As educators become increasingly familiar with technology, they seek new and innovative techniques, methods, and strategies for infusing technology into curriculum and instruction. On the other side of the educational coin, today's students must achieve a level of technological literacy prior to graduation in order to meet the challenge of utilizing technology once they enter individual professional fields. In 1964, Marshall McLuhan said, "We live in a global village because transportation advances allow us to move,"
and technological advances allow our ideas to move, both producing significant contact across cultures” (1964, p. 93). In 1997, students seeking an education—in public and private institutions—are proving that this statement is very true. Tapscott (1997) suggests that schools have been invaded by a new type of student population—one that has grown up surrounded by digital media. These students, now attending preschool through college, have been immersed in digital technologies since birth. Computers, video games, and remote controls have always been part of their natural landscape.

Sometimes referred to as the “‘Net Generation,” these students between the ages of three and twenty-one have been making history since birth. The digitally savvy children of baby boomers are the first in history to enter schools possessing a level of technological literacy that most of their parents have not yet achieved, in part because of experience with telecommunications and the Internet. It is predicted that as future employees, students of the N-Generation will demand fully networked computers instead of a desk and will consider poor technology tools cruel and unusual punishment (Tapscott, 1997).

Tennessee leads all other states, boasting 100 percent — every school in every system — Internet accessible.

Yes, we do indeed live in a global village; however, it may not be the one McLuhan envisioned or intended in his statement. The global village to which students are accustomed today is enabled in part through the technological advances brought about by widespread access, in homes and in schools, to the Internet and telecommunications. A technologically literate student body paired with the vast opportunities for instruction provided through Internet resources is creating a revolution in education, and Tennessee is in the forefront in terms of meeting the challenge head on. The introduction of the innovative digital media of the Internet to Tennessee schools took place over two years ago.

Beginning with ConnecTen, a K-12 telecurricular bicentennial project, Tennessee students had their first state-wide experience with the Internet and telecommunications. The term “telecurricular” implies that instruction is integrated, with telecommunications as one of the disciplines (Craig, 1997). The ConnecTen project enabled every school in the state to gain access to the Internet through at least one connected computer located somewhere in the school. By providing each school in the state with one Internet connection, Tennessee is ahead of the nation. In a 1996 study, Heaviside, Riggins, and Farris report that an average of 65 percent of all United States schools have access to the Internet. This includes elementary, middle, and high schools across the country. Tennessee, however, leads all other states, boasting 100 percent—every school in every system—Internet accessible (Klaunsnitzer, 1997).

Through ConnecTen, students were able to take part in curriculum-driven activities enhanced through telecommunications. For approximately four weeks, utilizing the Internet for research, collecting data, problem solving, analyzing data, and exchanging data via telecommunications became part of the classroom routine. ConnecTen provides a model, one of the first in the country, for educators to follow as they design meaningful technology-enhanced instruction. The widespread accessibility common in Tennessee schools is not the case in most states.

Prompted by this inequality, concerns have been raised by parents and business leaders regarding the haves and have-nots, those school systems and states fortunate enough to place technology in a top priority slot and those systems that do not have the funds readily available for any form of technology. The implications for students attending deficit schools are grave. Without access to the Internet and technology-infused instruction beginning in the primary grades, students may become technologically delayed. The potential level of technological literacy needed to secure jobs in the future becomes jeopardized. In answer to these concerns, the Federal Communications Commission (FCC) has taken action to insure that students across the country will be fully prepared as they compete for jobs that have not even been invented.

Connecting and Networking

As we approach the year 2000, government funding is contributing to the state of technology, particularly Internet access, within public schools. With the implementation of the Telecommunications Act of 1996, the FCC is helping schools across the United States connect to the Internet through an integrated effort between federal and state governments, state and local education agencies, public utility regulators, and businesses. An amendment to the act, the Snowe-Rockefeller-Kerry Amendment (1997), prompted the FCC to allocate more than $2 billion per year per state to cover internal connection costs needed to wire classrooms. In addition, the funds will provide the opportunity for schools to take advantage of special discounts and Educational Rates (E-rates) that will help with monthly telecommunications costs.

The E-rate comes into play when a school purchases specific telecommunications products and services. These special discounts, known as “universal service discounts,” vary and range from 20 percent to 90 percent, with rural and economically disadvantaged schools purposely receiving larger discounts. Allocations for funds began in January 1998 with a 75-day “funding window” where schools submitted technology plans and applications (Tye, 1998). Funding decisions—made by the Schools and Library Corporation (SLC), a nonprofit corporation under the direction of the FCC—have enabled more than 90 school districts and/or individual schools in Tennessee to connect internally to the Internet. As the fourth “wave” of funding commitments, totaling more than $6.3 million, are distributed, the Tennessee State Department of Education announced in a January 12, 1999, news release that additional funds are expected to follow continued on page 6
later this year. According to Commissioner Jane Walters, “the universal service discounts will help bridge the digital gap between our wealthiest and poorest schools and bring the wonders of technology to those who otherwise could not afford it” (Ed-Mail, 1999, p.1).

In his book, The Connected Family: Bridging the Digital Generation Gap (1997), Seymour Papert suggests that the process of learning is the single most important issue facing society as we move into the new millennium. Papert points out that familiarity with the Internet can open up vast opportunities to students of all ages. Telecommunications and the Internet allow students to chase after the knowledge they really want. Internet-driven instructional activities provide students with an avenue for self-directed exploration, adaptations to learning styles, and the scaffolding needed to connect new knowledge with old knowledge. Scaffolding is essential to the learning process. Students must be provided with activities that enable scaffolding to take place naturally in order to be able to access new knowledge and apply it in a variety of situations (Craig, 1997; Dixon-Krauss, 1996; Kay, 1997). Furthermore, Negroponte (1997) points out that the digital media of the Internet can empower students to see new notions of work and play, society and self, teaching and learning, concepts which no longer have crisp lines that separate them from each other. The learning connections needed by students in order to internalize knowledge may be realized through Internet utilization. However, there is a fine line between educators who use technology to help students understand ideas and those who do not. As more schools gain access to the Internet, those in decision-making positions must insure that this new tool will be implemented in a way that will enable students to progress in technological literacy, think, and inquire. Kay (1997) suggests that this especially challenging problem being presented to administrators and educators during this rush to “technologize” education must be addressed, or the technology and telecommunications provided will wind up being used for no more than vocational training, with no real educational value attached.

Meeting the Challenge

Several measures have been taken in order to address this new challenge brought about by readily-available Internet access in public schools. Both K-12 and institutions of higher education have established goals, benchmarks, and standards in order to set expectations and better prepare a population of technologically literate students for the future.

In 1996, the Tennessee State Board of Education drafted the Education Technology Long-Range Plan. The vision driving this plan involves a technology initiative that does not advocate simply placing computers in classrooms, but rather stresses that technology be used to support...
curriculum. The state’s plan includes the following six goals:

- **Goal I: Student Learning**—using technology to improve student learning by providing each student and teacher access to appropriate instructional technology.
- **Goal II: Connecting Students and Teachers**—using technology to connect students and teachers to learning opportunities outside the classroom through the Internet.
- **Goal III: Teacher Preparation and Professional Development**—increasing instructional technology training in teacher preparation and professional development programs.
- **Goal IV: Curriculum Coordination**—ensuring coordination between state technology initiatives and state curriculum initiatives.
- **Goal V: Management Information System**—developing and implementing a management information system to assist management of local systems and to improve communication between systems and the state.
- **Goal VI: Broad-based Involvement**—ensuring broad-based involvement in planning, developing, implementing, and evaluating technology initiatives.

While K-12 public schools in Tennessee are attempting to implement these six technology goals, institutions of higher education are also addressing appropriate standards, benchmarks, and requirements in order to prepare students for the future. McNerney (1997) points out that technology adds value to teacher education programs. In a recent article, he outlines several strong reasons for providing a technology-enhanced program for preservice education students. First, a technology-enhanced program may unintentionally draw nontraditional people into teacher education that may not otherwise enter the field. Second, the new digital technologies offered via the Internet may help to stimulate interactions between preservice students and practitioners. Third, technology-enhanced teacher education programs can foster technological literacy and prepare university students for the digital-savvy “Net Generation of students they will face upon entering the field.

In order to prepare preservice education students for the challenge of teaching a technologically literate student body, university programs must offer courses that engage students in classroom and field experiences which model technology-infused instructional practices. Working toward this goal, it is imperative that teacher education programs consider the National Standards for Technology in Teacher Preparation developed by the International Society for Technology in Education (National Standards for Technology in Teacher Preparation: ISTE Accreditation and Standards Committee, 1996). The standards, recommended for USA National Accreditation through the National Council for Accreditation of Teacher Education (NCATE), include the following:

- **Foundations: Basic Computer/Technology Operations and Concepts**, to include running software programs; accessing, generating, and manipulating data; publishing results; evaluating performance of hardware and software; and applying troubleshooting.
- **Personal and Professional Use of Technology**, to include applying tools; using technology to communicate and collaborate; conducting research; and engaging in problem solving.
- **Applications of Technology in Instruction**, to include using technologies to support instruction, and planning and delivering instructional units that integrate software, applications, and learning tools.

Research conducted by Northrup and Wesley (1996) and Beaver (1990) supports the implementation of technology standards in higher education programs. Find-
ings show that many practicing teachers believe that they are inadequately prepared to effectively use and integrate instructional technology. Setting expectations and striving to meet the standards set by ISTE and adopted by NCATE would insure that a population of professionals would enter the field capable of meeting the needs of students and equipped with matching technology skills. In addition, Lieberman (1996) suggests that providing opportunities for preservice students to build “learning communities” with practitioners sets the stage for sharing and collaboration, which in turn dignifies educators’ experiences, which are often invisible to those unfamiliar with life in a public school classroom. Collaboration and partnerships between K-12 schools and universities establish the virtual communities that build (a) a culture of continuous inquiry, (b) leadership, and (c) recurring networks, all of which strengthen and foster technological literacy for everyone involved (Lieberman, 1996).

Skills for the Future

In a few short years, the digital savvy student body of the K-12 classrooms of today will become the graduates of tomorrow and eventually the workforce of the future. Will these natural technology skills that have been further encouraged through technology-infused instruction emerge as a benefit or a hindrance when it comes to employment? Findings from a Cornell University study conducted by Davis (1997) revealed that employers view computer skills as either “important” or “very important” in the hiring process. In fact, employers contacted throughout the course of the study agree that “computer literacy is important to all positions” and that “if students graduate without skills, they will have a distinct disadvantage upon entering the workforce.” Skills cited as essential for potential employees include (a) word processing and (b) basic computer skills, such as general knowledge of presentation, database, and spreadsheet software packages.

In a recent interview, Pryor Manning (account executive in sales service and marketing at Electronic Data Systems, Saturn Corporation) offered the following set of minimum essential skills desired of potential employees in the areas of finance, programming, and assembly work:

- Programming: Computer Science background and knowledge of networking in addition to basic computer skills
- Assembly work: Basic computer skills such as word processing and knowledge and familiarity with electronic mail

Manning added that technological literacy is part of the everyday work life of an EDS or Saturn employee. In addition, he felt that a general understanding of the Internet was a necessity for all future employees, along with familiarity of the basic workings and operations of a personal computer.

Considering the digital revolution that is impacting schools and the unique students that are in part responsible, it only seems logical that the metaphor of the “little red schoolhouse” be changed to one that represents the schools of today that are helping to foster and refine the skills that these students must possess for the occupations of tomorrow. According to Peel and McCary (1997), teaching and learning must be viewed through a new and updated vision. Technologically literate students are those who can solve problems, take risks, work collaboratively, and think. The educators of today must keep up with technological advances in order to assist the process of intellectual growth of the students of tomorrow.

Papert (1997) offers that the only competitive skill over the long haul is skill at learning. The technology in place in Tennessee schools is certainly helping the process; however, as with all innovations, the change is rapid and constantly evolving. The ‘Net Generation has arrived and is changing the climate of teaching, learning, and working. This new student body will carry us into the next century. The societal challenge, facing educators, parents, and businesses, of keeping pace with a technologically literate student body will definitely contribute to the transformation of the “little red schoolhouse” metaphor into something fitting for the digital-savvy workforce of the future.

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