POLICY BRIEF

The Promise and the Power
of Distance Learning in Rural Education

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The Rural School and Community Trust (Rural Trust) is the premier national nonprofit organization addressing the crucial relationship between good schools and thriving rural communities. Working in some of the poorest, most challenging rural places, the Rural Trust involves young people in learning linked to their communities, improves the quality of teaching and school leadership, advocates for appropriate state educational policies, and addresses the critical issue of funding for rural schools.

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PART I: INTRODUCTION

Revolutionizing the Concept of 'Schooling'

For most people the word 'school' still conjures up a mental image of metal desks, a fondly remembered teacher standing in front of a chalky blackboard, a basketball or football rivalry, cramming for tests, and the senior prom. In the age of new technologies and advanced telecommunications, is the concept of 'schooling' likely to change? Will it mean, as some have said, the eventual elimination of schools as we know them or will technology-enabled education and distance learning expand educational opportunity both within and outside the traditional classroom? The vast majority of rural elementary and secondary students still ride school busses and attend schools that have changed very little, at least in organization and structure, from the schools of a hundred years ago.

However, a rapidly growing number of rural students are increasingly involved in some form of distance learning for all or part of the school day (or night). The precise long-term impact of distance learning technologies on schooling will not be known for several years. But this paper embraces the likelihood that distance learning will revolutionize the concept of 'schooling'—not by abandoning schools and individualizing and isolating students in the process, but rather by enhancing individual and class educational opportunities most often in the context of a school. The concept of schooling will surely be altered in the process, but the school as a social and educational institution will undoubtedly remain.

The Context: Rural Schools and Rural Communities

One-third of America's schoolchildren attend schools in places of fewer than 25,000 people. One in five are in places with fewer than 2,500 people. Nearly one-third (31.3%) of public schools are in these very rural places. In 12 states—Alaska, Arkansas, Iowa, Kentucky, Maine, Nebraska, New Hampshire, North Carolina, South Dakota, Vermont, West Virginia, and Wyoming—rural and small town children are a majority in the public elementary and secondary schools.[1]

The schools that educate one-third of our children living in rural places are unique and diverse. One common characteristic shared by most rural schools is their size—they are generally small in comparison to most urban and suburban schools. Nearly 54 percent of rural and small town secondary schools (grades 9-12) have enrollments of 400 or fewer students.[2]

Extensive research findings[3] show that small schools and districts graduate a higher percentage of students and drop-out rates are lower in small schools. In small schools and districts, there is less violence, less vandalism, a heightened sense of belonging, better attendance, and members of the community, including parents, are more involved.

The importance of rural schools to their communities is significant and the educational value of retaining small, community-based schools is undeniable. But rural schools also face unique challenges:

- *Providing a Comprehensive Curriculum-* Size and/or remote geographic location may prevent small schools from offering a comprehensive curriculum.

All schools are held to state performance standards, but by also setting input or resource standards, such as a high minimum number of credits offered, an additional burden is selectively placed on small schools. Compounding the problem, national teacher shortages in subjects such as math, science, and foreign languages make it harder for small, rural schools to maintain advanced high school course offerings.

- *Recruiting, Retaining and Adequately Paying Teachers* - On average, rural teachers in the U.S. make only 88 percent of the salary of their non-rural peers.[4] With growing teacher shortages and a growing "teacher pay gap"[5] across districts, many small and rural schools may simply not be able to retain or hire new teachers. A 2003 report shows the range in average rural teacher salaries across the U.S. from a low of $24,234 in South Dakota to a high of $49,872 in New Jersey, with a U.S. average of $32,694.[6] While salary is not the only factor involved in attracting or retaining teachers, low teacher salaries weigh heavily against rural schools in the competition for teachers.

- *Meeting the Requirements of No Child Left Behind* - Rural schools have unique problems meeting the No Child Left Behind Act's "highly qualified" teacher requirements, as they struggle to find and hire certified teachers in every subject area. Educational requirements for paraprofessionals, providing supplemental services for students in schools identified as "in need of improvement," and providing for student transfer and options for school choice are all more burdensome to small and rural schools.

- *Funding Shortages and Threats of Consolidation* - State cuts in education funding particularly impact rural schools, which frequently have a low tax base, limited economic development, an aging population, and declining student enrollments. Coupled with the growing number of lawsuits arguing that state governments have a constitutional duty to provide schools with equitable and adequate educational funding,[7] many legislatures often blindly (and with no evidence to support them) turn to school consolidation as a way out of fiscal distress and a way to improve student educational opportunities.[8] It is almost always true that lowering costs through consolidation will be more than offset by higher costs in other areas.[9]

Distance learning is a fitting response to these pressing needs confronted by America's rural schools. Research shows that it can be as effective as classroom learning in terms of student performance.[10] It offers the opportunity for enhanced curriculum and advanced classes, as well as for students to participate in low-enrollment, high-cost classes such as physics, anatomy, chemistry, music theory, or calculus. Along with the academic advantages come economic ones: school size no longer determines the scope or breadth of curriculum offered. Schools of any size can offer a virtually unlimited curriculum without incurring the costs of hiring additional teachers. Savings increase even more if schools participate in distance learning consortiums to share master teachers, personnel and technology costs.

Most importantly, distance learning can enable small schools to remain open and small—thereby embracing more than a half century of educational research showing that smaller schools offer a multitude of educational advantages for students over larger schools.[11]

Purpose of the Paper

Distance learning is here to stay. Its future appears to be unsure only in its direction or extent of growth. This paper focuses on the applicability and potential of two-way interactive television for small and rural K-12 schools as a primary asset in improving educational access and equity and calls for the adoption of enlightened distance learning policies and guidelines at the state and local levels. Appendices include: (1) Characteristics of Major Distance Learning Technologies; (2) Types of Distance Learning Technologies; and (3) a Categorization of State Videoconferencing Policies. The Appendices are followed by a glossary of technical terms (that are also bolded within the text), and list of references.

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PART II: THE PROMISE OF DISTANCE LEARNING

Distance Learning Defined

Simply stated, distance learning is any instructional setting in which teacher and learner are separated by space and/or time. From early correspondence courses that involved remote students completing lessons and mailing them to an instructor for grading, distance learning today has made possible a multitude of newer methods where teacher and learner may be physically separated, but instruction and learning can still occur. In essence, distance learning in its many forms is defined in terms of four main characteristics: learners, time, instruction, and degree of interactivity.

- *Learners* - Distance learning can occur with students learning individually or within a group. On an individual basis, although two students are enrolled in the same distance learning course, one may be at home at the kitchen table, while another is in a school media center. In a class or group setting, a group of students enrolled in a distance learning course might be located in a high school classroom (with no teacher present), while other groups of students may also be participating from an alternative school, charter school, or military computer lab.

- *Time* - Distance learning can occur in **real time**, delayed time, or both. In **real time** or "**synchronous** communication," teacher and students simultaneously interact. In delayed time or "**asynchronous** communication," students can respond to previously developed instruction at their convenience—any time, any place. Increasingly, the line between **synchronous** and **asynchronous** communications is blurred by the blending of technologies.

- *Instruction* - Distance learning instruction can be provided by multiple methods. Students may learn from a teacher, much like in a traditional classroom, or from a set of prepared lessons, usually in the form of computer text and/or graphics. In text/graphics-based instruction, the student may never have contact with a human instructor. Newer forms of distance learning technologies may use a range of instructional or communication formats.

- *Degree of Interactivity* - Distance learning is often divided into "one-way" or "two-way" technologies. In one-way technologies, the learner typically can see and hear the instructor, but the teacher and student cannot spontaneously interact. In two-way distance learning technologies, the student(s) and instructor can see, hear, and interact with each other spontaneously.

Appendix I includes a chart showing the relationship between these four characteristics for each major distance learning technology.

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Advantages of Distance Learning for Small and Rural Schools

- *Academic advantages.* All distance learning technologies offer the opportunity for curriculum enhancement, advanced classes, and the opportunity for students to participate in classes that do not have a locally available certified teacher. Hard-to-staff classes or course scheduling problems caused by the departure of multi-certified teachers are barriers that small schools can easily overcome through distance learning. The opportunity for students to enroll in any number of Advanced Placement or dual-credit courses can offer college-bound students a significant academic advantage, and being able through distance learning to offer courses on an every year basis (as opposed to an alternate year basis) significantly improves students' academic and scheduling options.

- *Economic advantages.* Schools are accustomed to calculating the cost of instruction per student in order to economically justify offering a class. But in doing so, small school administrators—in the name of economic efficiency—are routinely forced to ignore the needs of a handful of students interested in advanced courses such as Anatomy/Physiology or Calculus. They instead favor assigning teachers to classes that can generate larger, more cost-efficient enrollments. Through distance learning, small schools can easily justify expanded curriculums that vary from year to year depending on individual student needs, without the requirement to alter local teacher hiring patterns.

With some forms of distance learning there are no incremental costs. The cost of offering a course for one student can be the same as for a class of twenty; the cost of offering a distance learning course every hour of the day can be the same as for offering one class a day. There are also economic advantages to students having graduated from high school with the equivalent of one semester of college courses already completed through dual-credit programs.

In addition to the primary academic and economic advantages of distance learning are the ancillary benefits that some distance learning technologies can provide, including:

- *Professional development and continuing education opportunities for teachers from across the state or the nation.* Rural teachers can gain additional certification or maintain certification using distance learning technologies without the accompanying costs of time and travel. Professionals with degrees in needed subject areas can complete requirements for alternative certification without leaving their communities.

- *Pre-service teacher education opportunities.* Distance learning technologies can facilitate extended clinical experiences for pre-service teachers and cross-district mentoring relationships between new and experienced teachers, as well as help provide ongoing contact between new teachers and college education faculty.

- *Virtual field trips.* Two-way I-TV technologies can enable students in remote locations to visit any site with similar technology in their state, the country, or the world. Opportunities like talking with NASA astronauts, viewing demonstrations at any number of I-TV-equipped science centers around the country, and visiting numerous art galleries, museums, or exhibits are only the beginning of the world of possibilities open to students at all grade levels, regardless of remoteness or geographic isolation.

- *Collaborative learning.* Distance is no barrier for students and teachers who wish to collaborate on joint research or authentic learning projects when they are equipped with appropriate distance learning technologies. Students in countries around the world can share their views and their experiences with U.S. students. Place-based education takes on whole new parameters when students can share their "place" with others while expanding their own concept of place.

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- *Specialized/ancillary student services.* Speech therapy, psychological testing, counseling, individualized assessments, and gifted education are but a few of the additional services students can access through two-way I-TV technologies.

The Impediments to Distance Learning in Rural Education

Even with significant advantages, considerable barriers exist when rural schools and communities begin their quest to implement distance learning technologies.

1.The "Digital Divide" [12] was the term coined in the 1990's to signify the gap between those areas of the country where access to telecommunications technology—especially Internet access—was readily available and those where it was not. Despite significant progress, much of rural America still looms behind its urban and suburban counterparts across the digital divide. The gap is now defined in terms of access to **broadband** telecommunications technology (high speed lines)[13] and the permeation of telecommunications technology in the workplace.

Prior to implementation of the **E-Rate** program—a telecommunications, Internet access and internal connections discount program—by the Federal Communications Commission in 1997, only 27% of U.S. public school classrooms were connected to the Internet.[14] By 2002, that number was reported to have grown to 99%, while 94% of public schools connected to the Internet reported that they had a **broadband** connection. For rural schools the picture was not quite as rosy. Two percent of rural schools and 7% of rural classrooms still had no Internet access. Ninety-one percent of rural schools had access to wired **broadband** Internet connections and 76% to **wireless broadband**, compared to 97% and 100% in urban schools.[15]

The availability of newer telecommunication technologies in rural areas, while not static, still lags behind that of urban and suburban areas. The E-Rate Program has indeed reduced but not eliminated this disparity. Broadband access costs, required for videoconferencing

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technologies, are typically much more expensive in rural, sparsely populated areas.

2. Rural educators often have limited training, information, and knowledge about the technologies available and how to use them effectively.

3. Technology selection is too often made on the basis of the "least cost," dooming the distance learning program and student success when the technology chosen fails to meet either the needs or expectations of students, parents, or teachers.

4. School district budgets rarely include money for distance learning technology implementation or maintenance and upgrades, forcing schools to rely on the whims of grant availability in order to implement or upgrade their program.

5. The combined lack of available funding and technical assistance places districts at a disadvantage when planning for distance learning technology implementation. The Telemedicine and Distance Learning Program as reauthorized through the USDA in the 2002 Farm Bill continues to be the only significant federal funding source for distance learning networks. Most state funds for distance learning have been curtailed in this era of education budget shortfalls.

6. Small schools lack the resources to attract skilled technology coordinators, making the technical upkeep of distance learning equipment problematic.

7. State education agencies (SEAs) often do not consider it within the scope of their services to provide assistance in selecting distance learning technology or course providers. Left on their own, schools can become unwary targets of unscrupulous vendors.

8. An evaluation component is often not incorporated into the distance learning technology planning and implementation process, leaving schools with no clear understanding of whether—or why—a particular direction succeeded or failed.

Distance Learning—Effective for Student Academic Achievement

At the forefront of many discussions about distance learning is the issue of how well students learn and how satisfied they are compared to traditional classroom learning. But research suggests that students in a distance learning environment learn just as well as traditionally taught students.[16]

Across hundreds of studies conducted in largely non-K-12 environments, "no significant difference" accurately describes the comparison between the achievements of distance learning vs. traditional students. While there is much more research to be done, we do know at this point that distance learning technologies can be just as effective in terms of student performance as traditional classroom instruction and student (and instructor) satisfaction can be very high.

Ensuring Student Success

There are three critical factors that significantly impact the achievement and satisfaction level of distance learning students:

1. *Degree of instructional effectiveness* - Just as in a traditional classroom, this measure is of paramount importance to student achievement. Distance learning advocates often say that distance learning technologies will not improve a *bad* teacher, but they can enhance the capabilities of a *good* teacher. Ultimately, what is most important is the instructor's knowledge and ability to convey information, encourage participatory learning, coach students through the learning process, and ensure that students can apply what is learned. The technology can facilitate, ignore, or disrupt the learning process, but without a high degree of instructional effectiveness any course—distance learning or traditional—will fail to achieve its goal.

2. *Extent of instructor training and comfort with the technology* - Regardless of the technology used, the instructor must be adequately trained, not just in the technical operation of the equipment, software, or hardware, but more importantly in the ways the technology and instructional techniques will interface. A teacher who believes that he can simply transfer course

notes from a traditional course to a web-based environment is just as ill-prepared to teach a distance learning course as an I-TV teacher who believes that all she has to do is to lecture for fifty minutes. The outcome in both instances will be negative.

3. *Level of student support provided* - Distance learning should not be an isolated process. A support structure for students involved in it is critical for student success. Depending on the distance learning technology, the support structure can include, among many other examples:
    - A school-based facilitator who handles all electronic, faxed, and mailed communication between the remote instructor and local students in an I-TV class.
    - The opportunity for frequent, direct, one-on-one contact between a web-based instructor and distance learning students.
    - A troubleshooter to turn to when technical problems occur.

Distance Learning Technologies—Not All Created Equal

The earliest form of distance learning was the correspondence course—students completed lessons and mailed them to a distant instructor for grading, unassisted by technology beyond the postal system. While traditional correspondence courses still exist, today's distance learning is most often aided by technology, and takes on a multitude of faces, including one-way formats where students receive information only (e.g., audiotapes, CD-ROM, and pre-recorded video) and two-way formats where interaction is at least intermittently possible (e.g., online learning, instruction by satellite, and desktop videoconferencing). For a full list and explanation of today's numerous forms of distance learning technologies, see Appendix II (page 28).

With so many available formats, it's important to know that all distance learning technologies are not created equal—each has a role to play in education, but each cannot equally ensure a positive learning outcome or be appropriate to all learners or in all learning environments. There is a danger in thinking that all distance learning technologies are equivalent in terms of quality of instruction or potential for learning, levels of satisfaction, and student outcomes. Distance learning technologies must not be chosen solely on the basis of lowest cost or ease of implementation. This will likely result in a frustrating experience for students, parents, teachers and administrators. Care must be taken to choose the technology most appropriate to local student needs and to fully implement the technology chosen.

The chart in Appendix I shows how each of the major distance learning technologies can be assessed for its potential for the best student learning outcomes.

Except in specific situations where student needs may dictate otherwise, the best distance learning technologies incorporate the following characteristics:

a) Instructor-led classes are preferable to text or graphics-based instruction.
b) Class-based instruction is preferable to individual instruction.
c) Full-time, two-way audio and video allows for a higher degree of interactivity than does one-way audio (or one-way audio/video).
d) **Synchronous** (**real-time**) instruction and communication is preferable to **asynchronous** (delayed) instruction/communication.

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Part III - The Power of Distance Learning in Rural Education

Choosing the Right Distance Learning Technology: I-TV

The goal of any distance learning course should be to maximize *both* student achievement and student satisfaction. While there are certainly scenarios under which virtually all distance learning technologies may be appropriate, two-way interactive television (I-TV) provides the best technology foundation for small and rural K-12 schools to meet their needs to enhance curriculum offerings, stem the effect of teacher shortages, provide for ongoing teacher professional development, and meet the requirements of *No Child Left Behind*.[17] In a technologically advancing world, schools with a foundation in two-way I-TV can easily and effectively bridge into the many and varied 'blended technology' options increasingly available, as the need and technical capabilities arise. Through I-TV, small rural districts can achieve a high level of empowerment and equity in course offerings while not being restricted by their size.

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Two-way interactive TV, as typically implemented, is the distance learning technology that most closely mimics a traditional classroom. It is taught by a live, human, real-time instructor to a class of students who are present at the same time (although located at different sites); it allows for students and instructor to simultaneously see, hear, and communicate with each other throughout the class. It is therefore the technology which is *most likely* to enable higher student achievement and a greater level of student, teacher, and parent satisfaction.

Two-Way I-TV—A Strategy for Saving Rural Schools

The cost of two-way I-TV technology has dramatically decreased in the last decade, making it both a wise educational and economic investment for small schools or districts. With the range of potential uses of two-way I-TV, the cost of the equipment and ongoing transmission lines is certainly justifiable. When comparing the costs of consolidation—including new facilities, increased transportation costs, increased administrative costs, higher dropout rates, etc.—and the costs of implementing two-way I-TV capabilities across small districts, the better option is clear.

Implementing I-TV allows small schools to retain all of the assets of small size, while overcoming curricular limitations. Through I-TV, small districts can share their teaching assets across all districts in their consortium or beyond. Hiring patterns can reflect the needs of the consortium, rather than the needs of individual districts. For instance, if one school hires a Spanish teacher and another hires a French teacher, all schools in the consortium can then offer students both Spanish and French as foreign language options. Physics can cease to be an every other year offering, as sufficient enrollment numbers accumulate across districts each year. Chemistry can be offered by a dedicated and qualified teacher to students across all consortium schools via I-TV with a centralized lab set up on alternating Saturdays.

Students can graduate from small high schools with the equivalent of a semester or more of dual or AP credit, given their access to a wide range of advanced classes. Through I-TV, the possibilities are endless. One or two students in each of several small schools in a consortium can access limited demand classes, without the prohibitive cost-per-pupil associated with traditional hiring of on-site teachers, even if they could be found. And, the potential for providing ancillary services via I-TV has only begun to be realized, including speech therapy provided by a regionally hired speech therapist; psychometric testing provided through a partnering higher education institution or college of education; diagnostic health services or nutrition workshops provided through a regional health clinic; state or regional child and family support services offered through a local school nurse; vocational rehabilitation services offered in conjunction with a regional practitioner; diagnostic testing for special needs students; and more.

The Rural Trust has amassed an impressive set of research studies and policy papers that speak to the academic and social advantages of small schools.[18] Adding two-way I-TV technology to the capabilities of small and rural schools only enhances their value to the students and communities they serve. No longer should consolidation be seen as the only or best alternative for increasing the quality or quantity of curricular offerings—the costs, in all forms, are simply too great, and I-TV is too viable as an alternative.

A Road Map to K-12 I-TV Implementation[19]

I-TV Adopters' Checklist[20]

If districts that implement distance learning follow the following step-by-step checklist as first promoted in *Virtual Classrooms: Educational Opportunity Through Two-Way Interactive Television* (Hobbs and Christianson, 1997) and reprised in *Recommended Standards, Guidelines, and Resources for K-12 Two-Way Interactive Television Network* (2002), the successful implementation of the technology will be greatly enhanced. Hobbs and Christianson (1997) provide a detailed description of the implementation steps included below.

- **Step 1: Assess Your Need for I-TV**
  Decide what you want to accomplish: expanded high school course offerings, dual-credit courses, virtual/electronic field trips, teacher professional development, continuing education, community/adult education, and/or community/economic development.

- **Step 2: Build Support for I-TV Within the Local School and Community**
  Involve teachers, administrators, counselors, and technical and other school staff in the investigation process. Incorporate the Board of Education and work with the community in planning for I-TV.

- **Step 3: Research the Technology Options—Doing the Homework**
  Determine what technologies are available to you and the advantages and disadvantages of each. See the technologies in operation—visit classrooms where distance learning classes are in progress. Involve a cohort of teachers, administrators, and board members in site visits. Determine your need for expert help. Above all, match local needs with the technologies available.

- **Step 4: Form an I-TV Consortium or Partnership**
  Identify school districts who are interested in a distance learning consortium partnership. Determine likely community and higher education partners. Secure a commitment from school district partners to adopt a collaborative calendar and common bell schedule. Identify a consortium director.

- **Step 5: Determine Your Transmission Options**
  Identify what your options are for transporting audio/video signals. Work with telecommunications providers, SEAs, state networks or vendors in selecting the optimum transmission mode to meet your educational requirements. Identify providers and understand and compare costs.

- **Step 6: Identify Sources for I-TV Classroom Equipment**
  Locate multiple equipment vendors who can bid on I-TV classroom equipment that meets *your* educational requirements.

- **Step 7: Understand Classroom Equipment, Facility, and Training Requirements**
  Work with vendors or consultants to choose an optimum I-TV classroom, and together manage lighting and sound control issues. Determine the appropriate furniture requirements. Understand recommended equipment standards and requirements for I-TV teacher training.

- **Step 8: Develop a Plan of Operation**
  Develop consortium bylaws and network policies and identify a fiscal agent for the consortium. Determine the basis for achieving equity among sending and receiving districts. Develop a collaborative calendar, common bell schedule, develop a consortium budget, and an I-TV course schedule. Establish enrollment policies and procedures. Secure commitment from I-TV teachers and arrange for their training. Prepare the I-TV classroom and install equipment. Write operational guidelines for I-TV classrooms. Develop a plan for community use.

- **Step 9: Maximize I-TV Usage**
  Explore all options for use of the I-TV classroom by students across all grade levels, teachers, administrators, staff, ancillary personnel, local government, community organizations, and citizens.

- **Step 10: Evaluate the Program After Implementation**
  Weigh the benefits against the costs. Maintain an ongoing evaluation process which includes both student achievement and satisfaction components. Systematically identify problems or frustrations as they arise and work toward their elimination.

Using an I-TV Consortium to Deliver Distance Learning

Schools frequently band together when cooperative efforts make common and economic sense and have done so throughout history. Special education cooperatives, vocational-technical consortiums, educational service cooperatives, and insurance collectives all are mainstays in school district operations that allow individual school districts to collaboratively meet needs not feasible if they were to operate on their own. But most educational technologies do not depend on cooperative or collaborative efforts across school districts. Therefore the idea of a distance learning consortium may not be readily apparent to many school administrators. I-TV differs from other educational technologies because its optimum use depends heavily on a cooperative organizational arrangement among schools or across school districts.

An I-TV consortium typically consists of a number of small schools or districts, all of which have a defined need for additional classes. Similarly sized schools or districts are optimum consortium partners. The consortium model also works best when *all* consortium members both send and receive classes. This places all member districts on equal footing and best contributes to the long-term viability of the consortium.

The Advantages of I-TV Consortium Development

The advantages of a consortium arrangement in the implementation and operation of I-TV programs stems from the ability of multiple schools to share resources—financial and instructional.

Advantages of a consortium arrangement include:

- Sharing teachers – Schools unable to hire teachers in a particular curriculum area can mix and match their needs with other consortium members.
- Overcoming local teacher shortages, especially in critical needs areas.
- Maximizing usage of the I-TV network investment by using a collaborative calendar and common bell schedule.
- Sharing cost of operations, such as those associated with the consortium director's salary, technical support, maintenance agreements, staff development, and/or transmission costs.
- Combining classes with low student enrollments across multiple schools
- Accessibility of a professional peer group for I-TV teachers, counselors, and administrators within an I-TV consortium.
- Using I-TV technology to achieve multiple ancillary purposes across athletic conference members, administrator groups, school health personnel, special education staffs, etc.
- Equal empowerment of all school districts regardless of size.

The Process of Consortium Development

In order to be effective, cooperative arrangements among schools or districts can maximize their chances of success by following a few common-sense suggestions:

a. Determine cluster size.

The optimum size is usually 5-8 districts. This number allows a critical mass of class availability and teachers and remains a workable size organizationally.

b. Identify member districts of an I-TV consortium.

Look at natural affinity groups—geographic proximity, pre-existing relationships (athletic conferences, special education groups, vocational-technical consortiums, etc.), complementary need groups, and similarly sized districts.[21]

c. Identify higher education partners.

Key to the broad utilization of the technology is the early involvement of selected higher education partners. Higher education partners can help to provide access to dual credit courses, professional development training, Advanced Placement opportunities, and other resources. Such a partnership can result in many advantages on both sides. The added resources made available to local schools is as important as well as the broadened access to students on the part of the higher education institution.

d. Identify community partners.

Look for the opportunity to partner with local government offices, health and human service agencies, hospitals, outreach and extension offices, telecommunity centers, or other agencies and organizations that may have a need for I-TV capabilities and see the value of participating in a joint network with area schools. Among the advantages of such a broad I-TV partnership from the schools' point of view is remote access to health consulta-

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tions for school nurses, diagnostic services, mental health services, counseling, speech or other therapy, using area professionals as part-time teaching faculty, etc.

e. Secure commitments to adopt a collaborative calendar and common bell schedule among school district partners.

Without a collaborative school calendar and common bell schedule agreed to by all consortium districts I-TV use is negatively impacted. Classes that begin on different days, at different times, with holiday breaks not in common, and lack coordinated staff development days and mandatory state testing dates, effectively reduce the amount of instructional time involved in I-TV classes operating across multiple districts. What may seem like an occasional variance in schedules in one school is magnified greatly when the entire consortium is considered.

f. Agree on Cross-District Fees

While receiving schools in some I-TV consortiums pay sending schools a fixed rate per enrolled student, a far preferable way of handling cross-district costs is to require that all consortium member schools offer a minimum of one course per year without charging a per pupil fee. In this way, over time, all districts both send and receive courses on par with other consortium member districts and the disincentive to enroll students—charging a per student tuition cost—becomes unnecessary.

g. Identify a consortium director.

A consortium director is typically responsible for a multitude of duties involving I-TV coordination: administration; promotion; training; course development; teacher recruitment; scheduling; calendar and bell schedule development; liaison with school administrators and counselors; budgeting; financial oversight; contract negotiation and oversight; problem resolution; policy development; etc. A consortium director can transcend the hierarchy of a traditional school. He/she can simultaneously relate to the superintendent, principals, board of education, faculty, students, and community outside the traditional role structure associated with these positions. In the absence of a hired consortium director the job usually falls to an existing school administrator already suffering from over commitment, time constraints, and competing priorities.

The Accommodations to Distance

It is important to understand how I-TV works best for teachers and students before it is fully implemented it in a district or school.

1. *Planning Ahead for Tests and Classroom Materials*

I-TV instructors must think ahead! Operationally, I-TV classes work best when: (1) tests are sent to off-site facilitators well in advance of test day, along with instructions for dissemination, test monitoring, etc.; (2) class materials are distributed to students in advance of the date needed; and (3) protocols for sending and receiving information between students and instructor are understood by all.

2. *Handling distance learning paperwork with remote I-TV sites*

In early I-TV networks, course handouts, tests, homework assignments, and other paperwork was routinely mailed, delivered by courier, or faxed. Today most I-TV paperwork can be easily handled through e-mail attachments or web-based course management software.

3. *Identifying a class facilitator*

Even when the teacher can see all sites at all times, it is useful to designate someone—possibly a school secretary or teachers' aide—to handle the day-to-day class facilitation issues such as receipt and transmission of all e-mail, regular mail, faxes, test distribution/ collection, etc. Providing an inbox and outbox for each I-TV class can ensure that materials are handled efficiently and sent to a remote teacher or received by local students in a timely manner. Regular delivery and pickup times, to and from the classroom, e.g., before and after school, will guarantee that materials are handled most expediently.

4. *Maintaining discipline in an I-TV classroom*

While an in-classroom facilitator is typically not required in an I-TV classroom, other techniques prove useful in maintaining discipline. A "student enrollment contract," signed by the student, his/her parent or guardian, and the high school principal can effectively predetermine the consequences of any disciplinary infraction. Typically, the first strike invokes a call to the student's parent and a second strike results in dismissal from the course.

A classroom management plan created by the instructor will help eliminate any confusion as to what is expected behavior, and will clarify all grading scales, late homework policies, and more. Many schools opt to include a small monitor/VCR in the high school principal's office.

Faced with the possibility of the principal tuning in at any point to the students in the local I-TV classroom, disciplinary problems are rare. Simply reminding students that the monitor is on effectively precludes any inclination to share answers during tests. It can also provide ample evidence to a questioning parent. Finally, the existence of a fax/phone with speed dial in each I-TV classroom allows the instructor to immediately reach a remote principal's office in the event of any problem. Such preventive measures are usually sufficient to deter disciplinary problems from occurring at all.

The Costs of Two-Way I-TV

1. *I-TV is a cost-effective strategy for distance learning.* In fact, for less than the cost of a beginning teachers' salary, a district can pay off the up-front equipment costs on a yearly basis, pay annual transmission costs, cover the joint organizational and technical director personnel costs for a consortium, and contribute to an annual maintenance/upgrade fund.

2. *Comparing the Costs of Two-Way I-TV with a Traditional Classroom.* Imagine hiring one teacher who—for less than a beginning teachers' salary—could teach any subject matter, seven periods per day; had no need for a planning hour; could provide unlimited after-hours' professional development training, and could teach community or adult education courses evenings and weekends. This is one way to explain the benefits two-way I-TV technology can bring to a school. As IP-based technologies continue to evolve and improve, the ongoing costs of I-TV will decline even further.

Two-way I-TV allows several small schools cooperating through an I-TV consortium to overcome the limitations of a restricted curriculum or the inability to find or hire teachers in advanced, high-demand curriculum areas. However, it is not a way to eliminate teachers or reduce instructional staff.

Table I. Total Estimated I-TV Costs

Capital and Operating Costs	Base Cost	With Federal E-Rate Discounts	
	With No Discounts	Value of Discount @ 50-74% F/R Lunch Rate (80% Discount)	Net Cost After Discount
A. One-Time Capital Cost Per Classroom			
1. Classroom Equipment (based on 65% equipment eligibility)	$28,000	$14,560	$13,440
Total Capital Cost:	**$28,000**	**$14,560**	**$13,440**
B. Estimated Annual Operating Cost			
1. T-1 line @ average of $500/month	$6,000	$4,800	$1,200
2. I-TV Teacher Training—two teachers trained per district per year @ $300/teacher	$600	--	$600
3. Organizational and technical support for school network consortia—1/10 of $50,000 I-TV network director/technical coordinator budget	$5,000	--	$5,000
4. contribution to equipment repair, replacement, and upgrade fund @ $2,000 per school per year	$2,000	--	$2,000
Total Operating Cost	**$13,600**	**$4,800**	**$8,800**

For less than the cost of a beginning teachers' salary, a district can pay off the up-front equipment costs on a yearly basis, pay annual transmission costs, cover the joint organizational and technical director personnel costs for a consortium, and contribute to an annual maintenance/upgrade fund.

Types of Costs

There are three types of costs to consider when implementing I-TV. The classroom equipment costs represent a one-time, up-front cost. Transmission costs are ongoing and are usually paid on a monthly basis. Finally, support costs are often overlooked as a necessary ingredient for successful implementation of distance learning technologies. Table 1 shows the estimated total costs for implementing I-TV.

1. *One-Time Classroom Equipment Costs*

   Classroom equipment costs are a one-time investment which currently ranges from $7,000 to $28,000 or more, depending on the capabilities desired in each classroom. Typically, for well under $30,000 (including installation and technical training), an I-TV classroom can include a **codec** with multi-point control unit capabilities; instructor, student, and document cameras; three monitors with carts (for students, instructor, and graphics); an instructor console (as the teaching station); a VCR; and a fax machine. Working with an equipment integrator, rather than multiple equipment vendors, will help to ensure a seamless, well-designed system, based on defined school needs rather than pre-packaged equipment "solutions." After applying eligible **E-Rate** discounts[22] a district with a 50-74% free and reduced-price lunch rate would receive an 80% discount on all **E-Rate** eligible costs. **Total Estimated Classroom Equipment Costs After E-Rate Discount: $13,440.**

2. *Ongoing Transmission Line Costs*

   Ongoing transmission costs will typically range from no cost to $3,600 per year, depending on the pre-existence of a statewide **broadband** network through which video transmissions are allowed. If a dedicated **T-1** line is desired or required, the typical (but highly variable) cost is $500 per month. But, all telecommunications costs are eligible for **E-rate** discounts, which will provide 20-90% discounts to the school based on free and reduced-price lunch eligibility. For instance, a school in which 50-74% of students are free or reduced-price lunch-eligible would receive an 80% discount on all telecommunications costs, from basic local service to long distance to distance learning transmission costs.[23]) After **E-rate** discounts, a school paying $6,000/year for a **T-1** line for distance learning would effectively pay only $1,200 per year.

3. *Instructor Training, Network Director/Technical Coordinator, and Maintenance Costs*

   The cost of training an average of two teachers per year in I-TV instruction is estimated to be $300 per teacher or $600 per year. Salary, benefits, and budget for a combined network consortium director and technical coordinator position are estimated at $50,000 a year. With an average of 10 schools in an I-TV consortium, the per school cost would be $5,000 a year. An annual contribution to an equipment maintenance and upgrade fund would add another $2,000 each year to the cost. **Estimated Cost: $7,600**

A Cost Model for Statewide Adoption of Two-Way I-TV

School finance lawsuits have been filed in 46 of the 50 states.[24] In November 2002, for instance, the Arkansas Supreme Court declared the state's system of public education to be unconstitutional because "it is both inequitable and inadequate."[25] The court directed lawmakers to develop a remedy that would make the system constitutional. As the debate about how to best reform Arkansas' education system unfolded, distance learning emerged as a cost-effective and educationally viable strategy to offer students high quality educational opportunities.

In late 2003, the Rural Trust released a cost analysis outlining various scenarios to implement effective distance learning programs for Arkansas' 234 school districts with enrollments of fewer than 1,500 students that were at that time threatened with consolidation. A given in each scenario was organizing small consortia of districts, each of which would develop and operate a two-way I-TV network. Each scenario considered the cost of equipment, services, and infrastructure, and included capital investment and annual operating costs, such as personnel training, ongoing technical support, and the program coordination necessary to assure that the technology is used effectively.

The report showed that the initial capital investment involved in providing two-way I-TV capabilities to the

state's smallest 234 school districts (under 1,500 enrollment) would cost as little as $3.98 million after applicable E-rate discounts. Annual operating costs, again taking advantage of available E-rate discounts, would likely be $2.7 million per year.

	Base Cost	Cost After E-Rate Discounts
Total Capital Cost	$6,772.963	$3,982,163 - $4,960,135*
Total Annual Operating Cost	$4,579,440	$2,726,160

* Depending on whether E-Rate applications are made as a Priority I or Priority II service

Table 2. Estimated Cost of Implementing I-TV in Arkansas' Smallest 234 School Districts

In other words, for far less than the cost of one teacher per school ($19,570 without E-Rate discounts; $11,650 with E-Rate discounts), small Arkansas schools can "share master teachers and students can participate in advanced high school classes in a technically seamless and instructionally sound environment. They can converse with their teacher or with other students just as if they were in the same classroom. Students requiring dual-credit or Advanced Placement classes can access those classes, taught by college faculty, adjunct faculty, or AP-certified instructors, from their own I-TV classroom. Remote students can participate in any virtual field trip from NASA to the Baseball Hall of Fame, from the Bronx Zoo to the California Science Center, from the Field Museum to an elephant sanctuary, and beyond. District faculty can participate in professional development opportunities without the typical time and travel costs involved."[26]

The Arkansas cost analysis clearly shows the economic feasibility of implementing I-TV in small districts on a statewide basis.

Part IV - THE IMPORTANCE AND IMPACT OF STATE AND LOCAL DISTANCE LEARNING POLICIES

What States Are and Should Be Doing: A Summary of State-Level Distance Learning Policy Study Findings, Implications and Recommendations

As distance learning grows in its use, local and state policies that guide schools and districts are increasingly needed. In an effort to help set the stage in the policy arena regarding distance learning, the Regional Technology in Education Consortia (R*TEC) attempted to categorize existing state policies and rules, as they apply specifically to **videoconferencing.** The paper provided both samples (suggested policies) and examples (actual policies with references), which both SEAs and local practitioners might use in creating distance learning policies.[27]

The "actor" or entity responsible for policy development, however, may shift from local school to district to regional agencies to the SEA to state legislative authority depending on the state. In an attempt to explicitly focus on the role of SEAs in the creation of distance learning policies, rules and regulations, the Rural Trust surveyed members of the State Educational Technology Directors Association (SETDA) in April-June 2003 to conduct a study of distance learning policies in existence across the United States. SEA technology directors in 34 states responded to the extensive, 10-page e-mail survey. An analysis of the study is available on the Rural Trust website [**http://www.ruraledu.org**]. Several important study findings are summarized below. Policy implications and recommendations are included as part of this paper, but are not part of the original study and should therefore not be attributed to SETDA. It should also be noted that the burden of implementation cannot fall to state technology directors alone. Likewise, SEAs cannot act in isolation. They are often under legislative or other constraints which impede or restrict their actions. Therefore, in order to fully implement the following recommendations, collaborative action will likely be required by all state-level policy makers.

Extent of Distance Learning Across States and the Potential for Widespread Adoption

Study Findings: Sixty percent of responding states indicate that more than 60% of their districts currently use some form of distance learning technology. These data point to the widespread adoption of distance learning across the U.S., in its many forms. Of equal importance, the potential for the broader adoption of distance learning technologies remains high. Over half of responding state technology directors (55%) said that more than three-fourths of the districts (who had not already done so) are interested in exploring distance learning, but 58% believed that, while the opportunity for schools to implement distance learning technologies is high, high costs and limited access to technology support are major impediments to adoption.

Implications: Distance learning is here to stay. Its widespread adoption, across multiple technologies is likely to continue for the foreseeable future, although the speed of adoption from state to state may vary along with impeding or facilitating factors.

Recommendation:

- *Embrace and facilitate the adoption of appropriate distance learning technologies.*
  Distance learning is not a fad whose time will pass. It will not likely foreshadow an end to schooling as we know it, but the adoption of distance learning technologies will increasingly expand how we look at schools, how schools view themselves, and how SEA policies must evolve along with them. SEAs have been and will continue to be faced with distance learning issues, including how they carry out their role as program monitor, state regulator, and/or assistance provider. Those states with SEAs that embrace and facilitate the adoption of appropriate distance learning technologies enable local schools to use the technology which best meets their needs.

Which Distance Learning Technologies are Most Widespread?

Study Findings: Web-based distance learning technologies and two-way I-TV are the predominant forms of distance learning reported by the states, but all forms of distance learning are used to some extent.

Implications: Current practices indicate the need for multiple distance learning technologies across schools. Limiting a school's choice of technology may not be in the best

As distance learning grows in its use, local and state policies that guide schools and districts are increasingly needed.

interests of students and could delay improvements in technology brought about by experimentation and widespread use.

Recommendations:

- *Allow for the existence of multiple distance learning technologies within states.*
  SEA adherence, promotion, or restriction to a single distance learning technology is probably not in the best interest of small schools—or schools of any size—given the hugely divergent needs and circumstances of students and schools. States should allow schools the option of selecting the distance learning technology that *best* meets their unique student needs.

- *Provide schools with ongoing access to technology selection assistance.*
  SEAs can be helpful to schools interested in distance learning by providing them access to valid, unbiased information about the various forms of distance learning technology available, best implementation practices, and advantages and disadvantages of each.

Impediments to Widespread Adoption of Distance Learning Technologies

Study Findings: The biggest impediment to broader distance learning adoption, as reported, is availability of funds (both local and state), followed by lack of in-district technology support, and affordability of **broadband** access. State regulation is not seen as an impediment to distance learning adoption, with almost 70% of the state technology directors responding to the survey indicating that their SEA was "supportive" or "very supportive" of the promotion of distance learning and the extent to which it enables adoption of distance learning technologies by schools. In only 57% of responding states, however, are state legislatures viewed as supportive of distance learning in schools.

Implications: Without access to a means of implementing distance learning courses, small schools will be placed at a disadvantage in meeting an increasing number of state-mandated course offerings and curbing renewed efforts to consolidate schools. Without state legislative support for distance learning, access will be even more difficult.

Recommendations:

- *Provide adequate state funding for initial I-TV equipment for small schools.*
  With a widespread reduction in funds available for education, nearly all states have seen technology funding reduced or eliminated. A priority should be placed on re-instating non-categorical state funds available for purchasing I-TV classroom equipment. Such funding would be most productive if targeted to small schools.

- *Prioritize funding access to districts based on demonstrated need.*
  Priority for funding should be given to districts that can demonstrate a need for I-TV technology. Technology entitlement funds to all districts or competitive grant funds available only to those who successfully apply will leave small districts incapable of implementing I-TV. Without personnel available with time to devote to grant writing, small schools are placed at a significant disadvantage in the competition for limited funding. The playing field is leveled when demonstrated need, not grant writing skills, is the basis for allocating grant funds.

Statewide Data Networks

Study Findings: Nearly two-thirds of the responding states (63%) currently have a state-subsidized, high-speed data network linking the state. In two states a statewide network is being established, but in 10 responding states schools must seek their own dial-up or **broadband** connections.

Those districts that most need distance learning technologies often have the least access to it—financially or infrastructurally. Schools in states that do not have a state-supported high speed data network are placed at both an economic and access disadvantage.

Implications: Those districts that most need distance learning technologies often have the least access to it—financially or infrastructurally. Schools in states that do not have a state-supported high speed data network are placed at both an economic and access disadvantage. Likewise, a disadvantage is placed on schools in states that limit the **bandwidth** available to schools for I-TV use or have insufficient **bandwidth** to support full-motion video.

Recommendations:

- *Develop and support a statewide, video-capable, high speed data backbone.*

  In states where the legislature has financially supported or authorized the creation of a "video backbone" or data transmission network for school interconnection, school districts can participate in an I-TV network at a fraction of the cost they would otherwise have to pay, even if **broadband** access is otherwise available. A state-supported "video backbone" can go a long way in helping small and rural schools affordably use I-TV technology. There are two requirements, however—the "backbone" must be robust enough to accommodate two-way full-motion audio/video and, unless data and video transmissions are routed over separate networks, the state network should provide schools with the routers and software required for maintaining QoS (quality of service). QoS ensures that audio-video transmissions have priority over data transmissions.

The Current Role of SEAs in Distance Learning Regulation

Study Findings: Local control remains an overriding consideration in issues of distance learning in approximately half of all respondent states, but almost three-fourths of the state technology directors indicate they have at least some authority to set state distance learning policies and establish implementation guidelines. Those guidelines, however, differ widely both with respect to the distance learning technologies encouraged and in the methods recommended. Seventeen percent of responding states indicate that the state places restrictions on the type of distance learning technologies school districts can implement, while two-thirds "encourage" the implementation of specific technologies. More than 80% of respondent states said they encourage the formation of distance learning consortia, while two-thirds of states also promote individual school or district adoption of distance learning technologies.

Implications: The issue of local vs. state control need not be a dichotomy. There is ample room for maintaining a high degree of local control while enabling, facilitating, and recommending distance learning implementation standards and guidelines. The SEA's role can go beyond regulatory and be one of assistance as well. Adopted state policies need not be a top-down mandate, but can result from the collaborative input of distance learning practitioners at the school level, developed with and for the benefit of schools involved in distance learning.

In I-TV, no classroom is an island. The interoperability and compatibility of I-TV classrooms is necessary at both a technical and operational level. I-TV classrooms within a consortium should have identical equipment in order to minimize troubleshooting and maintenance efforts. But it is also important for I-TV classrooms to operate using accepted audio and video equipment standards, so that interoperability problems across districts, consortiums, and states can be minimized. Where state networks exist it is infinitely easier to require standards of interoperability than in those states where each school is left to provide for its own means of transmission.

Recommendations:

- *Provide recommended I-TV implementation standards and guidelines.*

  There is a clear need for state implementation standards and guidelines for I-TV. I-TV adopter schools do not have to work through the large number of implementation decisions alone. By taking advantage of more than a decade's worth of experience in I-TV implementation around the country, SEAs can collect, adopt/adapt/develop, and disseminate recommended standards and guidelines for I-TV adopter schools.

- *Encourage standards of technical interoperability.*

  Until such time that states do implement comprehensive policies, recommended standards, and implementation guidelines to assist districts adopting I-TV technologies, the responsibility for maintaining interoperability and compatibility standards will fall solely at the district or school level.

- *Regulate I-TV courses in the same manner as traditional courses*

  As long as instruction remains **synchronous** (**real-time**), **full-presence** capabilities are maintained (the teacher sees all sites at all times), and I-TV instructors participate in a quality professional

The issue of local vs. state control need not be a dichotomy. There is ample room for maintaining a high degree of local control while enabling, facilitating, and recommending distance learning implementation standards and guidelines.

development training program, there should be no difference in the state regulation of I-TV courses and traditional courses.

- *Sponsor statewide contracts for course management software.*
  Such contracts enable I-TV adopter districts, if they choose, to use a common web-based format for handling all materials distribution and accessing instructional resources. Course management software vendors do not price their product to be accessible (or affordable) to individual small school districts. Having a statewide contract for management software allows each I-TV school or consortium equal access to the software at an affordable price.

- *Support statewide purchasing contracts for selected I-TV equipment.*
  It would be extremely helpful for each SEA to work with chief state information officers or other state-level policymakers to negotiate state contracts with multiple I-TV equipment vendors so that individual districts that choose to take advantage of the state contract can be assured of high quality equipment, fully integrated operation, and maintenance contracts as required, at the lowest possible price.

Distance Learning and School Accreditation

Study Findings: In 60% of responding states, schools are accredited based on the ability of the school to provide a minimum number and type of course offerings. In 13% of responding states, however, high school students are limited in the number of distance learning courses they can take for graduation credit.

Implications: Distance learning is likely to play an increasing role in the efforts of small schools to meet growing state demands for number and type of curricular offerings. Generically limiting the number of distance learning courses that can count toward graduation ignores a much more important measure of distance learning classes: quality vs. quantity.

Recommendations:

- *Eliminate restrictions on student credit earned through I-TV classes.*
  Currently, it is most often the *quantity* of distance learning courses that is regulated when it should be the *quality* of courses being offered. There should be no need for the state to limit the number of quality I-TV courses that can be accepted for graduation credit. That should remain a local option. SEAs must find ways in which distance learning courses—like traditional courses—can be monitored and regulated in terms of course content and instructional quality. Student outcomes, rather than "Carnegie Units" or seat time, should ultimately determine course value.

Accreditation of Distance Learning Course Providers

Study Findings: Only a minority of SEAs evaluate or accredit in-state (15%) and out-of-state (16%) distance learning course providers.

Implications: With few states operating state-supported distance learning programs and with few research findings in place, the sole responsibility for judging the integrity or educational value of commercial distance learning course vendors falls to local districts. This also places the burden on local schools or districts to evaluate whether distance learning course providers have linked their course objectives to state standards.

Recommendations:

- *Regulate commercial I-TV (and other distance learning technology) course providers.*
  If courses are provided from a commercial vendor via two-way **videoconferencing** or other distance learning technology, the state should implement course accreditation procedures, require the correlation of course objectives to state standards, and require state-approved instructor training. Ideally, states should also require vendors to apply for state approval. In-state I-TV consortiums that teach and receive courses from within their own consortium or across in-state school district consortiums should be subject to the same regulation as traditionally-taught courses in the state.

Distance Learning and No Child Left Behind

Study Findings: Only half of responding states (50%) indicate that they will take responsibility for soliciting or approving distance learning providers of supplemental

Distance learning is likely to play an increasing role in the efforts of small schools to meet growing state demands for number and type of curricular offerings.

education services in response to the *No Child Left Behind* (NCLB) legislation.

Implications: A small district failing to meet Adequate Yearly Progress (AYP) goals as mandated by NCLB and set by the state will be forced to try to improve student achievement by whatever means available. Although districts may have flexibility in choice, these districts may be left with little guidance in terms of quality of courseware. The involvement of the SEA may assist districts in making more effective decisions.

Recommendation:

- *Require registry and/or approval of providers of supplemental education courses.*
  At a minimum, SEAs should require the registration of providers of supplemental education courses by distance learning, which includes collecting sufficient verified information for school districts to judge the competency of the provider and the quality of the product or service. States should have suggested standards and procedures to help districts make informed choices.

State Requirements for Distance Learning Instructors and Course Content

Study Findings: Less than half of the responding states (48%) require distance learning courses to be taught by state certified teachers and in more than two-thirds of the states (68%) the SEA assumes no control over distance learning course content. In only slightly more than half of the states (58%), is alignment of in-state distance learning course objectives to state standards mandated; only 52% of the states make a similar requirement for distance learning courses originating out-of-state.

Implications: As online course vendors increasingly flood the distance learning market and little control is exerted over in-state providers, there is a disconnect between the push for increased accountability for traditionally taught students and the lack of instructional accountability on the part of distance learning course providers. This will be of increasing importance as schools struggle to meet state and federal (NCLB) requirements.

Recommendation:

- *Focus regulatory attention on issues of instructional content and quality.*
  Many SEAs require that school course curricula include state content objectives. Distance learning courses should not be exempt from this requirement. Ensuring the instructional content and quality of distance learning courses is appropriate, if done so irrespective of technology.

- *Carry out cross-technology evaluation studies.*
  SEAs should work with adopting schools to carry out cross-technology evaluation studies that measure both student achievement and student (and teacher) satisfaction. There is indeed a role for a nationally developed set of evaluation criteria and methodologies that states can use in carrying out such studies. Cumulative findings over time will then yield what no limited research study has yet been able to definitively do: determine how or whether student achievement and satisfaction differ across different distance learning technologies and define the circumstances under which specific distance learning technologies are most appropriate.

Preparation of Distance Learning Instructors

Study Findings: In one-fourth of the responding states (25%), first year, beginning teachers were judged to be "somewhat competent to teach in a distance learning classroom." In 75% of the states, however, beginning teachers were judged to be "somewhat unprepared" or "very unprepared" to teach in a distance learning classroom. Nearly two-thirds (63%) agreed or strongly agreed that the extent to which pre-service teachers were adequately prepared to teach in a distance learning classroom varied greatly by teacher education institution. While 74% of responding states report that they "encourage" professional development training for in-state distance learning instructors, only 68% "require" such training.

Implications: Pre-service teachers are not being prepared to use I-TV and other distance learning technologies. Distance learning technologies are rarely addressed in standard teacher preparation programs. I-TV is not a plug-and-play technology. While a computer can be taken out of the box, plugged in, and used, successful implementation of I-TV requires more than just the equipment involved. It requires that the instructor understand not only how to properly operate the equipment, but more importantly, how to maximize the use of the technology in the learning process. This only enforces the need for in-service professional development requirements and training opportunities for distance learning instructors.

Recommendations:

- *Ensure initial and ongoing I-TV instructor training for adopting districts*
  While it is not necessary to implement a separate teaching credential for I-TV teachers, it is important that I-TV teachers have access to both initial and ongoing, high quality pre-service and professional development training that focuses not only on technical equipment operation, but more importantly, on the effective use of technology teaching tools in the I-TV classroom. SEAs should work with teacher education programs and local professional development providers in developing/adopting/adapting quality programs that asssist teachers in learning how to teach effective distance learning courses.

Recommended Local School District Policies and Practices

Apart from carefully following the 10-step I-TV Checklist (page 11) when implementing two-way interactive television, there are several things adopting districts can and should do at the local level to ensure the implementation of an excellent distance learning program:

- The chosen distance learning technology should meet the needs of the local students. Be aware that distance learning technologies that "look" most like the traditional classroom are also the most likely to ensure student and teacher satisfaction as well as achievement across a broad range of students.
- Local school counselors must fully understand the distance learning courses being offered and the academic prerequisites for each, so they can advise students accordingly.
- Distance learning instructors should have appropriate training and be devoted to continuing their learning, regardless of whether they are located within or outside the district.
- Distance learning students must have as much interaction with their distance learning instructor as possible, with preference given to all forms of real-time, spontaneous audio-visual interaction.
- Each school should have a distance learning facilitator who can help distance learning students manage paperwork, troubleshoot problems, and assist students when immediate questions or problems arise.
- Technical assistance should be readily available at all times, whether provided for in-house, by jointly hired consortium personnel, or purchased externally.
- The curriculum of the distance learning course must meet the district's criteria for course rigor and alignment to local (and state) standards. This responsibility should remain with the local school in conjunction with the SEA. Beware of relegating this responsibility to any commercial vendor!
- Local school administrators should stay involved in distance learning courses, and should never turn over the education of local students to an unseen, unknown course provider. They should maintain continuous awareness of and involvement with remote distance learning providers, keeping local students' needs in the forefront of decision-making.
- Schools should work with the SEA to provide ways for schools with experience and expertise in implementing distance learning technologies to share that knowledge with other schools that may be in the early stages of distance learning implementation.
- There should be no difference between distance learning and traditional courses in terms of limits on credit earned, graduation requirements, etc. If distance learning courses, just like traditional courses, are continually meeting all local educational expectations, there should be no need to differentiate between them.

PART V: CONCLUSION

Distance learning can help small and rural schools capitalize on their primary asset—small size—while also providing equity in educational opportunity. No longer need small schools limit the scope of their curriculum simply because it is not economically justifiable (or possible) to hire local teachers in every advanced subject area. With distance learning technology—especially through I-TV—small schools can have access to low-demand, high-cost courses by sharing teachers across district and consortium boundaries. Through the localized and/or regional development of I-TV consortiums, groups of small school districts can band together to provide locally controlled, locally hired, but regionally shared teachers to provide high-quality, "high-touch" instruction across distance learning networks.

Unlike other distance learning technologies, I-TV has the capability to maintain both a "high tech" and a "high touch" instructional environment, where instructors know and interact with every student, where a facilitator solves any problems that may arise, and where the only significant difference between traditional and I-TV instruction lies in the remote physical location of the instructor.

No distance learning technology offers the quality, the immediacy, the potential for interactivity, the synchronicity, the level of student and teacher satisfaction, or the promise of I-TV. I-TV is a far more educationally viable, economically rational, and socially preferable alternative to school or district consolidation.

Distance learning is here to stay.

Clearly, distance learning is not a passing educational fad. Its roots are too deeply embedded and the needs it addresses are too great. This paper has laid the groundwork for making I-TV the accepted standard for distance learning technology. It remains to be seen whether newer technologies can approach the advantages of I-TV for schools that must rely on distance learning for curriculum enhancement or whether combining other technologies with I-TV will help to promote its advantages.

Distance learning technologies will not replace schools as we know them.

As Phil Westfall, President of the U.S. Distance Learning Association indicates, it is not likely that schools as we know them will gradually disappear. Their purposes—especially those of small schools—extend beyond the simple academic preparation of youth to include the very fabric of socialization of each succeeding generation. Such fear, however, should not cloud our visions of the future or cause us to discard forms of distance learning which force us to embrace new educational paradigms. For now—and likely for the indefinite future—schools are here to stay. We must learn to deal with the "messiness" of other learning environments and incorporate them into the future of education. Until that process is substantially improved, I-TV holds the highest promise for small and rural schools and the formation of future citizens.

SEAs and LEAs must work together in establishing policies.

Regardless of the distance learning technology chosen, it is important that SEAs and LEAs work together to develop recommended implementation guidelines, technical standards for interoperability, and operational policies which both protect the integrity of academic instruction and respond to student needs for flexible, non-traditional courses.

I-TV is the best application of technology in rural schools.

All distance learning technologies are not created equal. There is a substantial risk in premature, over-reliance on forms of distance learning that fail to provide quality learning opportunities and are thrust upon students of all learning styles as the instructional equivalent of traditional courses. Until safeguards are fully in place, and until an appropriate regulatory environment and support structure exists, I-TV is the optimum alternative, requiring little in the way of a demonstrably different regulatory structure or student safeguards.

No distance learning technology offers the quality, the immediacy, the potential for interactivity, the synchronicity, the level of student and teacher satisfaction, or the promise of I-TV.

I-TV is cost-effective for rural schools.

I-TV is an absolutely cost-effective form of distance learning in rural schools. For a modest capital investment and an annual operating cost less than the salary of one full-time teacher, small schools can offer students access to any advanced high school, dual credit, or Advanced Placement class, while providing a host of ancillary services to students, faculty, staff, and the community.

I-TV can help meet the demands placed on small and rural schools.

With the continued drain of young people from many parts of rural America and the decline of rural schools in many regions of the country, a significant resource is being lost. New, misguided waves of consolidation will only further damage the ability of small and rural schools to continue to produce tomorrow's educated citizenry. Distance learning opportunities—and most importantly, I-TV—can enable small schools to meet the curricular needs of its students while maintaining all of the advantages of small schools.

I-TV is a sound educational investment in rural youth.

In this era of decreasing dollars for education, increased cries for economic efficiency through consolidation, and increased academic standards to which *all* students are held accountable, distance learning—especially I-TV—offers a measure of considerable hope for small, rural schools. Adopting distance learning via I-TV can mean the difference between closing the small, community-based schools on which much of rural America was built and bussing students miles away to generic, reorganized districts having little or no connection to any community. It can mean the difference between students anchored to a community that they care for deeply and students who grow up without any sense of community identity. It can mean the difference between a viable future for rural America or its continued demise. The promise and the power of distance learning is its role in re-establishing the prominence of rural schools in the 21st century as academically excellent and economically viable sites of student learning.

Appendix I
Characteristics of Major Distance Learning Technologies

By comparing the attributes of each distance learning technology it is possible to determine—before implementation—the potential for optimum student learning. In Part II, distance learning technologies were discussed in terms of four characteristics: learners, time, instruction, and degree of interactivity. The following chart elaborates on those four dimensions, depicting each as a vertical continuum. The higher on the continuum the technology lies, the greater the *potential* for optimum student learning.

Explanation of Each Continuum on the Chart

- **Instruction Mode** ranges from instructor-led classes on the high end of the continuum to text/graphics-based instruction on the low-end of the continuum, with the possibility of mixed instructional modes occurring across the continuum. For the majority of learners, instructor-led classes are preferable to pre-produced text- or graphics-based instruction.

- **Learner Types** may include a group of learners, i.e., a class, or an individual, with the possibility of mixing individual students and classes with some technologies. For the majority of students, class-based learning is preferable to individual learning.

- **Degree of Interactivity** ranges from full-time, two-way audio/video to part-time or switched two-way audio/video to one-way video to one-way audio. For the majority of learners, full-time, two-way audio-video technologies are preferable to other modes.

- **Spontaneity of Two-Way Communication** exists as a dimension of **time** with **synchronous** (**real-time**) communication occurring at the high end of the continuum and **asynchronous** (delayed) communications occurring at the low end of the continuum. For the majority of learners, **synchronous** (**real-time**) communication is preferable to **asynchronous** (delayed) communication.

The major distance learning technologies listed in Appendix I are plotted on the chart as they typically fall with respect to each characteristic. Where each technology falls on the continuum, however, depends on both the technical limitations of the technology as well as implementation options (Appendix II list and defines types of distance learning technologies).

Understanding The Chart

Example:

Two-way I-TV, as typically implemented, appears at the top of each continuum. This means that it is an instructor-led technology—it is taught by a live teacher; the students involved in the technology are typically aggregated as a class, albeit at different locations, rather than as individuals; it is a full-time, two-way audio-video technology, meaning that the teacher and students can see, hear and interact with each other at all times; and it is a **synchronous** (**real-time**) technology—verbal student-to-teacher, teacher-to-student, and student-to-student communication occurs spontaneously. This technology, therefore, ranks highest in terms of *potential* for optimum student learning.

Example:

A typical online course involves text and graphics-based instruction, prepared, but not taught by, a live instructor; the student is typically an individual; it involves one-way audio and video, with the student able to see (and often hear) the pre-produced lessons, but unable to respond or ask questions except in written electronic form through the computer or using peripheral technologies; and communication occurs **asynchronous**ly—the student is not able to communicate with a remote instructor directly or spontaneously.

This chart is a valuable tool for rural school administrators or other distance learning technology adopters to weigh the advantages and disadvantages of each technology as it would be implemented, that is, the extent to which each characteristic "enables" or "disables" learning with respect to proven instructional strategies and communication theory. Equally important, however, is the use of the chart as a framework to evaluate any implementation strategy of any distance learning technology. It should empower administrators to choose (or insist on) implementation strategies which are more

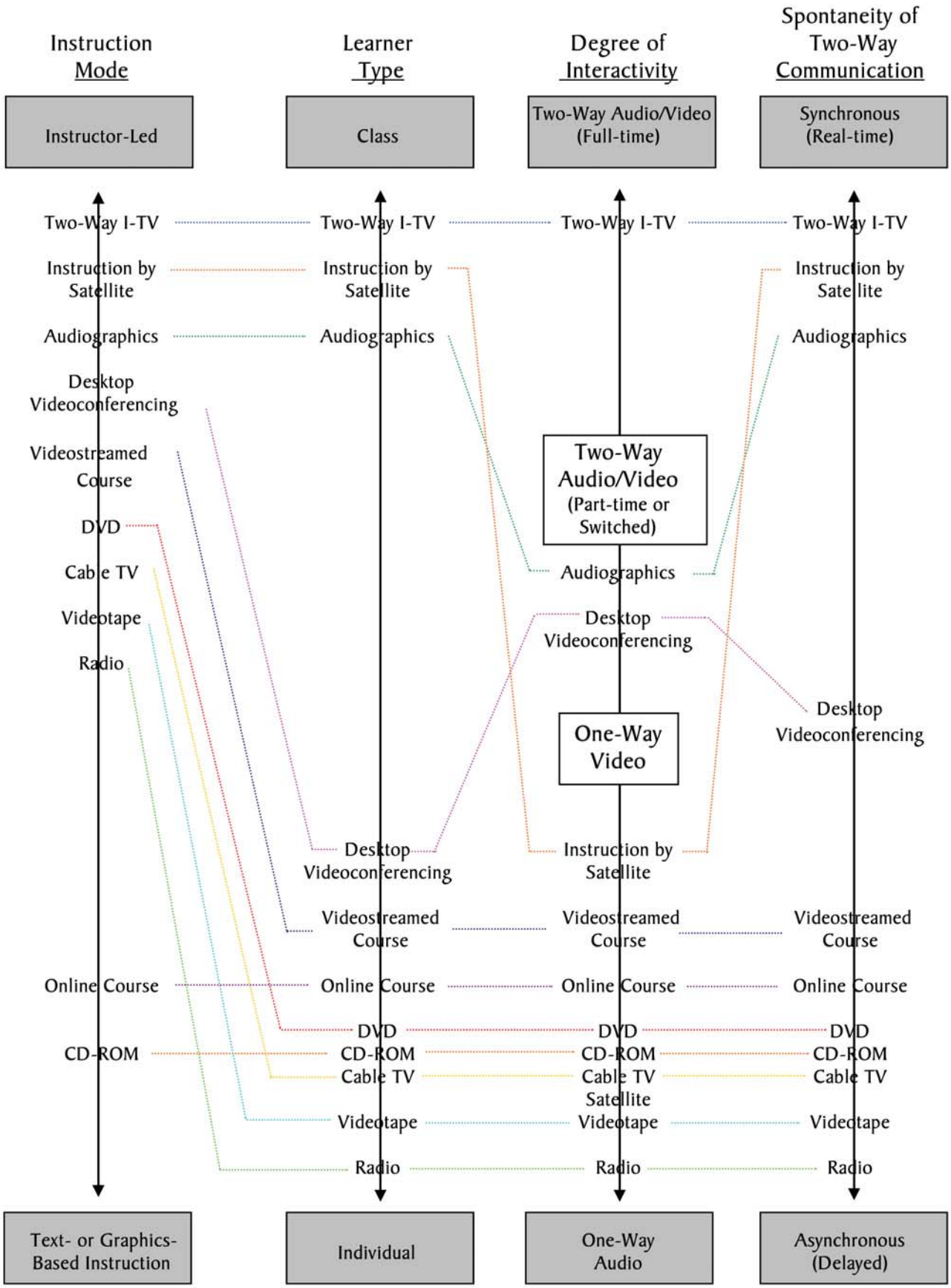
likely to enhance student achievement and satisfaction. The following chart should help an adopting school district understand three major points with respect to technology choice:

a) I-TV is the technology which is most likely to enable higher student achievement and a greater student, teacher, and parent satisfaction level.

b) Other technologies also have a role to play in distance learning. The degree to which they can ensure a positive learning outcome can be greatly enhanced by choosing implementation strategies that better facilitate or enable learning, for instance, by adding an in-room teacher aide to a class receiving instruction by DVD, or by blending **synchronous** communication components into an **asynchronous** online class.

c) Individual student needs may require that one technology be chosen over all others, without regard to maximizing the potential for student achievement or satisfaction. Most notable is the availability of online courses that can easily meet the "anytime, anywhere" requirements of some students. A home-bound student, a stay-at-home mom, a soldier stationed overseas, or a college student simply wanting to add another class on his/her own terms may each be pulled to a particular distance learning technology either out of necessity or convenience. What may be less than an ideal learning mode for one student, may be tolerable—or indeed, be no problem at all—for another student. A highly motivated, assertive, goal-oriented student is likely to succeed in virtually any distance learning medium. However, assuming that all students can or will succeed regardless of the distance learning technology implemented will usually result in student frustration, parent or administrator dissatisfaction, limited use, or abandonment of the technology investment.

Characteristics of Major Distance Learning Technologies



Appendix II: Types of Distance Learning Technologies

a. One-Way Live or Pre-Recorded Audio – Perhaps best known is Australia's School of the Air in which students received one-way audio instruction through their radio. Pre-recorded audio-taped lessons also fall within this category.

b. Two-Way Audio – **Teleconferences** in which students can hear an instructor and can respond and/or ask questions is an alternative for audio-based distance learning, but its use has languished in the educational arena with the advent of video-capable technologies.

c. CD-ROM Courses – Favored in alternative schools, special education classes, and other individualized, remediated instructional environments, CD-ROM courses take the individual student through a pre-programmed set of largely text- and graphics-based lessons. A teacher or facilitator is usually present in the classroom to assist students, but the CD-ROM course modules are the primary means for conveying instruction.

d. One-Way Live or Pre-Recorded Video –

- *Videotaped Instruction* – Students view previously recorded lectures or lessons via mailed videotapes or cable TV.
- *Instructional Television* – Once popular televised courses brought together a geographically dispersed 'class' of students who watched and listened to a pre-recorded lecture or in some instances, a live class that was being recorded. This was the first distance learning medium that offered each learner the versatility of recording a broadcast for future viewing. Its use continues to be widespread, especially for non-traditional learners.
- *DVD Instruction* – Complete video courses can also be available to students in a recorded format through DVDs.

e. One-Way Video with Two-Way Audio –

- *Audiographic Instruction* – Prominent in the previous two decades, this pre-Internet, computer and telephone-based technology allowed the instructor to link to students through a dynamically controlled computer screen. The students did not see the instructor, but could see any text or graphics generated or input by the remote instructor. A telephone link allowed for real-time, two-way audio communication. For instance, if the instructor typed in a math problem, students could see the problem on their computer screen, work on it, and then send it back to the teacher for review.
- *Instruction by Satellite* – A precursor of later technologies, instruction by satellite typically involves an instructor who broadcasts a live class to hundreds of students across the country who receive the class through a satellite downlink receiver in their schools. In an attempt to make this instruction two-way, students could often enhance participation by calling in questions to the teacher or by using a provided "call pad" to answer closed-ended questions. The expense associated with two-way instruction via satellite has precluded its far-reaching use.
- *IP Multicasting* – **IP** (Internet Protocol) multicasting over satellite is a new technology that allows quality transmissions at a low **bandwidth** while allowing streaming to the desktop. Rather than unicasting (sending the programming or data update to one recipient) or broadcasting (sending to all members of the network), multicasting allows for the targeted, simultaneous transmission of information to any number of selected recipients among a larger subset of members.

f. Two-Way Video – This form of distance learning is commonly known as two-way interactive television (I-TV) or **videoconferencing**. I-TV is live, interactive audio and video instruction; the teacher and remote students see and hear each other at all times just as if they were in a traditional classroom together. Similar to **videoconferencing**, I-TV differs slightly in its ability to achieve **continuous presence** (all sites see all sites at all times) and its ability to allow immediate interaction (with "always on" microphones).

g. Internet or Online Courses – Online or web-based instruction is a relatively new form of distance learning in which the student uses a computer and the Internet to interact in some form with a remote instructor or with a text/graphics-based course. In this highly accessible form of distance learning, a typical student needs only an Internet-accessible computer, a dial-up modem (or better connection), and an Internet Service Provider (ISP) to connect to local, regional, state-sponsored or commercial course providers.

h. 'Blended' Distance Learning Technologies – Given the divergent methods for implementing distance learning technologies, it is probable that the distance learning technologies adopted in the future will be a combination of technologies in a 'blended' environment. Imagine a basic two-way interactive I-TV classroom where remote students are involved in a course of study with a live instructor, and students and instructor are fully engaged in dialogue. The teacher incorporates short videotapes on specific instructional content, connects remote I-TV classrooms with an international guest lecturer by audio conference, routinely provides students the opportunity to send and receive homework via e-mail, encourages I-TV students to interact outside of class time through a class discussion list, provides remote students with access to class materials and tests through an online course management interface, and facilitates the continued real-time involvement of a home-bound (or home-schooled) student in the class through a desktop **videoconferencing**-capable computer in his/her home. This scenario, existing even more broadly and encompassing more instructional technology options than included above, is possible, and indeed, is being done today. Blending technologies is clearly the direction in which distance learning is moving.

• ***Virtual Schools***—In a generic sense, a virtual school is any public or private entity providing courses, where the student interacts with the courseware in a computer-mediated environment, rather than with a face-to-face teacher. It has come to mean a provider of a complete or restricted range of high school or K-12 online courses.

• ***Cyber Charter Schools***—Merging the concept of a charter school—a four-walls, bricks and mortar institution with a district or statewide charter—with that of a virtual school, the cyber charter becomes unbound by space or time limitations (within the limits of its charter) and can enroll any combination of public, private, home-bound, or home-schooled students. In those school choice states, such as Ohio and Pennsylvania, which have seen a rapid insurgence of cyber charters, the rules of engagement are only beginning to be worked out. Significant issues of teacher certification, Carnegie units, grading, diploma granting, state reimbursement, loss of revenue to public schools, etc. are just beginning to be addressed.

• ***Online Curriculum Providers or Virtual Support Companies***—This category of commercial vendors provides online distance learning resources, that can be purchased by other distance learning course providers (like schools), including: tutorials, curriculum, lesson plans, Web resources, e-learning applications, course management software, assistance with virtual school administration, training for online educators, enrollment management services, student evaluation and grade reporting tools, software platforms on which virtual schools can build their own programs, student information and data systems, and professional development.

Appendix III
Categorization of State Videoconferencing Policies

The following list, developed by the Regional Technology in Education Consortia (R*TEC)* categorizes state policies and rules, as they apply to **videoconferencing**, into categories and provides both samples (suggested policies) and examples (actual policies with references), which both SEAs and local practitioners might use in creating distance learning policies.

1. **Technical Considerations**
   a. Infrastructure
   b. Protocol
   c. Line dedication
   d. Hardware and software
   e. Tech support
   f. Quality of Service (QoS)

2. **Facilities and Budgetary Considerations**
   a. Room dedication
   b. Use protocol
   c. Local use fees
   d. Scheduling and schedule hosting
   e. Financial support

3. **Learner/Student Considerations**
   a. Technical support
   b. Qualifications for enrollment
   c. Supervision and remote site support
   d. Enrolling agency responsibility
   e. Academic support
   f. Completion expectations
   g. Individual attention

4. **Teacher/Curriculum Developer Considerations**
   a. Technical support
   b. Contract support (salary, benefits, preparation time)
   c. Content development support (purchased content, home-grown content development, ongoing professional development, content copyright requirements)
   d. Teacher and other staff training, professional development, and support
   e. Pedagogy, delivery, and curricular alignment
   f. Personnel qualifications

5. **Assessment and Evaluation Considerations**
   a. Federal and state assessment requirements
   b. Class, course, and school requirements for grading and credit
   c. Curriculum standards requirements
   d. Program evaluation needs
   e. Accreditation requirements
   f. Course and school "credibility" needs (standards of rigor and/or breadth)

6. **Management and Administration Considerations**
   a. Vision, goals, and objective needs
   b. School improvement plan needs
   c. Americans with Disabilities requirements
   d. Contract and union requirements
   e. Parent/Community involvement requirements
   f. Student and staff privacy needs
   g. CIPA (Children's Internet Protection Act) requirements

7. **Marketing and Public Relations Considerations**
   a. Class and program offering clearinghouse needs
   b. Local school contact plans (counselors, etc.)
   c. Ongoing program involvement and development plans
   d. Outreach plans

*From "R*TEC K-12 Interactive Videoconferencing: Policy Issues Review" by K. deFord and V. Dimock. June 2002. Available at http://neirtec.terc.edu/k12vc/resources/research.cfm

Glossary

Included in this glossary are words that you will find bolded in the body of the document or that you may confront as you delve more deeply into distance learning.

Asynchronous (Not Synchronous)

With reference to video and data signals and devices, asynchronous transmissions are those in which local and remote communication is not precisely in step, not of the same frequency, or does not happen together in time.

ATM – Asynchronous Transfer Mode

An international high-speed, high-volume, packet-switching transmission protocol standard. ATM uses short, uniform, 53-byte cells to divide data into efficient, manageable packets for ultrafast switching through a high-performance communications network. ATM is the first packet-switched technology designed from the ground up to support integrated voice, video, and data communication applications. High costs often make this transmission mode impractical for K-12 I-TV networks.

Bandwidth

The capacity to transfer data over telecommunications lines, usually measured in bits per second. The necessary bandwidth is the amount of spectrum required to transmit the signal without distortion or loss of information.

Broadband

A high capacity communications network that can enable the simultaneous transmission of voice, data, and video. Broadband networks are usually defined as operating at greater than T-1 speeds (1.544Mbps).

Codec

COder – DECoder. A digital device for the coding and decoding of video and/or audio signals usually to permit them to be transmitted in compressed and/or encrypted form.

Continuous Presence

A video processing, transmission, and display technique that electronically combines parts of two (or more) separate video images for transmission in a single data stream. At the receive location, two or more images may be viewed in quadrants on a single monitor or separated for viewing on side-by-side monitors.

DS-3

A telecommunications line (or digital transmission system) operating at 45 Mbps. A DS-3 line is approximately 30 times the bandwidth of a T-1 line.

DSL – Digital Subscriber Line

A generic term including a family of moderate speed access technologies that use sophisticated modulation schemes to pack data onto copper wires. They are sometimes referred to as last-mile technologies because they are used only for connections from a telephone switching station to a home or office, not between switching stations.

E-Rate

A telecommunications discount program for schools and libraries begun as part of the Telecommunications Act of 1996. Telecommunications services, Internet access, and internal connections are eligible for 20-90% discounts based on the free and reduced-price lunch rate of students within a school—or schools within a library district.

Fractional T-1

One or more channels of a T-1 service. A full T-1 carrier contains 24 channels; each provides 64 Kbps. Most phone companies, however, also sell fractional T-1 lines, that provide less bandwidth but are also less expensive. Typically, fractional T-1 lines are sold in increments of 56 Kbps (the extra 8 Kbps per channel is used for data management).

Fractional T-3 or DS3

A telecommunications service that uses a portion of a 672-channel T-3 circuit for any mix of voice, data, or broadcast-quality video.

IP – Internet Protocol

The set of rules that allow the transmission of data among all computers. IP specifies the format of packets and the addressing scheme. Most networks combine IP with a higher-level protocol called Transmission Control Protocol (TCP), which establishes a virtual connection between a destination and a source. IP by itself is like the postal system. It allows you to address a package and drop it in the mail, but there's no direct link between you and the recipient. TCP/IP, on the other hand, establishes a connection between two hosts so that they can send messages back and forth.

IP Address

An IP number is a numerical address consisting of several numbers separated by periods. Each IP address uniquely identifies a certain computer on the Internet.

ISDN – Integrated Services Digital Network

An international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires. ISDN supports data channel transfer rates of 64 Kbps (64,000 bits per second), but multiple channels can be purchased to increase bandwidth. There are two types of ISDN lines: Basic Rate Interface (BRI) and Primary Rate Interface (PRI). ISDN charges are typically incurred for each call or connection made. Costs increase as the number of channels used increases.

I-TV – Two-Way Interactive Television

An audio and video link between two or more remote locations with live, moving image transmission and display. Two-way interactive television allows all locations to see and hear the people and presentation materials at other locations. I-TV is the term usually used to signify videoconferencing in an educational setting. It should not be confused with Instructional Television (ITV), which is the one-way transmission of educational programming by television.

Kbps – Kilobits per second

Refers to the data speed of a telecommunications line. Data is transmitted in bits per second. A bit is the smallest unit of information on a computer network, a binary digit (0 or 1). A kilobit is 1000 bits.

Mbps – Megabits per second

Refers to the data speed of a telecommunications line. Data is transmitted in bits per second. A bit is the smallest unit of information on a computer network, a binary digit (0 or 1). A megabit is one million bits.

Point-to-Multipoint

A circuit that connects a single node to a switch. In continuous presence I-TV, it is a single site connecting to up to three additional sites, such that all sites can see all other sites at all times. In a switched I-TV network, it is a single site connecting to any number of additional sites. In a switched mode, each I-TV site will routinely see only the presenter or the site having last spoken.

Point-To-Point

A non-switched, dedicated communication circuit. In I-TV, a single site connecting to only one other site.

Real Time

Rapid transmission and processing of event-oriented data and transactions as they occur, in contrast to being stored and retransmitted or processed in batches. I-TV is a "real time" technology because it is broadcast live, as it occurs.

Synchronous

With reference to video and data signals and devices, synchronous means being precisely in step, or happening together at the same time. I-TV involves synchronous communication because the teacher and student interact at the same point in time through the same medium.

T-I/DSI

A telecommunications line (or digital transmission system) operating at a speed of 1.544 million bits (megabits) per second (1.5Mbps). A T-1 line consists of 24 individual channels, each of which supports 64Kbits per second. A T-1 line is a preferred means of transmitting I-TV, taking both cost and quality into account. T-1 lines, though transmitting lower quality, compressed video signals than DS-3 lines, for instance, are much less expensive and more widely available.

Tariff

A public document filed with a state public utility commission that outlines services and rates of telecommunications carriers. Usually, all customers are offered the same rate for a specific service, based on published constraints. In some states telecommunications carriers have filed special distance learning tariffs available to K-12 schools.

Teleconference

Live, two-way audio transmission between two or more locations. Usually includes speaker phones and microphone amplification systems.

Universal Service

The public policy that helps compensate telephone companies or other communications carriers for providing access to telecommunications services at reasonable and affordable rates throughout the country, including rural, insular, and high cost areas. Companies, not consumers, are required by law to contribute to the Universal Service Fund. The law allows companies to pass this charge on to customers. The E-Rate program is a separate part of the Universal Service Program.

Video Conference

An audio and video link between two or more remote locations with live, moving image transmission and display. Two-way video conferencing allows both locations to see and hear the people and presentation materials at other locations, although not necessarily in a continuous presence mode. I-TV is the term usually used to signify videoconferencing in an educational setting. Videoconferencing most often refers to the business

application of the technology, e.g., video meetings. Increasingly, the terms are used interchangeably.

Wireless

Radio waves, cellular, satellite, microwave, etc. are alternative modes of telecommunications transmission to land lines. I-TV via wireless transmission is possible, but is in its infancy.

Sources From Which Glossary Definitions Were Adapted:

1. The Glossary of Telecommunications Terms. Prepared by the US General Services Administration, Information Technology Service, Technology and Standards Division. August 1996. Available at http://www.its.bldrdoc.gov/fs-1037/
2. HEI Telecommunications Technology Consultants. Glossary of Telecommunications Terms. Available at http://www.hei.ca/glossary1.html
3. National Public Safety Telecommunications Council. Glossary of Telecommunications Terms. Available at http://www.npste.du.edu/documents/glossary.html
4. Webopedia. Online dictionary for computer and Internet technology definitions. Available at http://www.webopedia.com/

References

[1] Beeson, E. & Strange, M. (February 2003). *Why rural matters: The continuing need for every state to take action on rural education*. Washington, DC: Rural School and Community Trust. Available at http://www.ruraledu.org/newsroom/wrm_new.htm

[2] U.S. Department of Education, National Center for Education Statistics. (2002) *Common core of data agency survey, 2001-2002*. Washington, DC: Government Printing Office.

[3] Rural School and Community Trust. (March 2003). *School size: Research-based conclusions*. Washington, DC: Author. Available at http://www.ruraledu.org/docs/arkansas/schoolsize.doc.

[4] Jimerson, L. (March 2003). *The competitive disadvantage: Teacher compensation in rural America.* Washington, DC: Rural School and Community Trust. Available at http://www.ruraledu.org/docs/Teacher_Pay.pdf.

[5]

National Average Salaries*		
Salaries	Non-rural Districts	Rural Districts
Beginning	$26,895	$24,170
Average	$33,838	$29,828
Highest	$46,271	$39,487

* Based on FY2000 data. Average beginning salary is based on attainment of a BA + 0 years experience; highest salary is based on attainment of MA + 20 years experience.

[6] Selected state salaries for comparison purposes: From: *Why rural matters: The continuing need for every state to take action on rural education*.

Selected State Average Rural Teacher Salaries and Ranks			
Nebraska (49th)	$24,318	Illinois (27th)	$33,378
North Dakota (48th)	$24,395	Florida (26th)	$33,757
Montana (47th)	$26,458	Texas (23rd)	$33,979
Iowa (46th)	$27,052	Georgia (15th)	$37,867
Arkansas (45th)	$28,563	California (10th)	$40,383
Missouri (44th)	$28,584	Pennsylvania (7th)	$41,182
Mississippi (38th)	$30,284	New York (5th)	$42,659
West Virginia (29th)	$32,916	Alaska (3rd)	$44,658

[7] Lawsuits are currently pending in Arkansas, Kansas, Missouri, and Nebraska, among many others.

[8] In West Virginia, for example, 325 schools were closed over a 10-year period in an effort to make schools more efficient by reducing the number of administrators. It has since been shown that the number of central office administrators substantially increased even though the number of students being served by the system declined by 41,000 over the same time period. Meanwhile, per pupil transportation costs more than doubled. What appeared as sound logic, didn't hold up in reality. It is almost always true that lowering costs through consolidation will be more than offset by higher costs in other areas.

See Eyre, E., & Finn, S. (2002). Closing costs: School consolidation in West Virginia. *Charleston Gazette* series on the costs of school consolidation: August 25 and 30, September 8,12,24, and 29, and October 3 and 6, 2002. Available at http://wvgazette.com/section/Series/Closing+Costs.

[9] Rural School and Community Trust. (June 2003). *The fiscal impacts of school consolidation: Research-based conclusions.* Washington, DC: Author. Available at http://www.ruraledu.org/docs/arkansas/fisc_soc.doc.

[10] Russell, T. (1999). *The No Significant Difference Phenomenon*. Montgomery, AL: International Distance Education Certification Center. Retrieved August 17, 2004 from http://www.nosignificantdifference.org/nosignificantdifference/.

Cavanaugh, C. S. (1999) *The effectiveness of interactive distance learning technologies on k-12 academic achievement*. Available from ERIC Clearinghouse, Document No. ED428752.

[11] Cotton, K. (1996) School size, school climate, and student performance. *School Improvement Research Series*. Portland, OR: Northwest Regional Laboratory. Retrieved August 17, 2004 from http://www.nwrel.org/scpd/sirs/10/c020.html.

Cotton, K. (December 1996). *Affective and social benefits of small-scale schooling*. ERIC Clearninghouse on Rural Education and Small Schools. EDO-RC-96-5.

Funk, P. E. & Bailey, J. (1999). *Small schools, big results: Nebraska high school completion and postsecondary enrollment rates by size of school district*. Lincoln, NE: Nebraska Alliance for Rural Education. Retrieved August 17, 2004 from http://www.ruraledu.org/docs/ne_small.pdf.

Lindsay, P. (1982). The effect of high school size on student participation, satisfaction, and attendance. *Educational Evaluation and Policy Analysis* 4(1), 57-65.

[12] In 1995 when the National Telecommunications and Information Administration (NTIA) published the first in its Falling Through the Net research series (*Falling Through The Net: A Survey of the "Have Nots" in Rural and Urban America*), the rural poor were lowest of all groups in terms of household computer penetration at 4.5% and in modem penetration at 23.6% (as a percent of all computer owners).

In 1997 when NTIA published its second report, *Falling Through the Net II*, rural households earning between $5,000-$10,000 still had the lowest PC-ownership rates (7.9%) and on-line access rates (2.3%), followed by urban areas (10.5%, 4.4%) and central cities (11%, 4.6%). As in 1995 among all ethnic groups, Blacks had the lowest PC-ownership rates in rural areas (14.9%), followed by Blacks and Hispanics in central cities (17.1% and 16.2%, respectively). On-line access was also the lowest for Black households in rural areas (5.5%) and central cities (5.8%), followed by Hispanic households in central cities (7.0%) and rural areas (7.3%).

In its 1999 report, *Falling Through the Net: Defining the Digital Divide*, NTIA reported that urban households with incomes of $75,000 and higher were more than *twenty times* more likely to have access to the Internet than rural households at the lowest income levels, and more than *nine times* as likely to have a computer at home. Regardless of income level, Americans living in rural areas in 1999 were still lagging behind in Internet access. At the lowest income levels, those in urban areas were more than twice as likely to have Internet access than those earning the same income in rural areas.

By its fourth report in 2000, *Falling Through the Net: Toward Digital Inclusion, the NTIA found that* groups that had traditionally been digital "have nots" were making dramatic gains. The gap between households in rural areas and households nationwide that accessed the Internet had narrowed from 4.0% in 1998 to 2.6% in 2000. Rural households were much closer to the nationwide Internet penetration rate of 41.5%. In 2000, 38.9% of the households in rural areas had Internet access, a 75% increase from 22.2% in December 1998. However, while gains were made, it could not be denied that in rural households with less $25,000, the computer penetration rate and Internet access still lagged significantly behind those is urban areas and central cities. The divide still existed between those with different levels of income and education, different racial and ethnic groups, old and young, single and dual-parent families, and those with and without disabilities. With **broadband** services, a relatively new technology in 2000 and used by only 10.7% of online households, there were also disparities. Rural areas lagged behind central cities and urban areas in **broadband** penetration at 7.3%, compared to 12.2% and 11.8%, respectively

[13] A high-speed line as defined by the Federal Communications Commission is a connection that is faster than 200 **kbps** in at least one direction. Broadband connections are most often defined as operating at T-1 speeds or greater (1.54 mbps)

[14] National Center for Educational Statistics. (November 2003). *Recommendations of the task force on the prevention of waste, fraud and abuse*. Convened by the Schools and Libraries Division, Universal Service Administrative Company. September 2, 2003. Retrieved August 17, 2004 from http://www.sl.universalservice.org/taskforce/default.asp

[15] Federal Communications Commission. (December 2003). *High-speed services for internet access: Status as of June 30, 2003*. Washington, DC: Industry Analysis and Technology Division, Wireline Competition Bureau. Retrieved August 17, 2004 from http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/hspd1203.pdf.

NCES (November 2002)

National Center for Education Statistics. (October 2003). I*nternet access in U.S. public schools and classrooms: 1994-2002*. Washington, DC: Author. Retrieved August 17, 2004 from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2004011

[16] While the vast majority of research has occurred with post-secondary students, a few studies have been done in a K-12 environment and have shown similar results. A recent literature review of interactive **videoconferencing**, conducted as a precursor to the October 2002 National Symposium on Interactive Videoconferencing in Dallas, Texas, summarizes the current state of the distance learning literature at the elementary-secondary level:

a. Only a limited number of studies could be found at the K-12 level, with the majority of those including both university (or professional) and some high school students

b. In a Colorado study (1991) exploring the feasibility of using video technology to provide Chapter I (Title 1) remedial courses to eligible elementary children, it was found that I-TV classes were "at least as effective as traditional instructional delivery systems in producing student achievement" and was successful in "actively engaging the students for the entire program".

[17] Philip Westfall, President of the United States Distance learning Association, summarized much of the existing research and experience on two-way I-TV in a January 2003 interview:

> Interactive television (I-TV) emulates the classroom at a distance; it is the transition to distance learning that requires the least amount of effort. Instructors can achieve the same levels of learning they had with their resident[ial] courses. If the infrastructure is in place, development costs for I-TV may be next to nothing, and time to convert to I-TV can be done in a matter of weeks with a modest amount of training for the instructor…As far as general effectiveness as a medium, it is consistently reported by users of I-TV that student performance is at least equal to resident[ial] classes…dropout rates are very low.

The Enliten Management Group. (January 2003). An interview with Phillip Westfall, president of U.S. Distance Learning Association. *Page of Enlitenment.* Retrieved August 17, 2004 from http://enliten.net/useus/Enlitenment/Web_Westfall_Interview.pdf

[18] See: Small Schools webpage of the Rural School and Community Trust at http://www.ruraledu.org/issues/small.htm

[19] A Note On Infrastructure Requirements—Just as there are many distance learning technologies, so too are there several two-way I-TV technologies, each using a different transmission mode. Four basic options exist in order of audio and video quality: (1) Analog, **DS-3** (45 **mbps**) or **ATM** which provides the audio and video quality similar to the nightly news; (2) dedicated **T-1** (1.54 **mbps**) lines within a consortium; (3) **ISDN** lines for which there is a per minute charge: and (4) **IP** (Internet Protocol) over **fractional** to full **T-1** lines, e.g., 384 **kbps** to 1.45 **mbps**. There are certainly infrastructural limitations, regardless of whether the option chosen is a dedicated **broadband** network (**DS-3** or **T-1**), an **ISDN** line, or an **IP** connection. Most rural areas will potentially have access to at least a **fractional T-1** line, but all telecommunications companies (especially larger companies) are not always willing to provide them or make them available at a reasonable **tariff**ed rate. Districts will need either state-provided or other consulting assistance in researching the infrastructural options and in deciding on the best, most feasible transmission means available.

[20] *Recommended Standards, Guidelines, and Resources for K-12 Two-Way Interactive Television Networks*. A White Paper published by GreaterNET and the Missouri Distance Learning Association. Available at *www.ruraledu.org*.

[21] I-TV consortiums consisting of a single large school district and several much smaller districts sets the expectation that the larger school becomes the provider and the smaller districts assume a "receive-only" role. This is not a healthy relationship. In the short-run, it may appear to work; in the long run the advantages of a consortium arrangement will be eroded.

[22] Note that a portion of the **codec**, installation, and maintenance are eligible as a Priority I Telecommunications Service if included as part of a distance learning service provided to the school by an eligible telecommunications provider. Priority I services receive highest priority for discounts and are virtually assured. If purchased directly by the school, this equipment would be eligible as a Priority II Internal Connection and would therefore be limited by the total amount of **E-Rate** funds available; that is, not all schools requesting Priority II services will receive discounts—those at the highest free/reduced lunch rates receive first priority.

[23] For a complete description of **E-rate** discounts for schools and libraries, see http://www.sl.universalservice.org/

[24] Among the currently most active states in terms of school finance litigation are New York, North Carolina, South Carolina, New Jersey, New Hampshire, Kentucky, Tennessee, Arkansas, Iowa, Nebraska, Kansas, Missouri, Wyoming, Texas, New Mexico, California, Montana, and West Virginia.

[25] Rural School and Community Trust. (April 2003). *Distance learning Technologies: Giving Small Schools Big Capabilities.* Washington, DC: Author. Retrieved August 17, 2004 at http://www.ruraledu.org/docs/arkansas/distlearn.doc.

[26] Hobbs, V. (August 2003). *Two-way interactive TV: An educationally sound and cost-effective approach to distance learning in Arkansas' small schools.* Washington, DC: Rural School and Community Trust. Retrieved August 17, 2004 at http://www.ruraledu.org/docs/arkansas/arkdl.pdf.

[27] Heath, M. & Holznagel, D. (October 2002). *K-12 interactive videoconferencing policy issues review*. Dallas, TX: Regional Technology in Education Consortia (R*TEC). Retrieved August 17, 2004 from http://neirtec.terc.edu/k12vc/resources/litpolicy.pdf.