DOCUMENT RESUME

ED 323 909 IR 014 463

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TITLE The Promise of Distance Learning. Policy Briefs Number Eight.
INSTITUTION Far West Lab. for Educational Research and Development, San Francisco, Calif.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE 89
CONTRACT 400-86-0009
NOTE 15p.
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Assisted Instruction; Cost Effectiveness; *Distance Education; Educational Policy; *Educational Television; Elementary Secondary Education; Higher Education; Instructional Development; *Interaction; Program Implementation; *Rural Schools; *Small Schools; Telecommunications
IDENTIFIERS Arizona; *Audiographics; California; *Interactive Instructional Television; Nevada; Two Way Television; Utah

ABSTRACT

Designed to help educators and policymakers consider the effective use of currently-evolving distance learning technologies, this policy brief examines: (1) the need for distance learning; (2) the most promising combinations of technologies (two-way television, one-way television with audio return, and audiographics); (3) the cost-effectiveness of these three technology systems; (4) actual projects using these three systems; and (5) the issues of policy implementation that districts and states are likely to encounter. Inserts report on current applications of distance education in Arizona, California, Nevada, and Utah. (8 references) (GL)

FAR WEST LABORATORY

1989

POLICY BRIEFS

NUMBER EIGHT

The Promise of Distance Learning

Dean Bradshaw and Patricia Brown

Introduction

For some, the term distance learning may still call up old images of educational television. Students packed around a TV screen, while a "talking face" dispensed information. Or it may prompt memories of correspondence classes with their obscure method of routine assignments and anonymous graders. But in the 1980s, with the development of more sophisticated technologies, distance learning is taking new interactive forms that let teachers hear as well as speak to, and even see, students at remote locations.

Throughout the western region and other parts of the country educators are discovering that when designed and implemented well, live two-way instruction across long distances can expand curriculum, stretch budgets, and broaden student horizons, improving both teaching quality and student performance.

To help educators and policymakers consider effective use of these still-evolving technologies, this Policy Brief examines 1) the need for distance learning, 2) the most promising combinations of technologies — two-way television, one-way TV with audio return, and audiographics, 3) actual projects using these three technology systems, and, 4) the issues of policy implementation that districts and states are likely to encounter.

Far West Laboratory for Educational Research and Development serves the four-state region of Arizona, California, Nevada, and Utah, working with educators at all levels to plan and carry out school improvements. Part of our mission is to help state department staff, district superintendents, school principals, and classroom teachers keep abreast of the best current thinking and practice.

The Need for Distance Learning

Schools can use distance education to provide courses and opportunities they would otherwise be unable to offer. An estimated one third of the country's school children get an inadequate education because of limited staff and resources related to small school size and geographic isolation. Frequently, small, rural schools cannot attract sufficient numbers of qualified teachers in highly specialized areas. Often they don't have enough students to justify placing needed subject-certified teachers in each remote school. If, to meet state mandates, a district offers a required course at great cost, other parts of its program suffer.

Today, both rural and inner-city schools face new demands for better performance and access to a broader, more rigorous curriculum. Both have been hit severely by shortages of qualified teachers, especially in math and science. Inner-city schools, like rural ones, may not find enough students ready for advanced and specialized courses to support them economically, which deprives those students who could benefit.

What both urban and rural districts need is a more efficient and effective distribution of resources that does not require the relocation of staff. This is exactly the promise that the new distance learning technologies hold.

The New Technologies

Three new technologies make live two-way interaction possible: two-way television, one-way TV with audio return, and audiographics. These differ in the degree of live classroom simulation, in ease of operation, and in cost. All three differ from educational television in that they do not require expensive formal program development, and they provide a way for students to communicate with the teacher.

Here we will briefly describe each of the three systems in terms of their basic technologies and costs. While this is clearly a rapidly developing and highly technical field, we hope to give the reader at least a sense of the possibilities available and choices to be made.

Two-Way Television. This option, the costliest and most complex to operate and maintain, comes as close as technology can to bringing teacher and students into the same classroom. Each site in a two-way TV system resembles a little TV studio, with camera, microphones and monitors. Activities at each site are transmitted simultaneously so teachers and students across a wide area can both see and hear each other "live." Due

to the high degree to which it simulates a normal classroom, two-way TV is suitable for virtually all kinds of courses.

Its relatively high costs rise dramatically with increased distance between sites, which usually confines use of two-way TV within a limited geographic area. If transmission is by microwave and the terrain is rough, costs rise further. The sophistication of the technology makes two-way TV the most difficult of the three options to operate. It is also the most prone to technical problems; an engineer or well-trained technician should be on-call within easy travelling distance if not on-site. Some school districts enter maintenance partnerships with universities, cable, utility or local broadcast companies. To fully utilize the strengths of this system, teachers need to be thoroughly trained in the range of possibilities available, what works and what doesn't.

One-Way TV with Audio Return. Less costly than two-way TV, this system resembles traditional educational television except that students talk back by telephone or radio. The students at remote sites can see the teacher on their television monitor, but the teacher cannot see them. However, students can speak to the teacher by phone or FM radio during class to ask questions. Both the inquiry and the teacher's answers may be broadcast, although the large networks that distribute courses nationally use teaching assistants to help handle the large volume of student inquiries. The system can gain increased interactivity from telefaxing "hard copy" materials and other computer-linked enhancements. With its visual component, one-way TV can work for large-group instruction featuring teacher presentation as well as smaller group teaching.

Costs for setting up receiving sites are low. All that is required are TV and telephones and perhaps a satellite or microwave receiving station. But as schools develop broadcasting capacity, costs rise and maintenance requires the same technical expertise and training as two-way TV.

Audiographics. The least costly option and the simplest to operate, audiographics is the combined use of voice transmission, computer networking, and telefax transfer of materials. Teacher and students hear but do not see each other. In addition to speaking to the receiving classes, the instructor can use a digitized drawing pad and keyboard to "draw" on a computer monitor screen. The image immediately appears on students' screens at the remote sites. Students, in turn, use their own drawing pad and keyboards, as well as a speaker phone, to interact with the teacher. Adding a facsimile machine provides rapid transmission of paper "hard copies" of tests, hand-outs, and other materials. Districts in Colorado and Utah supplement audiographics with slow-scan TV that sends fixed visual images over the same phone line that carries voice and data.

Audiographics is typically the most economical of the three technologies, with costs tied to long-distance telephone rates and maintenance handled by a teacher with a few days training. Audiographics works best with small groups — usually no more than a dozen students at a time — and has been especially successful with foreign language, special group instruction, math and physics. The absence of two-way visual contacts puts a greater premium on attractive presentations by the teachers to maintain student attention.

Costs

Distance learning allows districts to expand high quality services while containing costs. The initial costs of installing a sophisticated distance learning capability can vary tremendously and in some cases may be more expensive per pupil than "traditional" classroom instruction. However, the long-term savings and benefits may outweigh these initial costs.

Assessing overall system costs is an extremely complex process, and consultation with a distance learning technology specialist will provide the most accurate profile. Realistic comparisons depend not only on fixed factors like technology and distance but also on the number of students served. The best estimates of installation costs will come from a bidding process, but this process cannot provide the longer-run ongoing costs of operation, maintenance, system replacement, course development, software and other materials, which will vary dramatically for different districts and projects.

For a minimal two-way TV system, ballpark figures for initial installation start at around $14,000 per site. But studio construction and equipment for the central broadcast site start at about $35,000. Long-distance transmission costs range from $6,000 per mile for fiber optic to $25,000 per 20-mile microwave hop and $85,000 per 50-mile hop. For one-way TV, receiving site costs are under $1,000, but fees paid to a central broadcast studio must also be figured in. Distance will not affect costs for one-way TV significantly within the signal area. Audiographic installation runs about $6,000 per site. Daily operating costs are tied to long-distance telephone rates. One rule of thumb: Annual maintenance and repair will cost four percent of initial installation.

What's Happening Now

While many of the oldest and most extensive projects have been started by universities, extension campuses, and community colleges, this review covers only K-12 systems. To give the reader a sense of distance learning's potential, we describe an example of each of the technologies discussed here and one system failure. These examples range from nationwide satellite networks to projects linking just two schools in a district. Many of these projects are still in their infancy. But evaluations overwhelmingly indicate that, when planned well, distance learning works.

In two-way educational TV, Minnesota is the national leader. Supported by an enthusiastic legislature, each district in the state is encouraged to join with others nearby to expand distance learning opportunities. Districts plan their own projects, the state reviews the plans, and projects are jointly funded.

In a thorough 1987 evaluation, K. Kitchen found that despite two-way television's expense in Minnesota, it is cost effective. Through cooperation, sharing expertise and resources, Minnesota districts have been able to offer an enlarged curriculum and have expanded community and adult education. In some instances this resource sharing has allowed small rural districts to survive.

Response to the system has been highly favorable. In Kitchen's evaluation 75% of tele-teachers said they would choose to teach on the system again, enjoying its challenge and growth opportunities. Teachers also felt that students in the remote sites learn as much, like the classes as well, and spend as much time on task as they would in traditional classes.

This is not to say there are no weaknesses. In another evaluation by Morehouse, Hoaglund, and Schmidt (1987) teachers and students noted the lack of personal contact, space and movement restrictions technical problems, and problems with conflicting school schedules and make-up work. Yet comparison of final grades and test scores for students in remote classes with those in traditional classrooms clearly indicates that the medium works. One evaluator (Windschill, 1988) concluded that students in remote classes learn as well as those in regular classes.

Three duplex video projects in Utah report similar results. In all classes, students at the receiving schools did as well or better than the students in the traditional or "live" situation (Ellertson, 1987). One American Government instructor reported that students actually work harder and prepare better for their "on camera" performances. Their speaking skills, he said, improved rapidly.

San Antonio, Texas, is the home of TI-IN, the largest of the nation's several one-way satellite TV networks with a telephone return. In 1988, TI-IN beamed approximately 25 different high school credit courses to more than 200 high schools in 14 states. All North Carolina schools recently subscribed, using state appropriated funds. The system will be further expanded under the newly funded national Star Schools Program. The network also broadcasts extensive inservice courses for teachers. Course development in these large networks is provided by the central broadcaster and individual schools, or districts subscribe to the courses or programs they desire.

An evaluation of the TI-IN system by Barker (1987) indicates that users and administrators perceive interactive one-way TV programming as "useful," "effective," and "good." Students report liking the teachers and finding the courses "interesting." They reported initiating two to three telephone calls per week to the TV instructor. And 75% say that though classes are impersonal, they would enjoy taking another class.

When programs are broadcast openly, instructors indicate that many adults tune in. Parents will often view the same courses in which their children are enrolled. Senior citizens will watch, and some even do the assignments.

Again, there are concerns: Users of these widely distributed satellite classes said that they often do not meet local curriculum needs. Moreover, some remote-site students feel more like observers than participants.

Other very active and successful networks include Oklahoma State University with its Arts and Sciences Teleconferencing Service, the Eastern Washington University Satellite Telecommunication Educational Programming Network (STEP), and Talcott Mountain Science Center, Avon, Connecticut, with its SciStar Satellite series. Courses offered by these networks include such advanced classes as German, Russian, trigonometry, calculus, and chemistry. In 1986, the Kentucky legislature approved a multi-million dollar plan that will add a satellite uplink and 1,650 downlink dishes to its existing broadcast system. Every elementary, vocational, and secondary school will be linked to the system, as well as libraries, colleges, and universities.

On a smaller scale, low-power TV cooperatives are rapidly forming across the country For example, the Region IV Educational Service Center in Houston, Texas, runs the InterAct Instructional Television Network, serving seven Gulf Coast counties using a broadcast facility atop Houston's tallest skyscraper The audio return comes into the studios via FM radio.

The audiographic systems pioneered by Henry Jolly and Todd Stubbs in the Garfield School District of Utah use an "electronic chalkboard" for instant communication between teacher and student. Far West Laboratory has been actively involved in expanding the use of audiographics into the Great Basin area of northwest Utah where districts have made further advancements. The Great Basin project simultaneously transmits data and voice communication using just one telephone line. A multiplexing modem splits the frequencies, using part of the band for audio and part for data. This innovation significantly reduces the operational costs of the system over long distances.

The Pennsylvania State Department of Education has invested heavily in audiographics and is reaping great returns. Tele-teachers receive across-the-board support and encouragement from state and district management. In one evaluation (Murray, 1987), a calculus teacher noted, "Teaching has never been so easy." A district superintendent called audiographics "a dream come true." In a voluminous study of the Pennsylvania system Wydra

(1987) concludes that a delivery system based on interactive audiographics is at least as effective as live teaching and in certain instances more so.

Poorly Designed Systems Do Not Work

Such systems, carefully designed and well implemented, are generally successful. But beware. **Poorly designed systems with inadequate support will fail.** The most notorious example is the Learn Alaska Network In 1982, after the State of Alaska spent $30 million to purchase and install statewide telecommunications technology, the network went on the air riding a wave of confidence. Four years later the system was closed down.

Why did this "cadillac" of distance technology fail? According to the major evaluation by Hersfield (1986), the answer lies in the planning and operation. Learn Alaska, he says, "was doomed to failure." The system was too costly, its operations under funded, and the governance structure ineffective. The audience of 30,000 native Alaskans was not large enough to justify the magnitude of the system, and after the enormous initial cost, only $200,000 was allocated annually for programming Educators and broadcasters clashed over program content versus production quality. University of Alaska departments struggled to control the network and use of programming funds.

Building Successful Projects

From successes and failures we can determine that the following elements are critical to a project's success

An Explicit Educational Need or Goal. Distance learning projects that work start from a clear educational need, not from a particular mode of transmission. They are not technology driven. If there isn't a coherent, well-planned program addressing significant educational needs, with quality courses and enthusiastic, well-trained teachers, then new machines sit idle or, perhaps worse, fail to bring meaningful learning results

Learning Audience. Assessing the learning audience and the educational need go hand in hand. What are the characteristics of the project's learners, their current and potential numbers, their age, sophistication, and geographic concentration? Whether planned courses are elementary, secondary, or adult, whether they will be remedial, basic, or advanced, they must be tailored to the real needs of real learners

Early Involvement of Key Parties All collaborative and innovative educational programs depend on the enthusiastic support of all parties — policymakers, administrators, teachers, program developers, and outside partners (institutions of higher education or businesses). Participant consensus on the project's goals, scope, support required, and method of evaluation, is vital to success Without this common agreement achieved by working together in all stages of the project, even well designed efforts fail from conflict or poor support.

A Fruitful Governance Structure. At whatever stage a project becomes formalized, its governance structure should be made clear. Identifying key parties to include in the governance process, outlining the roles and decisions appropriate for various levels (state, region, district, school, or classroom), and defining procedures for resolving conflicts, are all essential elements of a fruitful governance structure Depending on size and complexity of the project there might be several centers of decision-making involving different role types. A large project might include a Superintendents' Committee, a Principals' Committee, and a Teacher Committee. Representatives from each might report to the others or be part of a larger governing board. Smaller projects might collapse some of these committees together. In all cases, the governance structure should ensure leadership, clear direction, participation, and procedures for making decisions

Careful Teacher Selection. Teleteachers require certain qualities. Most important are a willingness to get comfortable with the technology and plan teaching with a view to its strengths and weaknesses. Other important characteristics include voice quality, self-confidence, stage presence, a flair for the dramatic and spontaneous creativity. While these are characteristics most teachers need, they are especially critical for teaching "in absentia."

Effective Teacher Training. Both tele-teachers and receiving-site aides need thorough training in the new delivery system Perhaps nothing has so crippled technology-based innovations in education as much as inadequate training and untimely involvement of teachers and aides Training should focus on the actual system used. For the most effective "tele-teaching," teachers may find or-camera performance training a better method than simple trial and error without serious assessment. The most successful projects place a trained aide at the receiving site with students to operate equipment, evaluate homework, and monitor testing and behavior

Creative Use of Materials Whether courses are planned by a large design team or the single teleteacher, they should be geared to take advantage of the technology's potentials while offsetting its weaknesses Visual aids, for example, become of crucial importance when teacher-student interaction is limited. In an audiographic system, students can't watch the teacher, so computer visuals should be planned for an entire presentation

Computer Use. Computer-assisted instruction along with creative use of other materials have a special role in distance learning projects. Computers stimulate interaction among students as they work on them in small groups. Interaction with the computer can replace interaction with the teacher to some extent

Setting Experts suggest receiving sites be warm and bright with

pleasant colors and a relaxing ambience. The room needs to be a quiet place with good acoustics. Furnishings should be arranged to allow full group viewing as well as small group activities and individual study. A minimum room size of 300 square feet or 30 square feet per student is suggested for audiographics or one-way TV, and 600 square feet for two-way TV sites. Technical help needs to be available at school or within a short drive.

Issues for Policy Discussion

States and districts inevitably face issues of policy direction as they construct distance learning projects. Most of these need to be addressed directly before a project is begun.

Clearly one of the major issues to be addressed is **who will control and direct distance learning projects.** A state may set a clear direction by putting forth a central plan or by encouraging district initiatives. Schools and districts may initiate, plan, and implement projects on their own. Whichever, a state exerts a strong influence on this local decision-making by its funding patterns, curriculum guidelines, certification standards, provision of local technical assistance and, perhaps most importantly, in its persuasive articulation of educational goals.

An important policy question that often remains implicit is should the state support the **preservation of small local schools** unable to offer a full range of courses taught by qualified teachers efficiently. Once it is acknowledged that such a decision has been made despite these schools' difficulties, states face an obligation to offer their students an adequate education at politically justifiable costs. This provides a clear rationale for state policy on distance education.

States face the issue of **whether specific funding should be earmarked for distance education and the bases for its allocation.** General state funding formulas based on attendance and teacher-student ratios may require modification in distance learning situations, since they are hard to apply to courses serving hundreds of students in different districts.

Location of stable project funding is be a key concern. Multi-year funding becomes an issue not only of educational opportunity but of efficiency if heavy start-up investment is wasted due to erratic operational funding for essentials like maintenance and teacher training. The alternative to steady funding may become the "add-on syndrome," long a bane of educational innovation, when "soft" funding allows construction of an isolated project, which then withers when funding expires, wasting large amounts of investment and effort, often demoralizing students and teachers.

A chronic funding question likely to arise at both local and state levels is how **much of a budget will go to "high-tech" distance learning projects.** If there is no clearly predetermined limit, there is often a tendency to buy the most expensive systems which, with their exciting potential, tend to inspire the most enthusiasm. Districts or states may want to consider setting a maximum percentage of supplies/materials budgets to go to distance learning projects and a minimum percentage for traditional resources like libraries and textbooks. If there is the usual potential for dissension between technology enthusiasts and skeptics, a local policy assuring both views are represented in such ongoing choices may maximize what can be accomplished well.

Another budgeting issue that must be addressed is balancing **expenditures for different parts of the project.** Reliable funding is needed for planning, purchasing and installing the hardware, teacher and staff training, program development, maintenance, and system replacement. Too often funding is adequate for the splashy parts of the project — equipment and supplies — but cut short for training and maintenance. Too little training of teachers and staff, inadequate maintenance, and insufficient time for program development can sabotage a project of any type, but projects involving technology are especially vulnerable. If innovations fail from poor preparation and unreliability, then the original fears and skepticism of teachers and students will dominate

If wide area distribution is involved, educators will face concerns about local curriculum development. While each course is an individual case, decisions about course programming can be both controversial and important. Local curriculum creation tends to heighten teacher control and involvement, along with specific course applicability to local needs. The issue of course programming is also **critical where there are local or state mandates for course content and sequencing.** At times, constraints of staff time, cost and expertise make local programming an expensive approach yielding a less than adequate product, requiring schools to tap into resources of nearby projects or national distributors. Previewing courses for quality and appropriateness is essential. Local adaption of outside curricula, when practical, may bring some advantages of both approaches.

New questions will also likely be raised about **state standards on teacher certification, school accreditation, maximum class size and teacher-student contact hours.** The best use of distance learning may require rethinking and adjusting of these standards. In order to allow teachers to instruct across state lines or to let students take university-offered courses by non-certificated professors, distance learning projects may be declared "experimental," exempting them from usual requirements. Such exemptions do require specific actions from school boards and even state departments of education, making these non-trivial issues.

Whether states or districts are developing distance learning

projects, there is a question of how much of a commitment to distance learning needs to be made at the beginning of a project. Experience suggests that projects have a smoother history, better decisions are made, and local conditions are more easily adapted to when distance learning projects start small and grow. The testing of small pilot programs provides the opportunity for working out the kinks, persuading skeptics, and developing a strong technical core for future expansion. There are two risks in starting small: the promise may be bigger than the delivery, and the initial enthusiasm for distance learning may wane as other issues take top billing on the policy agenda.

Conclusion

Distance learning offers a new set of technologies to deal with an educational need which has become more critical as our educational system upgrades its standards and expectations. Small, rural schools have always had difficulty offering specialized advanced courses and have required teachers to work in multiple content areas. But this traditional dilemma is drastically worsened by increased graduation and college entrance requirements and the shortage of qualified teachers. These same conditions of rising expectations with inadequate resources confront urban inner-city schools.

What distance learning promises in both rural and urban settings is a economical way to provide a quality education program when resources and qualified personnel are not available. The technology itself, while complicated, is not unduly so. Experience clearly shows that it works. Yet it also shows that distance learning projects must be well-planned and adequately supported or they will go the way of so many past innovations. Successful efforts need to be driven by an educational need, supported by administrators, school staff, and teachers, have ongoing technical and financial support, and be integrated into the daily operation of the school. These attributes are not unique to distance learning — they are in fact the attributes of most successful projects — yet, they remain the challenge.

A fuller treatment of this subject, The Promise of Distance Learning *by Dean Bradshaw, is available from Far West Laboratory.*

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Briefs is published by the Far West Laboratory for Educational Research and Development. The publication is supported by federal funds from the U.S. Department of Education, Office of Educational Research and Improvement, contract no. 400-86-0009. The contents of this publication do not necessarily reflect the views or policies of the Department of Education, nor does mention of trade names, commercial products or organizations, imply endorsement by the United States Government. Reprint rights are granted with proper credit.

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Distance Learning in California

David B. Coe

California has no formal state policy on the use of distance learning in education. Because of this, no policies are in place for appropriation or the application of funding, coordination among service providers and users, or guidelines for faculty and administration. Yet this absence has not stopped school districts and other educational agencies from implementing a decentralized, bottom-up, grass roots approach to distance learning, a movement which encourages entrepreneurial endeavors and independent problem solving towards meeting the demands of an ever-changing student population.

Such a movement has not been cost free. Little coordination exists among the California State University System (CSU), the University of California System, the California Community College System, the California Post-Secondary Education Commission (CPEC), the Department of Education and various schools, districts, counties and nonprofit and profit consortia who have either independently or on a system-wide basis promoted the use of distance learning in education.

California has 1,028 school districts serving 4.4 million K-12 students. Approximately, 400 of these are small, rural, districts with fewer than 2,500 students. Serving the higher education community are 106 community colleges in 70 districts, 19 campuses in the California State University System (CSU), and nine campuses within the University of California system plus many private institutions. Within these sectors, distance education is implemented at different levels of coverage through a variety of consortia. Currently, CSU, CPEC, the Department of Education, and the Northern and Southern California Consortia of Community Colleges are addressing the need for coordination, standards for adequate service, and a formal state support policy.

State Support of Technology

Through AB 803 California has invested heavily in classroom technology, but not in distance education. AB 803 provided seed money for instructional technology programs, instructional television, and computer purchases through a district-matching grant program. For the 1988-89 academic year, $13 million will be allocated for classroom technology. However, the provisions of this 1983 law are ending, and the legislature is now examining alternatives.

The Distance Learning Players

Educational agencies implementing distance learning projects have established both local and national reputations. The California State University System (CSU) has much advanced programming, and its Chico campus leads the state in the field of distance education. Of the 19 CSU campuses, 14 use different types of distance-education programming, such as ITFS and satel lite. Member campuses hold more than 30 ITFS licenses, and CSU-Chico is one of two universities nationwide that has two satellite uplinks transmitting high school and college courses to districts, off campus programs, and private industry. Various other CSU campuses have ITFS systems including the Los Angeles Basin ITFS Network, the Central Valley Microwave Network, and POLYNET. Cal State Pomona is nationally recognized for POLYNET, which offers distant learning classes to area high schools. Despite these programs, Dr David Levielle of the CSU Chancellor's office says "the involvement is minimal compared to what instructional technology can do as a whole. What is important is to establish a system that is sensitive to each CSU campus, recognizing that not all of the campuses are or can be like Chico."

With a C-band up-link, CSU-Chico has provided live satellite instruction with ITFS repeater towers for four years. Currently, Chico offers a masters degree in computer science through distance education and will soon offer a bachelors degree. The university also offers degree programs via satellite including social science and a paralegal program, and minors in California studies, family relations, gerontology, and sociology. Chico has established educational partnerships with such corporate purchasers as Hewlett-Packard, Texas Instruments, IBM, General Dynamics.

Through a grant from the national Star Schools Program the TI-IN Network is expanding its California base with Chico as the California uplink site. TI-IN is an interactive educational network offering classes to more than 200 high schools in 14 states. Currently, the network is connected to seven California school districts and is planning to broadcast to 15 more school sites in 1989.

The California community colleges lead in the development of instructional materials for distance learning. The Northern California Telecommunications Consortium and the Southern California Corporation for Community College Telecommunications function as non-profit agencies producing courses for community

colleges. At present, both consortia offer a total of 52 transferable courses through audio, video, or print to approximately 23,000 part-time students.

Community college educators feel that state policy restricts the type of distance learning courses they can offer. The California Educational Code places a cap on community colleges thereby limiting their growth in serving a diverse audience of students. The educational code specifies that only non vocational, transferable courses taught through distance technology to no more than 125 students per class will be funded by the state. Usually these are ITFS courses offered by cable and/or open broadcast. Other courses financed through local monies and student fees, are less likely to be offered through distance education. Even with the change from formula to program funding legislated in AB 1725(1988), this restrictive funding policy is not likely to change.

In K-12, the primary focus for current projects is on computer technology and instructional television for high schools. Several public television stations actively develop and market instructional materials, especially KQED in San Francisco. The California Instructional Video Consortia (CIVC) made up of the seven original ITV agencies in the state, the SDOE, Sacramento Educational Cable Consortium, and a few other educational agencies actively develop instructional programs for students and staff development. Examples of other California programs are:

- The Regional Education Television Advisory Council (RETAC) in Los Angeles County, provides similar ITV services to both elementary and secondary level programs to eight counties in Southern California.
- The Dos Palos Joint Union High School District in Merced County participates in ITFS courses through San Joaquin Delta College and Stanislaus State University, Merced Community College, and interactive satellite courses through Cal Poly in Pomona.

Funding for these and other programs is provided by county offices of education, PBS stations, per-capita SDE grants through AB 803, along with district monies.

In the fall of 1988, Los Angeles County began a most ambitious venture of staff development broadcasting. The County Office of Education offers twenty hours of staff development programming per month through the Educational Television Network (ETN) to 60 of the 81 school districts in the county. The program costs $1 million per year There are 57,000 teachers in the county, and this program is clearly a cost effective way of delivering services to this large number of teachers. Presently, programming is coordinated with the state curriculum frameworks in English-Language Arts and Mathematics. Dr. Robert Babcock of the Los Angeles County Educational Office is the architect of this program. He views this as a step "into the 21st century." The program uses trained content facilitators in the classroom during the broadcast and employs teachers in the writing of training materials as well as on the air broadcasting. The long-range goals of the project are to build a state-wide delivery system, marketed through county offices of education.

Approaches Toward Coordination

The California Post-Secondary Commission (CPEC) is developing a technology plan for public education. In December 1987, CPEC directed its policy task force to provide the governor with information about legislative and financial steps he can take to achieve important educational objectives through technology. Task force members include CSU, UC, the State Department of Education Technology Division representing K-12, community colleges and private industry (Apple Computers, Pacific Bell and AT&T). The report is due June 1989.

In addition, CSU is reviewing its own system-wide use of technology through the Commission on Instructional Technology. The goals of the commission are to elevate distance learning to a policy level, to understand why instructional technology is not used more effectively within CSU, and to promote distance learning implementation sensitive to each campus's needs.

Conclusion

In a survey on telecommunications in education, Hazal (1987) found that coordinated planning is harder in states where agencies have already established telecommunication domains. In California, the incorporation of technology in the regular learning process varies highly in different segments of education and on different campuses. While several substantial networks are well established, there is ample room for coordination, direction, and statewide incentives to continue to build partnerships that further distance learning, especially given the promise of distance learning to address resource equity and quality issues in education. Such leadership is needed if distance learning is to fulfill its promise.

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" . . . As Rapidly as Possible" Distance Learning in Utah

Michael Murphy

Utah's Educational Needs

Utah may well have more than its share of educational problems, since a larger percentage of its population attends public schools than any other state. Utah schools house the second highest pupil-to-teacher ratio nationally while struggling with the lowest per-capita income. Core classes in suburban schools sometimes have as many as 45 students per period. While Utah students generally do well on "normed" tests, they fall far below the national average in math, and a shortage of qualified teachers exists in science, language arts, and the foreign languages.

These problems are most acute in rural schools. Though rural classes may be small, qualified teachers are rare, budgets scanty, and curriculum offerings often inadequate. The Utah State Advisory Committee on Small Schools stated that the needs of rural students are not met by regular course programming.

Introducing Audiographics Delivery

As bad as these circumstances are, they present a fertile environment for distance learning. Garfield School District, the epitome of a troubled rural school, initiated the state's first interactive audiographics project following the far-reaching vision of an innovative superintendent and a creative teacher. Added science and math curriculum, transmitted over phone lines from Dixie Junior College, 120 miles away, had a positive impact on students. Unfortunately, when both the teacher and superintendent relocated, the project died.

In 1985 Northeastern Utah Educational Service Center (NUES) received a Utah State Office of Education (USOE) productivity grant to replicate the Garfield project. A state Impact Grant paid for installation of a two-way television microwave system connecting with the state system near Salt Lake City and terminating near the Wyoming border.

Because the audio system could transmit audiographics instead of using telephone lines, and NUES had audiographics but not adequate TV equipment, a hybrid system was created. Since then, some TV production equipment has been purchased, and an ITFS (low-powered TV) system has been added. Through this mix and match of technology, the project now offers a full daytime schedule of secondary core, AP, and concurrent enrollment courses.

Late in 1987, representatives from Box Elder, Tintic, and Millard districts, aided by specialists from Far West Laboratory and the USOE, developed the Great Basin Project for distance learning that draws on the resources available in large schools to provide more cost effective instruction to students in small, remote settings. An interactive audiographics system transmits instruction over existing local telephone lines. Schools use a new type of modem that splits frequencies, transmitting two-way signals simultaneously and requiring only one phone line, which cuts costs by 50 percent. Slow-scan video and hard copy transmission (Fax machines) are to be added, and all elements will be compatible on one phone line. CONTEL, US West, and Beehive phone companies, aided by TWL LABS, worked six months to develop new circuitry that allows multiple schools to network over a single phone line.

The first courses, offered in the fall of 1988, included applied physics, advanced math, eleventh and twelfth grade English, and computer-assisted drafting (CAD). French I was soon added. Three more schools joined and will soon receive courses. Nine other secondary schools plan to join, and three more districts are interested. When completed, the network will serve one-fourth of Utah.

Two-way Television

Carbon School District, in a poor area of east-central Utah, developed a duplex video or two-way TV project that linked its three secondary schools. Funded by a USOE productivity grant of $120,000, TV signals transmit via coaxial cable and microwave, with a satellite downlink added in 1985. This link delivered an accelerated Spanish course from the USOE-IBM-Bonneville International Consortium to a junior high and the remote East Carbon High School. All classes are totally interactive. Classroom learning is managed by an aide, and scores on the final standardized test show that East Carbon students, as a class, rank in the top five among 28 schools.

In 1986 the system connected by cable with the College of Eastern Utah as a subject-matter origination site In 1987 fiber optics replaced the cable, allowing up to 21 courses per quarter and facilitating a new concurrent enrollment plan Students at

participating sites receive both college and high school credit. A third-party evaluator found that the high school students at remote sites outperform the college students in all three courses.

The project is now being joined to the Utah State microwave system so Carbon schools can receive interactive television programs from other regions, especially urban Salt Lake City. The state system is also being extended into neighboring Emery School District, which will add two high schools to the network. Plans for the Carbon project include connecting with a local cable company (TCI) to provide services to neighboring communities and a link to high schools in the rest of Southeastern Utah for a regional network of one college and nine high schools. In turn, this network will unite with other sectors via the state microwave system.

Utah's largest school district, San Juan, is hundreds of miles from any large metropolis and contains some of the most remote countryside remaining in the United States. School enrollment is approximately 3,500 students with 50 percent of Native American descent. Two of the district's four high schools — White Horse and Monument Valley — are small, remote, and located within Navajo Nation lands. Good teachers are hard to hire and keep, and curriculum offerings are inadequate. In response to Navajo Nation demands for educational parity, the district sought and received several USOE productivity grants in 1984. The result is a $600,000 interactive television system. The district's high schools are now linked not only with two-way video, but also with multichannel audio — "a model system," according to the vendor.

Classes began in 1987, but Mother Nature temporarily shut down operations mid-year with a tremendous lightning strike atop Abajo Peak. Then excessive cloud cover and undersized storage batteries at another microwave site stopped the solar-powered unit for a time, but with larger batteries and a new transmitter the system has worked flawlessly. It is currently used every hour of the school day and most evenings. Courses include business English, college English, calculus, general science, marketing, AP history, French II, and psychology. A baseline data comparison of participating students shows that their performance equals that of traditionally taught pupils. Future plans include another channel to increase the interactive capacity.

Broadcast TV with an Audio Return

Nurtured by the University of Utah Media Services Department, the state has slowly built a complex microwave network capable of transmitting two-way television and several added channels of audio for voice and/or data. The university also operates two broadcast channels, with one signal extended over 95 percent of the state by a translator system.

Two years ago the Central Utah Educational Service Center, with the cooperation of the University Media Services Department and USOE, organized a one-way TV (with audio return) statewide distribution system to extend the services of its best teachers to central Utah and other areas.

Distance Learning and the Utah State Office of Education

Until recently, the Utah State Office of Education has followed a laissez faire policy regarding distance education, believing that locally developed programs are more creative, meet local needs better, and engender a stronger sense of ownership and pride among local districts. The USOE has secured annual funding from the legislature to encourage increased educational productivity, and substantial amounts have gone to districts for distance technology.

In 1987 the Utah State Board of Education assigned USOE staff to implement distance learning "as rapidly as possible." But because a common direction, coordination among districts, and elimination of duplication has not characterized the productivity grant program to date, USOE staff decided that a statewide needs assessment would be the best first step in developing a master plan. Staff members hope to have that an approved master plan ready for implementation by the 1989-90 school year.

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Distance Learning in Nevada

Myrna Matranga

Introduction

What constitutes reasonably equal educational opportunity within a state characterized by contrasts? In Nevada, promoting educational equity is an on-going challenge. Policymakers are continually grappling with issues that are mutually important to the state's rural and urban school districts. Population sparsity and geographical isolation make distance learning a vital tool for delivering educational services in Nevada, a tool now being developed into a strong statewide program.

Nevada has over 160,000 K-12 students in two urban districts and 15 rural county-wide districts. In some rural districts, bus rides to school of up to 60-70 miles one way are not unusual. In others there are elementary and secondary schools with enrollments that range from 32 students in grades 7-12 in White Pine County, to 40 students in grades K-6 in Esmeralda County, to 100-400 students in several other counties In contrast, Clark County and Washoe County serving Las Vegas and Reno, enroll approximately 100 000 and 35,000 students respectively.

While one-room schoolhouses have provided some of the state's most creative learning environments, a nagging concern about curricular enrichment keeps these districts seeking ways to assure a more equitable educational opportunity. All the rural county school districts have Chapter 1 programs. However, few of these schools have comprehensive vocational education curricula, foreign language teaching capabilities or advanced science programs Rural districts are also experiencing difficulties meeting new high school graduation requirements which now include four credits of English, two credits of science, one credit of arts or humanities and a half credit of computer literacy, and has strengthened its entrance requirements.

Distance Learning Activities

Nevada is on the brink of several important steps in expanding its technological capacity and service in regard to distance learning. Although one legislator recently expressed regret that the educational community has moved slowly in this direction, he is encouraged by the enthusiasm growing along with the state's increased knowledge of the technological potential in the classroom. To him, the time for distance education in Nevada is now.

In 1987, the Nevada Legislature passed ACR68 which required the State Department of General Services to study the needs of all state agencies, including education, regarding the potential to improve services through the use of technology. This report recommends developing "a pilot program to evaluate the potential of a statewide integrated voice, data, and video network." As envisioned in this report, the network will be primarily for interoffice communication but, in education, can definitely be used for staff development, specialty courses, and intercampus communication.

According to Dr. Frank South, the State Department of Education plans to move ahead with the study's recommendations that include evaluating the development of a statewide ITFS network similar to Clark County's and expanding the use of one-way video transmission with audio-return, such as the system being used in White Pine and Lincoln Counties. In addition, he reports that the state department of education is negotiating with Nevada Bell to develop a two-way television pilot program where the telephone company has fiber optic lines.

The state legislature has also established funding for distance learning opportunities between White Pine and Lund High Schools. Jack Havertape, Superintendent of Schools in White Pine County, is "elated" with the progress they have made. This year they offer audiographics transmission with drawing tablets, computers, FAX machines, and two-way audio continuously during the school day. Chemistry, Algebra II, English, advanced English, and psychology are all transmitted from White Pine High School to Lund High School. This may be the only audiograhic system in the country offering high school chemistry.

The University of Nevada is currently constructing its own ITFS system to be operated by UNR. It should be operational January, 1989, in the Reno/Sparks, Carson City, and Minden/ Gardenville areas. Eventually the system will provide programmed instruction to off-campus locations, including primary and secondary schools, state agencies, and industry.

The oldest distance learning project in Nevada is in Clark County. Clark County has operated an extensive educational network for over 20 years which offers 36 courses through five local television channels. These services are available as a supplement to regular classroom activities and are also used by

homebound students, adults, and other groups of students who cannot attend school.

Several districts are pursuing one-way television options through national networks. Lander County has a link to the Discovery Channel and is already using several of their courses in the local high school. Schools in White Pine and Lincoln counties participate in interactive courses via satellite and are also using the national TI-IN Network out of San Antonio, Texas. Lincoln County is conducting a cost analysis of this service by comparing foreign language courses provided by TI-IN with traditional classroom delivery.

Superintendents in several other rural counties also express an interest in exploring distance learning opportunities as well. In Nye County, Superintendent Robert Ragar reports a strong possibility of joining the national TI-IN Network. Elko and Pershing Counties want to develop technology as a way to expand services. Battle Mountain, Lovelock, and Winnemucca counties are discussing the possibility of developing a consortium on distance learning.

Conclusion

Nevada is a fertile area for distance learning. The expanse between population centers and the sparsity of population in many areas create conditions that make it difficult and inefficient to provide comprehensive educational services. Interest in exploring the possibilities of distance learning is high. According to an official in the State Department of Education, virtually every county in Nevada looks favorably upon distance learning as a way to expand services economically. But a catalyst is needed to transform the excitement and interest of policymakers into action. Districts need leadership and coordination to further distance learning opportunities.

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Telecommunications and Distance Learning in Arizona

Robert T. Stout and Kathryn Kilroy

In Arizona, policymakers and practitioners have demonstrated a growing interest in using technology for instruction. But a history of inadequate facilities and technology has impeded progress. For example, in 1980, the Arizona State University Teacher Corps Project sponsored a national satellite-assisted interactive television conference called "Enhancing State-wide Professional Development Programs." Though developed locally in cooperation with station KAET in Phoenix, the conference was broadcast from Denver due to lack of available technology in Arizona

At least four influences are coalescing to justify strong advances in distance education. 1) Phoenix and Tucson, with 80 percent of the population, are now characterized by traffic congestion, highly diverse life- and employment styles, and multiple needs for information, 2) Arizona is committed to economic development of its sparsely populated rural areas, requiring access to the information and intellectual resources in the cities, 3) The cost of buying, maintaining, and running sophisticated information systems lies outside the capability of single agencies, 4) Arizona's economy depends on the electronics industry for a large portion of its productivity.

General Telecommunications Projects

Multiple agencies and technologies already deliver educational services via telecommunications in Arizona. Several community colleges in the state offer courses and provide information by radio. Conferences, portions of courses, advising, and registration are offered through telephone conferencing.

The Arizona Educational Information System (AEIS), begun in 1972 and housed at Arizona State University, is a 100-member consortium of school districts and education agencies in Arizona, Alaska, California, Colorado, New Mexico, Oregon, Texas, and Washington. AEIS staff provide technical assistance, training, and prepackaged research packets on current topics, delivering about 4,000 in 1987-88.

The Arizona Department of Education (ADOE) is working to link all of the vocational education projects by computer. The ADOE provides training, equipment, and software that allows school districts to participate in electronic mail and data networks within the state. Potentially, this network can provide significant opportunities for department staff and project directors to exchange information and plan activities.

The public universities also have extensive abilities to send and receive data through on- and off-campus networks. Some government agencies have accounts with the universities that enable them to exchange information with other users. Other agencies belong to computer information networks

Distance Learning Projects

Founded in 1945, the Arizona Instructional Network (AIM-NET) is a private nonprofit corporation affiliated with Arizona State University and dedicated to providing media support to the schools. AIM-NET offers film and video circulation, technical assistance for ITFS, cable, broadcast, and satellite instructional programs, and other related services to about 125 nonprofit educational institutions such as public and private schools, state agencies, hospitals, and other service organizations.

Arizona School Services through Educational Technology (ASSET) is another consortium involving public and private schools and state agencies ASSET members — about 100 school districts — television courses that have sequenced lessons and teacher guides. Members provide 60 percent of ASSET's $500,000 yearly budget, with the balance funded by the Arizona legislature. Housed at Arizona State University, ASSET uses both KAET (Phoenix) and KUAT (Tucson) for two hours daily, five days a week during the school year. Currently, 97 academic courses are available, with concentrations in elementary language arts programs and secondary science courses.

Many school districts use cable TV to broadcast school-related matters. Some larger districts have on-site production capacity to produce intradistrict courses For example, the superintendent in rural Cochise County has equipped all schools with receivers for satellite television. The public universities and community colleges broadcast about 20 television courses per semester via cable networks.

Arizona State University has established an instructional television fixed service (ITFS) system for subscriber corporations Through ITFS, 46 courses are currently broadcast live to 16 subscribers and two branches of the university.

The Future of Distance Learning in Arizona

Three major efforts are underway in Arizona to coordinate and advance the use of technology. First, the Navajo Nation, working with the Navajo Community College, is building a television production and reception capability, intending to broadcast 12-20 hours per day and transmit Navajo language and culture programs in direct and interactive formats. The Navajo Community College Television Network now has nine operating sites, four fully licensed microwave sites, one production studio, and three FCC-licensed low-power broadcast stations. The network will eventually link 12 disperse Navajo communities in Arizona and New Mexico

Second, the Arizona Department of Administration (ADOA) has begun to talk about constructing a statewide telecommunications network. In 1987, ADOA representatives and major service providers throughout the state met and formed a consortium, the Arizona Educational Telecommunications Cooperative. Membership includes state public education entities. The cooperative's mission is to help public educational agencies fulfill their teaching, research, community service, and administrative functions via planning, development, and use of tele-communications. The cooperative will not own or operate facilities, but will encourage better use of existing and proposed facilities. It will also have a small, full-time staff and will be advised by user Councils that make recommendations to the Board of Directors and its membership on facility use, programming, research uses, and community services. Combinations of microwave, leased telephone circuits, and ITFS systems will transmit. Plans call for links among most of the state's population basins, with outreach to neighboring areas.

Finally, the Arizona Department of Education has begun aggressively planning a telecommunications master plan. Superintendent C. Diane Bishop has appointed a director of telecommunications with responsibilities to extend the department's ability to serve school districts via telecommunications technology. This effort relates to three of Bishop's major goals. assistance to small and rural school districts, literacy attainment, and increasing the management information capacity of the department. Eventually wide ranges of data can be exchanged between the department and the 250 or so school districts

A large-scale needs assessment of Arizona school districts is now underway for this plan. Findings will go to small groups of school district personnel and department staff who will then propose directions for the department and the Arizona Board of Education. Ultimately, a master plan will be presented for approval to the Arizona Board of Education and, if approved, will be submitted to the legislature during the 1989-1990 session. According to Superintendent Bishop, "We need to provide better and more efficient services to schools particularly rural and small schools We need to implement model programs which maximize the delivery of education in Arizona's K-12 system."

Clearly, leaders in Arizona view telecommunication technology as a promising tool to expand and enrich the delivery of education and related services statewide. Districts, colleges, and universities have long cooperated in projects using the latest technology to improve communications and services. The state's emerging role is to further promote and coordinate the use of this technology to benefit students.

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