Equity and Technology Literacy in the Mid-Atlantic Region
by
Alexander V. Schuh*

The American public education system has long sought to provide children with a basic level of literacy in order to allow them the freedom to live, work, and learn productively in society.[1] That basic literacy has most often included facility with reading and writing and working with numbers. While guaranteeing these skills is still a major goal of public education, many prominent organizations and government agencies see the increasing reliance on computers and the Internet as driving a need for a new kind of basic literacy for all: a need for "technology literacy." The ability to use computers for working and learning is seen as essential for full participation in society. However, there is growing concern over the widening gap between those who are developing skills to use computer technologies productively and those who are not (Benton Foundation, 2002). Computers and communications technologies have been promoted as potentially transformative tools that can dramatically alter learning opportunities for those who have been traditionally exposed to only limited educational resources. However, as Servon (2003) pointed out, "The very existence of the Digital Divide… is evidence of the ability of information technology to exacerbate existing inequalities" (p. 1).

Over the past decade, the states, federal government, and schools have made great progress toward closing the "digital divide" between those who could afford access to computers and the Internet for learning and those who could not. However, the focus of governments, businesses, and schools is beginning to shift from giving all children *access* to technology to giving them the *skills* they need to live, work, and learn in an increasingly digital world. The federal government's No Child Left Behind (NCLB) legislation is bringing this issue into sharp relief, placing a new emphasis on giving students skills to use technologies to improve their academic achievement. The NCLB legislation has set goals for the states that they must help all students to become technology literate and that they should facilitate this by incorporating the ability to use technology for learning into all areas of their state academic standards by 2006. The new federal NCLB law has moved technology literacy skills to the front of states' education agendas by linking them to student academic achievement and has identified key groups that must be helped to achieve those skills equitably. Yet, the federal government has left to the individual states the task of defining what technology skills are most important for students to learn, how to assess those skills, and how to structure the paths they will use to help them to learn those skills (Branigan, 2004).

The federal NCLB legislation (2002) in Title II Part D, Enhancing Education Through Technology, aims to improve student technology skills by setting goals and requirements for the

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* **Alexander V. Schuh** is the founder and director of FRONTIER 21 Education Solutions. Dr. Schuh holds a Ph.D. in educational psychology from the University of Pennsylvania, where he studied policy research and evaluation, collaborative learning, and the use of computer media for learning. His expertise is in multiple areas of youth development, including organizational development, education policy, quantitative and qualitative research methods, and computer-based learning. Dr. Schuh has taught science, mathematics, and anthropology in middle and high schools. Since 1992, he has helped to design and establish more than 24 charter schools across the country, including a charter school based on the ideas of emotional intelligence and a virtual charter school for distance learning.

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states regarding the use of technology in schools. It sets technology literacy outcomes for students. NCLB requires all states to submit a plan that shows how they will integrate technology fully into curricula and instruction of all schools by the end of 2006, as specified in Section 2413:

> SEC. 2413. STATE APPLICATIONS.
> (a) IN GENERAL.—To be eligible to receive a grant under this subpart, a State educational agency shall submit to the Secretary, at such time and in such manner as the Secretary may specify, an application containing a new or updated statewide long-range strategic educational technology plan (which shall address the educational technology needs of local educational agencies) and such other information as the Secretary may reasonably require.
> (b) CONTENTS.—Each State application submitted under subsection (a) shall include each of the following:
> (1) An outline of the State educational agency's long-term strategies for improving student academic achievement, including technology literacy, through the effective use of technology in classrooms throughout the State, including through improving the capacity of teachers to integrate technology effectively into curricula and instruction.
> (2) A description of the State educational agency's goals for using advanced technology to improve student academic achievement, and how those goals are aligned with challenging State academic content and student academic achievement standards.
> [and]
> (13) A description of how the State educational agency will ensure ongoing integration of technology into school curricula and instructional strategies in all schools in the State, so that technology will be fully integrated into the curricula and instruction of the schools by December 31, 2006.

This article examines some of the challenges that the states and districts in the mid-Atlantic region faced when attempting to improve technology literacy in their schools, identifies some strategies that proved successful in overcoming these challenges, and outlines possible areas for collaboration among states and districts that might lead to more effective development of technology literacy skills across different groups and communities.

Development of Technology Literacy in the Mid-Atlantic Region

While it is clear that the ability to use computers and communication technologies is becoming increasingly important for students to master and that state and local education systems are being assigned primary responsibility for ensuring those skills, it is not so clear how this might best be accomplished. As a federal grantee responsible for improving the use of educational technologies in the mid-Atlantic region, MAR*TEC conducted a small survey to assess the current situation in the development of technology literacy in schools in the mid-Atlantic region. In that survey, MAR*TEC investigated the following questions with state educational technology officers and several district-level educational technology directors: How prepared are the states and local districts to guarantee technology literacy skills for all students? What are states and districts doing to assess the levels of technology skills of their students? What are the challenges faced by the states and districts as they attempt to boost their students' technology skills? What strategies have been developed for improving these skills? And what potential strategies could be envisioned for increasing these skills equitably for all groups?

In light of the federal requirements, the state educational technology officers identified a wide variety of challenges that they faced in their efforts to improve technology literacy equitably across their states in accordance with the goals of NCLB and a variety of strategies that they believed were working toward achieving that goal. Some of those challenges and strategies were

similar across the states, and some were unique to each state. The strategies and challenges of the states are identified below.

Challenges and Strategies for Equity in Technology Literacy in the Mid-Atlantic States

State educational technology officers in the mid-Atlantic region identified a number of challenges that they faced to varying degrees in attempting to increase technology literacy in their states. These included

- Limited authority of state education departments over school district policy,
- Confusion over how to define technology literacy,
- Limited funds for facilitating changes,
- Large disparities in capacity of different schools and districts regarding educational technologies,
- Personnel turnover in the state education departments,
- Limited available information regarding student technology literacy skills, and
- Widely varying experience and knowledge of educational technology among administrators.

Each of these challenges is discussed below, along with some of the strategies the States are using to address these challenges.

Limited authority of state education departments over school district policy. In the mid-Atlantic states (Maryland, Delaware, New Jersey, and Pennsylvania), there is a strong sense of local autonomy. The states work primarily from a "bottom-up" perspective rather than "top-down," trying to fulfill the needs of the districts as they see them. They are careful not to issue many mandates but rather to provide guidance and targeted funds to facilitate the goals of the individual districts and schools. This has created a somewhat confusing situation when attempting to identify who is setting the course for educational technology in the region. For example, both the states and local districts may have their own standards for technology use in the schools, and those standards may be considerably different in their language and direction. In some cases, the districts are looking to the states for guidance, while the states are looking to the districts to identify their needs.

Strategy: The states and districts are working collaboratively through state-level committees to develop ways to identify educational technology needs and to determine how best to target funding in order to move educational technology forward more equitably. In some cases, collaboration is easier than in others. In Maryland, for example, the state department has 24 school districts to work with. By contrast, the New Jersey department must work with 664 individual school districts.

Confusion over how to define technology literacy. All of the state educational technology offices were concerned that in order to work more effectively, they first needed to develop a shared definition about what it meant to be "technologically literate." Creating a shared vocabulary around technology literacy is thought to be an essential step for the improvement of students', teachers', and administrators' technology skills in each state. A major challenge has been the need to reach consensus across a wide range of stakeholders in each state (e.g., teachers, principals, businesses, parents) In addition, many organizations have attempted to create and promote their own, sometimes competing, definitions of technology literacy.

Defining technological literacy is a particularly confusing task; the term includes a focus on understanding what technology is and using new digital tools to think about, store, and process information. The term "ICT" (information and communications technology) literacy is gaining

acceptance because it incorporates a focus on information, communication, and technology. Table 1 provides a synopsis of the most prominent definitions of ICT literacy.

Although the definitions from the variety of businesses and professional associations differ in emphasizing certain skills over others, they all subscribe to the notion that ICT skills are to be developed as active means to solve problems, and that those skills are fundamental to full participation in society. By adopting the term literacy—which has been associated for many years with the concept of essential skills needed by all members of society—educational organizations, the federal government, and business associations have recognized that the development of ICT skills is critical for all. Without these skills, traditionally disadvantaged groups will continue to suffer as they have previously from low reading and mathematical skills (International Literacy Panel, 2002). The term "literacy" implies language skill and has gained popularity because many feel that only a select group of people are being provided opportunities to learn the ICT language. Many believe that those without such opportunities will be increasingly isolated from the ICT speakers and from the higher paying jobs that require technological skills.

Perhaps the most prominent organization in advocating for universal technological literacy, and one of the most widely cited, is the International Society for Technology in Education (ISTE). ISTE's (2000) National Educational Technology Standards (NETS) for students, teachers, and administrators have been incorporated by the majority of states into their own state standards. ISTE's standards are comprehensive, including goals for understanding technology's role in society and for using technology to communicate and solve real world problems as well as goals for ethical behavior in the use of the new tools.

Another prominent organization facilitating the definition of technology literacy is the North Central Regional Educational Laboratory [(NCREL), 2003]. Its enGauge tool is used widely for assessing the progress of schools and school districts in the integration of technology into all aspects of student learning and educational management. NCREL has termed the whole set of skills that students need to know "digital age literacy" and has separated ICT into two parts: information Literacy and technology literacy. It has defined technological literacy as "knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals." It has defined information literacy as "the ability to evaluate information across a range of media; recognize when information is needed; locate, synthesize, and use information effectively; and accomplish these functions using technology, communication networks, and electronic resources"

Table 1. Leading Definitions of Technology Literacy

Name of Organization	**Definition of Technology Literacy (ICT)**	**Publication**
International Society for Technology in Education (ISTE)	***Students Who Are Technologically Literate:*** • Demonstrate a sound conceptual understanding of the nature of technology systems and view themselves as proficient users of these systems. • Understand and model positive, ethical use of technology in both social and personal contexts. • Use a variety of technology tools in effective ways to increase creative productivity. • Use communication tools to reach out to the world beyond the classroom	International Society for Technology in Education. (2000) *National educational technology standards for students: Connecting curriculum and technology.* Eugene, OR: Author

	and communicate ideas in powerful ways. • Use technology effectively to access, evaluate, process, and synthesize information from a variety of sources. • Use technology to identify and solve complex problems in real-world contexts.	
International Technology Education Association	"A person that understands- with increasing sophistication- what technology is, how it is used, how it shapes society, and in turn is shaped by society is technologically literate." (p. 1)	International Technology Education Association. (2000). *Executive summary of standards for technological literacy*. Reston, VA: Author.
American Library Association (ALA)	"To be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information" (p. 1).	ALA (1998) *Final report of the American library association (ALA) Presidential Committee on Information Literacy*. Author.
Programme for International Student Assessment (PISA)	"The interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate and evaluate information, construct new knowledge, and communicate with others in order to participate effectively in society" (p.11)	PISA (2003) *The PISA framework for assessing ICT literacy: Draft report to network A*. Author.
Partnership for 21st Century Skills	ICT literacy is: • "Using ICT to manage complexity, solve problems and think critically, creatively, and systematically; • Using ICT to access, manage, integrate, evaluate, create and communicate information; and • Using ICT to enhance productivity and personal development" (p. 11).	Partnership for 21st Century Skills (2003) *Learning for the 21st century: A report and mile guide for 21st century skills*. Author.
Educational Testing Service's (ETS) Center for Global Assessment	Technological literacy is "using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society"(p. 3).	International ICT Literacy Panel (2002) *Digital transformation- A framework for ICT literacy*. Author.
North Central Regional	"*Technological Literacy* is knowledge	NCREL (2003). *enGauge*®

Educational Laboratory (NCREL)	about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals" (p. 22). "*Information Literacy* is the ability to evaluate information across a range of media; recognize when information is needed; locate, synthesize, and use information effectively; and accomplish these functions using technology, communication networks, and electronic resources" (p. 26).	*21st century skills: Literacy in the digital age*

Strategy. The state departments of education are moving ahead with developing and adopting their own definitions of technology literacy and incorporating that definition into standards for student technology use. For example, in New Jersey, the state education department conducted a series of workshops across the state in collaboration with local school districts that focused on developing a shared definition of technology literacy. From these workshops, the state department developed a definition for technology literacy and a set of technology standards called the "New Jersey Core Curriculum Content Standards for Technological Literacy" that was adopted by the New Jersey Board of Education in 2004. The standards addressed the potential conflict between learning about technology (technology education) and technology literacy by developing two parts to the standards: one devoted to computer and information literacy and one devoted to technology education. The New Jersey standards are based on previously developed standards from several national professional organizations, including

- The American Library Association and Association for Educational Communications and Technology's (1998) information literacy standards for student learning;
- ISTE's (2000) national educational technology standards for students; and
- International Technology Education Association (ITEA) (2000) standards for technological literacy (STL): Content for the study of technology; and

As another example, Maryland has approached the improvement of ICT literacy skills for all students by convening a consortium of all 24 school systems in the state focused on technology in the schools (The TL8 Consortium, 2004). The grant-funded consortium has developed a draft definition of technology literacy for Maryland that is currently under review by the school systems. Its definition states the following:

> Information and Communication Technologies Literacy is defined as the ability of an individual, working independently and with others, to effectively, appropriately and responsibly use technology and communication tools to access, manage, integrate, evaluate, and create information in the 21st century (p. 1).

Limited funds for facilitating changes. All of the state department staffs surveyed indicated that the ability to create a system that truly enables universal technology literacy requires far more funds than they have access to. The State Educational Technology Directors Association's (SETDA, 2003) national study of states' progress toward implementing NCLB found that 25% of the states are completely reliant on the federal funds in Title II, Part D for funding educational technology initiatives. In Maryland, state educational technology officers stated that they do not

have enough money to effectively assess what the local districts are doing with their Enhancing Education Through Technology (EETT) grant funds. Limited funds are a major problem in trying to level the educational technology playing field for all students:

NCREL (2003) has developed the following "Indicators of Systemwide Equity," all of which are hampered by limited funding in low-income schools and districts:

- Equitable access;
- Equitable support for quality, technology-integrated instruction;
- Equitable student use; and
- Equitable opportunities for home-school communication.

Strategy. Many of the over 500 districts have very little money and lack the ability to purchase new equipment, software, or training to make the most of technology. The state education department has tried to use small amounts of seed funding and other low-cost means to increase the technology skills of their administrators, teachers, and students. They have tried several strategies to overcome funding obstacles. These include

- Using federal EETT money to increase technological infrastructure and school district capacity to improve technology for teaching and learning in poorer schools and school districts;
- Providing guidelines and opportunities for partnering with outside agencies, businesses, and organizations such as One Economy to bring needed technological resources and training to underfunded schools;
- Creating a leadership series of workshops for school principals that helps them to see the advantages and be more receptive to creative uses of technology in their schools;
- Giving $10,000 mini-grants (100 grants for a total of $1 million dollars) to further middle and high school principals' visions of innovative technology use in their schools, which included free palm handheld computers for teachers and students;
- Holding a "keystone summit" of 100 teachers who were particularly successful at integrating technology into their schools, who were then connected to a network for developing and sharing their ideas; and
- Teaching grant writing skills and communicating with school districts about grant opportunities for obtaining funding in support of their visions for technology use in their schools.

Disparities in capacity of schools and districts regarding educational technologies. All of the state education departments surveyed for this report indicated that there was a wide disparity in the capacity of schools and school districts, and that those differences made adopting more universal strategies very difficult. For example, in Pennsylvania, there are over 500 school districts, and each has a different set of challenges and issues related to technology. For example, some districts have computers in the large majority of student homes, and they are facing challenges of how to use the Internet to communicate best with parents. Some school districts lack Internet connections in many classrooms, and they are focusing on networking their schools.

Strategy. The states are using the EETT funding to provide grants for districts that target particular needs. Grant funds cover a wide variety of projects but are targeted on the districts with the lowest income levels or with the greatest need in other areas, such as a large percentage of English language learners.

Personnel turnover in the departments. Two states surveyed for this study stated that they had had difficulty maintaining momentum on efforts to improve technology literacy because they had lost key personnel who were instrumental in assisting the planning and implementation of the state plan. The problem is exacerbated by the fact that state education departments are often

short-staffed, and particular individuals tend to take on large amounts of the responsibility for a particular area, such as educational technology. When that person leaves, someone else with limited experience in the area generally takes over. When another person leaves, even if not in the same department, that person cannot serve as institutional memory for the first. As more burden is placed on those who are left, there is a tendency to leave more quickly, and the pace of leaving accelerates.

Strategy. No strategies were identified to resolve this particular problem. One possibility is to increase the amount of federal EETT funds allowed for administrative costs, providing a buffer to limited state funds for administration. Another possibility could be increased collaboration among states so that the institutional memory is shared not only within one state, but also across states.

Limited available information regarding student technology literacy skills. The state educational technology officers noted that they were not sure how their students were faring with regard to equity and technology literacy skills because none of them had developed an assessment to determine the current levels of student skills. All of them were working on a plan for assessing those skills, particularly in state-level technology planning committees such as Maryland's TL8 project. Two educational technology officers expressed concern about adding more testing to the schools, as there was already an expression of frustration from teachers and schools that they were spending too much time on testing.

Strategy. Several of the states are encouraging the use of the NCREL enGauge instrument as a proxy measure to assess student skills. New Jersey has long had a technology survey that is completed by all districts to estimate students' skills. The state educational technology officers stated that they were considering building technology skills assessments into the existing State achievement tests, including technology literacy skills as an indicator that would be provided along with student achievement scores in mathematics, reading, and writing.

Varying experience and knowledge of educational technology among administrators. Administrators are key to setting and carrying out a vision for educational technology in their schools and districts. However, most educational administrators were not chosen for their posts because of their facility with computers or other technologies. They are often reluctant to implement technology because they are not certain how it can be best utilized to improve learning. Those who do have that experience can plan for and allocate funds in a more consistent and reasoned way and can advocate for more funding for educational technology projects.

Strategy. One state in the mid-Atlantic region described a training program for administrators in the state, in which every principal and district superintendent was invited to participate in ongoing professional development regarding the state's educational technology plan goals and how educational technology could be used to improve student standardized test scores. Linking the professional development for administrators to achievement test outcomes for which they would be held accountable under NCLB had been very successful in keeping them involved over the long term.

A State Model for Achieving Technology Literacy: Wisconsin

Wisconsin provides an example of how a state has developed a successful collaboration among universities, state education officers, teachers, local school districts, and local businesses to make progress toward achieving widespread technology literacy. In a recent policy analysis of technology literacy efforts in the north central United States, Dede (2004) notes the following:

> "In the North Central region, Wisconsin and Indiana have the most thoroughly developed integration of technology into their curriculum standards for students. In Wisconsin, the

> state has detailed Model Academic Standards for information and technology literacy, as well as for technology education. Also, Wisconsin has Model Academic Standards for English language arts, mathematics, science, social studies, and 12 other subject areas. Fluency in the use of technology and media is integrated into many of the curriculum content standards. For example, the English language arts standards contain substandards for the use of media and technology. As another illustration, the mathematics standard for statistics and probability references technology but does not explicitly prescribe its usage" (p. 1).

Dr. Stuart Ciske, education consultant for information and technology planning at the Wisconsin Department of Public Instruction, noted that the state had made great progress in developing its standards for technology literacy and in incorporating technology use within all of its academic standards primarily through a collaborative effort among many interested parties. The state superintendent has made technology literacy a priority and has charged Dr. Ciske with overseeing the assessment of all 426 districts through their use of NCREL's online enGauge tool. The department requires all districts that receive grant money for educational technology to use the enGauge tool to assess their progress. Dr. Ciske stated, "We also encourage districts to work into their tech plan a Library media strand, as our 'tech standards' are really Library Media & Technology Standards. So we advocate for a combined plan and a combined delivery of services and programs [in classrooms and libraries]"(personal communication, August 1, 2004) The standards have a strong library media connection in part because the director of the instructional media and technology team is a former district library media director. The Wisconsin plan works because it has three key components: sets of standards for technology literacy and for the use of technology integrated into academic subjects, a planning process overseen by the state that insists on the use of those standards in district plans, and an assessment process that examines progress toward those standards that is managed by the same person providing oversight of technology planning. These components are consistent with Dede's (2002) recommendations for improving state and district level educational technology planning through joint planning and coordination.

Despite the relative sophistication of Wisconsin's system for promoting technology literacy, it does not yet have an assessment in place that will gauge student technology literacy skills by eighth grade, as is required by NCLB. Also, it does not have a mechanism for gauging how well they are doing regarding equity in technology literacy (e.g., by gender, race, income level, special needs, limited English proficiency). Dr. Ciske felt that they had a system for addressing equity in technology literacy in Wisconsin, however, and that that system was working well. He stated the following:

> We haven't really addressed equity issues directly at the Department. We talk about it in the context of everything that we do. We don't have an equity type person in the agency at the State level. It's the responsibility of everyone in each of their divisions to ensure that they are meeting the needs of all of the students equitably. We feel we've always done a good job with equity in Wisconsin (personal communication, August 1, 2004).

Challenges and Strategies for Equity in Technology Literacy in Mid-Atlantic Districts

Several districts in the mid-Atlantic region were asked how they were approaching universal technology literacy in their district. Like the states, the districts mentioned both common and unique challenges and a range of strategies to attempt to overcome these challenges and fulfill the goal of technology literacy for all. The challenges identified by these school districts included

- Lack of trained teaching staff;
- Limited personnel to oversee technology, high turnover of skilled staff;
- Lack of high-quality computers and Internet connections in the schools;
- Lack of student access to computers and Internet connections outside of school; and

- Insufficient funds to purchase and support hardware and software.

Lack of trained teaching staff. All of the districts surveyed for this study indicated that their efforts to improve students' literacy levels were limited by the knowledge and skill levels of their teaching staff. Roschelle, Pea, Hoadley, Gordin, and Means (2000) note that giving adequate time to teachers to explore and learn with technology is essential for developing their skills:

> Numerous literature surveys link student technology achievement to teachers' opportunities to develop their own computer skills. Yet teachers commonly are required to devote almost all of their time to solo preparation and performance, with little time available for training in the use of technology (p. 90).

Strategy. The federal EETT grants to the states require that 25% of the funds be spent on professional development. However, it is left to the states to decide what types of professional development might be most useful and who should participate. The states have used their competitive EETT grants to promote high-quality professional development that facilitates technological literacy. At least one district in Pennsylvania is using some of its competitive grant funds to fund technology consultants in each of its schools. The teachers receive special training in how to teach to the state standards using the Internet and a variety of tools including graphic organizers. These trained teachers are providing technology-supported lessons that they have developed to other teachers in the district and are paid a stipend to assist other teachers in their school with implementing those lessons. The technology consultants are provided with additional software, a computer cart with a laptop, and an LCD projector to model lessons in classrooms throughout their school. They are provided with one week of professional development in the summer and meet on a monthly basis to discuss challenges and solutions to problems they are facing.

Limited personnel to oversee technology, high turnover of skilled staff. In small school districts, a few people must take on a wide range of responsibilities. A person that is seen to have a particular set of skills, such as skill in uses of educational technologies, is likely to be assigned the majority of responsibilities in that area. There are advantages to giving one or two people the majority of responsibilities for educational technology, including ease of coordination, the ability to see the "bigger picture" of technology in the district, and reducing the costs of professional development. However, there are many downsides as well. For example, in one district an assistant principal was given the responsibility of managing the technology for all of the student personnel information. When that person left for another district, the school was left without the ability to create schedules for the coming year or to access student information other than in the paper files.

Strategy. One strategy for compensating for limited trained personnel in education technology is developing collaboration within the district where people with different roles all take responsibility for managing one aspect of the educational technology. For example, a high school teacher and an elementary school teacher in one district are in charge of ensuring that the student information system is being maintained and kept up to date. One teacher manages the database technology, and one teacher reviews the data that is being entered in the system. If one of the teachers is out, they each know enough to be able to cover the other's responsibilities.

Lack of high-quality computers and Internet connections in the school. One of the biggest hindrances to using computers for teaching and learning in school is the often piecemeal fashion in which computer systems have been put together. In one of the districts surveyed, one computer lab had four different types of computers connected to the network. Each set of computers had

been bought at a different time and set up by different people each time. Whenever new software needed to be added in the lab, it required dealing with computers with different operating platforms and widely differing capabilities. A similar situation occurred with Internet connections; some rooms had several connection drops for network connections, and some rooms had only a single connection or no connection at all. These types of inconsistencies made supporting the computers particularly complicated and led to limited use of the computers due to the complexity of adapting them all to suit the needs of the teachers and the students. It is this type of inconsistency that led to the requirement that all schools and districts develop comprehensive 3-year technology plans under the federal E-Rate program and the current EETT grant program. The total cost of upgrading a school's computer system to work consistently across classrooms, however, is considered to be beyond the reach of most school systems. Studies of the U.S. Department of Education (1996) estimated the cost of upgrading the nation's public school systems to having at least five students to one computer at $8 to $20 billion per year. That figure is three to seven times what the country currently spends on educational technology. The federal government is estimated to provide approximately 30% of the costs of upgrading technology in the schools.

Strategy. Several school districts have developed innovative solutions to the problem of replacing older technologies and piecemeal school computing environments. The strategy used most often is concentrating on purchases and upgrades of technology in one school or even in a few classrooms in a school. For example, one school used some discretionary funds they had received for good student attendance levels to purchase a laptop cart with six computers and a wireless port to connect to the classrooms' single Ethernet connection. The school's Home and School Association bought another six laptops of the same type for the cart. The school has still not reached its goal of 30 laptops for the cart, but it will be adding more of the same type of computers as new funding becomes available. The cart is now in high demand and is scheduled by the teachers in the school for use in their classrooms.

Some school districts are including the costs of new computers and network infrastructure in the outlays for new building construction. For example, one school district in New Jersey is systematically demolishing all of their old school buildings (16 total) and replacing them with new buildings that are designed around the use of new technologies. While this approach may seem extreme, there are many potential cost savings in reducing the inefficiencies of supporting myriad systems with low interoperability in settings that were not designed for learning with computers.

Lack of student access to computers and Internet connections outside of school. One of the biggest obstacles to improving technology literacy skills for students is a lack of student access to computers outside of school. Limited access to technology outside of school limits teachers' abilities to use computers for assigning homework, communicating with parents, providing assignments for students who are absent, and providing assignments to student within class. Teachers working in lower income communities face much greater challenges in this area than teachers in more affluent communities. A recent study by the Kaiser Family Foundation (2004a) shows "important disparities in the quality of access to the Internet continue, even though 96 % of 8-18 year-old-students report ever having gone online. The federal government's most recent large study in 2001 found half (51.7%) of all children ages 3-17 with family incomes of $75,000 or more had Internet access at home, while just 15% of those with incomes of $20,000-$25,000 did" (p. 2). Likewise, new data released by Kaiser (2004b) indicates that school-aged children ages 8-18 with less-educated parents or who attend school in lower-income communities were significantly less likely than other children to use the Internet in a typical day or to have Internet access from their homes." The Kaiser Foundation (2004b) reported the following:

* In 2004, 80% of White children 8 and older have Internet access at home, compared to

61% of African American children in this age group. Similarly, 8 in 10 (82%) children whose parents have a college education have home Net access, compared to 68% of those whose parents have a high school education or less (p. 4).
* Among children 6 months to 6 years old, only 8% of children from homes with incomes of $75,000 a year or more did not have a computer at home, compared to 40% of children from homes with annual incomes between $20-29,000, and more than half (55%) of those from families with incomes under $20,000 a year (p. 2).

Strategy. Lack of student access to computers outside of school remains a huge challenge and limits nearly every potential advantage that is offered by technology. Several districts surveyed had developed partnerships with local community technology centers and churches to create after-school programs for their students to use computers outside of regular school hours. They had been awarded 21st Century Community Learning Center (CCLC) money that was being used in part to provide access to computers outside of school. This year's 21st CCLC grants prohibited the use of funds for purchasing technology, however. One district surveyed had formed a joint technology committee with its county government and attempted to coordinate technology access for its students with library and community center programs throughout the area.

Insufficient funds to purchase and support hardware and software. All of the school districts surveyed mentioned a lack of sufficient funds as a limitation to teaching students technology literacy skills. The problem is not only a lack of funds for hardware, software, and technology support but also inconsistent funds. The members of one district, for example, mentioned they had made great progress in creating a distance learning program. But, the funds were only for a limited time. As one member stated, "Money is still a problem for us. We have been flat funded for several years and have an increase in student population. A 5 year distance learning fund from the state dried up at the same time providing us with about a 250,000 loss of funds" (personal communication).

Recent declines in state funding coffers has led to a lowering of investment in educational technology across all schools and districts in the mid-Atlantic region. A study by SETDA of state uses of EETT funds found that 25% of the states relied solely on federal funds for funding educational technology initiatives. This limits the opportunities that states can offer districts, particularly poorer districts, for supporting ongoing improvements.

Strategy. Several districts reported that they had hired grant writers that worked educational technology into a wide range of proposals to federal and state agencies and foundations. These grant funds had provided opportunities to develop targeted pieces of their programs that the district could not fund on their own. For example, one district used a state grant to purchase an entire computer lab and learning software that focused solely on improving mathematics achievement.

Potential Benefits of Regional Collaboration

ISTE has recommended that the states not try to go it alone in defining, implementing, and assessing technology literacy skills. ISTE instead suggests using regional approaches to improving those skills. In the SETDA (2003) national study of states' progress toward implementing NCLB, it found that the shrinking pool of funds for educational technology was forcing increased cooperation and collaboration among agencies and programs in order to maximize resources. Given that resources for educational technology will continue to be limited (the current proposal is to reduce EETT funds by 15% for the coming fiscal year) and that the national deadline for ensuring technology literacy equitably is fast approaching, it is useful to ask: How might a productive collaboration be developed that could help all states and districts in the mid-Atlantic region achieve technology literacy more efficiently and more quickly.

Quovix (2004), a business services company, has identified four dimensions of collaboration that support problem solving through networks of disparate groups. These include:

- "The Connected Worker," or providing the physical online communications infrastructure;
- "The Evolution of the Community," or inviting all members of the community to participate in that communications infrastructure;
- "The Evolution of the Problem," or the ability of the infrastructure to maintain a working definition of a problem and support the ad hoc development of smaller teams within the community to solve the problem; and
- "The Problem Portfolio," which is a common working area that enables quick review of where the problem is, what solutions have been suggested, and the ability to move particularly promising solutions forward by administrative authority or consensus.

Developing a regional collaboration among states and districts along these four dimensions could be particularly valuable, as they would support the development of a community focused on the difficult issue of improving equity in technology literacy. A common meeting place around these problems could support general efforts to share ideas and pose questions around improving ICT literacy as well as individual strands devoted to problem solving and testing of ideas related to particular equity issues.

Developing such a system could help to more readily identify universal challenges and promote useful strategies such as those that have been outlined in this paper but would allow all members of the community to explore their particular needs in depth with those who are creating solutions. Furthermore, such a system could be used to provide an informal assessment of how much progress educators in the mid-Atlantic states are making toward achieving the goals of the NCLB legislation: technology literacy for all students "regardless of race, ethnicity, gender, family income, geographic location, or disability."

Regional collaboration would be most productively organized if focused on solving problems common to all of the schools and districts in the region. The areas of most universal concern appear to be the following:

- ACCESS (e.g., to computers in classrooms, across subjects, outside of school hours, in their homes, wireless, broadband);
- QUALITY (e.g., types of learning technologies, broadband vs. dial-up web access, e-mail type, percentage of teachers and students with active accounts, percentage of classrooms with active webpages, use of Internet telephony ("voice over IP," or voIP) in the school or district.);
- QUANTITY (e.g., numbers of computers and PDAs, amount of time available for use, count of applications);
- TRAINING (e.g., training from non-school sources, levels of teacher skills, types of training provided);
- KNOWLEDGE/SKILLS (e.g., ability to use Boolean operators, use of word processors, e-mail, instant messagers, graphics software, presentation software, spreadsheets, statistical software); and
- APPLICATIONS/USE (e.g., how teachers are using technology in high poverty/high minority schools versus affluent schools).

Conclusions and Guiding Questions

The learning tools that may help reduce inequities for children who have traditionally fared poorly in school may still be out of their reach. Fifty years after the landmark Brown v. Board of Education decision, there remain inequities that may lead to an effective exclusion of some students from the increasingly "wired" world of their peers. Chris Dede (2004) warns that, when state and federal funds are tight, there is a tendency to lose focus on reducing inequities in schools. The current requirements of the federal No Child Left Behind Act are keeping the states

and districts focused on achieving technology literacy for all students. Yet, the NCLB Act does not specifically define technology literacy and, therefore, states and districts are unsure how to address the issue. A survey of the states and several districts in the mid-Atlantic region has found that systems across the region are facing many of the same challenges in their efforts to fulfill the NCLB requirements. A regional collaboration focusing on finding solutions to these issues could lead to considerable savings in time and resources. In order to facilitate a productive discussion in the interest of promoting such a collaboration, we offer these potential guiding questions:

- How can states and districts best measure technological literacy skills?
- How can states and districts develop shared understanding of goals for technology literacy?
- How can states and districts provide access to high-quality computers and software in classrooms for all students?
- How can states and districts compensate for the disparities in home computing environments among different groups of students?
- How can states and districts ensure that all students have access to technologically literate teachers?
- How can states and districts ensure that all students have access to hardware and software appropriate to their particular abilities and disabilities?

These questions can begin a conversation that will lead to the creation of school systems that truly increase the technological skills and knowledge of all students, regardless of their race, ethnicity, gender, family income, geographic location, or disability.

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