goals often reflect the system planners' orientation to education. Therefore, where coordinated planning is envisioned, goals should be created by consensus among the planners. The establishment of ambitious goals often leads directly to setting priorities and strategies for implementation. Strategies are derived from the confluence of needs, goals, target student characteristics, curriculum with past evaluation research and distance education telecommunications experience.

The observation and study of successful and unsuccessful distance education projects in the U.S. leads to several conclusions regarding planning phases and strategies to be undertaken. Using the

state of Minnesota as a model, states may wish to require that technology planning satisfy some established criteria before funding will be considered. Planning should include: (1) a thorough needs assessment; (2) clearly defined goals and objectives; (3) documentation that selected technology offers cost-effective and efficient means of reaching objectives; (4) a technical feasibility study; (5) a description of system coordination and management; (6) evidence of local financial support; (7) a 3-year projection of use, clientele, support, maintenance, training, costs, revenues; (8) evidence of faculty involvement in planning; (9) opportunity for cooperation of neighboring institutions; and (10) capacity to link to other appropriate statewide telecommunications networks. States should also assure that the system addresses future needs for expansion, and includes a plan for evaluation (State of Minnesota Task Force on Instructional Technology, 1988).

Economic and Funding Issues

One of the most vexing problems in distance education in the U.S. today is the lack of funding for far-reaching (or even conservative) visions of education and technology. Many individuals and organizations are prepared to describe in great detail the technological classroom of tomorrow—and in many of the scenarios the technology is currently available. And as usual, visionary plans are thought to be expensive. The telecommunications plan for Iowa at $30 million or the Star Channels plan for Kentucky at a price of $22 million are viewed by some citizens and legislators as outlandish in cost, especially for states where per capita income and per pupil expenditures are below average.

Funds specifically designated for distance education and technology are extremely limited for implementing the visionary systems or even the not-so-visionary, but needed, technologies. In general, the federal government, across all agencies, has more dollars set aside for technology uses and the support of technology than most states, but there are many organizations competing for the funds. One of the most visible of the federal programs, Star Schools, will provide $14.8 million in fiscal year 1990 to four or five fortunate consortia. Through its Public Telecommunications Facilities Program, the National Telecommunications and Information Administration (NTIA) assists in the purchase of equipment, but much of the money will go to public television or radio stations or to colleges for the development and improvement of broadcast facilities. In total, federal expenditures for educational technology are paltry in comparison with the need and the educational goals, as established by President Bush and the governors, to be reached by the year 2000.

The availability of state funding varies wildly from state to state. The variability is associated with (1) the fiscal health of the state, (2) the vision of the governor and the legislature and their understanding of the benefits of technology, (3) the institutional and political strength of the central planning organization, and (4) the demonstration of need for funding. In Iowa, a state that has a firm resolve to take ambitious steps toward the development of educational telecommunications, the legislature has been willing to appropriate substantial funding on the system. By contrast, the state of Montana, which especially can benefit from distance education technologies to cover sparse school populations dispersed throughout the large area, has authorized just $500,000 for a feasibility study and for implementation.

State legislators are faced with hard decisions about whether to rely on general revenue funds for learning technologies or to make a long-term, large-scale investment in education by floating bonds. Using general revenue funds for ambitious technology packages usually results in tax increases. Sizable tax increases are never popular, and they are even less palatable in times when many states are running deficit budgets. Bond issues are sometimes politically easier mechanisms to finance telecommunications and school technologies. Bonds, however, shift payment for current spending into future years. In times of increasing public scrutiny regarding deficit financing, the bond issue is becoming a politically more risky financing resolution for intangibles like education. Furthermore, politicians are justifiably concerned that the financed technologies and telecommunications systems may become obsolete before the bond issue has been repaid.

Several other types of funding are available to states and schools, including grants from philanthropic organizations, corporate sponsorship, leases and vendor donations, in-kind funding among participating institutions, and user fees (cf. Goldstein & Woolsey, 1987). Among these, the most promising and durable funding comes from the establishment of business-education consortia sharing technologies. Business training needs are expected to increase dramatically during the next 10 years, and the American Society for Training and Development is forecasting that many

businesses will need technology and telecommunications for training. This decade, then, should be an ideal time for schools and state education agencies to link with businesses in the formation of educational collaboratives, wherein schools provide businesses with essential skills training and businesses offer technology training to schools.

National and state policies are urgently needed for technology-specific planning and implementation. For example, the federal and state governments can assist in providing information about which technologies are currently available, which are practical, which are obsolete, and which have a solid future. States can best support the statewide inventory of technologies and telecommunications systems within the states (e.g., Michigan State Board of Education, 1989), and the state level is most appropriate for undertaking a survey of educational applications of communications technology within the state (Nelson & Sommer, 1989). States can also be instrumental by providing districts with a master technical plan for the entire state and by developing telecommunications standards and protocols suitable to member institutions, so that, for example, schools in Millinocket and Rangely, Maine, can provide programming for one another; or more broadly, schools in Berea, Kentucky, and Ames, Iowa, can use the same programming.

States should avoid the designation of specific statewide technologies, such as computing or interactive television, or fiber optics or satellite telecommunications, in favor of using the most appropriate technologies for the variety of needs expressed at the local schools (Colorado Commission on Higher education, 1990). Furthermore, the establishment of any new technology infrastructure should be based on the combined needs for instruction, instructional support, and management applications (New York State Education Department, 1989). Technology planning should be integrated into the planning of entire educational curricula and school restructuring.

Like Virginia, states should also establish policies that permit the funding of telecommunications technologies that have been demonstrated to be cost-effective, flexible, expandable, and accessible to users at convenient locations, and technologies that provide services which allow for statewide distribution of quality and effective instructional, research, and public service programs provided by the educational community (Virginia Department of Information Technology, 1985). In Virginia, a hybrid system that relies on many telecommunications transmission technologies, such as satellite, broadcast, and microwave, is in place.

Both state and federal government need to review telecommunications regulations and policies in light of how the regulations affect the potential for delivery of educational resources. In particular, education agency staff should work with state and federal regulatory bodies to study and possibly remove barriers to the development of integrated broadband networks, which offer diverse information and educational services, by local telephone companies and long distance carriers (Gallagher & Hatfield, 1989).

State Policy Issues

Among all levels (federal, state, local) of policymaking for educational technology, state policy is probably most important. State technology policy has far-reaching impacts on agencies and educational institutions that are dependent on state funding. At the state level, numerous issues, identified throughout this paper, need to be resolved for the satisfactory implementation of educational technology. Therefore, state educational technology planners should make strong recommendations to the governor and legislature regarding the adoption and funding of technologies in the schools (e.g., Minnesota Higher Education Coordinating Board, 1989).

The involvement of the governor's office in planning for technology appears to be critical (Hezel, 1990; National Governors' Association, 1988). State legislatures can also have a central role in technology development by developing a statutory basis for telecommunications planning. Statutory actions include establishing a high level telecommunications commission, vesting the commission with authority to govern technology planning and implementation, and providing the commission with expert consultation. Legislation that develops uniform authorization requirements and that vests one agency with authority to review educational telecommunications may also be helpful.

The planning and use of technology are enhanced when a state agency provides a method for the exchange of information about technology. Assignment should be made to one state agency—such as a division of telecommunications—to facilitate telecommunications consortium building and to another agency—such as the department of education—to work with schools to develop

criteria (e.g., appropriate need assessment) for effective educational programs. Still, policy should be made regarding the locus of program authority—either at the state level or at the local institution.

Policies are needed that define the state's position regarding the importation of interstate educational telecommunications. Either at the federal or at the state level, there is an urgent need for guidelines governing courses and instruction that cross state lines (England & Bowman, 1988) and policies to guide the conditions for the acceptance of technology-based instruction from out-of-state institutions operating within any state.

Governance Issues

The preceding policy issues are critical to planning and establishing distance education telecommunications service. Governance is critical to the continuing successful operation of the system. Governance issues are sometimes thorniest for technology users, and rank behind only funding and planning as most problematic issues identified by state telecommunications coordinators (Hezel, 1990). At issue is the establishment of a structure for telecommunications coordination activities and how the coordinators are chosen, their decisionmaking responsibilities and reporting functions. Governance problems most often occur at the state level as organizations compete to exert influence over system development. Many states have no laws regarding governance of educational technology or assigning governance to an agency or commission.

State education agencies, telecommunications divisions, legislatures and governors' offices should work together to develop a governance structure that will suit all participants and will advance their goals for the system. The objective of the structure should be to avoid duplication of efforts, to reduce capital and operating expenditures, and to avoid redundancy in technology implementation.

The governance structure should also address how decisions are to be made regarding the development and dissemination of product or programming. Governance policies are needed that enable the development of guidelines for a multi-institution plan for technology coordination and administration.

The most effective management often comes through the formation of a statewide technology or telecommunications council, for which an operating policy should be established. California's Educational Technology Committee is a good example of such a council. The policy should articulate the goals and responsibilities of the council, its members, and the institutions they represent, the term of participation, who heads the council, to whom the council reports, among many other policy issues.

System Management Issues

Closely associated with the governance of technology planning and implementation is the management of technology, especially where a telecommunications system has been implemented. Effective telecommunications system management requires a vision, a mission statement, and a set of goals statements and objectives. The mission statement is the foundation for a long-range or strategic plan (e.g., Texas Education Agency, 1988; Kansas Board of Regents, 1989), and the goals are the basis for an action plan. How the system reaches its goals and accomplishes its plan of action depends on the management of the system. Several policy decisions should be made on the management of the system.

Those who operate the system need to consider what is the range of uses of the system, whether the technology or system will be used for education only or for corporate training also, and whether the system will be used exclusively for higher education or exclusively for K-12 education, or whether vocational-technical education is to be integrated into the system.

Decisions also need to be made about the area of coverage of the system, which institutions are to have access to the telecommunications system, what are the conditions for joining the system, which institutions are to be transmit and receive sites, who has responsibility for maintaining network and local components of the system. Responsibility for staffing and training system users must also be assigned through policy.

Program Issues

Programming is the heart of the distance education or telecommunications system. Instructional programming to be delivered on a telecommunications system—via satellite, telephone system, broadcasting or microwave—should conform to some predetermined quality review criteria that are clearly established in a policy statement. The criteria may include such issues as production quality, the expertise of the teacher/presenter, how the program development process works, who should participate in the program review process, how the program is evaluated, and

what steps are taken to remove a course from being offered via the system. In addition, policies are needed about who decides what courses or materials will be produced and disseminated, who will produce the materials, how they will be distributed, how production and distribution priorities are established, and how decisions are to be made about course or material changes.

Programs and courses are often received from other schools or from out-of-state, and the quality review criteria must be applied equally to those programs and courses as to in-school or in-state courses.

Faculty Issues

Policies regarding the involvement of faculty in technology planning and implementation are among the most important to be treated by policy. Inadequate training for faculty and staff in distance learning and telecommunications teaching has been identified as a barrier to the use of telecommunications for instruction (e.g, Educational Telecommunications in Utah, 1987). If technologies are to be used effectively in classrooms of the future, new teachers should receive training in the appropriate uses of technology. In addition, teacher in-service training should make extensive use of technology (California Postsecondary Education Commission, 1989). Teachers and their unions should be represented in technology discussions and planning sessions.

Policies about teachers' workloads in the face of integration of technologies in the classroom need to be formulated. Decisions about whether teachers receive compensation or course reductions for the integration of technology in the classroom must be made. Policies should take into account how the teacher's use of technologies and the preparation of instructional materials for technologies affect hiring, tenuring, and salary levels. Intellectual property rights for courses and instructional materials that are used beyond the teacher's classroom walls must be negotiated. Every level of educational institution should set as one of its personnel objectives to find, identify and recruit faculty who are good teachers, who have experience with technology applications, and who are enthusiastic about teaching via telecommunications. Teachers should be offered every opportunity for in-service professional development in the integration of technology and the curriculum.

Pedagogical Issues

Technology implementation requires the consideration of policies regarding conditions for learning, such as age, time requirements for utilizing technology in the classroom, requirements for site preparation, class size, formative testing of the system, instructional design, learning styles, and instructional strategies.

In addition, support services, such as academic advising, counseling, financial services, and job placement, to be offered to students, faculty and administrators should be described in the policymaking. Opportunities for teacher-student interaction through two-way technology, tutorials, and electronic mail should be identified. Student access to libraries can be arranged through local libraries, and academic counseling services should be available to off-site learners as well as local learners.

Evaluation of Effects

There should be a commitment to an on-going evaluation of the effectiveness of technologies in schools. The evaluation should be undertaken at key points in the development of the system and should include assessments of the technologies, delivery methods, instructional strategies and techniques, and the economic efficiency of the distance learning system (England & Bowman, 1988). The comprehensive policy should include a statement of commitment to the assessment of technology impacts. Effects on primary users, such as students, teachers, and administrators, should be measured. Actual impacts should be measured against expected or criterion levels established during planning and goal-setting. In general, the evaluation should include formative and summative assessments of: (1) uses of the technology, the conditions of uses, ease of use by instructors and students, and persistence of students' attention to task; (2) learning measures, including recall, comprehension, and skill development; and (3) attitudes of students, teachers, and administrators toward the technology and its programming. Formative evaluation tests programs and systems while they are still in development so that the testing has an impact on the final product. Summative evaluation is undertaken at the conclusion of the project and it provides a statement of total impact of the project. Finally, an evaluation of how the technology affects changes in the curriculum should be undertaken.

Aside from research on the impacts of particular technology in particular settings, some policies may

address the need for research to assess the current needs of potential users of the technology. In addition, some research may be warranted that leads to improved strategies in using the technology, as well as basic research that provides generalizable information about the use of technologies.

A National Agenda for Supporting Educational Technology and Telecommunications

As noted above, the locus for much of the planning and policymaking has been state agencies and local institutions. Aside from the Star Schools Program and scattered other grant programs, the federal government, especially the U.S. Department of Education, has been noticeably absent from the development of educational technology. National organizations, such as the Council of Chief State School Officers (CCSSO) and the National Governors' Association, have expressed occasional—and what appears to be temporary—interest in school technology and educational telecommunications, but their interest has failed to result in significant impacts at the national level.

Federal policy on the support of educational technology and on the design and development of telecommunications delivery systems that transcend state boundaries is urgently needed to assist states in planning. Such policy should be designed to provide a coherent approach to planning and funding technology development. Any national organization should establish as policy priorities regarding the support of technology. Among the priorities are:

- Support projects that aggregate institutions for planning and implementation.
- Support projects that have state government support.
- Support projects that have the potential to provide telecommunications leadership.
- Support projects where technology and experience can be shared.
- Support projects that demonstrate innovation in the use of technologies.
- Support projects that demonstrate openness to divergent technologies.
- Support projects that demonstrate an affirmative commitment to evaluating project goals against specified criteria.
- Support projects that demonstrate an affirmative interest in sharing research data and results.
- Assist states and local school districts by providing strategies for funding distance education.
- Undertake research on the economics of distance education and share findings and strategies from the study.
- Encourage the development and expansion of educational telecommunications consortia that can increase the uses of available materials.
- Establish a series of publications to assist state and local education people understand the issues to be confronted in adopting technology and developing a distance learning system.
- Establish a series of meetings to assist state and local education representatives plan for the adoption of technology and telecommunications.

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Telecommunications and Restructuring: Supporting Change or Creating It

by Saul Rockman

Introduction

This nation has been through a series of recurring educational reforms over the past century. We've had reforms of pedagogy based on theory (Skinner, Piaget, Montessori). We've had curriculum reform based on the perceived needs of a specific subject area (new math, process science, affective education). We've tried reforms based on political and demographic issues (tuition-tax credits, vouchers, desegregation). And we've had reforms that have focused on technology (ITV, Model Technology Schools). Our reform efforts have dealt with practically every instructional issue one-at-a-time—and still we persist in our belief that schools are not performing as well as we would like and are in need of additional reforms.

Today, we hear a call for "restructuring"—a multi-faceted approach to school reform based on a collection of issues—sometimes contradictory ones—that have greater evidence of efficacy and wider support from unions and professional associations than ever before. Some of what is being proposed as "restructuring" has historical and intellectual roots in research on reform (e.g., effective schools, school change, Berman & McLaughlin, 1978; Elmore & McLaughlin, 1988). Other pieces seem to emerge from the political strength of teacher reforms and current dissatisfaction with testing and school accountability. And curriculum reform is stronger than any time since the immediate post-Sputnik era, about 30 years ago. (See, for example, AAAS's Project 2061.)

(Somehow, in our American preference for contradiction, we want to reform testing programs to be "authentic" while, at the same time, use traditional test scores as benchmarks in the game of progress; and we want more teacher accountability while we talk about increased teacher professionalism.)

The focus of this paper is restructuring and telecommunications. That is not to say I will ignore other technologies. Different views on restructuring efforts in schools might emerge if I started from the role of computers in education, rather than telecommunications. Computers can be integral to many projects in telecommunications, as can (or will) multimedia and these other technological perspectives will be noted whenever appropriate. They will not be the primary focus, however.

Many technologists would not want to differentiate the perspectives of communications technology and computer technology. Paul Saffo, from the Institute for the Future in Menlo Park, has noted:

> The value of a work station will be like that of a telephone which by itself is worthless, but has tremendous value as a connectivity device. For example, by 1995, everyone will want a cellular modem on their laptop computer. It will not only have real value, but it will be a cool thing to have. You can't overestimate the importance of status in determining these advances.

Historical Perspectives

More than 30 years ago, at another time of crisis in American education, technology was called on to help solve significant problems. These efforts need to be remembered and lessons learned from them as we look to new technologies to help today's schools. I want to provide some historical perspective on technology-based reforms before describing the current reform movement and its collection of components.

• As most districts during the baby boom, Hagerstown, Maryland was faced with a significant teacher shortage; more than 20 percent of the elementary teachers had emergency credentials. Supported by the Fund for the Advancement of Education, AT&T and the Electronics Industries

Association, the county connected all of its schools into a six-channel, closed-circuit television system. While it started as a means to provide enrichment courses in art, music, and foreign language, eventually virtually every major subject in the curriculum was included. Since this experiment in distance learning was started in 1956, prior to widely available video recording systems, six production studios were equipped to deliver live instruction. The Hagerstown experiment was established as a reform effort to use technology to achieve significant change in schooling (Wood & Wiley, 1977).

• In American Samoa, in the early 1960s, instead of bringing in 300 to 400 new teachers to upgrade the educational system, educators brought in television and thirty teachers. The entire instructional program was provided over the broadcast system. While the comprehensive television instruction didn't last, the major outcome was to improve the quality of the native teachers who saw good instruction modeled over the air (Murphy & Gross, 1966).

• In the mid-1960s, reformers in mathematics education turned to television to help in the dissemination of and staff development efforts in new math. "Patterns in Arithmetic," developed at the University of Wisconsin, included workbooks and three-to-five times a week television lessons broadcast to elementary school students and their teachers. Initial use was quite high, but as teachers learned the content, they no longer relied on the television lessons to provide the basic instruction and stopped using them (Rockman, 1976).

• During the early 1960s, America's first distance education transmissions from up in the sky took place from MPATI's "low flying satellite." The Midwest Program on Airborne Television Instruction had two channels of instructional programs broadcasting from a DC-6 circling four miles above Montpelier, Indiana, and could be received by schools in a 200-mile radius in six states. A full schedule of high quality courses (for its day) were distributed for almost 10 years (Murphy & Gross, 1966).

In 30 years we have been able to add a talk-back capability to classroom television. Is that sufficient to have us return to a system that didn't last or provide a lasting change in education? While it did provide classes to those who would not otherwise receive them and used certificated teachers where none were present, are those reasons enough? Technology was not a "silver bullet" to solve education's problems in the sixties.

Twenty years ago we were making the same projections we make today about the roles of teachers and learners and the imposition of technology in the instructional equation. We talked about individualization, about teachers being the facilitators of learning rather than the single source of information, about technology providing basic instruction and supplementary instruction in classrooms, about increasing teacher professionalism, and so on. We also knew then about the barriers to overcome in getting teachers (and administrators) to use technology. (See Hyer, 1972, for an interesting summary of staff development for technology.)

For more than 20 years we have continued to see teacher preparation and teacher training as significant barriers to the use of technology for instruction and classroom management (Rockman, 1987). We know what we need to do, yet we have not been able to accomplish it, so far. After years of research on instructional materials, we have strong evidence that implementation is everything (Elmore & McLaughlin, 1988). What a teacher does with *it* is more important than what the *it* is. Our infrastructure seems capable of creating the *it*. We have learned how to develop interesting, entertaining, and sometimes effective telecommunications projects; low levels of implementation continue to plague us.

Cuban (1986) notes that the transfer of technology to schools follows a cycle beginning with exhilaration and exhortation from the advocates of any new technology and support for research on effectiveness to gain scientific credibility. This is followed by the reality of low level implementation in the classroom and disappointment on the part of administrators and the general public. The realization that the technology had not lived up to expectations and ended up covered with dust or in the closet concluded the cycle when people blamed teachers for standing in the way of progress.

Technohype

Technology, in whatever contemporary form it takes, is routinely touted as a single, simple yet elegant, answer that, when applied conscientiously in an approved program of instructional hygiene, will prevent dropouts and dullards. I call it "technohype," and it can be seen, at present, in ads on television and in print for computer hardware and software. Sometimes we see it in descriptions and promotions for new multimedia technologies. For more specific detail, we can read technohype in the testimony of technology advocates before

legislative bodies and in press conferences. It can be characterized by extremes in promises and little evidence in performance. And it often appears to be a solution seeking a widely-shared problem. Most of us involved in technology in education have been guilty of technohype in speeches and articles.

By this time, we should know better—and so should our legislators and policy makers. Nevertheless, it doesn't stop them—and us—from proposing, supporting and funding stand-alone solutions that have no chance of having significant impact on our complex educational system. We should insist that we reduce expectations so that we can do the work necessary to prepare for, support, and enhance implementation. We need to plan and conduct the kinds of research that show us how to use the technologies effectively, not research to show that one technology is better than another. Nor should technology be touted as the "silver bullet" to improve education without any other changes occurring simultaneously.

Restructuring

Our nation's current disenchantment with its educational system and the products of its schools is well documented by those within education (Boyer, Goodlad, Sizer, Shanker) and those outside of it (Kearns, The Business Roundtable, CED). The American system of near-universal education represents an infrastructure that legitimately includes everyone—taxpayers, business leaders, and elected officials, as well as teachers, administrators, parents and students. In the past few years, a new conglomeration of ideas and organizations have become bound together under the rubric of restructuring. All sectors are involved. In fact, private sector and foundation initiatives have frequently led the way in this round of educational reforms.

The ideas on which restructuring is founded are not new; but the *combination* of ideas is new and relatively untried. The approach to change links old ideas in new ways so that the ideas are more likely to be considered in wholistic rather than isolated ways, in context rather than as single issues. Restructuring refers to an array of changes in curriculum and instruction, in school governance and accountability, and in the roles of teachers and administrators that, together, are meant to improve student learning.

> Restructuring school systems is a complex, time-consuming process. Districts involved in restructuring are not taking shortcuts; they are taking multiple, reinforcing actions that fundamentally change relationships between schools and districts and, ultimately, between teachers and students. (David, p.41)

Cohen (1988) starts his discussion of restructuring with two assumptions: (1) that the primary rationale for restructuring schools is to improve the productivity of the education system and teach student higher order thinking skills; and (2) that improving educational productivity requires a restructuring of the entire education system (including governance and control), not just the schools. These are issues that strike a responsive chord among business and industry leaders and has involved them in supporting school change at an unprecedented level.

In his foreword to David's (1989) review of districts in the midst of restructuring, Cohen further defines restructuring as concerned with:

- modifying curriculum and instruction to promote the acquisition of higher order thinking skills for *all* students;
- decentralizing authority and decisionmaking, so that the most
- important decisions are made at the school site rather than the central office or the state capital;
- developing new, supportive and collaborative staff roles to improve the instruction process; and
- accountability systems that clearly link rewards and incentives with student performance at the building level.

We could add to the list of restructuring issues, for instance, the notion of changing the relationships between schools and institutions of higher education so that research and development is linked closely with practice (Mirman, 1988). Or we could connect and contrast restructuring to earlier efforts, such as typical school improvement initiatives and applications of school effectiveness research to schools in search of excellence (Harvey & Crandell, 1988).

No matter how we define restructuring, its application in the real world of education is not what we say it should be. There is an equivalent to technohype in the education field as well. ("Hopefulness is the most important characteristic of strategies to restructure American schools.") While many are talking and planning, only a few of the 15,000 school districts will be capable—either through their own resources or through local leadership and motivation—of substantially reforming their schools without major outside intervention and help. What many are doing is

really tinkering around the edges. Restructuring—as educational leaders are defining it—is *not* adding more of the same, tinkering around the edges, or making significant improvements to the current structure. It is about substantive changes to the way we do business in education.

Among the issues discussed under restructuring are: site-based management, cooperative and collaborative learning, interdisciplinary curriculum, projects rather than textbook-based curriculum, teacher-as-manager, increased parental and community involvement, parental choice, redefinition of grade levels, personalized learning plans, waivers from regulations, new forms of accountability, focus on cognition and higher-order thinking skills, and shared-decision making. Other "catch phrases" could also be mentioned, but can be included in defining changes in rules, roles and relationships.

Nevertheless, McDonnell (1989) points out that we haven't moved very far from the single-theme reforms of the past. Many restructuring reforms are addressing different parts of the education system in isolation; there is little effort being made to design any type of comprehensive strategy; and many restructuring leaders and advocates do not even talk to one another. Moreover, the relationship between the problems of poor educational performance (the fundamental concern of restructuring) and the specific solutions embodied in restructuring proposals is not always clear or well articulated. Although most reforms are justified by their presumed effects on student outcomes, the issues discussed most often concern teacher empowerment, parental choice, and public credibility.

McDonnell concludes that there is little or insufficient research to establish either a causal or an empirical link between the various strategies and improved student performance.

Our problem comes in that we have good research evidence that some of the individual variables in instruction—the single-theme reform efforts—can have a substantial impact on aspects of student performance; we do not have support for the impact of broader models, such as those proposed in complex, sophisticated restructuring efforts (Slavin, 1990).

Policymakers want to see changes in student performance associated with a comprehensive approach to restructuring. Change for the sake of change is no longer acceptable, especially when businesses and political forces are continuing to oversee the change process. Policies on and implementation of educational restructuring should focus not on *inputs* such as class size, graduation requirements, longer school days and salaries, but on *outcomes*—what are our students capable of doing, what they know, and how they get along in society. The first set of simple solutions—inputs—is easily displayed on a wall-chart and quickly grasped by a confused, though interested public. However, the simple stimulus-response approach embedded in these variables is not having a rapid or substantial impact. The second set—outcomes—is not easily measured nor displayed, nor can the changes associated with these issues emerge quickly. They imply a different sort of classroom and school environment where the approaches toward learning and governance are not what we have today. Profound questions about how public education should be governed and which values should prevail frequently are considered only after we implement policies that deal with trivial aspects of schooling.

At present, we have no widely accepted definition of restructuring. Furthermore, we have learned that change comes slowly in education and that it is most effective when it occurs at the local school-site, not at the district or the state levels (Elmore & McLaughlin, 1988). Yet, we continue to press for short-term advances in test scores and wish to impose models that work in one location on as many other schools as we can. We have imposed an inappropriate business model on a system traditionally unresponsive to outside influence for change.

Restructuring and Technology

Technology and telecommunications have not been mentioned frequently in the various institutional reports and policy publications about restructuring—except those written by technology advocates (e.g., Pearlman, 1989 and Perelman, 1987, 1989). The Coalition of Essential Schools, for example, seems to avoid the use of technology in the implementation of its Common Principles. While the National Governors' Association's initial report on education, *Time for Results,* did have a chapter on technology, its followup of that initiative has been limited. And many other reports describe technology as central to America's industrial competitiveness, but not central to instruction in America's schools.

If Power On! (OTA, 1988) and the recent OTA report, *Linking for Learning* (1989), and Star Schools legislation have done anything, they have raised awareness of the American educational and

political elite about the potential of technology and distance education to stimulate educational changes now spreading throughout many states. Thus, it is not completely surprising and quite pleasing to see technology finally mentioned in a report from two significant organizations concerned about educational restructuring (ECS, 1990).

In their recent "Road Map for Restructuring Schools," the Education Commission of the States and the National Governors' Association list fourteen Principles of Restructuring—the last of which is that there is no 'silver bullet' to solve education's problems—and 13 Action Steps for Policy Makers to Take. The last of these—number thirteen, following such areas as building business partnerships, changing teacher education, and providing flexibility—is "using technology to support restructuring." The discussion points for this step are:

• Use technology to explore new ways to deliver instruction. Do not use technology as an "add-on" to the traditional lecture, recite, test method of instruction.

• Be prepared to handle policy decisions on jurisdiction over distance learning, i.e., teacher certification, textbook and curriculum approval.

• Strive for new collaborative arrangements between urban and rural schools and institutions out of state.

(It is interesting to note that, for many of the 13 steps, examples of successful state implementations were listed. There was none for technology.)

Certain state-level perspectives can be immediately derived from these suggested policy action steps. The first is that technology is for the delivery of instruction; learning is derivative and students are never mentioned, except by inference, as objects of instruction. The second is that there are obvious policy problems when the teacher is not physically present in the same classroom as the students, based primarily on jurisdictional issues. And third, that technology, when it is used for restructuring, should be changing relationships among various educational institutions.

Two Questions

There are two approaches to assigning the role of telecommunications in restructuring, each offering a policy perspective. One considers communications technology as a support to ongoing changes in educational practice. The other asks how communications technology can be applied to create the substantive changes often mentioned in restructuring. The first asks, "How can telecommunications be used to assist and extend the ongoing restructuring movement?" The second, "How can telecommunications create educational restructuring to increase the productivity and success of schooling?" Two different questions, two different directions.

Supporting Restructuring

To assist and extend educational restructuring, telecommunications can certainly reflect on modest accomplishments, many of which are noted in Linking for Learning (OTA, 1989). These accomplishments and initial demonstrations have stimulated continuing interest in supporting distance education by most states. Many of the recent telecommunications efforts are addressing single aspects of the restructuring movement in isolation, although implementation of these projects certainly can enhance ongoing school change.

Telecommunications can provide the context for site-base, cooperative instruction, helping students become independent learners, improving problem solving skills, and extending the classroom beyond its four walls. For instance:

• Kids Network (National Geographic Society) and its projects in Acid Rain and Weather, and the TERC project under Stars Schools legislation demonstrate important uses of a computer network/distance education system integrated into the classroom structure. These efforts provide a natural use of the technology for data collection, analysis and communication, one that parallels technology use in the world of work and in the conduct of science.

• Margaret Riel (Cohen & Riel, 1989; Riel 1985) has demonstrated that children's writing will improve when they are writing for an audience that includes peers—and especially when using telecommunications.

The research on international telecommunications and writing found that students write better for a distant audience of peers than for high grades from their own teacher. Furthermore, they write better when they write for a purpose, such as for a multi-school newspaper connected through telecommunications.

• Riel has also begun working with AT&T to develop a long distance learning network. Using computers with modems and long distance lines (and satellites), children can communicate and exchange ideas with others from around the world. By creating the technological infrastructure for the

creation of many Learning Circles, large numbers of classrooms and students can be connected to one another. A Learning Circle consists of schools—six to nine classrooms from around the world—that are matched according to grades and common goals and diversity in geographic diversity. Learning Circles can focus on specific issues such as journalism, creative writing, environmental issues, and political science.

Telecommunications can help make connections among members of the school staff through electronic mail and facilitate professional development through interactions with other professionals having common interests.

• The Los Angeles County Office of Education has used telecommunications to replace transportation in staff development programs via its Educational Telecommunications Network (ETN). Curriculum reform, the key to educational change in California, means constantly updating instructional staff on revisions in the State's framework. Satellite distribution of informational meetings and instructional programs is a cost-effective way to reach teachers and administrators at their district office or at a school building, rather than have them drive the congested highways to the county office.

• Established with FIPSE funds, Iowa State University's Teachers on Television (TOT) program provided an opportunity for education students and beginning teachers to see exemplary teaching practiced in classrooms around the state, without ever leaving their campus. The teacher preparation aspects of the restructuring movement look increasingly for new ways to enhance the development of both knowledge and craft aspects of teaching; telecommunications provided both. Providing that link also improved the relationship between university researchers and practitioners.

• The use of a computer network has been helping new teachers survive during their first year of teaching. This project was begun by Harvard Graduate School of Education several years ago and was picked up and replicated or further developed by others (e.g., Boise State University, The Curry School of Education at the University of Virginia). The goal is to reduce the dropout rate among first-year teachers who find themselves in a sink-or-swim situation. With telecommunications, fledgling teachers can use the network to carry on conversations with each other and with their former faculty to obtain support and advice.

Telecommunications can change the relationship among schools and parents and the community, bringing the community closer and enhancing exchange and involvement among the participants.

• Connecticut and its local telephone company, Southern New England Telephone, have developed a voice mail system for schools, making it possible for teachers and parents to communicate regularly and easily with each other. Students can no longer get away with saying "there is no homework tonight," when a parent can call up and find out what has been assigned by all of the child's teachers. The system permits outgoing messages to all students in the school from the principal, messages to all students in a class or to any single student's family from the teacher. Parent-teacher exchanges no longer have to be in real time.

Telecommunications can increase the choices of courses available to students, providing instruction to all students no matter where they may be located, and making possible additional staff development programs to improve teacher skills and knowledge.

There are numerous examples of these contributions to the ongoing improvements in schools. From TI-IN, to SERC, to the STEP Network in the Northwest, to the audiographic projects in New York, Pennsylvania, and Utah, to mention only a few. They have, in common, the ability to expand the options of students who wish to obtain AP or college credits, to meet college entrance requirements, or to take take courses not presently available at their own school. Benefiting significantly are the rural areas, where consolidation has reduced the number of truly "local" schools. Telecommunications has provided a means to preserve those that are left. However, there are still significant policy questions to be answered, primarily those associated with the teacher credentials and state-level regulations on class meeting times.

Distance learning, as presently delivered, is a highly focused, needs-oriented technology, where people who want something are motivated to participate. Motivation is critical, especially after the novelty effect wears off. If the outcome is vitally important to the student—college credit, meeting entry requirements, completing a course of study, learning skills that will produce income—then motivation is going to be relatively high and nominal barriers will be overcome.

Take a look at what has been accomplished and what can continue to be done by states and local districts. Many of their activities have been locally

initiated, often with initial help from foundations and the private sector, and modest support from federal initiatives. But most of the projects described here and elsewhere have been stand-alone activities designed to improve instruction, which is not to say that they are not well-intentioned efforts that are likely, in fact, to improve the quality of education our children receive.

Nevertheless, for the most part, these activities are fiddling around on the periphery of school change; they are not part of the restructuring movement. If telecommunications and distance education were not available to help us do these things, they would be done in other ways or not at all—and in either case, there would be no significant difference in the way we conduct schooling in this nation. Without a comprehensive approach to changing the governance and control of education, new delivery systems may just be doing more of the same rather than advancing restructuring. From a restructuring perspective, distance education projects that are designed merely to augment and complement conventional school programs may just be another means of sustaining and disseminating the mediocre in teaching and in instructional content. By taking traditional approaches, distance learning supports traditional relationships between teachers and students, between teachers and administrators, and between schools and districts.

A few telecommunications activities have been a small part of larger state and local programs to restructure education; most have not. There are districts that have, in fact, used technology as a major part of their restructuring effort. Central Kitsap School District in Washington, the new Saturn School of Tomorrow in St. Paul, Forest Hills Public School in Grand Rapids—these are all efforts in which some aspect of communications technology has played a significant but not central role.

Creating Restructuring

Now let us ask the second question. How can telecommunications create educational restructuring to increase the productivity and success of schooling?

Not by doing more of the same with only slight improvements, but by substantially changing the nature of who learns where and how. If incremental changes are not sufficient, then how should we consider using distance learning technologies to make more substantial changes. If we presently believe we have mediocre instruction provided to our students with teachers physically present, do we want more of the mediocre delivered from a distance? What kinds of changes—significant changes in both content and delivery—are possible given the technologies we have (or will have soon) and what are the policies that will encourage the application of technology in significant ways to change the education system?

If the hope of the business and political communities—stakeholders and decisionmakers in our education endeavor—is to make a capable and productive workforce for the 21st century, then let us apply some of what we know about the effective use of technology in the workforce to the tasks and processes of schooling. Let us imagine how we are using telecommunications today to increase productivity and achieve success and apply it to education.

How is business using telecommunications? For the most part, its traditional educational and training applications are similar to what we see in schools. Distance education programs may be even more prevalent in the business world than in schools and its uses are direct and purposive. The more highly motivated workers and the well-specified outcomes make it easier for business to use distance learning technology successfully and to tie success to productivity and profits. But business also uses communications technology to seek and share information, to work collaboratively for a common goal, to deliver information (and work) from one place to another, and to develop information-based products.

If we would only believe our own rhetoric about the value and potential of distance learning, then we as distance educators (or advocates thereof) could strive for substantive changes in education. Look at the business world for a moment and consider the potential of technology's impact. If business can begin to move from using technology to make modest increases in productivity to using technology to transform the workplace into a new environment, then why can't education. Here is a bit more educational technohype that proposes to move schools directly into a transformed educational setting that includes changes in administering, teaching and curriculum choices.

A New Scenario

We see around us people's increased interest in and willingness to become at-home workers. Driven by an information-age job market that permits work efforts to transcend location, by people's increasing frustration with long, unproductive commutes, and

by the expanding capabilities of the personal computer, modem, copier and fax machine, many workers—and their employers—see benefits to doing at least part of their work at home. Link Resources (Hall, 1990) reported that more than 5 million people started doing at least some of their work at-home in 1989, up from one million new, at home workers in 1987. Estimates are that 38 percent of the people who work at home own a computer.

Not all workers wish to become telecommuters; the technology industry tends to overestimate the desire to use technology. To be fair, the downside of working at home is the isolation and loss of interactions with colleagues in the workplace and the fear of reduced career advancements. People also don't know when to stop working, since there are few natural break points. It is also more difficult for companies to supervise people working at home (Pacific Bell, 1987).

Consider the potential transfer of this model to schools. Distance education makes it possible for students—especially high school and college students who are the primary audience for distance education at present—to conduct much of their work from their homes, stressing qualities of self-reliance and independent learning, improving problem solving abilities, and most likely applying cooperative learning, cross-age tutoring, and other productive approaches in instruction. Working from home (or from an office setting) a student can be part of a class through satellite or cable or over-the-air instruction, can work with others—no matter where they are—on computer conferencing networks and electronic mail, can have access to libraries that exceed that of practically any high school through subscription to information data bases, and can even receive and respond to pop quizzes via the computer or the fax machine. School work can be regularly monitored by providing teacher access to work-in-progress, electronic conferences can be recorded and saved as part of the students' record, and teachers can provide feedback to students via electronic mail.

In an educational setting that uses communications technology as a central metaphor and underlying structure, students might participate in a series of learning circles for different subjects or skill development activities. On some days, students might find themselves attending school for a series of small group meetings—sort of what we do—not in a classroom, but in a conference room. One of the first computer programs to be mastered should be the calendar and scheduler. After the meetings, they might go to the library to check out materials that cannot be obtained electronically or to use equipment that is too costly for individuals but would be helpful for developing, producing, or disseminating their work, such as color printers or video production equipment.

If we want a change in instruction that moves away from textbooks and teacher-directed activities—even those provided at a distance—towards more hands-on activities, a home-office approach to distance learning will provide it. The role of teacher becomes that of a manager of people and ideas and the school becomes more like a contemporary workplace where independent group and individual projects are assigned, resources are allocated, and assessments of progress are made. The teacher's responsibility is to define a task or outcome and provide a means of access to the information that students need in order to get their job done. And the student's responsibility is to make certain that the teacher is informed of progress being made on assignments and tasks. Both must be cognizant of the information they must provide to others, be they collaborators or managers.

If the student is anything like the at-home business worker, he or she will work longer hours and be more productive. With an investment of less than $3,000 in capital equipment, and monthly charges of less than $100, this student can participate fully in the information age world that he or she will be entering after high school or college. For traditional distance learning, the value, for the most part, is getting people into the system who wouldn't otherwise get in. In this case, the value is increased efficiency and productivity.

Now this scenario may also play havoc with after-school sports, school bands and other group activities, but attendance could be a two- or three-day-a-week event, not five days. Some activities could be moved to the weekends; the school year could be extended to increase instructional time and reduce the years in school. Not all students are candidates for this approach; only those whose maturity and ability to perform independently can be demonstrated. The schools will have to provide for those students whose home environments are not able to support an independent learner model and who nonetheless wish to participate in such a program.

Waivers from rules and regulations are common issues in attempts to restructure schools. In this scenario, state mandates for content and sequence, state standards on teacher certification, school

accreditation, maximum class size, teacher-student contact hours, and non-certificated faculty (especially from universities outside of the state) all become negotiable items for unions and state regulatory agencies.

> The personal computer [and communications technology] is going to enable us to create any-time, any-place, any-topic learning, and give us the means of breaking the rigid schedule that imposes itself on the education process.
>
> Bernie Gifford, Apple Computer

In the scenario I have described above, school has been released from being time- and place-bound. Teachers can assign and monitor work done on home computers and can be available at any time on the electronic mail and conferencing system. Students can enter a task when they feel prepared and leave a task when they have completed it.

This approach does not demand a common telecommunications system as a single solution for all schools. It proposes built-in overlap and redundancy. It proposes a social solution, not a technology-driven one. Decisions about the choice of technologies, access and utilization are all made at the school site.

"The promise of restructuring lies in an array of strategies that have emerged from the natural variation among schools, the experience of other countries, the exemplary practices of particularly creative educators, and a growing number of pilot projects." (McDonnell, 1989). These are not the attributes of a centralized system that develops an infrastructure to the exclusion of providing resources for those who wish to fiddle around with the system.

In a restructuring environment, the district or state would be responsible for connecting the building to the outside world. Federal, state or local subsidies to schools may be necessary to provide basic telecommunications services, ranging anywhere from installation of equipment to subsidized services for access to information data bases or connections to communications networks to fees for monthly services. If the companies that provide telephone service can provide access to a range of information services or are eventually able to provide those services themselves, then education needs a safety net of services to accommodate equity concerns.

Under today's system, as state legislatures begin to pass regulations and plan for the significant expenditures of resources for telecommunications, they often are responding to the lead of the service providers, not to the schools in their jurisdiction. People other than educators are deciding how schools should be using distance learning technologies. Under a restructured system using telecommunications for instruction, states provide access to multiple systems; schools choose the level of use appropriate to their notion of teaching and learning and the needs of their students and teachers.

A recent OTA report (1988) concluded that, if we wish to build a new educational infrastructure we presently have the technology to make significant changes in the level of productivity and the quality of teaching and learning. The report concludes that a system that allows any person, with any background, and any assortment of gaps in education to access training on any subject is within the state-of-the-art of existing technology. The capabilities are present; not all the software is in place. What we lack are the resources, the will to apply them, and the level of leadership that will stimulate and moderate the needed changes.

If states are going to provide access to a set of infrastructures, then they, or the federal system, must be prepared to support the operating costs and provide stable funding over reasonable periods of time. We know from research on schooling that change does not come immediately after the introduction of a new instructional approach, it takes time. Star Schools projects have, at best, two-year funding, barely sufficient to get the infrastructure off the ground, barely enough time to get good instruction designed and delivered. Without stable, long term funding, the capital resources will go to waste rather quickly. Long term funds can go to the development of programming, and the upgrading of the technologies over time, something schools are not presently capable of doing.

If we are going to initiate educational programs that create change in the infrastructure of schooling, rather than merely creating an increasingly more comprehensive and complex technology infrastructure, then costs of implementation are even more important. Only a small portion of the state or district budget can go for the technology, and the initial temptation will be to provide the "sexiest" technology available, because that is what generates the most enthusiasm from funders and technologists. However, these hardware budget decisions, since they are easy to make, often limit the amount of money available for teacher training and program development. These are the two most important issues for, more

than the technology, they will ultimately determine the impact of the program on students.

Since people and their capacity for accomplishing important educational goals--not the hardware--are central to dramatic and meaningful changes in schooling, we need policies that speak to their needs. We must encourage a willingness to take risks that businesses appreciate, the opportunities to fail in some of the tasks we undertake, and a belief that all students can learn higher order thinking skills in order to become productive participants in the information-age workforce.

In one of the most recent OTA reports on technology and communications, *Critical Connections* (OTA, 1990), three clearly drawn communication policy options are developed for consideration--approaches that have meaning for education. The alternatives include: (1) a consideration of communication as a market commodity, subject to the whims of the marketplace where economic efficiency is a measure of the optimal social outcome; (2) communication as a springboard for renewed economic growth and development, making the United States more competitive in world trade; and (3) communication as a basic societal infrastructure, where access to communication and services means access to power, wealth, and societal value. The report notes that this last option is not well-represented in the communication policy community, but it does tend to represent the perspective of many in education who see access to the communication system—and access to the information available through that system—as a vital issue for the future of schooling.

Telecommunications and restructuring are both fundamentally issues of equity. They both seek to provide *all* students with the best education possible. Federal and state policies must be developed to provide access to the full range of communication systems and resources for all schools and especially for those who are unable to provide services themselves. It is how we deal with our most disadvantaged students that best portrays the effectiveness of our education system and the vision we have for our nation's children.

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Using Technology to Support Professional Development for Teachers and Administrators

(Implications for State-Level Policy and Planning)

by
Judson Hixson and Beau Fly Jones

Overview

Throughout the nation, educators, policymakers, legislators and the general public are increasingly interested in the potential of modern technology to transform education—both in terms of what is taught, how it is taught, and how the educational enterprise is managed. More and more schools are seeking new computer hardware and software as a vehicle for addressing poor academic performance, providing enrichment options for students already performing well by traditional standards, and improving their ability to collect and analyze data to support management and planning. Similarly, through new curriculum standards, policymakers and legislators are encouraging or even requiring that computer literacy, keyboard skills, and, to a lesser degree, programming, be included as part of the "new basic skills."

In addition, as state departments of education have increased requirements for high school graduation, an increasing number of schools are exploring distance learning technologies as a means to fulfill these new standards. The broader community, including business, has also has played an active role in focusing attention on technology by reminding educators that in order for our nation to remain competitive in the increasingly technological and global economy, the workforce must be a technologically literate one. Tomorrow's adults must function effectively in a world that will increasingly use technology to create, process and manipulate information; to develop innovative products and services, and to increase the productivity of a shrinking workforce.

Additional evidence for this growing interest in technology as a means to reform or restructure education comes from a myriad of sources. For example:

- In recent years the number of journals and other periodicals as well as professional organizations devoted to educational technology has increased exponentially.
- In the 1989-90 school year there will be no fewer than 16 national conferences on educational technology (Education Week).
- In a recent survey of state departments of education by *Electronic Learning* magazine (October 1989), 77 percent reported increasing use of educational technology as a continuing priority.
- Twenty-three states and the District of Columbia require all, or at least some students to take computer courses in order to be certified.
- Led by California, Florida, and Texas, more and more states are developing partnerships with technology companies, as are increasing numbers of schools and local districts (*Electronic Learning*, April 1990).
- There are few educational publications that do not contain information on new hardware and software.
- Educational research has increasingly focused on the use and impact of technology in all areas of the educational enterprise.

However, in virtually all cases, references to educational technology are decidedly skewed toward technologies used for instruction, and primarily by students, with the next highest category being administrative applications.

While these instructional and administrative applications are important elements in the equation for educational improvement, we believe that they tend to overlook the potential power of today's technologies to provide expanded, innovative and improved options to meet the professional development needs of both preservice and inservice

teachers and administrators. Currently, however, with a few notable exceptions such as the TI-IN and STEP networks, most references to professional development and technology refer almost exclusively to training teachers how to "use" computers, or to providing general computer literacy. We believe that this perspective on the role of technology for professional development is unnecessarily narrow, and tends to minimize the important contributions that technology-supported professional development can play in improving, and subsequently, restructuring schools.

This is particularly unfortunate in light of the rapidly increasing need for professional development to enable both current and prospective teachers and administrators to transform proposals for major changes in the organization and operation of elementary and secondary schools into meaningful realities.

Clearly, teachers must become familiar with instructional applications of technology, if it is to be effectively used to improve student performance. However, there are other important areas in which teachers and administrators will need to learn new skills, develop increased familiarity, and understanding, of the results of research and practice, and explore the implications of proposed changes for redefining their roles and responsibilities both in the classroom, and as members of the school community.

Further, while professional development is becoming increasingly important for all schools, the need is especially acute in geographically isolated districts that do not have easy access to professional development opportunities, and urban districts that serve large numbers of students who are increasingly at-risk of either not completing, or adequately benefiting from their elementary and secondary school experiences.

However, while there is growing awareness of the importance of professional development as the primary vehicle for changing education, similar attention has not been paid to exploration of new strategies for its delivery. We believe that various technologies can, in many cases, provide more effective vehicles for professional development than the currently typical practices of one-time workshops or institute days, or even longer summer institutes or other courses. Further, in many districts, budget limitations have resulted in the large-scale reductions, or even total elimination of professional development services. In these cases, technology can provide a viable, cost-effective alternative for providing services that would otherwise be unavailable.

Technology, however, no matter how exotic or innovative, is primarily a tool for accomplishing new goals for professional development. Utilizing technology to more effectively or efficiently accomplish goals and priorities that are no longer appropriate, will not result in meaningful improvement in student outcomes. Accordingly, it is important that we first examine the new forces that are influencing change in our schools, the implications for professional development, and the manner in which combinations of various technologies (especially interactive ones) can be used to support its delivery and effectiveness.

Frameworks for School Change and Professional Development

For the purposes of this paper, this framework is organized around the notion that the process of education is, at its root, a process of teaching. Whether that teaching is the dispensing of basic factual information to be simply remembered; guiding the development of utilitarian skills; promoting the capacity to learn independently; assisting in the acquisition of higher order skills, (such as problem-solving, application of current knowledge to new situations, or development of new knowledge or insights); or, understanding one's relationship to a diverse society and world—it is still "teaching" of one sort or another. The whole of our educational enterprise, therefore, is, or should be, one which focuses on issues related to the teaching process in all of its shapes and forms; and by implication and necessity, on the reciprocal process of learning by both teachers and students.

The framework includes five strategic issues derived from this metaphor:

1) Why we teach—redefining the role and responsibilities of schools. As American society has changed, so too have the needs of children, and the resources and institutions available to meet them. Schools, currently, are the only societal institution dedicated to serving the needs of children—the only place where the vast majority of children can be expected to come for an extended period of time.

As such, the schools are increasingly being proposed as the logical institutions around which to organize, focus, and coordinate the wide variety of educational and related support services for both children and their families. Many schools are

already moving in this direction through such initiatives as "Cities in Schools" programs, which provide on-site connections to various social service agencies, or "Lighted Schoolhouse," or similar evening programs that provide access to extended learning opportunities for the community's adults, as well as its children.

The need for a reexamination of the roles and responsibilities of schools is also a response to the growing realization that allowing almost a third of our future adults to either drop out—or complete high school with few, if any, useful skills—is no longer tolerable. This new sense of urgency suggests that the role of schools must evolve from being simply centers of opportunity, to centers of obligation. The approach of providing only access to equal educational opportunities, must be replaced with a commitment to maximizing equality of educational outcomes. Indeed, many educators and policymakers are proposing that meeting the needs of the increasing numbers of "at risk" students must become the new standard of success for the nation's public schools—those students for whom public schools represent both their first and last alternative.

Teachers who will work in such schools will have to be prepared to be more than dispensers of information to a fixed number of students. Instead, they will need to function as members of a broad-based team of professionals concerned with the overall welfare of the children, families and other adults in the school community. They will need broader understandings of the non-school factors that influence student learning; as well as, different perspectives on their responsibility for addressing those factors as an integral part; as opposed to an interruption or interference of the educational process.

This does not mean that all teachers will need to become social workers, psychologists, or specialists in adult or family education. Instead, the implication is that they will need to have sufficient understanding of those areas to be effective as participants in the expanded role that schools of the future will play in their communities; and, as colleagues and collaborators with the non-teaching professional staff who will increasingly come to work in, and with, schools.

2) Who we teach—understanding the schools' new clients. The clients of America's schools (both students and their families), particularly those in urban areas, have permanently, and significantly changed. As Harold Hodgkinson has noted, the demographic and socioeconomic trends are clear. The student population is becoming increasingly diverse—more students will be from various minority groups; more students will come from families where English is not the first, or primary, language; more students will have parents with less than a high school education; and tragically, more students will live in poverty, or even on the streets. These new demographics, however, are not, as some would like to believe, simply a temporary aberration—there is no other pool of "better" students waiting in the wings. Who we have is who there is.

Though the predominant discussion in this regard tends to focus on the increasing number of minority student in American schools, the true diversity is reflected in students who bring to school more than differences in skin color, physical appearance or language. Today's students also bring to school different histories, cultural perspectives on the world in general and schooling in particular, different patterns of experience and expectations, and, diverse styles and approaches to learning and organizing information. Teachers and administrators who find themselves faced with this increasingly diverse student population are also frequently confronted with new (and for most, unfamiliar and confusing) "belief systems" that govern student's motivation, interaction with teachers and other students, and ability to successfully adapt to educational structures that were not designed, and teacher who were not trained, to meet their unique, different, but no less legitimate needs.

Future educators must not only be aware of this "new" diversity, but must be attitudinally and practically prepared to be comfortable and confident in accepting it as an expected part of the context in which they will work.

We can no longer afford to have teachers or administrators who have little understanding or respect for the students they teach, or who explain away poor student performance by simply condemning or lamenting the characteristics or circumstances of those students who come to school not prepared to adapt to whatever the teachers and school happen to be prepared to offer. Nor can we continue to accept the less offensive, but equally ineffective, "missionary" approach, where more time is spent describing, and being "appropriately" sympathetic, to the conditions of their students lives than to ensuring that students have the skills to change them.

All educators will need to develop new attitudinal infrastructures regarding their responsibility to find a way to connect with "whoever shows up Monday." Their sense of efficacy must be tied to a belief system founded not only on the reality that all students can learn, but that the differentiating factor is the appropriateness and effectiveness of the instructional experiences to which they are exposed, rather than the characteristics of the families and communities from which they come, or the "learning credentials," they bring to the classroom. As Ron Edmonds noted, "we can successfully educate all students whose schooling is of importance to us."

Most teachers and administrators however, were not prepared for the challenges and realities of today's classrooms and schools. Helping them develop the understandings and skills, as well as a new sense of confidence and efficacy, can most easily and reasonably be developed through professional development experiences at both the preservice and inservice levels.

3) What we teach—redefining curricular goals, content, organization, and strategies for assessing student progress.

As noted earlier, a fundamental issue in restructuring American elementary and secondary education, is the matter of the goals we are seeking to achieve, not simply the manner in which they are pursued. It is truly a matter of desired outcomes over preferred processes.

In general, we believe that there are three central organizing constructs in this arena: a "new definition of learning;" the "thinking curriculum;" and multidimensional strategies for assessment.

The first point of departure is to consider a "new definition of learning." As opposed to the typical definition of learning as student proficiency in simply repeating isolated facts that have been more often memorized than understood; the new definition of learning reflects an increasing consensus that an information-dominated society will require adults able to cope with a continuous onslaught of ideas, symbols and images; and who are capable of understanding, manipulating, constructing and applying information and knowledge to solve novel and complex problems. Tomorrow's adults must be prepared for a lifetime of inquiry, analysis, collaborative learning and problem-solving, decision-making in a context of uncertainty, innovation and change. These abilities represent the "new basic skills" of the future, and the "new definition of learning" that must drive new models of schooling.

Secondly, we must explore the content and structure of the curriculum. The concept of the "thinking curriculum," means that, if students are to engage in meaningful learning, a dual agenda of teaching both content and applied thinking skills must be implemented. It is no longer acceptable for students to simply master isolated skills or facts as ends in and of themselves. If schools are to become "learning communities," the collaborative, interpersonal, and, intellectual skills needed to support it must become part of the curriculum. Skills to monitor and assess their own learning and motivation, must become part of the instructional agenda for students of all ages and abilities, but especially younger students, and students at risk. Finally, higher-order thinking and reasoning must pervade the entire elementary and secondary curriculum.

In support of this new concept of curricular organization, many of the content area professional organizations are, or have, developed new guidelines for curriculum development. These new priorities for teaching science, mathematics and reading are primary examples of this new approach that focuses on the curriculum as a vehicle for promoting understanding, manipulation, and application of knowledge, rather than simply increased catalogues of factual information that students are expected to memorize and store for future recall.

"What we teach" must also be guided by an increased awareness of the importance of ensuring that the history, culture and patterns of experience, and, contributions of the diverse groups that comprise American society are both reflected and respected in the content of all courses, at all levels.

Lastly, curricula must be organized in an increasingly interdisciplinary manner to allow students to understand and explore the interrelationships between different content areas that have, more often than not, been separated for convenience, and in deference to the drive for professional specialization; rather than as a reflection of a lack of connectedness between them.

The third concept driving this new approach to what we teach is that of multidimensional assessment of student performance and progress.

If the curriculum is to change, the current debate over the validity and utility of standardized tests is likely to be intensified. It makes little sense to redesign curricula to teach for conceptual understanding and reflection, when the main assessment instruments measure primarily the

accumulation of isolated facts, and performance of lower order intellectual skills. Alternative assessment methods must be developed to evaluate, and promote, the capacity of learners to engage in higher-order thinking, to be aware of the learning strategies they use, and to recognize and employ multiple aspects of intelligence, such as creative, artistic, or interpersonal expression. Thus alternative modes of assessment are both valuable to students in promoting their individual development, and to teachers in increasing the effectiveness of their instruction.

In addition, this new view suggests that multiple choice, norm-referenced, standardized tests should no longer be used as the primary vehicle for assessing the progress of individual students, or the effectiveness of teachers and schools. While they will likely remain part of the mix for the foreseeable future, other measures are increasingly being included in the overall assessment process. Further, the movement toward new assessment strategies, including those that involve the students themselves, will have the important advantage of being integrated into the instructional process to provide ongoing feedback on what is occurring, and how it might be improved. This is in stark contrast to the current approach of measuring what has, or has not been accomplished at a point in time when it is usually too late to do anything about it.

4) How we teach—new goals, models and strategies for instruction. If there are profound changes implied from the new definition of learning and the thinking curriculum for what students learn, there are equally significant implications for the role of teachers in the classroom. Teachers would engage in such roles as facilitating, mediating, modelling, guiding, assisting, sharing, listening, and adjusting. Teachers in the "collaborative classroom" will help students set their own learning goals, and assess what they have learned. Moreover, teachers may well be teaching persons of all ages, both inside school and out; as well as increasingly diverse groups of students within heterogeneous classrooms.

This new approach to instruction will also require that teachers learn how to assess, and build on the personal, cultural and social strengths student bring to the classroom, and assist students in learning how to build on those foundations to develop new skills and competencies.

This vision of teaching however, goes beyond current approaches to cooperative learning, in which the teacher sets tasks for individuals who work in groups. Indeed, the teacher in these classrooms works strategically to give students a voice in setting their own learning goals and assessing what they have learned, providing information and support where it is needed, and helping students build connections between home, culture, and schooling. In this conceptualization, students are active participants in the learning process, not passive recipients of it.

Truly collaborative classrooms will require teachers who have a comprehensive understanding of group dynamics and process, and excellent interpersonal as well as, pedagogical skills and content knowledge. They must be able to manage and monitor multiple tasks and activities simultaneously, and make ongoing judgments about the type of instruction that makes the most sense for what is happening in the classroom at any particular moment. As such, teachers must learn to function as "situational decisionmakers," rather than as actors reading the curricular script, or football players running whatever play was called from the bench (or, if you will, the central office).

How we teach in the future will also involve new instructional arrangements than are currently typical. Increasingly, the organization of schools will no longer reflect the current pattern of one teacher having essentially total responsibility for the education of approximately 28 students (or five classes in high schools). Collaborative teaching, multiple strategies for grouping students for different types of instruction will become the rule rather than the exception in tomorrow's classrooms. Partnerships with others outside of the school will also become a regular part of the instructional process, with teachers serving as coordinators of learning experiences, as well as deliverers of instruction and information.

Teachers, therefore, must be prepared to assume these new roles and responsibilities in the classroom, and in the school as a whole. They must have the appropriate skills to work collaboratively with other teachers; to understand, appreciate, and respect student diversity as a resource, rather than an obstacle; and, to use a wide array of teaching strategies as an integral part of their instructional repertoire. Such changes however, will require aggressive leadership and innovation by institutions that train both teachers and administrators, as well as the school districts in which they will work.

5) Where we teach—restructuring the organizational context of schooling. The last major strategic priority that is driving the school restructuring

movement involves the nature of the school as a workplace. If schools are going to effectively serve new functions and roles in their communities, address the needs of a dramatically changed clientele, and adopt new learning goals and instructional strategies, they must be organized and managed differently.

The evidence is clear and compelling—schools as they are currently structured, both physically and philosophically, are not organized to fulfill these new goals. We must rethink the norms, priorities, organizational structures, and the rationale for them, that describe today's schools. New organizational modeis for schools must be developed —models that provide a new vision of how schools could be organized and managed; the beliefs and norms that define their institutional culture; and the nature of the relationships between the people who work there, and people, organizations, and agencies in the broader school community.

In terms of school management, teachers will play a larger role in making decisions about school governance and operations than has typically been the case. The current trends toward school-based management, local school improvement teams, teacher-designed curriculum, and teacher participation on local school councils with members of the broader community are likely to accelerate.

Teachers in these increasingly locally managed schools must be able to function effectively as members of school-based teams, to make judgments about allocation of staff, fiscal and material resources, uses of time and space, student assignments, curriculum and instructional materials, and in some cases, the hiring and firing of other teachers and staff. Teachers will be expected to extend their involvement in planning far beyond individual lesson plans for their classes or subject area, to the development of long-range plans for the school as a whole.

If these changes are to be effective, administrators must also adopt new strategies and perspectives on their roles and responsibilities, as well as their relationship to other school staff. They must increasingly become facilitators and enablers, as well as managers.

In addition to these organizational management-type activities, such schools will also function as learning communities for the adults, as well as the students. This means that teachers and administrators collaborate with each other to learn; that parents come into the school to learn; and that members of the community share their expertise in the school. Teachers and students will both teach and learn outside of the school, become involved in a variety of community service activities, and, connect with community agencies and organizations that can augment and support learning of both teachers and students. The community can also provide a rich context for applying learning to complex, real-world problems, and for broadening learners' perspectives on their learning.

These areas then, though certainly not exhaustive, form a strategic framework for thinking about the priorities of the school restructuring movement in America's elementary and secondary schools.

Clearly these new directions for schools and schooling will require teachers and administrators who have been trained differently than their predecessors—who will have knowledge, skills and experiences that go beyond those required to function in isolated, autonomous classrooms with essentially homogeneous groups of students, and covering standardized curricula—all organized around instructional goals that are no longer fully sufficient to meet society's needs; and, management strategies that inhibit, rather than promote, change, innovation, and shared responsibility.

New Directions for Professional Development

Clearly the myriad of new directions and priorities for schooling as outlined above will require major expansions of the professional development resources, opportunities and options available to both current and prospective teachers and administrators. While the full range of these professional development needs far exceeds the scope and space limitations of this paper, we believe that they can be grouped into seven major categories:

Expanding the Knowledge Base: Responding to this complex of new realities will require that teachers and administrators develop new understandings of the changing goals and expectations for education, the increasingly diverse students they will teach, what they will be expected to teach them, how it can most effectively be done, and the context within which the educational process will occur. In most cases these new understandings are far different than those they were taught as teacher education students, what they have learned from their on-the-job experiences, and the results of research previously conducted.

Today's, and tomorrow's teachers, must have ready and effective access to the tremendous pool of knowledge, research, and experience that provides the foundation for the new models of schooling being proposed and experimented with around the country. In far too many instances, educational improvement is not impeded by a lack of information, but by either the lack of access to it, or lack of experience in the use of information technologies.

Learning from Practice: Access to information is clearly a necessary ingredient for educational improvement, but by itself, it is not sufficient. This is particularly true when one is seeking to help people develop new skills and patterns of practice that are different from, or even contradictory to those they have established over many years, and that have been previously considered fully acceptable. Teachers and administrators must not only become knowledgeable about new concepts, ideas and models, but must have opportunities to learn how they can be applied in "real world," as opposed to ideal or special situations. Administrators, policymakers, and the public must also recognize that learning new skills often temporarily lowers productivity. Accordingly, implementation and evaluation timeliness should reflect that reality.

Developing New Attitudes and Beliefs: Much of current educational practice is based on beliefs about students' capabilities and development, proper student and teacher roles and responsibilities in the instructional process, how learning occurs and can best be facilitated, and the responsibilities of schools as contrasted to those of the home and community. Changing attitudes and beliefs are among the most difficult aspects of any professional, or for that matter personal, development experience. Most often these can be changed by opportunities to engage in continuing dialogue with others who share similar realities, responsibilities, challenges, and problems, but who approach them from different perspectives and points of view; and, who are willing to share their successes, failures and strategies for maximizing the former, and minimizing the latter.

Flexibility of Access: It is axiomatic that no matter how excellent a professional development opportunity might be, it is of little value if it is not accessible to either those who need it most, when they need it most; or to such small numbers of people that its impact is minimal or irrelevant. The majority of current approaches to professional development more often than not suffers from one or more of these limitations. Issues of geography, scheduling, numbers of staff to be served, availability of substitutes, and the long-term availability of "expert" researchers or practitioners are just some of the impediments to easy and flexible access to professional development opportunities for most teachers and administrators. While there are examples of summer institutes, long-term professional development partnerships with colleges, universities, and intermediate or private agencies, and courses held at school sites, these options tend to be significant exceptions rather than typical examples of what is generally available.

Opportunities for Self-Renewal: As is true for virtually all other segments of society, the content and context of schooling is changing rapidly, and at an ever accelerating rate. Accordingly, professional development is less and less an objective to be achieved, but instead, a continuing journey—one that must be undertaken in part, by each individual operating within the contexts of their own unique needs and circumstances. Like students, educators too must become lifelong learners who are both disposed, and able, to pursue continuing growth in their knowledge, understanding and skill in the increasingly complex and changing environment of today's schools and society.

Collaborating with, and Contributing to the Growth of Others: We believe that, similar to other professions, the continuing growth and professional development of educators will be substantially enhanced by opportunities to collaborate with others who share their realities, but experience them in varying contexts and circumstances; and also by opportunities to share their own experiences, expertise, strategies and innovations with, and for the benefit of others. The opportunity to take advantage of the expertise of others, as well as to be recognized for their own, can provide important reinforcement and incentive for continuing growth and development, as well as the enhanced personal status and respect that comes from membership in a "community of learners" with their professional colleagues.

Rethinking Preservice and Administration Preparation: The previous discussion has focused primarily on professional development for current teachers and administrators. However, if tomorrow's schools are going to be substantially different than the ones we currently have, it is equally important that the nature of the preparation of future teachers and administrators be altered. In fact, many have suggested that, with the large

number of teachers and administrators likely to retire within the next ten years, changing the preparation of incoming teachers and administrators may well have a greater and more long-lasting impact on substantially altering the character of schooling than inservice programs for current staff. It is, after all, the content, structure and experiences of these programs that help form teachers' and administrators' expectations, perspectives and attitudes about their future roles and responsibilities; as well as about the students they will teach and the types of environments in which they will work. Equally important, these preparation programs also provide the knowledge, experiences and skills that provide the foundation upon which subsequent expertise can be developed. Improving the quality and content of preservice and administrator preparation programs will not only result in educators better able to respond to the challenge of restructuring schools to meet the needs of all students, but also, educators that are more fully disposed to do so.

The next section of this paper explores how technology can be used to enable and advance these major professional development priorities.

Technology As a Vehicle For Professional Development

As we mentioned previously, with regard to professional development, technology is primarily a tool that can allow us to pursue desired professional development goals in a more effective, efficient, flexible, and innovative manner than would otherwise be possible. This section explores some of these possibilities.

In each case, we have discussed the types of expanded options that can be made available through use of existing technologies, or those that appear to be worth experiment or investigation. This is therefore not, nor is it intended to be, an exhaustive examination of what may be possible. Neither do we intend to imply that technology can, or should, totally replace more traditional forms of professional development. Instead, we simply propose that we exploit the options afforded by technology to extend and make more effective much of the excellent professional development that is practiced in many schools, school districts and states.

Expanding the Knowledge Base: Different people learn best at different times, under different circumstances, and through varying modalities. People also come to any learning experience with different quantities and qualities of prior knowledge. Use of technology can allow us to address all of these issues in a manner not easily duplicated by "live" workshops, demonstrations or lectures, no matter how well organized and conducted. For example:

- Video technology can allow us to take advantage of the tremendous power of combining images with text and audio to maximize learning.
- Use of videotapes can ensure that large numbers of people, or small numbers of widely dispersed people can receive the same information, and maximize the likelihood that they develop the same understandings.
- Use of videotapes can ensure that large numbers of people, or small numbers of widely dispersed people can receive the same information, and maximize the likelihood that they develop the same understandings. Use of videotapes, therefore, can eliminate the persistent problem of having various individuals give different interpretations of a new policy or instructional strategy to different audiences. Videotapes can also maximize broad access to information according to the time schedules of the target audience, including the option for home viewing at times when school is not in session, or when it may not be possible to convene a large group, an option not available with live presentations.
- Similarly, use of teleconferencing, cable and radio provide opportunities to reach large, diverse or scattered audiences efficiently, and in a cost-effective manner; or can provide college courses to audiences who may not be otherwise able to access or afford them.
- Audio tapes provide additional flexibility in providing well scripted information to both those who learn effectively by listening, as well as those who spend a great deal of time in their cars, or who could not attend a particular workshop. In addition, following the example of the corporate sector, complete instructional programs and courses, books and periodicals can be effectively made available through audio programs.
- Unlike reliance on workshops or expert presentations, use of video and audio tapes provide opportunities for unlimited review of information presented, as well as access for new staff and parents.
- New interactive technologies (e.g. hypermedia, and video-disc) also provide extremely effective self-paced learning environments.
- Computer and phone conferencing can also provide opportunities for schools staff to question

and dialogue with experts who may be otherwise unavailable, and therefore have opportunities to clarify their understanding of information that may have been presented through any of the vehicles outlined above. In fact, new phone technologies that allow for simultaneous transmission of voice and data communications, offer even more exciting conferencing possibilities, by allowing participants to share information visually by either computer or fax while it is being discussed.

These examples present some of the ways in which technology can provide new options for expanding the knowledge base of teachers and administrators. However, the real power of technology will be more fully realized when schools and school districts begin to combine these individual applications into more comprehensive technology infrastructures.

Learning from Practice: As we mentioned earlier, people develop new competencies best when they both have knowledge and examples that demonstrate how that knowledge is applied in practice. Again, videotapes and teleconferencing technologies, and to an increasing degree videodiscs, provide unparalleled options for teachers and administrators to visit classrooms and schools across the district, or across the nation to examine in depth, or in brief, how others apply new concepts under conditions similar to their own. Simultaneous or delayed computer or phone conferencing can also augment these video demonstrations by providing viewers with the opportunity to interact with the teacher, principal or whoever was the subject of the demonstration, including students and parents.

Videotape also provides the option of developing low-cost libraries of exemplary instructional practices which can be used by teachers either at home or at school, and can be replayed as many times as desired. Some teachers have even used videotapes of classroom demonstrations of a new instructional practice to help students understand how their role in the process will change.

Developing New Attitudes and Beliefs: Beyond the awareness raising, knowledge transmission and examples that can be provided by video or audio tapes, or even interactive teleconferences, developing new attitudes generally requires sustained opportunities for dialogue and debate with others. In this instance, computer networks, phone conferencing arrangements, and even voice mail technology provide effective extensions of face-to-face conversations, as well as the opportunity to express possibly unpopular (or socially unacceptable) ideas in a relatively anonymous or "safe" situation. Controversial ideas can be debated, challenged, and argued without the personal animosity and residual anger that often accompanies such "confrontations" when held in person, or in a group.

Flexibility of Access: Because many of the technologies we have focused on here are recorded in one format or another, they are not time-bound, and can allow access in accordance with the schedules and preferences of individuals as opposed to groups. In addition, other options (e.g. teleconferences, or radio broadcasts), while time-bound, are not location-specific, and have the options of repeated rebroadcasts at a wide variety of times. Access to basic informational or more directly instructional programs at home, in the classroom, teacher's lounge, office, or car all provide increments of accessibility not typically available through traditional professional development strategies. Alternately, interactive technology can provide access to large numbers of people simultaneously, even though they may participate in small groups in a variety of locations. This can be particularly important in large school districts that need to reach thousands of teachers and administrators. This flexibility will also be significantly enhanced and expanded by new broadcast satellites and receivers that can literally provide options for satellite reception at virtually any location for as little as $400, using dishes that can be mounted on a window sill.

In addition, flexibility also involves providing individuals to access just the information or programs that meet their interests or needs. As with students, maximizing individualization of learning opportunities is an important flexibility that should be similarly available to professional educators.

Opportunities for Self-Renewal: Technology provides diverse, flexible and relatively cost-effective means for providing information, examples and instruction related to new models and methods for managing and organizing schools or instruction. As such, they can be provided as periodicals to allow educators with continuing access to new information, ideas, and examples from practice. Further, the flexibility afforded by various technologies helps to maximize the opportunities, as well as the likelihood that individuals will take advantage of them during times when they are most amenable to learning, as opposed to being forced to "get ready to learn" at times that are most convenient to others.

In addition, effective self-renewal strategies should include the opportunity to examine one's own knowledge, understanding and practice under "safe" circumstances that are not complicated by concerns about evaluation by superiors, or unfavorable judgments by peers. New videotape technologies provide an inexpensive means for educators in all roles to record their behavior for later examination and evaluation, either by themselves or "trusted" colleagues.

College courses are also another vehicle for self-renewal that can be made more accessible through technology—whether it is a video or audio-based course with periodic in-class seminars, or one in which the instructor conducts office visits via computer or phone.

Finally, increasingly available and affordable multi-media technologies (e.g. Hypercard, Linkway, or interactive videodisc simulations) provide educators with options for designing their own learning programs, or to examine the implications or results of their judgments or approaches to a variety of school situations that could not be duplicated in real settings.

Collaborating with, and Contributing to the Growth of Others: We have mentioned several times in this narrative the various options for using technology to dialogue electronically with colleagues across town or across countries. Such computer and phone conferencing options, bulletin boards, and two-way interactive video technologies provide flexible, and increasingly cost-effective, means for broad-based collaboration; as well as the opportunity to share ideas, instructional materials and strategies, to get feedback on problems, and to develop relationships with colleagues that may not be otherwise easily arranged—particularly for teachers and administrators in geographically isolated schools.

Rethinking Preservice and Administrative Preparation: Clearly the uses of technology for professional development described above all have similar applications and benefits if used as delivery vehicles in preservice education programs. There are however, several areas in which we think technology can provide particularly important benefits for preparation of prospective teachers and administrators.

Beginning with teachers, most reports on preservice education have cited the lack of access to the most current research, insufficient and often, poor quality, clinical experiences, lack of opportunities to learn from expert practitioners, and lack of followup support as critical and pervasive shortcomings. In each case, technology can provide new options and alternatives that have not been well explored by preservice educators.

For example, technology can provide access not only to information about current research, but through videotape and interactive videoconferences, examples of how such research can be applied in practice. Interactive technologies can also allow prospective teachers to ask questions of practitioners as they teach. Such dialogue, either in real time, or through conferencing technologies can help preservice students understand not only what expert teachers do in the classroom, but why. Such access can also be extended to provide an alternative (though to be sure, not a fully satisfactory one) to on-site clinical experiences where constraints of time and distance minimize the opportunity for extensive visits to classrooms.

Opportunities for prospective teachers to videotape practice lessons for subsequent review by panels of expert teachers provides another option for establishing closer connections with current practitioners, and for obtaining a range of feedback and suggestions for improvement that they would unlikely have access to under typical circumstances.

Further, conferencing technologies, coupled with easily available videotaping technology can provide important opportunities for continuing support from preservice faculty, or indeed other content area specialists.

Going further, fax and electronic mail can allow new teachers access to immediate feedback on lesson plans, teacher-developed tests, or instructional strategies for addressing particularly challenging classrooms situations from both their former professors, as well as their colleagues.

Preservice instruction can also be enhanced through the use of sophisticated simulation technologies that allow preservice students to explore possible consequences of classroom decisions, without the need to "experiment" on a cooperating teacher's students. Such simulations can be particularly useful in preparing teachers for school environments and students with which they have no familiarity or experience. Similarly, hypertext technologies and interactive data base software can assist preservice students in exploring options in curriculum design or instructional planning, and in evaluating the implications of their daily or weekly lesson plans for what students will be expected to do.

For prospective administrators, technology can similarly provide opportunities for communications with practicing administrators to dialogue about strategies for management, leadership with staff, working with diverse parents and communities, handling discipline appropriately, and addressing racism and discrimination. Such easily accessible conferencing options can also provide the opportunity to query administrators in a variety of settings to get their perspectives on how administrative issues might be handled under different situations and circumstances.

Simulations, as described above, can be equally powerful learning tools for administrators, particularly as they grapple with complex planning issues, and seek to develop strategies for mediating between competing priorities.

Combinations of various distance learning technologies can also provide effective vehicles for providing preservice and administrative education courses to those for whom distance, time and costs make enrollment in a "traditional" program all but impossible. This can be particularly important in providing access to non-traditional pools of potential teachers, especially minorities and those interested in pursuing alternative certification options now available in many states.

Lastly, as educators become more aware and concerned about the need for teachers and administrators adequately prepared to work in urban schools, or with at-risk students, technology can provide access to faculty across the country who have special expertise and experience that may not be available on the students home campus.

Technology as Content for Professional Development

The primary focus of this paper has been uses of technology as a vehicle for professional development. We believe, however, that technology as a content area is also important, and we would be remiss if it were not addressed in this discussion.

We have noted earlier that most discussions about professional development and technology focused on either helping teachers to understand and manage instructional technology that will be used primarily by students or assisting administrators in learning how technology can improve current approaches to data collection and analysis. We believe that these priorities, while important, overlook another important aspect of technology as a content area for professional development.

In the classroom, for example, we believe that it is important that technology be viewed as much as an instructional and management tool for teachers, as it is a learning vehicle for students. Technology can help teachers both improve their current instruction, as well as expand their instructional repertoire far beyond what is currently possible in most classrooms. In addition, technology can help teachers effectively monitor student progress, plan necessary interventions, or alter instructional strategies and priorities. This is particularly important as instruction becomes more individualized, multidimensional approaches to assessment more common, sources of instructional resources more numerous, and students more diverse along any of a number of dimensions.

At the administrative level, technology can surely assist in more effectively tracking standardized measures of school effectiveness and student performance (e.g. tests scores, special services placements, attendance rates, credits accumulated, etc). Similarly, technology can assist administrators to more effectively and efficiently manage increasingly complex budgets, personnel records, or legal obligations (e.g. provision of bilingual or special education services). Technology can even help administrators save money by using computers to control heating and lighting systems, or manage supply acquisition.

However, technology can also be used to support decision-making by providing the opportunity to explore the impact of various alternatives in a wide variety of situations, such as: allocation of fiscal resources, new schedules, varying assignments of personnel, equipment purchase and utilization alternatives. Technology can also provide new options for communicating with student's homes or other community agencies, or for making information readily available to school staff.

None of these new options will be effectively put into practice unless teachers and administrators are both made aware of, and trained to use technology to accomplish them (ignoring for the moment the issue of the initial costs in acquiring them). We believe that school improvement will be significantly enhanced if these areas become content priorities for professional development.

Implications for SEA Policy

Clearly, the implications and possible area for state involvement in any or all of these areas are too numerous to atempt to review for the purposes of this narrative. We would propose, however, the following as areas in which use of technology for

professional development can be best advanced by state-level policy and programmatic initiatives.

1. Development of statewide (and ultimately multi-state) technology infrastructures, or electronic highways

Currently, use of communications technologies is hampered by incompatible transmission systems, multiple phone companies, lack of common connectivity and data transmission standards, and the high costs and ineffiiency of attempts for individual districts to address these issues individually. Such networks can also be integrated into statewide economic development initiatives, and can provide services for business and commercial interests, as well as schools.

In addition, as professional development opportunities extend beyond the school day and school facilities, issues such as access and line usage costs for teachers and administrators who utilize conferencing technologies will need to be addressed. Exploration of statewide educators "800" access lines may be an issue whose time has come.

2. Development of capital investment funds to provide low-cost access to hardware, software, and programming.

The negotiating power of the state as a major purchaser, as well as the opportunity to finance large scale purchases by local districts against future revenues, or issuance of bonds, needs to be explored. This is particularly important for those districts with relatively few discretionary resources, or who would require major capital investments to provide a critical mass of technology sufficient to make access meaningful and readily available to large numbers of staff.

3. Develop new school construction and renovation standards that will allow subsequent installation of technology easy and cost-effective.

In most schools, including a significant number of those newly constructed, access to technology is limited by lack of appropriate wiring, phone lines, cable connections, internal distribution networks, or at minimum, cable channels that subsequent installations without the inconvenience and expense of cutting through walls, ceilings and roofs.

4. Review existing standards regarding the use of technology-delivered professional development for new or continuing certification.

In many states, professional development is limited to face-to-face contact, or to distance learning courses authorized for only a limited number of institutions. As telecommunications and related technologies become more available, accessible and common, states must address these issues, as well as those of cross-state certification of instructors, standards for content and acceptable levels of participation, and entirely new guidelines for professional development activities that are provided using computer and related conferencing technologies.

In addition, program approval guidelines for preservice and administrative preparation programs should be examined to ensure that, at least, they do not act against incorporation of new technologies, and at best, encourage and support its use.

5. Evaluation of the effectiveness of various technology-supported professional development opportunities—particularly for new or continuing certification—should be another area for potential SEA involvement.

Though the options possible using available technologies are well established, the relative effectiveness of varying purposes is still an unanswered question. Use of technologies in the ways suggested here are still largely experiments, and much data needs to be collected and carefully evaluated to provide guidance for future initiatives in this still infant area.

6. Establish partnerhsips or consortia to support the development of programming and software.

Though hardware has become relatively inexpensive, even for the most sophisticated interactive systems, initial program development, videotape production, and development of more elaborate interactive videodisc-based simulations remain fairly high cost investments—particularly if undertaken by single schools or districts.

Since many of the issues, concerns and needs are similar across schools, districts, and even states, this seems a logical area for state leadership and fiscal support. In addition, this area provides exciting opportunities for partnerships with the private sector, particularly those corporations that have been involved in utilizing technology for their own professional development and training for many years.

7. Establish opportunities for pilot projects to explore the use of technology to provide professional development for persons seeking alternative certification, as well as for beginning teachers through induction and other first-year support programs.

In a majority of states, general, or subject specific teacher shortages have led to the creation of various alternative certification strategies. In addition, increasing numbers of states are encouraging or requiring some form of support for beginning teachers.

In both cases, technology can provide a variety of professional development opportunities that can help meet the expanded and variable professional needs of widely diverse audiences. How best to utilize technology to fulfill these roles, and how technology can best be integrated with current programs however, has not yet been established.

Because of the SEAs' overriding interests in, and, more often than not, responsibility for, both of these areas, SEAs seem the logical agency to take a leadership role in promoting and supporting such explorations.

8. Develop strategies to use technologies to promote equity of access to high quality professional development opportunities.

As in other areas of education, use of technology for professional development requires access to resources. The dilemma this poses is that those schools and students who already have access to the most resources, are also best able to take advantage of new technological capabilities; while those schools and districts most in need of improvement, and with the fewest resources, are also best able to take advantage of new technological capabilities; while those school and districts most in need of improvement, and with the fewest resources to support their efforts, seldom have access to technologies that could provide effective and exciting professional development opportunities for their staff. There is a clear and compelling danger that new technologies—rather than reforming or improving education as a whole—may simply exacerbate and expand the current inequities that exists.

We believe that the states have a primary responsibility for developing policies and strategies for ameliorating this potentially tragic situation. SEAs will need to consider the types of initiatives that will allow technology-supported professional development to be an equalizing force in the quest for educational improvement, rather than a divisive one.

9. Utilize the state's professional development staff, or intermediate agency network, as models of the use of technology for professional development.

Increasingly, states are developing various professional development delivery systems to support school improvement. Whether these systems are organized around individual consultants or SEA staff, or networks of intermediate agencies, they provide an excellent vehicle for demonstrating and supporting the use of technology for professional development in two particularly important areas: (a) using technology to provide professional development related to implementation of state-wide improvement initiatives; and (b) providing a structure for professional development within which technology can be effectively used.

There are, no doubt, a myriad of other areas in which we have implications for SEA involvement and policy development. We believe, however, that these represent a starting point for those discussions. Toward that end, we hope that this narrative has been useful.

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The Mass LearnPike: Educational Telecommunications Comes to the Commonwealth

(the Memories, the Myths, the Momentum)

by Inabeth Miller

Throughout the 1980s, various state governments looked to the skies for an answer to increasing problems of educational equity, delivery of instruction to remote areas, and a quality response to declining numbers of teachers in mathematics, science, and foreign languages. Consortia grew from school districts, academic institutions, public television and private entrepreneurs. In the case of Massachusetts, a new quasi-public agency was developed by the University of Massachusetts in consultation with other private and public partners, proposed by the legislature, and implemented by the governor to bring distance learning to a broad constituency.

During these years Massachusetts found itself on a roller coaster ride both politically and fiscally. Employment was at its lowest ebb, the economy was sound, the economy was faltering. Proposition 2½ limited local spending and significantly affected school programs, overrides failed in most towns, the Governor ran for President, lost the Presidency, announced he would not run for reelection, the legislature amidst many cross pressures passed a tax package, the Governor placed the question of the legality of the tax package before the court, $600,000,000 must still be cut from the budget—all of these headlines left the citizens confused, the politicians fearful about reelection, and the state bond rating the lowest in the nation.

While other states built vast networks and began to broadcast satellite courses, the Massachusetts Corporation for Educational Telecommunications (MCET) sought to demonstrate to its citizens, steeped in the mythology of their own educational superiority and hostility toward technology, that a myriad of possibilities could be realized in public service, health, government, and schools if they would vote sufficient funds to begin the construction of a network and the support of programming. At the same time, MCET assisted in the passage of federal Star Schools legislation, doing much of the research and background work. Myths of massive funding from the federal government, large-scale construction from the state, or full underwriting by cities and towns proved to be vaporous. A Northeast Star Schools proposal for a regional satellite network was unsuccessful. By 1989, with a five-year plan written and accepted by the legislature, monies appropriated for 50 satellite dishes, the momentum was about to begin.

The Mass LearnPike

The Board of Directors decided to focus upon K-12 education rather than the technology alone. A new Executive Director in February 1990, an enthusiastic Board of Directors, and an often neglected Advisory Council met for several days with staff to redirect the organization. They constructed a mission statement and a set of goals for MCET. These are still being refined by staff into a working document. Together they created the concept of the Mass LearnPike. The Mass LearnPike offers powerful imagery of a successful statewide initiative that is immediately recognizable. It appeals to educators and legislators alike. Terry Deal in *Corporate Cultures* (1981) discusses the necessity of building a positive mythology in an organization. Selection of the turnpike metaphor and an outline of goals led staff quickly to process. As collaborative development of a consistent process in network building takes place, using cost-effective and comprehensive strategies, the goals have resulted in definitive and fast-paced actions that are building within the organization and the outside community an image of rapid growth, a mythology of promise from a mighty new educational champion.

Goals and Objectives: Actions

Goal: Identify Constituency Needs

Although the enabling legislation and mission statement are broad based, and call for education of all citizens of the Commonwealth, in the words of former Speaker Thomas P.(Tip) O'Neill, "the only thing that happens to an umbrella is it gets rained on." The recent decision to give priority to K-12 school children and their teachers allows MCET to build a membership base with common interests.

Many other states have concentrated on high schools and low-enrollment courses. Massachusetts has determined to stretch this concept of distance learning and demonstrate that technolcgies can serve the needs of elementary and middle school teachers in whole classrooms, not just the motivated few. Surveys and testing by the Department of Education revealed needs for group problem solving, use of tools, arts and humanities activities as well as specific courses. As a brokering organization MCET must forge linkages among major organizations to serve these needs.

The legislative call for satellite service to 50 schools has been interpreted by the Executive Director as downlinks to 50 cities or towns. The current plan establishes a statewide base, broadens it to include the seven-state region in the future, then looks to national marketing and distribution of new programs.

Action: Call to Arms

Following the Board, Staff, and Advisory Committee retreat a public meeting was attended by 180 administrators and teachers throughout the state. The Mass LearnPike offered a plan of action that was profoundly altered by the participants. Together new ideas were put forward for investigation. Universities questioned the K-12 decision. Meetings throughout the state with open questioning flushed out misconceptions and resulted in an offering that urban, suburban, and rural areas are eagerly accepting. Quickly, ideas were formulated into a contract for schools to approve. A videotape was made by MCET for school committees and the public, explaining the concept of distance learning, and its mission. Seventy school systems asked to save one of the 50 places on the Mass LearnPike.

Goal: Offer Quality Services

One of the advantages of joining the game as a latecomer is that it is possible to benefit from all of problems and successes of others. The straggler can even take advantage of the best of programming, that is available around the nation. Massachusetts services to member school systems should include access to established networks and courses at reduced costs (TI-IN United Star Network from San Antonio, Arts and Sciences Teleconferencing Services out of Oklahoma State University, Satellite Communications for Global Learning-SCOLA), and the development of a range of enrichment and in-service training using the extraordinary academic and cultural talents are available in Massachusetts. Services beyond satellite should be piloted in willing school systems. Above all else, teachers must be informed and supported in the use of the LearnPike. If MCET attempts to push the boundaries of present distance learning services, a research component must accompany activity.

Included among services should be programs for parents and school committees. Recognizing the political nature of institutional change, it is necessary to demonstrate the technology in areas of community concern. In all cases, during the formative years of establishing services, visibility is of great importance. MCET must project an image of creating opportunity and options, of quality and equity, in times of economic stress.

Action: Negotiate and Initiate

Program contracts have been negotiated with TI-IN and SCOLA. Other arrangements with available consortia are under discussion. Boston Museum of Science, Children's Museum, Educational Development Corporation, WGBH, faculty from major universities, artists, musicians, leading athletes, libraries, and health organizations, have joined with teacher advisors to produce a first year program. A committee of teachers will continue to advise on program, searching to exploit the various media, to advise on the development of new services. A research component and teacher preparation program is built into each offering as MCET attempts to forge new learning for kids.

A computer network, supported by Digital Equipment Corporation, but accessible through those computers commonly available in schools (Apple, IBM, Macintosh, etc.) has been proposed. It will require ground level interaction—teacher to teacher, instructor to teacher, student to student. Consistent two-way communications and intensive interactions are the "buzzwords" for MCET's educational change aspirations.

Committees have been formed for programming (all teachers), and for policy issues/services, that

include superintendents and other school administrators. These committees of subscribers will guide and advise. Among initial offerings are an open forum for school committees on "Doing More With Less" and a parent teleconference, "Selecting the Right School." The Museum of Science will develop a spring series, "Doing Science With Your Kids." MCET is seeking funding for a comprehensive pre-school pilot program at ten school sites using two-way video that combines the resources of NYNEX, Bunker Hill Community College, Wheelock College, Children's Museum, and 10 school districts.

Two new staff members will begin their operations as site coordinators in September. One will work with local communities at integration of video into the school curriculum, finding "the right people" and providing the supportive hand-holding. The other will assist teachers in the establishment of a "front porch" computer network, to make the computer as comfortable a communications adjunct to their lives at school as the telephone is at home.

Goal: Forging Linkages with Other Organizations

Massachusetts has an excess of riches in its academic, cultural, medical, and media base. Strong organizations, minimally funded by public monies, have competed for philanthropic and federal funds. Educational programs from this area have won national recognition, yet have little dissemination locally beyond pilot sites. By offering delivery systems and a large school system constituency, MCET can provide the platform for the Department of Education, cable stations, public utilities, WGBH, government agencies, corporations, and educational researchers to work together. Because it is not wedded to one model, MCET can consider alternative technologies, weaving program ideas from multiple organizations into a sum greater than the parts.

Built on the federalist principle, the Commonwealth of Massachusetts clings firmly to local prerogatives and independent choices. This necessity of offering options rather than pronouncements extends to all of the linkage organizations as well. Each partner must find the piece of the LearnPike that is in its own self-interest to adopt.

In the coming year there will be an effort to bring colleges, universities and corporations into collaborative efforts with schools. As MCET negotiates lower prices with service, equipment, and program providers for the state, universities will find it cost-effective to become members. As the agency negotiates with program providers on behalf of universities, the ties will increase. Schools of education are presently considering using student teachers as distance learning facilitators in concert with Mass LearnPike courses, under the tutelage of master teachers, expanding their concept of pre-service training.

The future of distance learning also lies in collaboration with other regional consortia in program initiation, studio usage and transponder time. Why should TI-IN fly a Massachusetts instructor to San Antonio, rather than asking MCET to broadcast from a local studio? At a recent installation ceremony MCET arranged for an exchange of views between two Massachusetts schools, entailing uplink and considerable staff costs. For a subsequent installation opening event MCET has arranged an exchange with SunySat, where there is an available uplink. Both networks will broadcast the exchange of views. Only through collaboration can distance learning be a cost-effective alternative locally, regionally, and nationally.

Action: Working Together

MCET has, for the first time, brought 21 organizations together to submit a federal Star Schools proposal. When the representatives of these organizations met, long known to each other, it was with a sense of joy in collaboration. The breadth of knowledge and participation that they brought will continue to feed MCET with new initiatives. Already, many have called suggesting joining together in other proposals. These 21 organizations are the basis of this first year of programming. MCET can offer delivery mechanisms, and a large school constituency. A varied menu, alternatives, and direct support for the individual organization's efforts have brought a fresh spirit of cooperation. Increasingly, these organizations and institutions are looking to MCET when they think of new ventures. The State Department of Education has recently made MCET an essential component of the statewide restructuring effort.

Goal: Build Alternative Delivery Systems

During its development MCET had a preconceived idea of a single fixed satellite dish, and an array of courses to be offered to member schools. Immediately the leadership was disabused of that notion. Schools asked for steerable, programmable dishes (C & Ku Band) that can reach any satellite in the United States or Europe. Leverage on the part of towns with their local cable companies (over 99 percent of the communities in

Massachusetts are served by cable), should result in the request for educational channels to serve whole communities, schools, homes, prisons, and hospitals.

There is a need for an origination studio and mobile uplink, since MCET must lease both facilities. The dreams for future programming will only be viable with accessible low-cost facilities.

It would be shortsighted, however, to tie any distance learning agency to a single technology. Educational planning requires multiple avenues of access. Cooperation with public television and with cable, making them active partners in the delivery of learning to an ever increasing audience, will result in strengthening the options and building an infrastructure that can act quickly when opportunities present themselves. A potential statewide data communications network will include MCET as the education partner.

Action: Build The System

Immediately after the statewide meeting, MCET sent out Request for Proposals (RFPs) for steerable dishes, telephones, and classroom packages. The company selected gave such a good bulk purchase price that universities and independent schools have requested membership in the LearnPike, though they are not presently eligible for a legislative equipment subsidy. As signed contracts are returned to MCET, an immediate site survey takes place. The Associate Director of Engineering is getting to know every town building inspector, and the individuality of communities in the Commonwealth. By September 1, 1990, there will be 50 satellite dishes installed in Massachusetts cities and towns.

Plans for this year include a cable series promoting the use of cable and Mass LearnPike offerings, over the air broadcast with WGBH, common carrier, microwave, phone (fax, audio bridge) with New England Telephone, computers (modems, software) with Digital Equipment Corporation and the Merrimack Education Collaborative, and connection to existing video systems. A specific action plan accompanies each of these technologies. A technical committee, composed of interested audio-visual personnel from subscriber towns has been very active in planning, in reviewing bids with staff, and in support with local building officials.

Goal: Become Financially Stable

In the short term, building and financing for the state networks will come from the legislature. It is necessary to become quickly visible and operational during 1990 so that the present level of funding is likely to be increased. Construction, openings, new image, new quarters, and a steady stream of information will begin to make people aware of MCET's presence. Each new member school system brings with it a political constituency to speak for the organization.

The money from state government should level off as the various systems become operational. A strategy that combines application for federal or state funding, and private sources for new program origination with participation in organizational collaborations and brokering state educational telecommunications and information services is necessary. A revenue stream from importing and sales of programs will supplement annual state appropriations for operational costs. A cadre of businesses that will support MCET on an ongoing basis is desirable. MCET's status as a quasi-autonomous public organization gives the funding corporation the latitude necessary for developing a stable financial operation.

Action: Move on All Fronts

Support from the Board of Directors, the competent advice of MCET's experienced legal counsel, and the use of respected and effective legislative agents brought immediate actions with the legislature. Packets of information, and progress reports went out to all Massachusetts legislators as well as the federal delegation. A growing constituency offered assistance. When a representative questioned MCET's budget in the legislature and it was seen on local television, he received an immediate call from his local superintendent. The following day he rose to retract earlier comments. A political reporter came to criticize "years of inactivity" and wrote a strongly supportive article of present operations. MCET began installation of dishes, and built a mobile tollbooth as a physical presence for Mass LearnPike openings. The Massachusetts Senate President agreed to be a speaker at the first gala Cambridge opening. He promised a doubling of the legislative appropriation in the coming year.

At the same time, MCET created a new logo and a dynamic presentation in stationery, cards, portfolios, and transfers for each satellite dish around the state. The MCET office was moved from the waterfront (perceived as excessive), to more professional quarters at University Park in MIT, giving the less political and more credible image of association with an educational environment.

The federal Star Schools proposal was put together with great spirit and cooperation of the entire staff. There is great pride in its quality, and commitment to the ground-breaking effort it proposes. Additional grant requests are underway that will establish Massachusetts firmly as one of the important states in distance learning innovation. The Board of Directors has approved the request to hire a Director of Development and Sponsored Research.

Critical Issues Resources and Funding

Financial Concerns

Massachusetts is in the midst of a severe financial crisis. Legislators are forced to make decisions, presented with the dilemma of choosing between educational funding and closing detoxification or pre-natal clinics. The clamor of talk show hosts and anti-tax naysayers combine with a hostility towards both technology and change in an atmosphere of distrust toward state government. It is necessary, in such a situation, to position MCET as an effective, low-cost response to educational curtailment.

If the major funding proposals that have been submitted are not successful, MCET still can remain optimistic about the growth for the Mass LearnPike. It has been an essential strategy that funding proposals are to develop particular programs or formats, not to fund the network. At the same time successful development efforts must not be construed as displacing the commitment of the state.

Telecommunications Policy

Cable Cooperation

Cooperation of the cable companies in Massachusetts is essential to growth of the satellite network. In this area, a history of suspicion and distrust pervade any initiatives. The formation of a cable committee to plan for joint efforts at promoting use of video in the classroom will serve mutual ends. The cable companies have devoted time and personnel resources in Massachusetts to promoting the applications of cable programming for classroom situations. Utilization of SCOLA for the community may reap local praise to the cable outlets, as cable operators can offer daily foreign language news specific to their populations on an educational channel as part of the LearnPike's contractual arrangement.

Two-Way Video

Plans for the Mass LearnPike include two-way video operations. Until telephone company tariffs for schools become affordable, MCET is limited to pilot programs that have little hope of sustaining themselves beyond the funding cycle. It is time for public utilities to stop tiptoeing at the edges of education. The use of telephone technologies should be essential to long-range planning.

Educational Policy

Teachers

The assistance and cooperation of teacher organizations is essential. The MCET staff's dream of creating a Teacher Academy, taking the very best teachers from across the state, and supporting them in the development of distance learning courses, the redeployment of teachers into active roles as facilitators, the recognition that teachers should be supporting kids through modems at home, that professionals must grow and be respected in their work, has not yet been translated into concrete proposals. Both large teacher organizations in Massachusetts must be brought into active participation. The Mass LearnPike must be perceived as an ally, not an antagonist to teachers.

Education

The relationship between MCET and the Department of Education is critical to the Mass LearnPike's growth and success. The Commissioner of Education presently serves as Vice-Chairman of the MCET Board of Directors. His influence upon cooperation and enthusiasm about distance learning has enabled MCET to move forward without obstacles that many others have faced. Certification of distance-learning teachers is extremely flexible, both for those coming in through other networks, and for alternative professionals who will teach on the LearnPike. New certification requirements recently enacted look to the future and do not erect walls for new formats or providers of instruction. Accreditation is in the hands of local communities, not interfered with by the State Department of Education. Liaison with regional offices, sometimes problematic, is a joint problem to be solved collaboratively.

Local Issues

Autonomy

The zealously guarded local autonomy of school committees makes overall programs difficult to administer. MCET's decision to provide steerable satellite dishes made every downlink liaison person "master of the house," and put decisionmaking into the local community. Constituent committees will continue to advise and conduct evaluations. A tendency of towns to imagine that "they can do it better" has already appeared with the previewing of available programs.

Support and Training

New technologies and innovative programs litter the landscape of school systems in the area. Rarely has continued support and training of teachers accompanied these efforts. Rarely has change become ingrained into the fabric of daily activity. Dozens of satellite dishes and varied program offerings will not change the way teachers teach and students learn. MCET's commitment to staff site coordinators, local identifiable liaisons, and to a long-range change process may accomplish these ends. Each member school says, "you didn't write (speak, contact) the right person." The success of distance learning involves finding the right person(s).

Communications

Lack of experience and information, unrealistic expectations, and the preconceived notions of the whole school community can affect the acceptance and use of distance learning in a particular city or town. Everyone must be involved viscerally, using the medium as its own message. A videotape is sent to each school committee considering membership. Without fanfare or glitz, it sets out some possibilities and a simple explanation of The Mass LearnPike. Programs and meeting throughout the year via distance learning will reinforce present offerings and continually inform the community.

Research and Evaluation

Research

MCET must begin to research, understand, and assess the impact of distance learning efforts. Research that leads to educational improvement, not educational approbation, should be intrinsic to the plans. Each course, each staff development exercise, each new combination of technologies crosses a fresh threshold that may lead to unexplored vistas or revisit traditional territories of knowledge and skills. There is a need for formative evaluations, incorporating teachers and students deeply in the process. Summative evaluations should assess cognitive gains. MCET recognizes that multiple approaches are necessary for teaching as well as learning. National research results will be incorporated into program planning for future collaboration.

Conclusion

Massachusetts has created a small rolling snowball called The Mass LearnPike. This rapidly developing network has been formed with a modest initial investment and a hard core of dedicated school districts who were the first to respond to the network offering. MCET has listened to the particular concerns of each respective constituency. It will stall and shed underbrush as the months pass. It will build its own myths and stories. Universities, colleges, hospitals, corporations, cultural, and governmental organizations will construct their auxiliary highways. Delivery systems will bring equity to rich and poor, black and white, public and private schools. The public will be able to participate and benefit from the new distance learning opportunities.

As telephone calls come in asking for information and expressing excitement, MCET realizes that the momentum is gathering, that the reality must adhere to the dreams. Within three years every town and city in Massachusetts should be part of the Mass LearnPike. Then MCET and the Commonwealth will see what kind of unique snow sculpture that cooperation can craft.

A Depiction of Distance Education

by
Donald C. Holznagel

This report is the result of an independent research activity of the Northwest Regional Educational Laboratory. No federal funds have been used in its development.

Introduction

More and more discussions among Northwest educators have focused on "distance education" over the last three years. In rural schools particularly, it has come to be symbolic of academic opportunity for secondary students and staff development opportunity for teachers. The high-tech delivery systems involving satellite technology have appeared to dominate the publicity about distance education.

It was apparent when Northwest Regional Educational Laboratory (NWREL) staff members came together in the summer of 1989 to discuss the nature and extent of interest in distance education in the region that a wide range of activities were under way, both in the development of instruction for distance delivery and in the use of existing delivery systems. Some systems were satellite-based and some made use of other technologies. In addition, a number of statewide plans were in the process of development which were designed to address the technical and organizational structures necessary to provide more opportunities for schools and other agencies to use distance education. As a result of the discussion, this report was commissioned to provide a summary of the status, prospects, and future implications of distance education in the region.

This study does not cover the broad range of telecommunications in schools. Rather, it is concerned with those systems which provide or could provide instructional units, courses, or instructional supplements to elementary and secondary schools.

Delivery Systems in the Region

The term "Delivery System" in this report describes an organization which develops and presents instruction in either full course or supplementary form for use by a range of communities or client agencies. Of the six examples described in this section, STEP and EDUNET make their resources available by subscription to any school district, and IREDS and Alaska CCS serve their specific states. The fifth example, Community College of Spokane, is included primarily as an example of a particular technological approach to serving several communities. While it does not sell services to a general audience outside its area, the approach it uses could be used in other geographic areas.

Satellite Technology Educational Program (STEP)

The Satellite Technology Educational Program (STEP) has been in operation for five years. It is a cooperative operated by Educational Service District 101 in Spokane, Washington, but governed by an advisory committee representative of the member school districts. The organization develops and produces televised secondary school courses and staff development sessions and delivers them by satellite to 93 schools in 74 districts in the region, and to many districts outside the region as well.

Six full-year secondary courses are offered in two foreign languages, mathematics, and advanced English. School districts wishing to use the services pay a base fee of about $4,500 the first year plus usage fees based on the number of courses taken and number of students enrolled.

The project is entirely funded by the usage fees, including development, instruction, and transmission. STEP contracts with a local company for transmission. The cost of a satellite antenna, other local receiving equipment, and installation at the school are part of the initial base fee. Course offerings and topics for new course development are determined by the advisory committee.

Primary enabling conditions for the continuation and growth of STEP are the rural nature of the region, the increase in university entrance requirements for foreign languages in the region, and the positive reception of the system in the subscribing schools. The initial consortium members were small rural districts and the nearby states have a preponderance of such districts. They all share the problem of obtaining teachers qualified in special content areas to meet all students' needs. An additional motivating factor is incorporation in the system of a plan of support to subscribers which makes use of teachers in addition to the television teacher to handle homework and interaction with students. They are located in geographic clusters of subscribers which are a long distance from Spokane.The constraints on expansion of the system are the initial and ongoing costs of the service to a school district and, in some states, the rules for teacher certification and graduation credit. The rules sometimes require that the television teacher be certified in the receiving state, and that a certified teacher be the in-school monitor of the receiving students. The first is an imposition on the deliverer and the second on the receiving district.

EDUNET

EDUNET is a private, nonprofit organization formed to provide instructional opportunities to schools in Montana through a computer-based system of electronic mail and on-line testing. Ordinary voice-grade telephone lines and standard microcomputers commonly found in schools are used for course delivery. Individual teachers develop and monitor the courses. Student instructions, worksheets, support materials, and tests are stored on a central microcomputer, and printed at any school computer on request. A course is conducted on an individual progress basis, and operates much like a correspondence course, except that student-teacher communication takes place with no more than a 24-hour delay and testing takes place on the computer with results immediately provided to the student.

The organization provides over 50 course options and has 37 subscribing districts in Montana, one in Washington, and three in Idaho with a total of 110 students. Districts subscribe for service by student and course at the rate of $250 per student per semester. The user fees are intended to pay all costs of the central system including equipment and software, although some grant support was obtained initially for some hardware. Course development and instruction costs are also covered by the fee, because course developers and teachers are paid a percentage of the fee of each student enrolled in their courses. The board of directors governs the organization. An advisory board composed of representatives of subscribing districts provides advice on needs, suggestions, and problems.

The EDUNET schools are extremely enthusiastic about the system and are a strong force in the involvement of new users. The simplicity and relatively low cost of the system, especially the in-school equipment, is attractive to small districts. Cost, however, is also a constraint in that the costs could rise for EDUNET proportionally faster than for STEP or IREDS because the fee levels charged in the beginning years did not include a percentage for expanding the hardware and staff in the system to improve response time and capacity to support a heavy increase in users.

Idaho Rural Education Delivery System (IREDS)

The Idaho Rural Education Delivery System (IREDS) is a consortium of the State Department of Education, Boise State University, and the Idaho Public Broadcasting System. Now in its third year, the system develops and produces television courses for broadcast to Idaho secondary schools. The State Department is the governing agency and provides program planning assistance and funding; personnel of the Simplot-Micron Center for Educational Technology at Boise State University carry out course development and production. Teachers of the courses are selected from the Boise School District. The courses are transmitted by the broadcast facilities of the three television stations in the IPBS system. The difference in transmission method between IREDS and the STEP system described above is that only members can receive the STEP signal, while anyone having an ordinary television receiver who is within range of the public broadcast signal of an IPBS station can view an IREDS course. In both cases, a telephone link between the studio and the receiving classrooms permits conversation between students and the teacher, so a casual viewer of IREDS could not participate in that part.

The cost of the system in the first two years was paid by a combination of funds appropriated by the legislature, corporate grants, and in-kind support of staff and facilities from the State Department, Boise State, and Boise School District. Legislative appropriations and possibly user fees are anticipated to be the long-term basis of financial

support. Presently three courses are offered: Spanish I and II, and Advanced Mathematics. A total of 11 districts are participating, with nine receiving Spanish I, five Spanish II, and two Advanced Math, enrolling a total of 74 students.

The enabling and motivating conditions for IREDS, in addition to the rurality of the service area which is true for all the systems described here, are the political support from the legislature and communities, the financial support of private industry as well as government, and the availability of inexpensive development and transmission facilities of Boise State and IPBS. A constraint on expansion is the uncertainty of long-term financial support.

Alaska Centralized Correspondence Studies (CCS)

The Alaska Department of Education has within its organizational structure a correspondence school, Centralized Correspondence Studies (CCS). The school provides a complete faculty and a full curriculum. It serves many individual students in remote or isolated locations, and is making an effort to support the in-school use of correspondence courses and instructional materials as a means of increasing the educational opportunity in schools with a small staff. It has been using telephone conferences of teachers with their enrolled students to increase the teacher-student interaction. Also, it has introduced the use of electronic mail for messages between students and teachers in a few courses. Student work is sometimes transmitted in this fashion, and students are using the system to communicate with each other. Teachers supervising the in-school use of the courses also communicate with the CCS teachers about various aspects of course content and student progress. The electronic mail system is provided by the University of Alaska which operates UACN, a statewide telecommunications network. As a result of initial success, the redesign of courses will increasingly incorporate electronic mail as a component as CCS teachers learn to use the technique effectively. Currently, three districts are using CCS courses incorporating electronic mail in an in-school setting.

Community College of Spokane

The Colville Center of the college has used an audio-graphics system for four years to link students in five remote communities with a classroom at the Center. The system consists of a microcomputer, graphics tablet, and speakerphone at each remote site and the classroom. Classes are conducted by a teacher in the classroom in the standard manner. Individual students or small groups of students at the remote sites participate in discussions and listen to classroom presentations over the phone. Either freehand graphics or computer-generated graphics produced at the classroom or any remote station are displayed at all stations on the network. The graphics tablet can be used as an electronic blackboard by teacher or students.

Courses for this system are not specially designed and produced for transmission as in the other options described above. However, teachers who have used the system are learning some techniques for dealing effectively with students at remote sites. Receiving equipment and production costs are far less than for televised courses and, although the phone line costs are likely higher, the total cost of delivery and reception in such a system is also far less. However, the cost of an installation is not usually spread over as many users as in a television system such as STEP. Financing of the Colville Center system was by a combination of grant and institutional budget (partially reflected in student fees). A typical class session would have about 20 students in the Center classroom and one to three in each remote site. Two to four class sessions per day use the system.

The college does not serve clients outside its area. That is, a student must enroll in a college course. However, this type of system could be used in any situation in the region where qualified teachers exist at one site, and students need instruction at schools within a few miles. Once installed, there are few constraints on the expansion of the use of an audio-graphic system. Extensive production and teacher training are not required. The initial cost of $25,000 to $50,000 for the delivery site equipment is a constraint. A prospective implementing agency must have a sufficient population to serve to justify the cost.

Big Sky Telegraph

The Big Sky Telegraph is an electronic mail network located at Western Montana State College. Originally, it was designed to link the teachers in the 116 one-room schools in the state with each other and with the resources of the College. In two years, it has grown to serve social service agencies as well, becoming a resource to entire communities. It has begun to serve areas outside Montana, including Wyoming and Colorado. A recent grant from the U.S. West Foundation has supported the expansion. Also,

National Diffusion Network coordinators in the 15 western states will soon be using the system. In addition to electronic mail, the system includes on-line bulletin boards and databases, and supports teacher requests for assistance in locating resources, obtaining items from the College, and assistance with instructional problems. Having been established and operated so far on grants, the organization is beginning to implement a user fee structure as partial support for the system.

Big Sky is not a full-fledged distance education delivery system in the manner of the previous examples because it does not develop instructional programming for elementary or secondary students. However, it is a major resource in the region which could serve a wide range of educational systems having similar problems of rurality, isolation, and lack of access to information resources. It could be a vehicle for distance education of the EDUNET and Alaska CCS types described above, and the TERC and Kids Network systems described in the next section. The system is being used for delivering two undergraduate courses to students at the college in the current term.

Opportunities Originating Elsewhere

A number of delivery systems are located outside the Northwest region whose services are available in some or all of the states in the region. All but one of the major examples described in this section are based on television transmitted by satellite. In all of the cases, participation is open to any school district which can receive the signal regardless of state boundaries. In the satellite systems, the signal transmission has boundaries (known as the "footprint") which vary with the location of the particular satellite being used. Thus, Alaska and Hawaii are unable to participate in certain delivery systems because the signal does not reach them. The organizations operating delivery systems are investigating ways to extend their services to unserved areas.

TI-IN

TI-IN is a Texas corporation which has been developing secondary school courses, supplementary elementary school instruction, and staff development courses for several years. The original courses were developed in conjunction with a regional educational service district in Texas. The instruction is televised and delivered by satellite. However, the signal is encrypted to ensure that only subscribers with appropriate equipment are able to participate. A specially designed classroom receiving station is provided to subscribers and either a fixed or steerable dish antenna may be installed.

The footprint of the TI-IN satellite does not include Alaska and Hawaii. Currently, 21 schools are receiving sites in Idaho, Montana, Oregon, and Washington. Four are supported by the Star Schools project operated by TI-IN, and 17 are regular subscribers. Star Schools sites received a free loan of equipment for as long as they are participants. Ongoing costs of programming will be the responsibility of the districts. Northwest students are enrolled in Japanese, Spanish, Physical Science, Algebra, and Anatomy-Physiology. In addition, a job service center and a Job Corps center are subscribers.

Oklahoma State University

The Oklahoma State University in Stillwater, Oklahoma is one of the first agencies to operate a satellite-based delivery system, the Arts and Sciences Teleconferencing Service (ASTS). For school districts, it currently offers nine televised secondary school courses and two middle school courses, and a wide range of courses and teleconferences for staff development.

All states in the NWREL region can receive the signal from this source. Currently, four schools in three states, Idaho, Montana and Washington, are subscribers. A total of 41 students are enrolled in German, Calculus, Physics, Chemistry and Basic English.

Satellite Communications for Learning (SCOLA)

Satellite Communications for Learning (SCOLA) is a nonprofit consortium of schools, colleges, and other agencies which provides access to television news programs from over 40 countries around the world. Programs are received by satellite and redistributed to subscribers in the same manner from the organization headquarters at Creighton University in Omaha, Nebraska. The service operates 24 hours a day, year-round. Reception and rebroadcast is live from France, Italy, Mexico, and the Soviet Union, and by tape for other countries. The service has been used by elementary schools as well as colleges and high schools. A fee structure is based on the number of students served, so that a school district, a university system, or even an entire state agreement can be arranged, achieving lower per-student costs as the student coverage increases. For example, the annual cost for K-12 usage ranges from approximately 40 cents per

student for 10,000 students to 12 cents per student at the level of 100,000 students.

Simultaneous English translation on an audio subcarrier of their satellite signal is provided. Thus, the programs can be used by foreign language classes for current material in both the language under study and in English. Also, courses in geography, global studies, and other social sciences in which current events are useful can use the English version. Different perspectives on the same event can be viewed and compared. Secondary foreign language teachers who have used the broadcasts report that they must spend extra preparation time to review tapes and select useful segments for translation or other activities. However, they believe the opportunity to receive and use current material is of high value and worth the effort. Local or state projects could be developed to produce some of the instructional materials which are usually required for teachers and students to use the broadcasts effectively, lessening the impact on teacher time. While the information from this source is direct and not packaged for instruction, it offers a wide range of possible applications in many curricular areas and student age levels.

Currently, there is one subscribing university in the region. The SCOLA organization appears to have a resource of great potential for schools, but no process for getting its message to the K-12 audience in the Northwest region. A few contacts with state education department personnel have been made.

Technical Education Resources Center (TERC)

The TERC organization is unique among the major delivery systems, providing supplementary instruction rather than full courses and using electronic mail rather than television. The main premise of their approach is that students of science and math will be more motivated and will learn better if they engage in hands-on experiments and are provided the opportunity to communicate with other students the nature of their experiences and conclusions. This approach is being used in two separate but similar projects, Star Schools and LabNet, both federally funded. In both projects, TERC is developing instructional units in secondary science and math and establishing an electronic mail network. In addition, a group of collaborating agencies in various parts of the nation have been identified to act as regional training and dissemination centers for schools. NWREL is participating as one of those centers in both projects. The centers train teachers and other trainers, and provide advice and other support to teachers by phone and electronic mail. Approximately 20 units are under development or in pilot test. In the Northwest region, four Oregon high schools participated in Star Schools pilot activities during 1989 and 1990, and teams of trainers have been trained in Hawaii and Oregon, with workshops planned in the other four states.

Long-term plans are in process for the instructional unit materials to be available from a publisher in the 1990-91 school year, and for an economical electronic mail system to be established and available for subscription in that same time period. Costs of the pilot activities and teacher training have been supported by grants from the U.S. Department of Education and the National Science Foundation. At this point, ongoing costs are undetermined. TERC intends for the units and telecommunications to be made as inexpensive as possible to maximize the participation of school districts, but the system will need to become self-supporting.

Experience in this region thus far indicates that this mode of instruction is interesting and exciting for students, and brings some realism to the study of science. Pilot teachers have all been excited about the possibilities offered by the system. However, the instructional approach is a great departure from standard practice for many. There are questions about how to make the units fit with the existing curriculum, especially when a major effort in this direction would imply major change in the curriculum.

National Geographic Society

A source of similar instruction is the National Geographic Society Kids Network project, which produces hands-on instructional units for elementary students and operates an electronic mail network linking students across the nation. The TERC organization was a partner in developing the first units and conducting the pilot test. The ongoing service is now provided directly by the National Geographic Society. Schools in Oregon and Washington were involved in the pilot testing phase. Currently, 32 schools in five states of the region subscribe to Kids Network. One subscription represents one school and usually involves about 30 students. Hence, about 900 students in the region are now users of the system. The target audience is grades 4-6, and plans are to develop middle school activities in the future. In both the TERC and Kids Network projects, a

continuing concern of participating schools is the cost of telecommunications. Some consideration has been given by people in the region to the possibility of foregoing national contact to focus on statewide or more local links to provide the experience at lower cost.

Education Satellite Network

ESN is a function of the Missouri School Boards Association. It is a clearinghouse and broker for satellite-delivered instructional television programming of all types, including student material and staff development. ESN provides a custom-designed school receiving station including video monitor and satellite antenna which is capable of receiving the signal from any delivery system with which ESN has an agreement. The organization provides users with a limited amount of original programming, but primarily serves a clearinghouse function. If a district wishes to obtain a course from a delivery system such as Oklahoma State, it must subscribe directly to that service source. The ESN service is available outside Missouri through state school boards associations. In the Northwest region, only the Idaho School Boards Association is currently a subscriber. Within Idaho, four districts are now participating and have installed the equipment, although they are not yet heavily involved in course reception.

Other Resources

A number of opportunities exist for supplementary instruction from outside the region, primarily by television and electronic mail. The most well-known of these is the Channel One service of Whittle Communications, in which a 12-minute news and current events program is sent to schools by satellite daily, including up to two minutes of product advertisements. A participating school pays no fee, and receives free equipment including a satellite receiving dish, color monitor, and related cabling and equipment. The school must require students to watch the program. This type of arrangement has caused great controversy within the region and across the nation. In Oregon, for example, the *Portland Oregonian* newspaper has printed two statements from school officials in favor of the arrangement, and 19 schools in five districts have signed agreements to participate. However, the Oregon Education Association Board of Directors recently voted to oppose Channel One on grounds that classrooms should be free of commercial pressures. The Oregon State Board of Education has passed a resolution that a decision to use such resources should be made by local districts, but that class time used for commercial advertising shall not be regarded as instructional time under rules requiring minimum class times for students. The Board also requested that the State Superintendent conduct an impact evaluation of such programming. The overall regional use of Channel One is by 36 schools in 13 districts in Oregon, Washington, and Idaho, with additional commitments in process. The service is not offered in Alaska and Hawaii at this time according to a Whittle representative.

Educational programming of a similar nature but without commercial advertising, CNN NEWSROOM, is now being offered on the CNN cable television channel by Turner Educational Services, Inc. The program is designed with the assistance of professional educators and is provided free to schools. Schools will tape the 15-minute program because it is transmitted at 3:45 a.m. weekdays, and may use the tape for any in-school educational purpose. Daily classroom guides and supporting instructional materials are provided by subscription to the X*PRESS/X*CHANGE text service on cable or the GTE Education Service electronic mail.

In September 1989, a consortium of major cable television programmers formed the Cable Alliance for Education to foster partnerships between system operators, cable programmers, and the schools. In addition to coordinating commercial-free programming and clearing copyright restrictions, the alliance proposes to develop curriculum-based support materials for teacher use with programs.

In this category of services, statistics on the level of use in the region are not available, except for the Channel One figures already stated above.

Statewide Plans and Studies

In addition to the major development efforts in several states in the region described in the previous section, some of the states are conducting studies and implementing activities directed at statewide planning, coordination, and development of the infrastructure for distance education. These efforts vary from a focus on the telecommunications network to plans for statewide licenses for programming and support for potential users. In some cases, a wider user community than education is covered in a plan, including corporations, nonprofit agencies, and government departments. The Oregon ED-NET plan involves a strong collaboration among different state agencies and private nonprofit and for-profit corporations.

The Oregon and Hawaii plans show a strong link between education agencies and the public television system, a link already demonstrated in the IREDS system noted previously.

Alaska

The statewide delivery of distance education is evolving from the Centralized Correspondence Studies division of the state department of education and its increasing use of electronic mail and computers in course design. A five-year plan for distance education for the period from 1987-92 was developed by CCS staff, and it has been followed by CCS in its expansion of the use of technology in correspondence courses. The telecommunications aspect of statewide service is vested in the University of Alaska UACN system providing electronic mail, and in the Rural Alaska Television Network (RATNET). Neither of those systems is under the control of the state education agency. They are in the CCS plan only as systems which CCS can use, not as systems whose expansion or improvement is integral to the overall plan.

A survey of all district superintendents and school principals in the state, currently being carried out by the State Department of Education with the assistance of NWREL, is to be completed in March 1990. The survey is intended to identify the level of interest in distance education for schools and communities in the state, and the needs and priorities which it could address. Information from the study will be considered by the State Department of Education and the State Legislature in the next few months as they contemplate the next steps in the state support of distance education.

Hawaii

One of the few state plans in the nation having the term "Distance Learning" in its title was developed by the State of Hawaii through the collaboration of three agencies: the Department of Education, the Department of Labor and Industrial Relations, and the University of Hawaii. The "Distance Learning-Technology Plan" published in August 1988, recommends actions which support a goal of barrier-free lifelong learning opportunities. Distance education is broadly defined to include support for a wide range of student needs, including career exploration, advanced courses, foreign language contacts, and many others. The plan incorporates a variety of technologies including computers, television, radio, and telephones. Full implementation is projected for 1994, and will require an investment of over $10.6 million for the six-year period.

Although delayed for a few months, the plan was begun in 1989 and is proceeding as projected. Seven pilot projects addressing several different technologies and need areas were begun in 1989-90. The videophone and electronic mail pilots are actually ahead of schedule. A videophone will be installed in every school by April 1990, and electronic mail is available to teachers and students in every school which has a modem with a microcomputer (approximately two-thirds at this time). The seven initial pilots can be considered supplementary and enrichment for the regular curriculum. The eighth pilot, called Teleschool, will begin in 1990. It will use the Hawaii Interactive Television System (HITS) for student courses. HITS is currently used for interactive teleconferences and other staff development purposes.

Idaho

Idaho has no comprehensive published plan for distance education and telecommunications. In 1988-89, a statewide survey was conducted by the Rural Education Program of NWREL and the Idaho Department of Education which provided some basis for planning for services to districts. In 1989, the Simplot/Micron Technology Center developed a proposal for a statewide multimedia teleconferencing system for education and government based on integrating existing public and private telecommunications resources. The proposal is one of a number of options under consideration by the state.

Montana

As the result of an earlier task force effort, the State of Montana in 1989 formed the Montana Telecommunications Cooperative composed of both education and noneducation public agencies in the state. The Cooperative has issued a contract to a private firm to conduct a study of the needs for and feasibility of a telecommunications network for the state for a variety of educational and other purposes. The study, now under way, is managed by the Department of Administration, and will address the needs of elementary and secondary education, higher education, and other agencies or groups in state government. It is scheduled to be completed in the summer of 1990. The cooperative is currently chaired by the Superintendent of Public Instruction.

Oregon

The development of a state plan for a telecommunications system was conducted during 1988 by a broad advisory committee established and funded by the Oregon Legislature. The result was a plan and recommendations for Oregon ED-NET, published in July 1988. The plan was approved and funded with seed money by the legislature in 1989, and a board of directors appointed by the governor has embarked on a program to establish a network and provide services. A goal is to become self-supporting on user fees and other income in three to five years. The ED-NET organization will provide a statewide network using a satellite, microwave, ITFS and other links, and will supply satellite receiving dishes (downlinks) to all higher education institutions, high schools, middle schools, and some elementary schools in the state. A satellite uplink capability is planned for installation at Oregon Public Broadcasting. The network is intended to carry video and audio signals and data.

State agencies, private nonprofit agencies, and corporations are envisioned as potential members in addition to education organizations. Programming services will be provided primarily by the agencies using the network. The Oregon Department of Education, for example, is making arrangements for courses to be available in September 1990. A fee structure for receivers and providers of programming will be established.

The organization is envisioned to have a small staff and a high level of contributed expertise on active advisory committees provided by the major institutions having a high level of interest in the system for their constituents. A strong contractual relationship with Oregon Public Broadcasting was recommended for facilities and other support. The network structure is being implemented in three phases, and proposals have been requested for implementing the first phase specifications.

Washington

In December 1988, the Washington Superintendent of Public Instruction published a "Linking for Learning: K-12 Educational Telecommunications Plan." The plan, produced by a task force of educators, contained goals of increasing access to educational opportunities, improving the quality of teaching and learning, and enhancing professional growth and development. It was comprehensive in dealing with the complex variety of implications of telecommunications in instruction, dealing not only with the technical infrastructure but also with inservice, curriculum development, technical assistance and consultation, and policies, with a budget of over $8.7 million for the 1989-91 biennium. The State Legislature, which requested the plans in 1987 legislation, declined to fund the plan in 1989.

State Policies Concerning Distance Education

In a national study of state policies regarding distance education in 1988, NWREL staff found that such policies come from a variety of sources, depending on the agencies in a state which have responsibility for various components. Although we first looked to the state education agencies, we found that other governmental units often had responsibility for telecommunications networks, and still others for programming, teacher certification, and accreditation. In addition, legislation sometimes contains specific references to distance education. Also, in some cases, policy is embodied in state plans which may be drawn up by a cooperative group of representatives of education departments, higher education, administration, and other organizations. The status of each of the states in this region in regard to statewide planning was described in the previous section.

One way to characterize the policies in the region is to examine the general approach of states regarding the place of distance education in the overall concept of education. Three distinct approaches are evident. The Hawaii approach through their state plan takes a strong proactive stance by stating general goals and specific objectives which clearly say that distance education and related technologies are very important for the future of education in the state at all levels and ages. It proceeds to identify stages of implementation and pilot activities to test concepts, together with a budget.

A second approach, more moderate, is exemplified by Oregon, where the State Legislature at the request of the State Board of Education modified statutes to add explicit references to distance education to the radio and television references already included which declare them to be suitable means of instruction, and authorizing (but not requiring) the Department of Education to engage in development, planning, and other activities for school districts.

The third approach is the stance taken in Montana, where a rule of the State Board of Education states that distance learning may be used as part of the instructional program of a school district, but categorizes it as an alternative to the standard for

which districts must apply. The burden of justification, evaluation, and other requirements are placed on the district.

A review of policy statements collected in the aforementioned national study led to the identification of major categories of concern for users and producers of courses or other opportunities for distance education. It is a useful way to look at the status of policy in this region as well.

Certification

There are two major concerns in this area. One is for the certification of the teacher in the originating organization as, for example, the teacher of a STEP course. In that case, states other than Washington might be concerned that the teacher be certified in their state if their schools are to use the course. The problem for STEP is that they must certify the teacher in most of the receiving states as well as Washington, which sometimes requires the person to take special courses. A second problem can occur in specific subject areas such as Japanese language, where a person is available who is fluent and can teach but is not certified for secondary teaching in any state. This frequently happens when an organization tries to make use of an instructor from a university.

The second major concern is for the person who is responsible for the students at the receiving school, usually referred to as facilitator, monitor, or coordinator. Some states require that the person be a certified teacher, while others allow an aide but require that the person be supervised by a certified teacher.

In the 1989 Oregon Legislature, amendments were made to state law to deal with some of these concerns. They exempt from the provision regarding forfeiture of basic school support funds a school district that assigns a teacher to be present during a distance learning situation whose assignment does not conform to terms of their teaching certificate. It also considers teachers presenting distance learning to have met certification requirements if they hold a current certificate of another state and pass a nationally recognized basic skills test. However, this allows neither for an aide to supervise a distance learning class nor for an uncertified teacher from the delivery system. The Oregon Teacher Standards and Practices Commission is currently revising their regulations to reflect these changes.

In the rules issued by the Montana State Board of Education, part (d) addresses certification by requiring the applying district to validate "that the teachers of distance learning courses are certified and appropriately endorsed in Montana, eligible for certification in the sending state or certifiable in their resident state and have experience in delivering instruction via distance learning. If the teacher of a distance learning course cannot meet any of the above certification criteria, then the facilitator in the receiving classroom must be certified at the appropriate level, but not necessarily endorsed in the area of assignment."

The Idaho Department of Education has issued a distance education policy which includes the statement that a teacher in a distance education program "must hold a teaching certificate valid in the state where the program originates and must meet the minimum academic requirements of the Northwest Accrediting Association." Furthermore, in regard to the school, the policy states, "The receiving site shall employ an adult to supervise and monitor students enrolled in the distance learning class. This person may be a paraprofessional, although it is recommended that such a person be a certificated professional."

Content Review and Quality

Concern for the content of instruction delivered by distance education methods is parallel to that for any instruction. States do not generally draft new rules specifically for distance education in regard to matching the state content objectives or other guidelines. However, a concern for the quality of instruction does show up as a special consideration.

The revised Oregon statutes provide that the State Board of Education shall approve distance learning programs for both direct instruction and enrichment. Also, the Board is directed to appoint an advisory committee to advise the Department of Education on standards and criteria for such approval, among other items.

Montana rules stipulate that to use a distance course, a district must apply for an alternative to the standard, and must describe how the course will meet learner goals and show how the effectiveness of the course, teacher, and facilitator will be assessed. This implies that advance indicators of quality are not required, but only that a process for evaluation must be planned.

Idaho policy states that any elective course must be reviewed and approved by the Department of Education, and that any course required for graduation must contain all the critical components for secondary school courses as outlined by the

Department. The burden of proof is apparently on the district.

Other Policy Areas

On a national basis, state policies sometimes reflect a concern for other factors in instruction such as class size and credit. On those two issues particularly, only Idaho within this region appears to be explicit in applying existing rules for regular classrooms to distance education courses. They specify that since the teacher at the sending site interacts with, evaluates, and remediates students, the maximum class size shall not exceed 32 students per teacher. Regarding credit, Idaho limits credit earned through distance education to three units or six semester credits for graduation purposes.

The advent of the initiative by Whittle Communications to provide a satellite dish and related classroom equipment free to schools in return for a commitment to show a 12-minute daily news program to students has caused controversy across the nation. There are two minutes of commercials in each program. In this region, the Oregon State Board of Education has resolved that local districts should decide whether or not to participate. However, time spent on commercials may not be counted as instructional time for basic school support purposes, and students must be excused if parents object. Other states have not taken an official position.

Analysis

The overview of available distance education services in sections II and III indicates that interested school districts have a wide range of options in types of systems and subject areas. However, some of those options are open at this time only to districts within the state of origin. It is also true that the two systems within the region which are made available across state boundaries, STEP and EDUNET, still have most of their impact within their own states. The charts on the following pages summarize the current school district usage of the technology-based systems.

One general observation about the data is that the penetration of the major systems in the school market appears more limited than one would expect judging from the publicity about distance education since 1986, and from the number of schools and districts which could benefit from it. It is known from the needs assessments done by NWREL in Washington and Idaho in the past two years that distance education is important to educators, especially in rural settings, primarily for expanding and enriching instruction and providing equality of opportunity. If this picture is correct, the services are available and there is a felt need, but a large number of districts are not using them. There could be many reasons for the disparity, and the truth is probably a complex interaction of them all. Some of the reasons were alluded to in section II, where some observations were made concerning the conditions which would enable or constrain increased use of those systems. The conditions are summarized and generalized here to provide part of the setting for the future development and application of distance education in the region.

Enabling Conditions

A significant characteristic of this region is that a large number of school districts are rural and small or very small, and many of those are quite remote from population centers. In a small high school staff of five teachers or less, it is difficult for a district to assemble all the skills necessary to offer a comprehensive curriculum, especially in foreign languages or advanced topics in science or other subjects, so there is a need to supplement the offerings, in some cases even for required subjects. Furthermore, as university requirements rise, capable students also need additional offerings, but there are very few such students at any given site, so a means of individual instruction is important. Although the per-student costs of instruction are high for those situations, there is strong support from the parents and legislators from rural communities for the increased use of distance education to equalize opportunity for their children.

A second condition is the concern in all the states in the region for their long-term economic health, and the resulting need to lay the groundwork for heavy involvement in the development of trade with Japan, Korea, and other countries of the Pacific Rim. A related issue is the sense of competition among the states of the region for business and investment from those countries. These concerns are reflected in the desire of both urban and rural school districts to offer foreign languages in their curriculum, especially Japanese.

A third condition is the sense, shared with the rest of the nation, that the United States needs to be more competitive economically in the future, and that to achieve such status implies improvement in and increased emphasis on mathematics and science instruction. This generates a desire for offering secondary students advanced studies in calculus, physics and chemistry, the teachers for which are sometimes difficult to obtain in rural schools.

1989–90 Student Impact of Major Distance Education Systems

Systems	Schools	Students
Full course:		
Alaska CCS	3	5
EDUNET	41	110
IREDS	11	74
STEP	93	1107
Oklahoma State	4	41
TI–IN	21	146*
Subtotal	**146**	**1483**
Supplemental:		
Kids Network	32	900 est.
TERC	39	350 est.
Subtotal	**63**	**1250**
Grand Total	**236**	**2733**

* This number represents only students enrolled in credit courses, and does not include students using supplementary enrichment programs for which enrollment is not recorded.

A fourth enabling condition is the high level of activity in the development of the telecommunications infrastructure in the states in the region. Statewide planning activities indicate that state governments in general are serious in their pursuit of communications access for education and other state agencies. If the plans come to fruition, as some are even now, improved and economical access to educational resources by telecommunications of various types will be a reality for most schools in the region by 1992.

Another condition is that the region is well-supplied with centers of expertise and production facilities capable of satisfying the range of needs. Instructional design expertise resides in the universities, school districts, and state education agencies. Experience in the design and development of student courses and inservice instruction for individualized and group-based instruction using various technologies resides in the personnel of the several existing projects, and in higher education institutions as well. Expertise and

1989–90 Usage of Major Distance Education systems as of March 1, 1990

(in numbers of districts)

	Alaska	Hawaii	Idaho	Montana	Oregon	Washing-ton	Total
Alaska CCS	3**						3
EDUNET			3	37		1	41
IREDS			11				11
STEP	6*		2	4	8*	54*	74
Okla. St.			1		2	1	4
TERC	7	8		1	11	12	39
TI-IN			1	2	9*	1	13
	16	**8**	**18**	**44**	**30**	**69**	**185**

* Some districts in these cases have multiple receiving schools.
** This identifies only the districts using e-mail supplemented CCA courses in school.

facilities for the production and transmission of instruction by telecommunications exists in STEP, IREDS, EDUNET and the state and local public broadcasting entities, and in certain universities and school districts as well. Courses and supplementary instruction are already supplied from within the region in math, science, and foreign languages. Significant collaboration between public and private entities can be seen in the STEP, IREDS, and Big Sky Telegraph projects.

Finally, teachers and other education professionals who have participated in the distance education delivery systems described here express excitement about the promise of the new technologies for improved opportunities for students and improved instructional tools for themselves. Interviews with teachers conducted by NWREL staff in the process of project evaluation reveal a positive attitude even when the inevitable problems in pilot tests occur. In addition, they show a healthy skepticism about the degree to which technology can take over teaching tasks, and make creative efforts at integrating the opportunities with the current instructional processes. In short, there appears to be a large reservoir of good will in the professional force, and a willingness to experiment with new approaches which have promise for improving opportunities for students.

Constraints

Although the enabling conditions provide a highly positive picture of the potential, some factors could work against an expansion of the use of distance education in the region. The high cost of a large expansion of production and use of distance education is a major constraint. The problem is that significant areas of all the states in the region are economically depressed, and in some cases the state structures for school funding provide insufficient resources for local districts to engage in special programs, or at least discourage districts from venturing new initiatives.

Cost is a factor for both the producer and the user, although in fact the development costs for

producers are reflected in the membership or subscription costs for the users. The cost of design and development of a new course for television delivery is at least $250,000 and can be $500,000 or more depending on the level of effort in such areas as graphics, use of other media, and custom filming or location filming. Costs for a potential school user are reflected in facilities, staff, and initial and continuing subscriptions to a delivery system. Initial costs are particularly associated with satellite-delivered television, because the school must invest in a receiving antenna (dish), which can be in the range of $4,000 to $5,000. In the case of STEP and TI-IN, this cost is included in the initial membership fee. With TI-IN, the initial hardware includes not only the external dish, but also a complete receiving station for the classroom with a telephone for contacting the transmission site. In the TI-IN case the total initial cost is approximately $10,000. Recurring costs for subscribers to any of the systems are based on the number of courses and the number of students. The more the use, the greater the total cost to a school, but the lower the cost per student. Hence, the highest per-student costs accrue to schools with the fewest students and the greatest need, those which are rural and small.

To a certain extent, the state rules for certification, accreditation, class size and course approval deter delivery systems from expanding outside the state of origin. Some of these rules were written before the advent of distance instruction based on telecommunications, when the assumption was that the teacher would be in the classroom, and would be the primary source of knowledge. Also, the states vary in the specifications for a teaching certificate, and it may be necessary for a delivery system to have its teachers certified separately in all the states it serves. Distance education systems frequently specify that an on-site monitor or facilitator be appointed to provide supervision and other functions usually handled by a classroom teacher. Rules vary regarding certification requirements for a person in such a position. Oregon and Montana have already moved to modify the rules to accommodate the new approaches, and such considerations are included in other state plans, but the rules still differ from state to state.

A third constraining factor is that some of the major resources in the region are designed as services within state boundaries. There is no mechanism or financial support for extending the service. One such example is the Alaska CCS, the most extensive technology-based correspondence study service in the region. Another is the EDUNET project, a system designed to be transportable to another locale and governance structure, but for which the actual transfer has not yet been tested.

A fourth constraint is a lack of knowledge of the field of distance education on the part of local school staffs, which restricts their ability to develop long-range plans, to incorporate distance education in existing structures and curricula, and to make informed selections from the variety of options available. Through the Rural Education Initiative, NWREL has provided limited assistance, and several state education agencies have provided advice and assistance, but many districts still need help.

Unanswered Questions

As noted previously, there are many services in different types of distance education available in the region and an expressed need or desire for them in many schools, but not a lot of schools are using the services in comparison to the number which could. In the evaluation activities conducted by NWREL staff between 1988 and 1990 in the STEP and EDUNET projects and in the Alaska needs assessment, district superintendents were interviewed or provided a questionnaire in which their opinions were solicited on priorities, roles, and preferences on aspects of distance education. The desire for distance education opportunities was high in all situations. When compared to other improvements which could be made in instruction, distance education ranked moderate to high in priority. Those who are current users of satellite-delivered television courses think it is a good technique but want more options, and some question the current quality. Those who are current users of electronic mail-based EDUNET system like the system for the opportunity it provides and the individual discipline it requires of students, but think a television system would be better. Those in Alaska who have neither system indicate a clear preference for interactive television as the delivery system.

In all cases, cost is cited as a primary deterrent to increased use of distance education, yet the members of the STEP project have supported the higher cost of the television system and have formed a cooperative to save costs where possible. If they were able to afford the cost of the system, why haven't others in other states, especially when STEP is one of the most transportable?

The preference for interactive television is clear, but the reasons for it are not. There seems to be a perception that a television course is higher quality instruction than one from an individualized electronic mail system. Do students taking a course by EDUNET compare poorly in achievement with those who take the same course from STEP, or perform less well in college? Some EDUNET users think their students are doing fine but are missing something. There is no evidence to provide guidance.

Finally, most seem to believe that a live teacher in the classroom is preferable to any of the distance methods, and this carries forward to the perception that students in a distance course should be supervised in the course activities by a certified teacher, though not in the subject of instruction. If this is true, is there anything to be gained from distance methods other than subject knowledge?

There are also questions from within specific projects which need answers. For example, the EDUNET project has experienced student dropouts in the second semester in many courses, and have identified no reasons for it. The problem must be solved for the long-term health of the project.

It appears that much research needs to be done on questions of quality, student outcomes, and cost effectiveness of the various distance education systems. Furthermore, if collaborative or cooperative projects have been successful in overcoming cost barriers in certain locales, research on the factors involved may provide guidelines for the technical assistance needed to transport that success to other parts of the region. It may be that regionwide collaboration on certain aspects of distance education would help bring costs to a more affordable level.

Potential Roles for NWREL

Distance education in various forms appears to offer great benefits to the region in addressing problems of rurality and size, subject area expertise, and richness of experience. The task of increasing the effective use of distance education to realize those benefits contains several roles suitable for regional attention which NWREL could consider.

Coordination: Certain major problem areas might be amenable to a regionwide coordinating effort by an independent agency. These include standardization and reciprocity with regard to crucial state rules such as certification. Cooperative acquisition of satellite time could be beneficial, as would assistance in dealing with cross-border issues between networks, public or private. Development and coordination of a plan to make existing resources available across the region by forging links between state networks could result in greater access for schools and less redundancy in instructional development. NWREL could act as the broker for services from delivery systems outside the region.

Clearinghouse: Information on available programming options for student instruction and inservice change regularly. A central regional agency could keep track of such information and disseminate it regularly to SEAs and LEAs. Some of the relevant tasks are now being carried out across the region in SEAs, LEAs, and regional centers for their own constituents, but many districts still have no access to the information. Thus, there is redundancy without complete coverage.

Technical Assistance: Inservice instruction could be provided through workshops for teachers, planners and others for different levels of expertise, dealing with design, selection, and integration. Planning assistance could be provided to the organizations operating delivery systems in the region.

Evaluation and Assessment: Evaluation could be conducted of courses, materials and programs from several standpoints such as design, effectiveness and impact. Needs assessment of economic or other special impacts could be carried out for a project, state, or the region.

Research: Many questions have been asked about such topics as the effectiveness of various modes of distance education, the effect of on-site intervention by teachers or aides, and other aspects of distance education which could be addressed through a program of research. Coordination of a broad-scale research agenda with higher education institutions in the region could be carried out.

Planning: Region-wide planning efforts could be carried out by NWREL in areas such as telecommunications system linkages and program offerings to minimize redundancy and maximize the effectiveness of limited development resources.

Telecommunications: The Critical Resource for Achieving National Educational Goals

by
Arthur D. Sheekey and Suzanne G. Douglas

I. National Workshop: An Overview and Context for Discussions

In an historic meeting in Charlottesville, Virginia, the President and the nation's fifty governors agreed on a set of six goals that they hope will guide the nation's schools during this decade. Immediately, it was clear that success in reaching these ambitious goals will require the effort of a broad coalition of agencies and officials, in addition to those responsible for managing and operating schools and colleges. Apparently, the challenge and problems are too great to be left to educators.

The Goals

The national educational goals are ambitious, and the resources available from federal and state sources are obviously limited. The economies of nearly half the states are shaky, and traditional solution strategies may be insufficient, if not too costly to consider seriously. Extending the school year, for example, has not met with much success, and implementing this idea, like reducing the number of students in a classroom, is terribly expensive.

The goals for guiding the nation's schools for the next decade are as follows:

- By the year 2000 all children in America will start school ready to learn;
- By the year 2000 the high school graduation rate will increase to at least 90 percent (we're currently at 72.6 percent—by dividing the 1988 high school graduating class by the number of 9th graders who entered schools);
- By the year 2000 American students will leave grades 4, 8 and 12 having demonstrated competence in challenging subject matter, including English, mathematics, science, history and geography; every school will ensure that all students are prepared for citizenship, further learning and productive employment in a modern economy;
- By the year 2000 U.S. students will be first in the world in science and math. (Among 20 countries, our 8th graders are ranked 10th in arithmetic and 12th in algebra. Of 15 countries, our 12th graders are ranked 14th in algebra and 12th in geometry. In science, our 14-year-olds are ranked 14th. Our high school seniors are ranked 13th in biology; in chemistry, 11th; and in physics, 9th among students in 13 nations);
- By the year 2000 every adult 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; and
- By the year 2000 every school will be free of drugs and violence and will offer a disciplined environment.

This paper serves as a background for discussing the role of the telecommunications industry in extending educational opportunities, including commercial and noncommercial telecommunications networks. Clearly, striving toward these national goals, communications technologies offer a major untapped national to be exploited to help educational officials make the necessary changes and improvements associated with the new set of national and state educational standards, needs further clarification. There are strong indications and some evidence that communications technologies can provide information and program resources (e.g., "distance learning") and that they will not serve as a complete substitute for the traditional interpersonal relationships between teachers and their students. There are also reminders from business leaders who say, "no organization can be better than its employees." Balancing the traditional roles of teachers and

schools with the expanded opportunities offered by telecommunications agencies represents a new and formidable challenge for education policymakers.

Unlike earlier periods of educational reform, when education officials and the academic community assumed the bulk of the responsibility for changing and improving schools, help is now being sought from a wide variety of public and private agencies. The problems of many public elementary and secondary schools, according to a recent RAND Corporation report (Paul Hill, et al., *Educational Progress: Cities to Mobilize to Improve their Schools,* 1989) "are too severe and intertwined. . . and entangled with broader community social and economic events. . . to be solved by the education bureaucracy." The RAND study indicates that state and federal policymakers can initiate improvements, but coalitions of local public and private interests can mobilize all available resources to really make things happen.

> Business should not be the sole participant; collaboration efforts for restructuring should be drawn from a coalition including educators, business people, elected officials and parents. If any player is missing, the chances for success can be compromised.
>
> A Blueprint for Business on Restructuring Education, 1989, National Alliance of Business

Another interesting development in the current educational reform movement of the past few years is the apparent convergence in the thinking of both "insiders" and "outsiders." Among the various plans for "restructuring" schools, both business leaders and education officials are urging the use of an alternative educational delivery system. In a recent issue of *Kappan* (January, 1990), American Federation of Teachers President Albert Shanker stated: "Our persistent educational crisis shows that we've reached the limits of our traditional model of education . . . An even bigger stumbling block in the path of fundamental change is the fact that almost everyone believes that we can solve all our problems by improving the traditional model of education" (p. 345).

> Most of what we're hearing about educational reform is merely ceremonial rain dances which are actually celebrating the demise of a model but not ready to recognize the need for a new one.
>
> John Goodlad, 1990

Several business leaders, including David Kearns, William Norris, and Lewis Branscomb, have urged a restructuring of the school environment and applications of technology that would require a complete overhaul of the conventional school and classroom.

The opportunities for exploiting available interactive technologies and telecommunications facilities, as well as the problems they create and the barriers inhibiting application, are discussed in two comprehensive reports produced by the Office of Technology Assessment (OTA). These reports indicate that educators are now "cautiously enthusiastic" about the possibilities of using technology-based programs, particularly to help "at-risk students." The reports also document the capabilities of these technologies in delivering additional resources to rural and isolated schools, and to urban schools as well.

Unfortunately, the major portion of reforms underway fails to take advantage of the programs and services that could be delivered through telecommunications. "The recent reform effort," says Shanker, "has merely been aimed at correcting the abuses of the 1960s." Exploiting technology-based instructional systems will require substantial changes in the way teachers teach and in how we expect students to learn. Reforms in public schools, involving alterations to the traditional school and classroom environment and the use of instructional technologies, obviously lag far behind those already implemented in many private corporations and government agencies. The $40 billion spent annually on training by major corporations includes "courses that are far superior to the traditional courses that exist in public schools and universities," using "interactive methods of learning that are far superior to the traditional lecture-based methods of teaching." (Jack E. Bowsher, *Educating America: Lessons Learned in the Nation's Corporation*, p. 42.)

The absence of sophisticated applications of new and advanced learning systems and technology in public education can be traced to several factors. The demand for accountability and a "bottom line" mentality represent a major part of the explanation. Corporate training programs cannot afford or accommodate failures. Unlike programs offered in conventional school settings, most instructional programs in the private sector rely on professional teams of instructional designers, content specialists, media professionals, computer programmers and testing experts (Bowsher). Instructors in corporate programs also rely increasingly on interactive video and self-paced learning systems to increase the student's involvement and level of retention.

Before discussing some interesting developments and opportunities for exploiting new and advanced technologies, it should be noted that over the past 20 years many attempts have been made to introduce "innovative technology-based" instructional programs into public elementary and secondary schools. Most did not succeed and the reasons for failure were multiple. A 1988 RAND report, *Steady Work: Policy, Practice and the Reform of American Education*, concludes past educational reforms failed because they relied on external authorities and offered "substitutes for the classroom teacher." A similar conclusion was reached in a study by Larry Cuban at Stanford in 1984 (*How Teachers Taught: Consistency and Change in American Classrooms, 1890-1980*, Longman, New York, 1984). With respect to technology-based programs, Cuban stated that too often advocates for new technologies are attempting to "outflank classroom teachers" by developing "teacher-proof" materials. Other studies confirm the fact that a much greater degree of success is assured when teachers are involved in the early stages of planning and when teachers are given adequate training, support and appropriate incentives.

Learning from experience is one major cautionary note. A second relates to cost: the cost associated with planning and development, and the cost of choosing from a wide variety of improvement strategies. State and local officials have limited resources. Decisions related to reducing class size, extending the school year, raising teacher salaries and purchasing new technology need to be weighed in terms of their relative merits (i.e., the extent to which the decision will improve the performance of teachers and their students).

Using Telecommunications to Facilitate School Restructuring

> The gap between educational needs and educational provision in this country is wide, and there seems little hope that it can be bridged by traditional means. In communications technology, correctly applied, it seems likely we have a way of bridging the gap and of solving many educational problems that themselves are the result of the technology age.
>
> Michael G. Moore
> Pennsylvania State University

After more than six years of educational reform and restructuring at the local school level, public education is still at the edge of disaster. As a result, educational policy makers are increasingly serious about major institutional reforms and heavier reliance on alternative and non-traditional instructional delivery systems. Most of the nation's 15,000 local school districts are either planning for, or in the midst of, school restructuring and decentralization. A relatively small percentage of these districts have the incentive and resources to make fundamental changes for improvement. Most schools will be forced to rely on traditional approaches; they will not have access to high quality instruction or have a sufficient number of well-trained and qualified professional teachers.

The need for a telecommunications system to support the efforts of locally controlled and operated programs could be compared with the earlier need for, and the federal and state cooperation in, building a nationwide expressway system. "Moving away from the old school systems will be like moving away from the old two-lane highways with all their curves and stoplights," writes Bowsher.

Several proposals have been developed for establishing a "national educational telecommunications system" (Louis Bransford, 1987). Serious discussion on, and further interest in, establishing a nationwide telecommunications system—one that could be tapped by any state, local, or private educational system—would require significant leadership at the national level, substantial involvement of the private sector (particularly the telecommunications industry), and support from leaders of the educational community, especially teachers.

In his column in the *New York Times* (December 24, 1989), Shanker stated that a national telecommunications delivery system could help transform education in local schools. Providing teachers with a wide range of data bases and available video programs "would be a great force for educational improvement." Shanker concludes: "Technology can allow us, for the first time, to put factory schools behind us and develop educational programs that suit the various needs of our various students. . . Putting this technology into every classroom so every teacher can use it to solve one of the enduring problems of our educational system must be a priority for the new decade."

Educators and the organizations and associations that represent them seem more mindful of and receptive to the potentials of instructional technologies and telecommunications.

• Whittle Communications reports that Channel One will be installed in 8,600 schools serving 6 million students by June, 1991. About 5,000 schools have already signed contracts for its news broadcast service. To support programming, Whittle has received over $200 million in

advertising commitments. Advertisers pay $150,000 for each 30 seconds of commercial time.

• The Learning Channel, a 24-hour television service, currently serves more than 17.5 million households nationwide, offering full-time formal and informal education programming for students of all ages. In fall 1989, The Learning Channel offered 19 programs for in-school use by teachers, including Spanish and French college prep courses.

• Hughes Aircraft is developing a project starting in the fall of 1991 with 30 schools, which will receive programming from Hughes' direct broadcast satellite. Hughes will raise the funds for the video programs, teacher preparation and for the installation of low-cost reception equipment.

• The Discovery Channel, also available from many local cable operators, offers a daily one-hour programming service devoted to teachers. Since 1985, "Assignment Discovery" provides a regular weekly schedule of programs on science and technology, social studies, natural science, arts and humanities, and world and current events. During the 1990-1991 school year, Discovery will offer interactive laser discs that complement school curricula, and which are compatible with most popular computers.

• The Cable Alliance for Education, a consortium of major cable television programming and multiple system operators, plans to establish a long-term partnership between the cable industry and schools to promote the use of TV in the classroom. While nearly 60 percent of the schools have access to cable, possibly more than 80 percent could be wired for cable at the end of this decade. One of the cable companies, CNN, now offers a 15-minute, commercial-free, daily news program for school use. The CNN program highlights the day's top stories and provides a detailed special report each day of the week.

• In 1990, the North Central Regional Educational Laboratory collaborated with PBS in the preparation of nine, two-hour interactive videoconferences. This series was designed for teachers, school administrators and policymakers. The series focused on school restructuring and school reform.

• A total of 1,600 schools in 40 states are now receiving courses offered by Star Schools federal grant recipients. Under current legislation, $100 million is authorized for this program; more than $14 million in grants will be awarded in 1990, the third year of a five-year authorization. Most of the schools participating in this program are making use of satellite downlink facilities that could also be used to receive additional programs and information services. Courses are offered in Japanese, French, Spanish, Latin, physics, chemistry, biology, algebra, trigonometry, and calculus. Since the inception of Star Schools, more than 80,000 students have enrolled in credit courses, enrichment courses, and computer-based curriculum modules. Many of these students are in school districts with total enrollments of fewer than 100.

All of these developments either complement or expand upon the educational services offered by public broadcasting stations. Last year, PBS spent $9 million for school programs. PBS stations claim they transmit an average of five hours each day of programming for in-school use.

States Committing Vast Sums to Developing Telecommunications Projects

> More and more states are adopting a comprehensive approach to educational telecommunications planning. In many cases, under mandate from the governor or state legislature, education institutions are ordered to plan in concert with one another. Some states have gone further by requiring education institutions to plan with non-educational agencies to share costs and to avoid redundancy.
>
> Richard T. Hezel
> Hezel Associates

In the spring of 1990, Hezel Associates completed a comprehensive study on statewide planning for educational telecommunications. The study found that more and more states are looking at telecommunications technologies as a means to provide schools and teachers with information and program resources.

> Continuing the trend of the past two years, distance learning, which brings educational instruction via television, cable or microwave, is the most prominent area of state involvement in technology. Distance learning initiatives and expansions were reported by 37 states. States are either implementing, expanding, studying or funding distance learning programs to provide special courses to schools with at-risk students, to enhance teacher education, or to offer instruction in locations where there are insufficient teachers or very low enrollments.
>
> Results in Education,
> National Governors' Association, 1989

According to the recent OTA report, Linking for Learning, "States have become major players in planning, supporting and organizing distance learning activities." Several states and their political leaders have recognized that the emergence of new interactive technologies provides opportunities for education, business and

cultural programming as well as a wide range of governmental services.

• This year, Oregon's state legislature approved $8 million in lottery money to support a statewide distance education network. Initially, the network will provide a single channel, devoting several hours a day to programs for K-12 instruction. West Virginia has solicited bids for a statewide network that would offer basic skills, and remedial and accelerated learning programs. Texas is planning to link all its schools to a single network as a result of the legislature's $6 million set-aside to build it. The goal is to have all schools, colleges, and regional service centers linked into a single network by 1991.

• The Massachusetts legislature authorized $1.2 million to purchase 50 satellite dishes for a new distance learning network. Initially, a two-way audio, one-way video system will link 400 schools.

• North Dakota is planning the construction of a statewide educational telecommunications network, which will involve a "fiber optics corridor circling the state." Eventually, this network will link colleges, libraries, and schools throughout, the state.

• The Iowa state legislature allocated $50 million—one-half the estimated cost—for a statewide educational telecommunications network, which will have a digital fiber backbone and other new interactive technologies, in order to link every school in the state. Governor Terry Branstad indicated the network is a vital part of the economic plan to improve Iowa's competitive advantage.

• In California, a new $13.7 million grant program will provide schools with awards up to $100,000 to obtain or expand technology-based programs. California officials expressed an interest in promoting school/private ventures. Also, a California Educational Technology Business Roundtable was formed to work with the office of the governor.

• Southwestern Bell Telephone Company announced it has begun installing 168 miles of fiber optic cable to handle the company's first interactive video network. The Advance Plan for Linking Unified Schools Network will offer full-motion analog video with multi-channel capacity, enabling schools throughout Kansas to share instructors and permitting students to participate in class discussions via TV monitors.

• Maine has raised $5 million to build a combination fiber/microwave network which connects the seven campuses of the University of Maine, six vocational technical institutes and all the public high schools. Many sites will be equipped with cameras as well as monitors to permit video interaction between students and instructors. New England Telephone is building the network.

• As part of one of the most radical statewide educational reform efforts to date, Kentucky's Council on Education Technology will make recommendations for a five-year plan for purchasing, developing and using technology in public education. Kentucky plans to install a satellite downlink for every school in the state—more than 1,200—paid for by a state bond issue. The system will offer full credit high school courses and teacher training programs. In 1988, Kentucky, Nebraska, South Carolina, and Wisconsin formed the Satellite Educational Resources Consortium (SERC), which shares courses with 18 states.

• The state of Mississippi has formed a partnership with South Central Bell and Northern Telecom to install a fiber optic interactive distance learning network to offer two-way video and audio. Many other states, as well as counties, are planning or operating communications networks for interactive full-motion video programming as well as one-way broadcasting of information services to schools and community colleges. A growing number of these systems are making use of fiber optics.

Rural Schools and Telecommunications

> In the year 2000, converging and emerging technologies could present rural America with a far greater degree of choice in the number and types of telecommunications and information services available.
>
> NTIA Telecom 2000
> U.S. Department of Commerce

The National Telecommunications and Information Administration (NTIA) report indicates that fiber optic and microwave networks may be somewhat analogous to the railroads of the 19th century and the interstate highway system of the 20th century. These new technologies in connection with satellite communications and digital microwave radio systems are already having an impact on rural America and should continue to do so in the future.

The NTIA study reports that more than two million homes, located in rural areas, are already equipped with home satellite dishes, putting rural America on the leading edge of technology, and that the prospects of direct broadcast satellites using high-power satellite transponders will add

significantly to rural areas' capacity to receive high quality services.

The importance of telecommunications technologies for improving educational services is highlighted in a 1989 report prepared for the Aspen Institute and Ford Foundation, *Rural America in the Information Age: Telecommunication Policy for Rural Development.* This report concludes. "One of the most promising uses of telecommunications in rural America is to improve access to education." It also warns that distance education could end up being used in inappropriate settings, such as grade school, where it is less effective than traditional instructional processes.

Challenges to Educators and Educational Policymakers

Past experiments involving applications of technology-based programs and the use of instructional broadcast television have not had much impact on teaching and learning in school settings.

However, more than ever before, education officials recognize opportunities for using instructional technologies. They have a more realistic, if not guarded, view of what technologies can and cannot do. As the demands for excellence increase, state boards and legislatures see the possibilities of using technologies for helping teachers in addressing specific educational needs and providing them with resources that school personnel could not otherwise provide (e.g., high-quality science and foreign language programs). Unlike past attempts to influence school practices with available technologies, recent developments have resulted in systems and programs that are more affordable, flexible and suitable for individualized instruction, as well as group instruction.

As state and local educational systems consider the adoption and adaptation of these technologies, they need to consider several major issues. Among the critical issues are the following: the changing role of the teacher; choosing from a wide array of transmission systems and interactive technologies; the cost to develop and maintain state, local or regional networks; establishing appropriate institutional linkages (e.g., school-to-school, school-to-college); public versus private program suppliers; federal, state and local regulatory responsibilities; accreditation and professional development of school personnel using and delivering programs from remote sites; and assessing the relative effectiveness of alternative educational delivery systems.

> Rapid change requires a continuing evaluation of the government's proper telecommunications and information role. Yesterday's institutional arrangements have lost and will continue to lose relevance in the face of technical and commercial developments.
>
> NTIA Telecom 2000

National Workshop on Education and Telecommunications Technologies

The Workshop, supported by the Office of Educational Research and Improvement, in cooperation with the Annenberg Washington Program and the Public Service Satellite Consortium, and convened in April 1990, was designed to deal with the implications of both educational reform and the availability of new and advanced communications technologies. The Workshop focused on several critical policy issues. Among the questions raised were the following: If officials who control and operate public schools have the responsibility to improve the performance of schools and students, what are the responsibilities of those who control and operate public and private telecommunications networks? What critical policy issues are associated with recent developments, such as direct broadcast satellites and fiber optics? And what are the implications for federal and state educational policies? If educators have the primary responsibility to address the new standards for educational performance, how can they make effective use of telecommunications and information resources? Who will operate them? What are the respective roles of federal, state, local and private agencies? When new partnerships develop, what are the implications for school personnel and the maintenance of conventional school settings?

Participants in the Workshop were called upon to help the Office of Educational Research and Improvement to identify specific issues and problems and to recommend a strategy for overcoming the barriers that inhibit collaborative relationships between the educational and communications systems.

II. National Workshop: Results

A Pre-Workshop Survey served to identify and rank some key policy issues relating to applications of telecommunications technologies to education. In rank order these include the following:

• Partnerships and aggregation of resources (establishing consortia and recognizing the need for new governance structures);

• Teacher preparation (both pre-service and staff development and training of school-site projects);

• Financing (how state and regional educational telecommunications planning, demonstration and service efforts find and sustain financial support);

• Training of school administrators;

• Interstate certification and accreditation;

• Federal and state legislation and regulation; and

• Physical plant design.

In addition, participants also identified the following issues in the Pre-Workshop Survey:

• Research and evaluation;

• Development of software/courseware;

• Restructuring of support services (i.e., libraries);

• Teacher and administrator implementation support;

• School-level planning for effective implementation;

• Deregulation of education at state level;

• Telephone regulation and costs;

• Compatibility of data communications sources and ease of use;

• Need for a broader base of public support and awareness—educators, legislators, parents, press; and

• National coordination and direction.

In a Post-Workshop Survey of participants, additional policy issues and concerns surfaced. In general, the five issues deemed most important on the Pre-Workshop Survey maintained their relative position on the Post-Workshop Survey. Teacher preparation topped the list, followed closely by partnerships and aggregation. Financing for hardware and software was next. Interstate certification and accreditation and telecommunications training for school administrators were tied for fourth. Physical plant design and federal and state legislation and regulation lagged far behind on both surveys.

Research and evaluation, which was not included in the Pre-Workshop Survey, was ranked sixth. The remaining issues were grouped relatively closely, but with an aggregate ranking far behind the top six. It was interesting to note that the issue of national curriculum was ranked last. This would suggest that the issue is no longer the controversial topic it once was when electronic distance learning was first introduced.

If it is assumed that the workshop participants are a representative sample of the educational community, the observations gleaned from both the Pre- and Post-Workshop Surveys tend to indicate that the principal issues are generic and could literally apply across other disciplines and innovations in the schools. Teacher preparation, certification, training for administrators, financing, partnerships and research are issues not unique to telecommunications. Perhaps the over-arching issue is the integration of telecommunications technology in the educational process.

A Synopsis of the National Workshop on Education and Telecommunications Technologies

During the first day of the Workshop, participants discussed broad issues associated with national educational reform and opportunities for linking schools with telecommunications networks. There was general recognition that national policies associated with universal access to education—offered by the nation's public schools—and universal access to information services—offered by the nation's telecommunications infrastructure—were converging. Cooperative planning for the integration of conventional and alternative educational delivery systems needs to be conducted at the national, state and local levels.

National Versus Federal Policies

The participants accepted the role of the federal government in conducting demonstrations in connection with policy studies, research and evaluation, and in the regulating of public and private activities. However, they were more intent on identifying national policies and private cooperation, as well as clarifying federal, state and local responsibilities. Michael Goldstein indicated that we tend to use national and federal policy interchangeably. "They're really two different things." National policies need not originate from federal officials—they can result from decisions at other levels of government—for example, the governors. The Star Schools Program represents a federal effort that encourages national policy. National policies could clarify what the governors should do, what the federal government should do and options for local school districts (Goldstein). Clearly, there is a need for a national policy that encourages state and local actions (Goldstein). The government's role is a complex one. Its motives need to reflect overall public policy considerations—recognizing that commercial interests may have more narrow motivations (Maurice Mitchell).

Using Telecommunications Technologies to Improve Science Education

> My point is that what's different about the circumstances now, why we have a chance to use technologies in interesting ways to foster better education in the sciences or anywhere else, is because of the confluence now of communications technologies, information technologies and display technologies.
>
> F. James Rutherford

In his presentation to Workshop participants, James Rutherford indicated we now have at hand the kinds of technologies that allow students essentially to behave like scientists—keeping records, writing reports, modeling, and assessing data banks. "Thinking of technology as delivering set pieces of programs and information is probably the least of it." Rutherford emphasized two points: technologies should be viewed collectively in terms of the character of what it is we want our young people to be like when they come out of school; and the power and full potential of these technologies will not be realized unless we are willing to make more fundamental school reforms. ("It's not to think of them as making the existing system work better.") Rutherford argued for a bold, long-term national strategy—the federal role should be part of a comprehensive approach involving all levels and sectors.

> The real question is how can we, as we have done over and over again, use the federal investment and participation actually to increase the options and flexibility and opportunities at the local and state levels?
>
> F. James Rutherford

Rutherford' proposal for a new federal agency to oversee the design, construction, installation and maintenance of a national telecommunications network seemed to have precipitated the most interest, as well as some anxiety and opposition. "What worries me about a national telecommunications system is that it would not necessarily affect the way teachers teach and students learn," responded Goldstein.

Frank Withrow reminded the participants that "we have had much of this technology available for the past 40 years, . . . that there is a substantial amount of good programs available and that a small percentage, possibly 10 percent, of the schools are making good uses of technology."

Joseph Scherer's response was that there are too many barriers in the public sector. Whittle Communications' entrance into education is an example of a successful bypass of the political structures. "Some place at the national or federal level, there has to be an assertive posture supporting applications of technology."

Robert Shuman also gave some credit to Chris Whittle's Channel One proposal: "It's probably one of the reasons that we're focusing so much on technology today." According to Shuman, "teachers have too much coming at them, . . . and they don't know how to use it." There is a "transfer of technology issue" here and it's unclear which federal agency has the responsibility.

Gregory Benson urged stronger national leadership, and improved information-sharing activities. "There's a considerable amount of ignorance about what other regions and states are doing;" " . . . [S]tate initiatives come and go—depending on the availability of discretionary funds . . . [T]he redundancy across the country is significant."

> In our state, and I would suspect in most states, the proportion of dollars in the budget spent on telecommunications or other technologies is enormous.
>
> Gregory Benson

Changing Role of the Classroom Teacher

The availability of telecommunications facilities will not have much effect unless teachers are trained to use these facilities. According to Sally Johnstone, "we're moving into an environment in which teachers are becoming facilitators." Rutherford suggested that a much wider array of skills and knowledge will be needed—there are not enough highly trained individuals entering teaching, particularly in mathematics and science.

Mitchell expressed concern over "national strategies" and national or federal agencies overstepping their bounds. "If you want to get along with state officials, you'd better be nicer to them."

Beyond Classroom Learning

Arnold Wallace agreed with the overall idea of some type of school-based network to improve the availability of information services. But he cited examples of other nations that use television to reach families and individuals in their homes—successful examples. The greater opportunities for educational telecommunication technologies might be in providing non-traditional and community-based programs.

Integrating State, Local and Regional Networks

Participants periodically discussed and questioned the need for a "national educational telecommunications system." There was less interest in a national network than for a need to establish standards and guidance for integrating existing public and private networks and services. Several participants used the "highway analogy," that educational institutions needed access to national programs and services.

Distinctions Between the "Conduit" and the "System"

Federal, state and commercial interests will all have some role to play in building and maintaining the nation's telecommunications infrastructure, but clearer definitions of "the system" and the "public telecommunications infrastructure" are needed.

There was a general discussion about viewing a "national education telecommunications system" as a solution. Further recognition was given to the importance of a professionally trained and skilled work force and that pre-service college training programs were vitally important.

Kathleen Fulton indicated that we should be more honest about the fact that there is not an abundance of highly competent teachers in science and foreign language, and that distance learning programs represent a reasonably good and practical alternative.

> It is time to establish a "bottom line" in education because anyone who will purport to be a chief executive officer of a school and not provide his or her staff with the most basic telecommunications tool to be a professional is not an effective CEO.
>
> Michael Goldstein

After presentations and discussions of the Department of Education's Star Schools Program and the Department of Commerce's Public Telecommunications Facilities Program (PTFP), some brief comments were made about the status and role of public broadcasting. Larry Dickerson commented that the public broadcasting system had changed considerably since the 1960s and that a good percentage of the PBS schedule was devoted to instructional and educational programming. Dennis Connors indicated that Congress was increasingly interested in improving the education aspects of public broadcasting. Connors cited several examples of PTFP-funded programs involving educational program delivery.

After Richard Hezel's discussion of statewide educational networks, Gregory Benson and Inabeth Miller emphasized the need for comprehensive planning and an analysis of what's working. Benson reiterated his comment that states are already spending a considerable amount of money on telecommunications services and programs. He said state officials should deal with three basic questions: How much are we spending? What can we show in terms of benefits and outcomes? Are there other ways that we can achieve those outcomes more cost-effectively?

In reviewing the presentations and discussions during the first day of the Workshop, Mitchell commented on the dilemma of "public" versus "educational" programming. As a nation, we need to come to terms with the role and responsibilities of the public broadcasting system. Mitchell made the point that a considerable effort needs to go into the production of programs that address particular curricular demands, rather than general audience programs that often fail to meet the specific needs of teachers and schools.

In his final comments the first day, Mitchell noted that examining telecommunications issues relating to education was extremely difficult because responsibilities and controls are so diffuse. There is a paucity of good hard research—too many decisions are based on anecdotal evidence.

Partnership and Long-Term Planning Around Educational Goals

Throughout the discussions, workshop participants recognized the need for educational institutions to build alliances and partnerships with other public and private agencies and institutions. There was concern that many equipment procurement decisions did not consider the long-term public and educational interests. Cooperative relationships between educational institutions and public and private broadcasters would reduce inappropriate purchases. However, Louis Bransford indicated that some partnerships brought "mixed blessings;" they were mostly desirable when not established as "forced marriages" to satisfy pressures to "do something innovative."

Interstate Partnerships

Interstate certification and accreditation issues were clearly difficult barriers to overcome. The Star Schools projects broke new ground in this area as programs crossed multiple state lines. Regional consortia were seen as one solution to this difficulty.

> Every industry or business that has survived has applied technology appropriately. Education has not. I think it's interesting to note that the interstate highway system was rationalized for "defense

purposes." Educators need to recognize the value of a national telecommunications system.

Gregory Benson

Unfortunately, technology and technology-based solutions are proposed without the full consideration of public or educational interests. Goldstein said that too many advocates for change and improvement in education fail to appreciate the complexity of the learning process. He urged policymakers to "tie the application of technology to the current set of national educational goals."

I think the idea is to focus on educational outcomes and then go back to work out how technology can achieve these outcomes.

Michael Goldstein

Scherer noted that there has been a shift in expenditures for "instructional materials," including spending in technology. "We're now at around 3.5 percent of the school's instructional expenditures, which is higher than the 1 percent estimated in 1983." Goldstein countered that this increase may be due to the rising costs of textbooks and school supplies.

Johnstone remarked that while we are obviously getting more information about total expenditures, we're not getting good research and evaluation information about effectiveness—particularly the effectiveness of using technologies to reach unmotivated students.

Someone said to me a few years ago if the Army found they could train recruits to operate a tank in five hours instead of five days with videodisc, there's no question that they would implement the technology program immediately.

Sally Johnstone

Participants agreed there's much to be learned from current demonstration projects, such as the Star Schools Program and the Annenberg/CPB telecourses developed for postsecondary education.

It was more important to "build consensus around national educational goals," argued Shuman, than try to figure out what each technology and each network could do. Shuman cited the example of the handicapped regulations, Sections 503 and 504 which established access to educational facilities as a national goal. "People all of a sudden figured out how to build ramps and buses . . . ." Once there is consensus for a national educational goal, "then I think the job of the government is to put in place a framework that encourages that to happen, and it could include financing." (Shuman)

Holznagel responded by saying the current set of national educational goals doesn't give us a sense of the vision. "What do we expect schools and teachers to do differently?" He said we need to help educators, particularly teachers, understand the value of these new technologies.

The "Vision Thing"

To facilitate the development of a national consensus on the role of telecommunications in improving education, several participants stressed the importance of "a vision." Firestone pointed out that "technology should empower" the classroom teacher. "Ultimately, we may be able to reach all schools and students, but what should happen at the end of this process?" Charles Firestone questioned.

Mitchell noted his concern over the possibility of a "$500 million flop." Who would take the risk in suggesting major investments in educational technology? He said, "It's politically profitable to be critical of education today." If this workshop is about "determining pathways for better uses of technology, we should recognize that this world is not waiting for us to tell them what to do."

My library is full of books on what's wrong with education, but not very many on what's good about it.

Maurice Mitchell

Most participants agreed that "using the medium to get the message out" was what would help policy makers understand the "vision." Withrow suggested the major broadcast networks and several cable programs were starting to depict the vision. Some participants agreed that Chris Whittle (Channel One) and several others in the private sector were bypassing bureaucratic structures and demonstrating a vision of what could be accomplished.

A teacher listens to all the education bashing and says, yes, probably there's some truth in that but on balance when I go home at night I did the best I could under the circumstances I'm living with here.

Don Holznagel

Scherer agreed with earlier comments that information relating to successful educational technology prospects needed to be shared. "There are many wonderful positive examples." Scherer emphasized the point that it's not only business that knows how to apply instructional technologies.

The National Education Goals: A Good Place to Begin in Establishing Objectives

> The current crisis is not terribly different from the situation triggered in the late 1950s by Sputnik.
>
> Maurice Mitchell

Mitchell suggested a followup meeting of top-notch legal scholars to assist the Congress and state officials in drafting new legislation—legislation that would authorize funds for making substantive improvements. Mitchell and Bransford agreed that there was need for a national leader, someone well-known and respected, who could champion the cause of educational technology. Previous legislative movements have depended heavily on national advocates, they argued.

> I strongly support moving toward a vision based on the current set of national goals.
>
> Charles Firestone

Firestone urged the development of a set of objectives—objectives that the U.S. Department of Education could accept. The first objective should relate to the "empowerment of students to obtain education and knowledge in a variety of settings, and give teachers the technology necessary to motivate students to learn."

The second objective for the Department should be to "provide a clearinghouse of useful information to schools, administrators, teachers."

The third objective should be to determine the transmission systems necessary to provide teachers and schools with the programs and information they need. Possibly, this last objective could be accomplished in part through the Department of Commerce's Public Telecommunications Facilities Program (PTFP).

Goldstein thought the Post-Workshop Survey identified actions for developing national objectives. "What do we need to do in teacher preparation?" "What do we need to do in telecommunications training for school administrators?" "What do we need to do with interstate certification and accreditation?" According to Goldstein, these objectives provide guidelines for new legislation. This legislation, he explained, should recognize the research and information requirements and encourage state and regional networks and partnerships necessary to carry out the agenda.

Participants agreed on the importance of capturing a vision and establishing a bold set of objectives, as well as identifying a "champion" who would pave the way for introducing technologies for education purposes. Nevertheless, several participants pointed out the realities of the political environment and possible negative reactions to a "radical overhaul of education." They agreed with Goldstein that any change would have to be incremental and that many institutions, including public schools, should participate in the reform. Museums and public libraries were cited as prospective educational technology application centers.

Fulton commented that proposals for expanding the uses of learning technologies should incorporate multiple visions of how learning takes place. Scherer indicated that pressures to make wider uses of instructional technology will continue to come from the "outside," from parents and not from the school officials. Hezel suggested that the "markets for technology" are multiple—state legislators, state superintendents, and school board members. Each of these audiences needs different amounts and levels of information. Hezel said that the commercial vendors were not responsible for research, evaluation and policy analysis; the federal role in sharing information with these different groups is crucial.

In a closing comment, Mitchell indicated that the Department of Education needed to draw upon experiences of the past three decades, and recognize that the public educational system has been remarkably successful. Much of the severe criticism of public education has not contributed to improvements or to the identification of sound models for improvement. He thought the nation's educators were accepting of change and open to suggestion of how and where students should learn.

Mitchell once again noted that too many proposals for change and improvement were based on anecdotal evidence and that the tough questions confronting schools and technology required hard evidence and, possibly, big expenditures. He concurred with the suggested strategy to establish national educational goals and the development of specific objectives which would serve as legislative specifications for Congressional and state actions.

The agenda and strategies accepted and recommended by the participants at the two-day Workshop at the Annenberg School of Communications were quite similar to those incorporated in the report by the National Task Force on Educational Technology four years earlier (ED/OERI, April 1986). They argued that the needs of the nation's school system would not be met if technology is allowed to percolate

randomly, and that technology not be allowed to determine educational goals, but must be used to achieve them.

Participants urged new institutional mechanisms at all levels of government—national, state and local—which would encourage demonstrations involving a wide array and mix of hybrid technologies. But, the likelihood that the integration of formal education and telecommunication networks would come about without the issuances of new legislative and policy mandates from federal and state officials was doubtful. They did not accept the need for single or dedicated a "national educational telecommunications system," but did recognize the need for the development and use of "multiple delivery systems" and stronger national leadership and coordination.

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