Introduction

In the last few decades, the world has been saturated with changing and complex technology, leading to a 21st century marked by its interconnectedness and an increasingly globalized society. This presents a challenge for policymakers, because America’s children must be prepared to thrive in this new world and the United States educational system must adapt to meet the needs of 21st century learners and workers.

Technology has the potential to transform learning environments in ways that will benefit the 21st century student. As with many emerging societal trends, younger generations are the first to incorporate technical change into their everyday lives. Increasingly, however, our nation’s schools also are becoming adopters, dramatically changing the way students and teachers use technology in the classroom.

Effectively integrating technology in education settings, understanding technology’s effect on student learning, and articulating the role state policymakers have in that effort is far from complete. The unique nature of technology investments makes them a difficult fit with traditional district and state budgeting processes. Although several states have made great strides in using technology to improve education, others are lagging behind. This brief presents goals for 21st century education technology, discusses the challenges of access and funding, describes how technology is successfully being used in schools around the country, and highlights state leaders and state-led initiatives in the innovative use of technology in education.

Why Is Technology Important in Meeting the Goals of 21st Century Education?

For students to compete in a global economy, experts agree that students must be equipped with certain skills that will prepare them to succeed in the work force and in college. Complex thinking, sophisticated information technology literacy skills, and highly developed, life-long learning skills are essential for all students.

According to The Partnership for 21st Century Skills (an organization that brings together the business community, education leaders, and policymakers to define a vision for 21st century education in order to ensure every child’s success as citizens and workers), it is increasingly important that today’s education system bridges the gap between how students live and how they learn. Students will spend their adult lives in a multitasking, multifaceted, technology-driven world, and they must be prepared for such an environment. The Partnership, therefore, proposes six key elements of 21st century learning.

1. **Emphasize Core Subjects.** As defined by the No Child Left Behind (NCLB) Act, this includes English, reading or language arts, math, science, foreign languages, civics, government, economics, arts, history and geography.
2. **Emphasize Learning Skills.** This includes information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills.

3. **Use 21st Century Tools to Develop Learning Skills.** Technology plays an important role in engaging students in the learning process.

4. **Teach and Learn in a 21st Century Context.** Students understand and retain more when their learning is relevant, engaging and meaningful to their lives.

5. **Teach and Learn 21st Century Content.** This includes global awareness; financial, economic and business literacy; and civic literacy.

6. **Use 21st Century Assessments that Measure 21st Century Skills.** Sustainable and affordable assessment at all levels must use new information technologies to increase efficiency and timeliness.

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### Does Technology Improve Student Achievement?

A Missouri program has demonstrated that the thoughtful implementation of technology in a classroom is correlated with higher standardized test scores. The Enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) program provides each participating teacher with technology for the classroom, extensive professional development and ongoing support. Specifically, each classroom receives the following equipment:

- One computer for every two students, with a high-speed Internet connection,
- Teacher workstation computer,
- Teacher laptop,
- Interactive whiteboard and projector,
- Digital camera and scanner,
- Printers, and
- Microsoft Office and Inspiration software.

Research conducted by Missouri’s Office of Social and Economic Data Analysis concludes, “…students of teachers who consistently apply the inquiry-based instructional practices emphasized by the eMINTS professional development program scored higher on the Missouri Assessment Program (MAP) tests than did the students whose teachers used other instructional practices.”

The program has expanded beyond Missouri to Utah, Maine, Nevada and Illinois. Test results continue to show that, on most state tests, students enrolled in eMINTS classrooms scored higher than students enrolled in non-eMINTS classrooms and that low-income and special education students in eMINTS classes generally score higher than their non-eMINTS peers.

Why is technology important in education? According to the Partnership’s report, *Learning for the 21st Century,* technology will continue to be a driving force in workplaces, communities and personal lives in the 21st century. Technology helps prepare students for the workforce when they learn to use and apply applications used in the workplace. When content and strategies meet accepted education standards, research shows that technology increases mastery of vocational and work-force skills and helps prepare students for work when emphasized as a problem-solving tool. In this environment, the need for technologically literate citizens and workers increases every year, and skilled people in the 21st century need to understand how to use technology tools.

Technology also is important in engaging students in the learning process. Most young people have never lived in a world without computers, the Internet, cell phones, multi-media, and software applications. Their personal lives are filled with “gadgets” that allow them to easily connect with people and direct their own discovery. Most education settings, however, have been slow to incorporate these options, creating a “reverse digital divide,” where students experience technology saturation out of school but have lesser access during school.

The Partnership defines technology tools as information and communication tools (ICT). Current ICTs include computers; networking and other technologies; plus audio, video, and other media and multimedia tools. These tools enable people to perform effectively at work and in their daily lives. However, today’s technology may be obsolete tomorrow. That’s why it is important for students to acquire higher-order thinking skills so they can quickly adapt to changes.
Access to Technology: Results Are Mixed

The National Center for Education Statistics (NCES) conducted its first survey on information technology in schools and classrooms in 1994. Although the results of this report indicate access to technology has increased dramatically in the decade since, significant room for improvement still exists as schools have slowly struggled to provide all the essential elements—beyond the hardware and connectivity—of a highly functioning, transformed learning environment.

According to the February 2005 NCES report, *Internet Access in U.S. Public Schools and Classrooms: 1994-2003*, in the fall of 2003, nearly 100 percent of public schools in the United States had access to the Internet. Even more encouraging, however, is that 93 percent of public school instructional rooms had Internet access, compared with 3 percent in 1994. The ratio of students to instructional computers with Internet access in public schools was 4.4 to 1 in 2003, a decrease from the 12.1 to 1 ratio first measured in 1998. This indicates dramatic improvement in the opportunity for student access to technology in recent years. Schools also have begun offering access to technology in their buildings during non-school hours as a way to address the digital divide. In 2003, 48 percent of public schools with Internet access reported making computers available to students outside regular school hours. Nearly all public schools (97 percent) used some method to control student access to inappropriate material on the Web.

Many types of technology are used by schools. Among the more popular are laptops; hand-held computers that are smaller, lighter, and more easily transportable; and Web sites. In 2003, 8 percent of public schools lent laptop computers to students. However, the median number of laptop computers available for loan was five, making access to mobile units limited. Only 10 percent of public schools provided hand-held computers to students or teachers for instructional purposes. Nearly 88 percent of public schools connected to the Internet in 2003 used a Web site or Email to make information available to parents and students. (Later sections of this report will focus on specific examples of the technologies being used as a result of statewide policy setting.)

In 2003, 95 percent of public schools with Internet access used broadband connections to access the Internet. Broadband, as opposed to dial-up connections, allows larger amounts of information to travel faster, decreasing the amount of time spent waiting for information to arrive to the end user. Broadband is loosely defined, however, and many schools still suffer from inadequate bandwidth to accommodate increasingly complex information. Thirty-two percent of public schools with Internet access used wireless connections. This permits a computer to be free of cables plugged into a wall, allowing it to move freely throughout a building and still access the Internet. However, only 11 percent of public school instructional rooms had wireless Internet connections, a decrease from 15 percent the previous year.

In 2003, 82 percent of public schools with Internet access indicated that their school or district offered professional development to teachers on how to integrate the use of the Internet into the curriculum in the 12 months prior to the fall survey. However, only 37 percent of schools have a full-time school technology coordinator and only 62 percent of teachers felt that their pre-service education on technology prepared them.

Although connectivity has largely been addressed in school buildings, access to technology remains limited. Computer labs require a teacher to take students to a new room outside the typical instructional setting to integrate computer-based lessons into instruction. Although
making a few computers available in a classroom adds value, it can be insufficient to truly transform teaching and learning. In addition, if teachers are uncomfortable or have little or no training in how to use the technology that is available in their school, the effectiveness of the technology is severely diminished. In fact, teachers report that the greatest barriers to their use of technology had to do with time: limited time to develop new activities that incorporate technology, limited time in the school schedule to conduct activities, and limited time to practice technology skills.\textsuperscript{5}

Teacher surveys reveal a slightly different story than do hard statistics. Although more than 70 percent of teachers said they use the Internet “frequently or always” to prepare for class and 58 percent said they use the Internet in class with similar frequency, most complained of inadequate availability of hardware. Just over 47 percent said they have only a single computer with Internet access in their classrooms, and 41 percent said they have access to a computer lab. A quarter of teachers do not have such access, however, and others who do say it is difficult to get into the labs.\textsuperscript{6} This presents a challenge for schools and policymakers. An essential link in using technology to improve student learning is teacher training. A computer or software application does little good if teachers are not given sufficient time and professional development opportunities to learn to effectively incorporate technology into classroom instruction. The progress of the past decade will be fully appreciated only when teachers are prepared to use technology.

**Funding Technology: Challenges and Opportunities**

Understanding the role of the federal, state, and local governments in funding technology is not easy. Districts bear most of the cost of technology used in schools, although the federal government has taken the lead in providing schools with connection to the Internet and states also are beginning to take a more active role.

The E-Rate (Education Rate) program was established in 1996 with Congress’s reauthorization of the Telecommunications Act. As one of the initiatives of the longstanding Universal Service program, which collects fees from and through telecommunications providers to extend telecommunications services to Americans who would not otherwise have access to such services, E-Rate is subject to an annual spending cap of $2.25 billion. The E-Rate program, administered by the Universal Service Administrative Company (USAC) at the direction of the Federal Communications Commission, seeks to improve access to digital technology by providing approved schools and libraries with discounts ranging from 20 percent to 90 percent on qualifying telecommunications services. Discount rates are based on the percentage of students eligible for participation in the National School Lunch Program and on whether the school or library is located in a rural area. The E-Rate program supports the acquisition of digital technology infrastructure, including telephone services (basic, long-distance and wireless), Internet and Web site services, and the purchase and installation of network equipment and services. Other components of educational technology—such as computer hardware and software, staff training, and electrical upgrades—are not covered under E-Rate. E-Rate has been given much of the credit for narrowing the digital divide by allowing networking capability for low-income and rural schools.\textsuperscript{7}

<table>
<thead>
<tr>
<th>Student to computer ratio</th>
<th>4:1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public schools with Internet access</td>
<td>100%</td>
</tr>
<tr>
<td>Instructional rooms with Internet access</td>
<td>93%</td>
</tr>
<tr>
<td>Public schools with wireless Internet connections</td>
<td>32%</td>
</tr>
<tr>
<td>Instructional rooms with wireless Internet connection</td>
<td>11%</td>
</tr>
<tr>
<td>Public schools with a full-time, paid technology director</td>
<td>37%</td>
</tr>
<tr>
<td>Public schools that offered professional development for technology to teachers</td>
<td>82%</td>
</tr>
<tr>
<td>Teachers who report feeling prepared after initial technology training</td>
<td>62%</td>
</tr>
</tbody>
</table>

**Technology Statistics in Schools Nationwide, 2003**

Enhancing Education Through Technology, also known as E2T2, is Title II Part D of the No Child Left Behind Act that provides grants to states for technology to improve student academic achievement. Under E2T2, the U.S. Department of Education provides grants to state educational agencies on the basis of their proportionate share of funding under Part A of Title I. States may retain up to 5 percent of their allocations for state-level activities and must distribute one-half of the remainder by formula to eligible local educational agencies and the other one-half competitively to eligible local entities, defined as high-need schools or a partnership of a high-need school and another qualifying institution. Between 2002 and 2005 more than $2 billion dollars was awarded to states, although funding for E2T2 has decreased every year, down from an initial amount of $700.5 million in 2002 to $496 million in 2005.8

State initiatives to fund technology are diverse in their purpose and funding amounts. According to a survey of state technology directors, Education Week reports that eight states, Alaska, Colorado, Maryland, Nebraska, New Hampshire, Oklahoma, Oregon and Utah, do not allocate state funds specifically for educational technology as of 2005. Of the 42 states that do allocate money specifically for education technology, amounts range from a low of $318,000 in Mississippi to a high of $196.3 million in New York.9

Texas, for example, allots $30 per student to provide for the purchase by school districts of electronic textbooks or technological equipment that contributes to student learning. It also may pay for training educational personnel who are directly involved in student learning in the appropriate use of electronic materials, and for providing access to technological equipment for instructional use.10

Other states, instead of allotting a per pupil funding amount, designate funding for specific projects. Utah, for example, reported to Education Week the allocation of $5 million (one-time appropriation) in 2005 to be used to build capacity and infrastructure to deliver online, state-mandated, end-of-level tests in reading/language arts, math and science.11

One difficulty in understanding technology funding is that many funding sources exist from all levels of government. Titles I, II and V of NCLB each allow federal funds to be used for technology purchases. When answering surveys of technology provisions, states may or may not include funding for virtual schools or pass-through funds from the federal government. Thousands of local education agencies also make funding decisions independently of the federal or state governments.
There are many challenges to funding technology. Given the combination of major equipment purchases, the hiring of specialized staff, and the ongoing training of existing staff, technology funding holds a unique distinction. “It is neither a labor expense nor a capital expense nor a recurring material expense, but rather a hybrid,” according to Larry Picus, an expert on school finance. Two funding philosophies currently are at work: Local governments will either choose to continue to raise funds as needed, tacking technology onto existing line items in the budget, or they will attempt to incorporate and design flexible budgets that allow for a wider array of funding options.\textsuperscript{12}

As states consider investing in technology initiatives, they may wish to consider identifying those elements that are essential to ensuring that technology has a real and lasting effect on student achievement.

### Essential Elements to Ensure Technologies Are Used to Support Real Gains in Educational Outcomes

1. **There must be leadership around technology use that is anchored in solid educational objectives.** Simply placing technologies in schools does little good. Effective technology use is always targeted at specific educational objectives.

2. **There must be sustained and intensive professional development** that takes place in the service of the core vision, not simply around technology for its own sake.

3. **There must be adequate technology resources** in the school including hardware and technical support to keep things running smoothly.

4. **There must be recognition that real change and lasting results take time.**

5. **Evaluations** must be conducted that enable school leaders and teachers to determine whether they are realizing their goals, and how to adjust if necessary.

**Source:** Margaret Honey, Vice President and Director, Center for Children and Technology, testimony and statement before the Labor, Health and Human Services, and Education Appropriations Subcommittee, U.S. Senate, July 25, 2001.

### States Lead the Way

Just as schools and districts are in various phases of adopting technology, so are states. Some, however, are leading the nation. In 2005, *Education Week* named technology leaders based on recently collected statistics. South Dakota is the leader in providing access to technology. At the school level, there are 1.7 students per instructional computer and 1.9 students for every Internet-connected computer. At the classroom level, there are 3.5 students per instructional computer and 4 students per Internet-connected computer located in classrooms.

Utah leads the nation in the use of education technology. It is the only state that has state standards for students in technology, tests students on technology, has established a virtual school, and offers computer-based assessments.

Virginia is the national leader in the capacity to use technology. Its state standards include technology for both teachers and administrators; an initial license for both teachers and administrators that requires technology training, coursework, or a test; and a requirement for technology training, a technology test for recertification, or participation in technology-related professional development.
Schools and districts have long experimented independently of their state with education technology initiatives. However, states have recognized the potential of technology to enhance and improve learning and have taken an increasingly proactive role in developing technology initiatives. Some examples of these state initiatives follow.

**Laptops**
Taking advantage of the mobility of laptops is one way schools are bridging the digital divide and transforming teaching and learning. Research shows laptops can have a positive influence on student and teacher outcomes.

- Laptop students spend more time engaging in collaborative work than do non-laptop students.
- Laptop students participate in more project-based instruction.
- Laptops lead to more students writing and to writing of higher quality.
- Teachers who use laptops use a more constructivist approach to teaching.
- Teachers who use laptops feel more empowered in their classrooms.\(^\text{13}\)

Although many districts and individual schools have laptop programs, three states—Maine, Michigan, and New Mexico—have funded laptop initiatives in some form.

The Maine Learning Technology Initiative (MLTI), a “state learning technology plan to prepare students for a future economy that will rely heavily on technology and innovation,” is the largest educational technology project in the state’s history. Maine is the first state to embark upon a plan to eliminate the digital divide by providing a laptop to every seventh and eighth grade student and teacher. The initiative, begun in 2003, cost $37.2 million over a four-year period and equipped more than 30,000 teachers and students. Wireless access to the Internet has allowed students and teachers to acquire information that is not available through conventional methods. Curriculum is being developed that will leverage this technology so that both teachers and students will excel in a world that is driven by information.

Maine focused not only on providing the technology, but also on providing the professional development necessary so teachers could integrate the technology into their instruction. A program of professional development that introduced teachers to the laptop and basic computer skills was developed early in the program and is continuing, with increasingly sophisticated training focused more specifically on teachers’ academic content areas.\(^\text{14}\)

**Online/Distance Learning**
Online education has the potential to enhance communication between teachers and students and the ability to accommodate different learning styles. Students may be enrolled full-time in an online program and forego attending a regular school or might be involved in only one or two online courses as a supplement to traditional education environments.

During the 2002–2003 school year, students in about one-third of public school districts (36 percent) were enrolled in distance education courses.\(^\text{15}\) Many schools are taking advantage of the Internet to offer classes to their students that the school cannot offer. Small schools with few students and teachers are able to offer Advanced Placement classes online, allowing their students to meet the same high academic achievement standards of large schools. Parents who choose to school their children at home or whose children need a more flexible schedule can take advantage of online courses, creating a virtual community of online learners. When it is not economically viable to offer courses for a few students who are interested in a subject,
students can instead choose to take the course online with students from around the country. In fact, 80 percent of public school districts said that offering courses that are not available at their schools is one of the most important reasons for having distance education. Some states even have full-time virtual schools in which a student’s entire public education is provided via online technologies, including supervision by a certified teacher and provision of standards-aligned curriculum.

As of the 2004-2005 school year, at least 22 states had established a virtual school. Sixteen states have cyber charter schools and/or district programs. Florida Virtual School (FLVS) has become a leader in developing and providing virtual education solutions to students throughout the country. The Florida Legislature initially funded the FLVS as a pilot project in 1997, at $1.3 million to begin course development with limited student enrollment. The 2000 Florida Legislature enacted Statute 228.082, establishing FLVS as an independent education entity with a separate governing board appointed by the governor.

Today, FLVS serves schools across the nation, offering virtual education solutions for grades six to twelve, as well as for adults who are seeking GED alternatives. Courses are free to Florida residents and are available to public, private and home school students. National and international students may enroll in FLVS on a tuition basis. FLVS offers more than 80 courses—everything from GED to honors to 11 Advanced Placement courses.

Beginning in 2003-2004, FLVS is funded through the Florida Education Finance Program, according to how many students pass the school’s online courses. Traditional public schools are funded according to the number of students enrolled. The virtual school’s 2004-2005 budget was approximately $16.2 million, based on 3,171 full time equivalent students. Prior to 2003-2004, the FLVS was funded through a line item in the General Appropriations Act. In 2003, the Florida Legislature also created a separate, full-time virtual K-8 pilot program that now serves 1,000 students across the state.

<table>
<thead>
<tr>
<th>States with Virtual and/or Cyber Charter Schools, 2004-2005 School Year</th>
</tr>
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- Virtual Schools
- Cyber Charter Schools and/or District Programs
- Both Options Available
- No Options Available

Sources: “Technology Counts, Electronic Transfer: Moving Technology Dollars in New Directions,” *Education Week*, 24, no. 35, (May 5, 2005); and John Watson, “Keeping Pace with K-12 Online Learning” (Naperville, Ill.: North Central Regional Educational Laboratory, October 2005).
Online Tutoring for Students
Few things are more valuable to a student's learning than one-on-one time with a knowledgeable instructor. Limited time and teachers can make it difficult for a student to receive the amount of individual attention he or she needs during the school day; tutoring programs also are limited by the knowledge of the tutor and the time allotted. Online tutoring can be one solution to these problems.

Beginning August 1, 2005, all Alabama students in fourth through twelfth grades are able to take advantage of free online tutoring between the hours of 3:00 p.m. to midnight in the subjects of math, science, social studies and English. Students can connect to a tutor through any computer with Internet access. The tutors help students with homework through the use of instant messaging, an interactive virtual “chalkboard” and shared Web browsing. Drawing and diagramming features allow tutors to demonstrate math and science concepts. When the session is completed, students can print their session for future reference or share it with a parent or teacher. Both students and tutors complete surveys, which are shared each month with the Alabama Public Library Service and the individual public libraries. Although its primary intent is to assist school children, any Alabama citizen can take advantage of the service.

According to Rebecca Mitchell, Alabama’s state librarian, the program was started with federal funds from the Institute of Museum and Library Services in the form of a Library Services and Technology Act grant. The state partnered with tutor.com, which provides issue experts who are current or retired teachers, college professors or graduate students and who undergo an extensive background check and training. In the first three months of the program, there were 19,000 tutoring sessions, the most popular of which were middle school math and science assistance. The $300,000 federal grant lasts 12 months, and the funding for future years has yet to be determined.  

Online Professional Development Opportunities for Teachers
Research has found that quality, ongoing professional development for teachers is essential to ensure high-quality teaching and learning. As discussed earlier, teachers most often feel that lack of time is a barrier to learning how to integrate technology into the classroom. By offering online professional development, teachers have more freedom to schedule their own learning. The Louisiana Department of Education provides professional development projects through the Louisiana Center for Educational Technology (LCET), which was established to provide professional development for teachers, administrators and school personnel in K-12 school districts. The impetus for the program was the need to provide professional development for educators that better suited their learning styles and their schedules.

The program includes graduate-level online courses, community of learner networks, and workshops for specific educational needs. Through a variety of experiences, it provides learning opportunities and resources to support all teachers in their efforts to improve student learning and achievement.  

Data Systems and Online Assessments
Data-driven decision making is becoming popular in educational settings, partly due to the No Child Left Behind requirements and the capacity of information technology to allow decision makers access to data.
NCLB stipulates that all public school students must meet or exceed the state’s proficient level of academic achievement by the end of the 2014 school year. It also requires that each state develop a monitoring and accountability system to measure that targets are being reached. In light of this, states and districts are beginning to use technology to create systems that allow them to answer important questions, such as:

- Given where we are now, are we improving at a rate that will keep us on track to reach the target in the time remaining?
- If we are improving too slowly, what must we do differently?  

In 2003, the Idaho Legislature passed HB 367, authorizing the State Board of Education to provide for and implement the Idaho Student Information Management System (ISIMS) and requiring all school districts in Idaho to use it to the full extent of its availability. ISIMS creates a statewide, student information management system designed to provide new resources for parents, teachers, students and all stakeholders of education in the state. The J.A. and Kathryn Albertson Foundation dedicated $35 million to the development and implementation of the ISIMS system. The plan expands a $3.5 million pilot program in 13 districts that allows the districts to collect, maintain and share student information among their schools. The project will build a centralized, uniform system that includes a host of web-based resources and tools for education stakeholders.

Virginia has developed a model and implemented a statewide initiative for integrating data systems and statewide online assessments. The goal of this initiative is to have Virginia schools use Internet-based systems to administer assessments to improve student achievement with use of data by stakeholders. Online testing became a major component of the initiative due to a need to speed up return of preliminary test results for educational decision making. Four objectives of the initiative are to:

- Provide student access to computers at a ratio of one computer for every five students;
- Create Internet-ready local area network capability in every school;
- Ensure adequate high-speed, high-bandwidth capability for instructional, remedial and testing needs; and
- Establish a statewide Internet-based standards of learning test delivery system.

An executive order from the Virginia governor that required the entire state to move toward “electronic government” was the first step in establishing this program. Developed through a partnership between the Virginia legislature, the Virginia Department of Education and the Governor’s Office, the legislature included Item 143 C. 11. of the 2000 Appropriation Act, which by May 2004 received $232 million in support.

**E-Textbooks and Digital Instructional Materials**

Accurate and current textbooks are crucial to quality education because teachers rely on them to aid in the instructional practice. Textbooks represent a significant expenditure, however, and updating them regularly can be a challenge for school districts.

Texas, one of few textbook-adoption states in the country, began early to incorporate digital materials. In 1989, Texas amended the definition of a textbook to include “computer software” and, in 2004, the State Board of Education adopted instructional materials for technology applications that included many online and computer-based products. These materials are available to schools for the 2005-2006 school year.
During the 2005 legislative session, several proposals were considered that would keep Texas moving in the digital direction. Although none were passed by the Legislature, they continue to be considered and debated. Several proposals would add flexibility to the process of textbook adoption, changing the review and adoption cycle and the funding and purchasing process. Another proposal provides for an instructional materials and technology allotment and allows for purchase of traditional print materials, digital materials, technology, professional development and network infrastructure.

**Emerging Technologies**

If you were to walk into any school in America, you would likely see a wide variety of technologies in use by students, teachers and administrators beyond those discussed above. Unique use of technology tends to occur first in schools and districts. The following excerpt from *Hot Technologies for K-12 Schools*, a report from the Consortium for School Networking (CoSN), highlights emerging technologies in schools.

*Addressing diverse learning styles*

One emerging technology is classroom audio enhancement, which evenly distributes the teacher’s voice above background noise in the classroom, making the sound more intelligible to students. According to CoSN, research shows that all students, and especially those with attention deficit problems and those for whom listening is an effective learning style, benefit from this technology. In Anaheim Public Schools in California, a study of third and fourth graders showed gains in reading, math, language and spelling scores in sound-field enhanced classrooms, compared to the previous year’s test scores without audio enhancement implementation.

*Galvanizing the instructional process*

Datacasting allows teachers to go online to find a rich collection of high quality media content packaged with software, interactive time-lines and activities, and games, to stream into classroom computers or TVs. Teachers can access and navigate large data files easily using the Internet, select what they need, and have it delivered to their desktop computers immediately or overnight. In North Texas, the public television datacasting service provides more than 75,000 K-12 students and teachers with more than 8,000 learning objects.

*Improving assessment and evaluation*

Digital assessments come in all shapes and sizes and have the power to deliver immediate results using a wireless or online tool. Students answer questions in a classroom setting electronically using a remote control-like device, PDA, or graphing calculator. Teachers see the results immediately on a computer, gaining immediate insight into “knowing what the students know,” allowing them to adjust classroom time to meet the needs of the students. In Cleveland, Ohio, math and language arts teachers have built diagnostic assessments, called “testlets” for each of the indicators in Ohio state standards.
Conclusion

Understanding why and how technology is being used in schools is an important first step for state legislators. Education is lagging behind all other industries in adopting technology as a tool to increase efficiency and improve performance, and the pace of change will not slow as we progress through the 21st century. Effective implementation of technology in education will require thoughtful and diligent leadership at all levels.

The National Conference of State Legislatures (NCSL), through the Education Technology Partnership and as part of a project with the NCSL Foundation, will continue over the course of a year to produce materials that assist state legislatures as they consider their role in education technology. Thanks to the legislators, legislative staff and private partners who are participating.

**Co-Chairs**
Representative Dave Hogue, Utah  
Delegate Nancy King, Maryland  
Julie Pelegrin, Colorado

American Federation of Teachers  
Apple Computers  
Audio Enhancement  
Connections Academy  
Dell Computers  
National Education Association  
Microsoft  
Software Information Industry Association
Notes


3. North Central Regional Educational Laboratory, “Critical Issue: Using Technology to Improve Student Achievement” (Naperville, Ill.: NCREL, 2005).


16. Ibid.

17. “Technology Counts.”
18. John Watson, “Keeping Pace with K-12 Online Learning” (Naperville, Ill.: North Central Regional Educational Laboratory, October 2005).


24. “Toward a New Golden Age in American Education–How the Internet, the Law and Today’s Students Are Revolutionizing Expectations.”

