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ACHIEVING 21ST CENTURY SKILLS—THE ROLE OF TODAY'S SCHOOLS

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Foreword

This paper provides an interesting review and discussion of the wide range of issues relating to dozens of recent reports on the role and purpose of schooling in the modern world. Eric D. Marvin, who wrote this paper, has captured the underlying arguments and rationale for re-examining the role and responsibility of elementary and secondary schools in light of new market forces and emerging telecommunication technologies.

The paper provides a brief historical overview and explains why federal and state educational policymakers are recognizing the need to integrate "21st century skills in the classroom." Schools must continue to ensure that all students learn basic core principles and subject content. They must also focus on ensuring that all students learn how to learn and how to use the technological tools that facilitate learning. Learning how to think creatively and how to communicate and collaborate are among the key skills that all students need to succeed in all of their endeavors beyond their school-age years.

The challenge for achieving the decade-long goals of the *No Child Left Behind Act* and ensuring that all of our students and workers are able to meet the demands of our new and emerging economy requires a stronger and sustained federal/state partnership to reform and improve schools. The nation can no longer afford to maintain a large number of failing or mediocre schools that produce large numbers of graduates who are forced into low-wage and low-benefit jobs. The "Learning for the 21st Century Project," has received support from the U.S. Department of Education and from several major U.S. corporations. Its goal is to stimulate a national dialogue about the resources and strategies needed to support school reform and improvement efforts. Significant progress has been made to ensure that all schools, teachers, and students have access and the skills to use advanced telecommunication technologies. The process of aligning the K–12 school curricular and testing requirements with the needs and demands of the workplace and lifelong learning experiences is moving at a slower pace. This paper suggests that post-secondary institutions, community-based organizations, and the private sector all have important roles to play in revitalizing and sustaining the quality of public education.

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No one is going anywhere in the 21st Century economy without mastering 21st century skills and technologies first. Economic and technological changes have raised the educational threshold for good jobs to levels beyond the traditional high school degree and expanded skill requirements beyond the old time religion of the three R's to a whole new set of more general problem solving and interpersonal skills. The future promises more of the same, compounded by skill shortages that will arise as we struggle to replace the retiring baby boomers. These relentless forces guarantee that this time education reform is here to stay.

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Background

Today, the role of schools is not inherently different from that of any other era. Foundationally, K-12 education is in place to provide our nation with an educated citizenry and to subsequently promote our nation's democracy. Over time, however, the definition of what it means to be educated has occasionally changed, as promoted by the changing skill set and demands of our society. Often, such changes are reflected in legislation, educational standards, and workforce demands. Our current times are testimony to such reflections.

As the world changes we see considerable variance among what most schools teach, how they assess teacher and student performance, and what knowledge and skills are now considered important in the workplace and for continuous learning. To a large extent, the universal availability and use of modern telecommunication technologies are contributing to these differences. The arrival of the personal computer and the high-speed digital networks that followed have brought us to a transitional point in history. In years past, we lived in a manufacturing-based economy. Coal, oil, and steel shaped the world into a labor-intensive environment. Today, that model of industrialization is giving way to a knowledge-based economy. This new world relies on applied intelligence and the capacity to obtain and effectively analyze information (Merrill Lynch & Co., 2000).

Such mental application and analytical abilities, however, are only a part of what it means to be "skilled" in our 21st Century economy. This term, "skilled," as it has been redefined by the information age in which we now live, encompasses a myriad of other relevant definitions. That is, skill now implies a possession of abilities related to communication, technology, leadership, teamwork, creativity, management, problem-solving, production, risk taking, and cultural awareness (Business-Higher Education Forum, 2003; Partnership for 21st Century Skills, 2003b; Thornburg, 2002).

Of course, previous generations defined skill in their own way, largely based on the demands of the age in which they were living. During the Industrial Age, for example, work was honed into smaller, more manageable parts. The assembly line affected that era's definition of skill. In that period, timeliness, rapid widget-management, and unquestionable conformity to authority were valued. That is, *those* abilities were beneficial to *that* society (Thornburg, 2002). Nevertheless, the specific abilities that define skill for a specific era are relative to the economy in which the term is defined.

Although the definition of skill in this manner is relative, the term has a permanent meaning that is additionally relevant to our forthcoming discussion. A dictionary definition states that it is "a learned power of doing something competently" (Merriam-Webster, 2003). Such a definition implies the importance of education or training. In a broad sense, it is the requirement for such preparation that determines whether a job is considered skilled.

Although this parsing of "skill" may be tedious, it is with reason. The purpose of this paper is to examine the role and importance of achieving 21st Century skills in today's K-12 schools. Such attainment includes reference to numerous issues, including school reform, technology literacy, technology access, workforce demands, and educational preparation. Underlying all of these issues is the aforementioned foundational issue of what it means to be skilled.

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As recently as 1950, only 20 percent of jobs were skilled jobs (Web-Based Education Commission, 2000b). This number pales in comparison to today's demand for skilled workers. Today, "approximately 85 percent of all

job positions in the United States require skilled workers" (Web-Based Education Commission, 2000a). This increase in demand for skilled employees is clearly illustrated by an examination of the comparison of the pay gap that separates college graduates from high school graduates. In 1980, the pay gap was 50 percent. Today, this gap is at 111 percent (Merrill Lynch & Co., 2000). Clearly, in this changing economy, much more value is placed on those who have an education beyond high school.

But surprisingly enough, only slightly more than one-quarter of American adults over the age of 25 have a Bachelor's degree or higher (United States Census Bureau, 2003). This statistic, relative to the above mentioned pay gap, highlights the need for skilled workers. Never before has human capital been so important, yet the skilled workforce to meet such needs is not available.

Seventy percent of Fortune 1000 CEOs believe that one of the greatest tasks concerning their companies' growth and competitiveness is their ability to "attract and keep adequately skilled employees" (Merrill Lynch & Co., 2000). A statement by Dick Davidson, Chief Executive Officer of Union Pacific, one of *Fortune* magazine's "most admired" companies (see http://www.uprr.com/newsinfo/fortune_amac.shtml), echoes this idea. Regarding highly skilled human capital, he said, "You just cannot operate without it" (United States Department of Labor, 2002). Clearly, our nation's economy relies on highly skilled human capital.

Knowledge-Based Workers

A broad educational experience and the development of technical skills are equally critical for anyone who intends to compete in the workforce. As the new economy evolves, education must evolve. Recent publications by both corporate and government entities indicate that the successful development of tomorrow's workforce is rooted in K-12 education (National Governors Association, 1999, 2002; Merrill Lynch & Co., 2000). A recent statement by Steve Balmer, Chief Executive Officer of Microsoft, emphasizes this idea:

There's a lot that we need to all be concerned about in terms of the workforce and its readiness for this [21st Century, global] transformation. I think the starting point is education, education, education, education. And, all of the excitement and stimulation in that area, in putting more resources, more effort into education, whether it's in rural areas, in inner-city schools, wherever, is very, very essential. (United States Department of Labor, 2001)

Leading CEOs recognize that schools play the foundational role in human capital development. Although corporations may train employees, the basic pool of workers must enter the market with more knowledge-based skills than ever before. Perhaps one of the greatest challenges to creating a large, knowledge-based pool of workers is inherent in today's educational system.

Today's educational system is essentially built on an agrarian model. This is not to say, however, that schools have not previously responded effectively to changes in the economy. When the economy was based on a society of "farmers, foresters, and fishermen" (Web-Based Education Commission, 2000b),

schools performed their appropriate function, and during the industrial age, schools embraced elements of the industrial revolution. At that time, one of the intrinsic goals of the educational system was to prepare students to complete individual tasks, memorize work, and learn to obey, rather than question, authority.

During that age, the educational system was meeting the economic goal of preparing a large pool of workers to be ready to complete tasks that the industrialized economy of that age demanded (Morrison, Lowther et al., 1999). With an economic shift to the information age, schools must continue to change to create the knowledge-based workers that the new economy demands.

Role of K–12 School Reform

If the workforce of tomorrow is going to be adequately prepared to meet the challenges of a new economy, today's educators need to prepare the next generation to think creatively, analyze information, and develop solutions to problems (Healy, 1999). After all, these are the types of skills that the new economy demands. Leaders in today's top technology companies recognize this point. Karen Bruett, Dell's Director of Marketing and Business Development for Education and Healthcare said, "In order to be better prepared to enter the workforce, it's clear that today's students will need a new set of skills" (Greeson, 2002).

The federal officials who drafted the *No Child Left Behind Act* (NCLB) recognized the need for a new set of skills. The Act establishes a framework on which a 21st Century vision of education can be effectively implemented. As shown below, policymakers, educational organizations, parents, and community members are supporting this federal framework.

The *No Child Left Behind* legislation is replete with references to the importance of technology in K-12 schools. The legislation's primary goal is "to improve student academic achievement through the use of technology in elementary schools and secondary schools" and to ensure that "every student is technologically literate" (United States Department of Education, 2001). Undoubtedly, federal officials realized the importance of reform within our educational system and the role that technology plays in ensuring that the next generation is properly prepared to participate in new and emerging workplace settings and in our evolving civic society.

As a part of their effort to advance the national goals for improving public education throughout the entire nation, President Bush and his key education advisors have endorsed the *Enhancing Education Through Technology Act* (Title 2-D of the NCLB Act). Likewise, they have supported the strategy to

allocate more than \$700 million annually to state departments of education by targeting these educational technology discretionary funds for the single purpose of improving school achievement. State recipients of such funds are responsible for developing and implementing state technology plans that include state goals for the use of technology and strategies for preparing teachers to use technology. Furthermore, states are responsible for tracking progress according to the stated goals of their implementation plans (United States Department of Education, 2002a).

Nevertheless, funding is available to states at the cost of accountability. Not only are states to be held more accountable, but they, in turn, must hold districts and similar entities accountable.

Likewise, the governors of our nation's states have been working together to develop programs and policies for building a 21st century workforce. Partially based on the recognition that states are being challenged by a public education system that is "falling short in preparing individuals for the new economy" (NGA, 2002), the National Governors Association has been working with business and educational association alliances to address such economic issues. Employers indicate that today's workforce is often lacking in reading and writing abilities, computing skills, problem-solving abilities, and collaboration skills. States are seeking to address the related educational concerns (NGA, 2002).

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Aside from such state-level efforts and the foundational role of the government through the *No Child Left Behind* legislation, other organizations are offering various sets of strategies and models of reform to help meet the 21st century needs of our nation's schools. For example, the International Society for Technology in Education (ISTE), in addition to creating National Educational Technology Standards (NETS) for students and teachers, delineated the differences between traditional learning environments and new learning environments. These differences are provided as examples of the types of reforms that are necessary to efficiently prepare students to meet the challenges of the new economy. Table 1 lists characteristics of the new learning environment that is needed to prepare students for a knowledge-based society.

Similarly, the recently developed public-private *Partnership for 21st Century Skills*¹ is charged with identifying the skills needed to be technologically literate in the 21st century. With the goal of drawing attention to the need for the integration of 21st century skills into K-12 education, the partnership has created the *21st Century Skills MILE (Milestones for Improving Learning and Education) Guide* that

¹ www.21stcenturyskills.org

Table 1: A Comparison of Traditional and New Learning Environments

Traditional Learning Environments	New Learning Environments
Teacher-centered instruction	Student-centered learning
Single sense stimulation	Multisensory stimulation
Single-path progression	Multipath progression
Single media	Multimedia
Isolated work	Collaborative work
Information delivery.....	Information exchange
Passive learning	Active/exploratory/inquiry-based learning
Factual, knowledge-based	Critical thinking and informed decision-making
Reactive response	Proactive/planned action
Isolated, artificial context.....	Authentic, real world context

Source: International Society for Technology in Education (ISTE) NETS Project, National Educational Technology Standards for Students, June 1998, pg. 2.

allows "educators and administrators to measure the progress of their schools in defining, teaching and assessing 21st century skills" (Partnership for 21st Century Skills, 2003a).

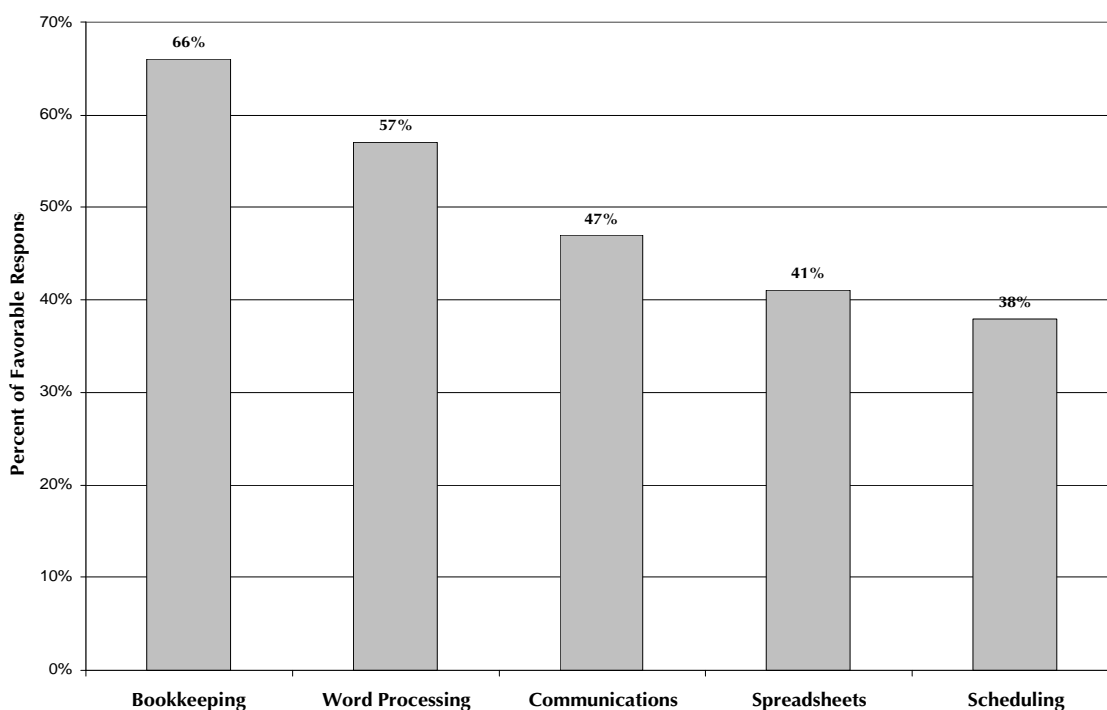
The MILE guide, as it is designed for use by states, districts, and schools, allows teachers and administrators to gain a clearer picture of their school's current condition regarding the implementation of 21st century skills. Its flexible design enables school leaders to adapt the guide to the uniqueness of their own educational environment. The guide's vision of 21st century skills provides a catalyst for spurring discussion and implementing specific strategies for improving 21st century skills (Partnership for 21st Century Skills, 2003a).

An example of the relationship between yesterday's society and the schools of the past supports the rationale for the effort of the government and numerous organizations to implement 21st century skills in our nation's K-12 schools. Years ago, even those who had little formal education were able to obtain well paying jobs in factories or on farms. But today, those who do not fit that pattern of a specific educational model will not have the same luxury. Therefore, schools, in order to provide all students with firm opportunities for academic success, are having to re-examine the impact of traditional classroom teaching (Healy, 1999). Because the information age is built on creativity and diversification, the educational system is appropriately recognizing the need to embed such characteristics within its framework.

K-12 and Workplace Competencies

The SCANS report from the United States Department of Labor (1991) provides further insight into the importance of school reform. According to this report, five competencies are needed by today's workforce. One of these competencies is the ability to work with a variety of technologies. Specifically, this report identifies three areas in which employees should be technologically competent: selecting technology, applying technology to task, and maintaining and troubleshooting equipment (United States Department of Labor, 1991). Further research has identified the most common uses of computers by employees in the workforce. The two most frequent uses are bookkeeping and word processing; Internet-type communications follow, with close to 50 percent reported usage. Figure 1 shows that spreadsheet and scheduling applications are also frequently used by workforce employees (United States Department of Education, National Center for Education Statistics, 2002).

Figure 1: Most common uses of computers by workforce employees



If today's students are going to be prepared to effectively use these tools, they must begin by gaining hands-on experience with them. In the same way that traditional learning environments prepared students for industrial and factory-based work, today's schools must reform to prepare students for the knowledge-based work of the information age.

Although, perhaps, it has merely been implied up to this point that technology is a necessary component of school reform, in all reality it is an essential component. The relationship between the type of school reform that is needed and the higher level of learning that today's students require in order to be prepared for the workforce of the information age leads to the conclusion that technology is nothing less than essential for proper school reform. This does not mean, however, that technology, in and of itself, is the save-all solution to our educational problems. Reformed curriculum, as an instrument to further assist in the changing of classroom practices, is also a key component to a new educational model. After all, without changing the curriculum we would merely be attempting to throw technology onto a curriculum that was developed for 19th century schools (Bruder, Buchsbaum, and Hill, 1992).

Without technology, however, students will not be able to use the processing power of a computer to extend the capabilities of their minds. A revelation of the National Council of Teachers of Mathematics (NCTM) better illustrates this point. The Council decided back in 1989 that math education needed to begin to emphasize the "analytic, problem-solving, and even creative aspects of mathematical thinking" (Bruder, Buchsbaum, and Hill, 1992). Since then, NCTM has advocated increased use of technology for improving mathematical learning. The organization and its members realize that getting beyond number crunching to higher-order learning demands more effective uses of advanced technologies. In this realm, calculators were often the instrument of choice, but, nevertheless, most mathematics teachers were supporting a vision for mathematics that would prepare students for our information age (Bruder, Buchsbaum, and Hill, 1992).

Role of Parents and Community

Aside from the necessities that are stemming from the changing role of the economy and the workforce demands of employers, others are interested in seeing schools teach students to become technologically literate. Parents and community members, for example, want to see students obtain the

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knowledge needed to succeed with technology. Results from a recent national opinion survey indicated that 91 percent of respondents believe it is "very" or "somewhat" important to prepare students with 21st century skills (AOL Time Warner Foundation, 2003). Such evidence,

coupled with that represented in the SCANS report, provides support for the ever-increasing demand for the effective use of technology by today's K-12 students.

The views of a Silicon Valley executive and concerned parent, Patricia Brogan, provide further insight into the increasing demand for technology in the classroom. Brogan is one who whole-heartedly supports the use of technology in her child's classroom. Although she has admittedly heard all of the reasons that technology should not be used in the classroom (e.g., computers give students an unfair edge over classmates, and penmanship should take precedence over keyboarding skills at a young age), she still continues to support the idea of using computers as learning tools. Specifically, she realizes that guided use of the Internet for research provides students with opportunities to think critically, contemplate multiple perspectives on issues, and analyze a variety of information. In her opinion, computers and technology should increasingly be used by K-12 students to help them bridge learning gaps (Brogan, 2000).

Although Ms. Brogan's view is only one opinion, her way of thinking exemplifies the thoughts of many other parents. According to *Education Week*, "in poll after poll" parents support the use of technology, as they believe it is "essential to a child's education" (Trotter, 1997).

Parents are not the only ones who are supporting the use of technology in schools. Government leaders are also demonstrating support and providing financial assistance to enable the necessary reforms to occur. President Clinton, according to a White House press release, increased educational technology funding from \$23 million in 1994 to \$766 million in 2000. Under his leadership, the Technology Literacy Challenge Fund and Technology Innovation Challenge Grants were implemented (White House, 2000). Both congressional leaders and political appointees are advocating support for technology within the framework of the *No Child Left Behind Act*. With overall goals to improve student academic achievement and enhance the technological literacy of all students, the implementation of policies and assessment strategies regarding the expansive use of technology within K-12 schools and the collection of data to determine its impact are in full-swing. The federal education policies of previous and current political administrations attest to the importance of technology in the transformation and improvement of public education, as well as the importance that technology must play in ensuring that all students are properly prepared to meet the demands of the information age.

Technology Standards

To what standard should students become technologically literate? An argument can be made that a local standard would be most accommodating, considering the structure of the American educational system and the needs of the local workforce. But considering the broader scope of American migratory freedom, it seems more appropriate to base such a standard on national needs.

With this understanding, the Partnership for 21st Century Skills united with leading technology corporations and educational entities to delineate the key components of 21st century learning. Supporting federal, state, and local efforts, the Partnership has sought to provide a united face to the national concern about 21st century skills. From this joint perspective, six elements have been recognized as necessary to 21st century learning. The partnership encourages schools to incorporate these six elements:

- Emphasize core subjects
- Emphasize learning skills
- Use 21st century tools to develop learning skills
- Teach and learn in a 21st century context
- Teach and learn 21st century content
- Use 21st century assessments that measure 21st century skills.

(Partnership for 21st Century Skills, 2003b)

With the recognition that core content continues to be the foundation of quality education, the Partnership supports the *No Child Left Behind Act* and its identification of core subjects (i.e., English, reading or language arts, mathematics, science, foreign languages, civics, government, economics, arts, history and geography). The range of subjects is broader than what has traditionally been deemed foundational subject areas. Local schools, local school curricula, and local assessment of educational performance must reflect the changes in the larger world. States, however, seem to be in the driver's seat. State officials and their test makers need to work more closely in redefining their understanding of what learning needs to take place in schools. They also need to determine how individualized opportunities for learning can take place any time, any place, and at any pace.

Beyond its recognition of the need for an emphasis on foundational core content, the Partnership has also recognized the need for people to be able to think critically, analyze information, solve

problems, and make decisions (Partnership for 21st Century Learning, 2003b). Today, knowing how to learn and apply new information is at least as critical as having a foundation of knowledge on which to base decisions. Rightfully, the Partnership has recognized this point as essential to education in the 21st century.

Likewise, the Partnership, in its effort to clarify a standard for 21st century learning, has naturally placed an emphasis on technology tools. It is no surprise that such an emphasis is included in its identification of key elements of 21st century learning. Considering the processing power of database and spreadsheet software, the effectiveness of presentation programs, and the communication ease of networks, it is only logical for such tools to be included as essential to 21st century learning (Partnership for 21st Century Skills, 2003b).

Furthermore, the Partnership has rightfully recognized the value of learning in a way that mimics and appreciates the world in which we live. Given the changes to our world and increases in technology and opportunities for communication, the Partnership encourages schools to make learning meaningful to students. That is, leading experts can become a part of classroom learning environments, merely through access to telecommunications services and interactive learning technologies. In the same way, other aspects of the world can be brought into the K-12 educational environment to enhance and broaden learning to include the world outside of classroom walls (Partnership for 21st Century Skills, 2003).

Leading experts can become a part of classroom learning environments through ... telecommunications services and interactive learning technologies.

Additionally, the Partnership has expanded the definition of what needs to be learned beyond the core content areas. Considering the global nature of our world and the importance of American democracy, the business and educational leaders of the Partnership have further emphasized the importance of global awareness and financial and civic literacy. These three areas, given their increased value in our nation and around the world, are especially relevant to teaching and learning in the 21st century (Partnership for 21st Century Skills, 2003).

And finally, the Partnership has reiterated the national focus on assessment, recognizing its value in promoting quality teaching and learning. From the Partnership's perspective, both standardized and traditional means of assessment are considered relevant. Yet, rightfully, the Partnership emphasizes that both forms of assessment could be expanded to more fully commit students and teachers to learning 21st century skills (Partnership for 21st Century Skills, 2003).

Technology Literacy and K-12 Teachers

Considering the societal demands for the use of technology in schools in relation to the presence of educational technology standards, determining the current level of technological literacy of today's K-12 teachers is the next logical step. Are teachers technologically competent enough to efficiently prepare students to become technologically literate? Fortunately, answers concerning this issue have become more positive in recent years. However, the current level of the technological competence of teachers is not ideal.

This reality is reaffirmed in a recent finding from the United States Department of Education, which reported that nearly two-thirds (66%) of all teachers feel not at all prepared or only somewhat prepared to use technology in their teaching (United States Department of Education, National Center for Education Statistics, 2000). In a similarly revealing finding from a separate research study, nearly two-thirds (65%) of all teachers had never used a computer prior to being introduced to one as a teacher in the school setting (Merrill Lynch & Co., 2000). These realities alone clearly introduce the actuality that teachers are in need of technological training. If our future workforce is going to be properly prepared to meet the challenges of the information age, we must ensure that today's teachers are receiving an appropriate education.

Highly relevant to this point is the positive effect teacher knowledge has on student achievement. Recent research by Linda Darling-Hammond, professor of education at Stanford University, concluded that teacher knowledge is the single most important variable associated with student achievement (McRobbie, 2000). Based on data from all 50 states, her findings indicate that "the strongest and most consistent predictor of a state's average student achievement level is the proportion of well-qualified teachers in the state" (McRobbie, 2000). Amazingly enough, this finding holds true even when student poverty and limited English proficiency are considered. But perhaps even more profound is the finding of a 1991 study by Ronald Ferguson that when teacher expertise is paired with class size reduction, even the influence of the home environment is exceeded as a predictor of student learning gains (McRobbie, 2000).

In another recent study, student writing and problem solving abilities significantly improved as a result of two factors: 1) 24-hour access to laptop computers and 2) teachers implementing student-centered, problem-based learning environments (Lowther, Ross, and Morrison, in press).

All of this is said to emphasize that increased teacher knowledge can make a difference in student achievement. Gains in teacher technology literacy, therefore, are not in vain. Well prepared and effectively trained teachers can make a difference; they are the hope of our nation's future.

Technology Access and Use

Our nation's schools have rigorously addressed the issue of student access to computers. In 1992, there were 19.2 students per instructional computer; in 2000 there were 4.9 students. This is optimistic news, especially considering the reality that every year since 1992 the student-to-computer ratio has gradually improved. This type of pattern is encouraging (Meyer, 2001).

However, an examination of the way in which computers are being used in schools gives a less satisfying result. Recent data from classroom observations in 8,200 elementary schools and 1,700 high schools revealed that technology use as a tool was "occasionally" or "frequently" observed in only 10 percent of elementary school visits and 23 percent of high school visits. Likewise, at both the elementary and high school levels, technology use as a tool was not "extensively" observed (Ross, Alberg, Smith, and Lowther, In press). These results are reflected in teacher survey findings, which indicate that, at best, only slightly more than half of teachers from high poverty schools provided students with opportunities to use word processing (53%) and spreadsheet (53%) applications; and less than half use Internet research (35%), problem solving / data analysis (43%), and graphical presentation (37%) applications to complete tasks (Meyer, 2001). Our nation and our students deserve a higher level of achievement.

As expected, students from more advantaged backgrounds tend to have more exposure to computer activities. The numbers are higher but, unfortunately, they too could be improved. In such schools, results indicate

... students from more advantaged backgrounds tend to have more exposure to computer activities.

that approximately 50-70 percent of the teachers are providing students with opportunities to engage in computer-related activities. The specific activities and results were as follows: word processing (70%), Internet research (61%), problem solving / data analysis (47%), and graphical presentations (52%) (Meyer, 2001). Our students need to be better prepared for the workforce demands that await them.

Student Perspective of School and Career Computer Use

Students realize that computers are going to be an important part of their careers. According to an *Education Week* study in which 500 telephone interviews of US public secondary school students were conducted, students viewed computers as more relevant for success in their career than for success in school. According to the interviews, 98 percent of students considered "knowledge about computers" to be, at least, "very" important for professional success (Doherty and Orlofsky, 2001). However, only 7 percent of students believed that knowledge about computers is "extremely" important to their success in school, and only 33 percent said knowledge about computers is "very" important to their success in school (Doherty and Orlofsky, 2001). Such numbers clearly illustrate the disjointed perspective that students have of their work as students and their future work in a career. Of course, this evidence supports the importance of school reform, but it also provides an example of the lack of technological vision that is present in our schools. Many students realize that computers are important, yet schools are not currently stepping up to the challenge to provide authentic methods of instruction in which students are encouraged to view and use computers as problem-solving tools. Thus, it seems evident that the way in which computers are perceived in schools is not currently mimicking the way in which they are or will be applied in the nation's workforce environment.

Summary

The situation before us is clear. No longer are we an industrial society focused on its demand for labor. The triumphant age of the factory is history; now we are facing the information age. Workforce demands are for intelligent, creative, problem-solvers that revel in thought about knowledge and how to manage information.

However, as we turn to our schools to examine the next generation of employees, we are concerned that they are not properly preparing students to meet the challenges they will face in the workforce. Our schools are still primarily based on an old and outdated model. Leading experts in this arena, including Anthony Carnevale, recognize the value of investing considerable resources to ensure that educational reforms contribute to our nation's overall well-being and competitiveness.

Fortunately, as first steps to reform, schools are gaining access to more technology and are using it to improve and extend opportunities for learning. Effective uses of technology are too often exceptions to

the rule. As Larry Cuban and other researchers report, a large percentage of teachers are not currently comfortable using technology, nor trained to integrate technology to achieve worthwhile educational outcomes. There is an increasing need for the private sector to assist schools and teachers in ensuring that all students are properly mentored in the development of workplace skills. Effective programs exist, and it is up to the states to expand and sustain these programs on a statewide basis.

To achieve the level of reform that is needed, federal and state leaders need to enter into a new partnership that embraces a new and broader vision for public schools. The guide provided by the Partnership for 21st Century Skills offers an attainable vision to initiate the necessary reforms. Through recruitment, training, planned implementation, and other such visionary efforts, schools can achieve 21st Century skills. A transformation of the nation's public school system obviously needs to take place within state mandates and under state leadership. The past suggests that change occurs incrementally, but the framework resulting from the passage of the *No Child Left Behind Act* creates prospects that did not exist in early reform efforts. Although the challenge that this piece of legislation presents is quite formidable and its goals impossible to achieve in the near future, the opportunities for equalizing access to education have never been better.

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Additional Reading

Educational Policy Makers and Researchers

Early literacy assessment systems: Essential elements. A research report from ETS. Available at <http://www.ets.org/research/>

The report describes the requirements for a coherent early literacy assessment system that produces information to enhance instruction and helps evaluate programs.

21st century skills: Realising our potential: Individuals, employees, nation. Department of Education and Skills, London, UK. July 2003. Available at <http://www.dfes.gov.uk/skillsstrategy/>

A report from the British government to Parliament. It outlines a strategic national plan to ensure that all students develop the knowledge and skills needed for life and work. It explains how the government is taking the lead by bringing departments and agencies responsible for education and skill preparation together with businesses and employers to work more collaboratively and effectively.

Digital transformation: A framework for ICT literacy. A report of the International ICT Literacy Panel. Education Testing Service. 2002. www.ets.org/research/icliteracy/

In January 2001, Educational Testing Service (ETS) convened an international panel to study the growing importance of existing and emerging information and communication technologies (ICT) and their relationship to literacy. The focus of the panel's deliberations was to examine the need for measures of ICT literacy and develop a workable framework for assessing and studying ICT literacy. The report lays out a framework for measuring ICT literacy.

How to ensure ed/tech is not oversold and underused. 2002. Edited by Arthur D. Sheekey (ed.). Langham, MD: Scarecrow Press, Inc. www.scarecroweducation.com/

This book includes stories of education practitioners who have successfully implemented various telecommunications technologies in schools and classrooms. The authors explain the conditions that were necessary to integrate technology and to use technology and different teaching approaches to achieve higher academic standards.

The knowledge economy and postsecondary education. National Academy of Sciences. National Academy Press, Washington, DC. 2002. www.nas.edu/

A report of a workshop that involved national leaders and higher education officials. Reports of the six workshop papers cover a wide range of topics; including the implications of changing workforce demands, changing demographics, and the respective roles of community and four-year colleges and universities.

The work of nations: Preparing ourselves for 21st century capitalism. Robert B. Reich. 1992.

What skills will be the most valuable in the coming century? How can our country ensure that all its citizens have a share in the new global economy? The author of *The Next American Frontier* addresses these questions in a trail-blazing new book that is certain to guide a generation of policymakers.

School Administrators

Building a nation of learners: The need for changes in teaching and learning to meet global challenges. Business-Higher Education Forum. 2003.

The forum is affiliated with the American Council on Education and is a membership organization of business, university, and museum leaders. Available at <http://www.acenet.edu/programs/bhef/>

The digital classroom: How technology is changing the way we teach and learn. Gordon, D. T. (ed.). 2001. Harvard Education Letter, Cambridge, MA

This edited book provides articles and essays from leading authorities on technologies and their impact on teaching and learning. Includes work from Howard Gardner, Milton Chen, and Chris Dede.

Partnership for 21st Century Skills. June 2003

This public-private partnership represents the work and commitment from leading corporate and educational entities throughout the nation. It has developed insightful suggestions for implementing new programs and practices. Its chief sponsors include AOL TimeWarner, Apple, Dell, Microsoft, the United States Department of Education, and the Appalachian Technology in Education Consortium. Recently released publications include:

MILE guide for 21st century skills: Milestones for improving learning and education. Available at www.21stcenturyskills.org

Learning for the 21st century: A report and MILE guide for 21st century skills. Available at www.21stcenturyskills.org

How to ensure ed/tech is not oversold and underused. Sheekey, A. D. (ed.) 2003. Lanham, MD: Scarecrow Press.

This edited book offers articles and essays in response to critics and cynics who have suggest that spending on educational technology has not contributed to improved teaching and learning. The book provides examples and supportive rationale for why policymakers and school administrators have an important role to play in technology use and integration.

Teachers and Practitioners

enGauge professional development program developed by the NCREL regional educational laboratory. Available at <http://www.ncrel.org/engauge/>

Based on two years of study, the *enGauge* model represents a new and interesting perspective in light of recent historical events, globalization, and the availability of advanced technologies. This guide presents a set of skill clusters that, when considered within the context of rigorous academic standards, are intended to provide the public, business and industry, and educators with a common understanding of what is needed by students and workers in the emerging economy.

Edutopia: Success stories for learning in the digital age. The George Lucas Foundation. 2002. San Francisco: Jossey-Bass

This book provides a look into classrooms where technology integration is being practiced in new and creative ways. A CD-ROM accompanies the book.

Integrating computer technology into the classroom. (Rev. 2nd ed.). Morrison, G. R., and D. L. Lowther. 2002. Upper Saddle River, NJ: Prentice Hall

This book provides an instructional design model for integrating technology into our nation's schools. It is a wonderful starting point for those who want to effectively bring technology into their classroom but are currently uncertain of how to begin.

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Author

Mr. Eric Marvin is a research analyst for the Appalachian Technology in Education Consortium. Currently, he is a doctoral student and adjunct professor in instructional design and technology at the University of Memphis. His dissertation research is focused on a comparison of preservice teachers' perceptions and abilities to use technology-integration-related computer skills.

Mr. Marvin has also worked as a Technology Literacy Challenge Fund (TLCF) site researcher where he has observed technology integration methods in numerous K-12 classrooms. He has recently co-authored a soon-to-be-released, ATEC sponsored *Technology Coach Handbook*, a resource to support effective technology integration in K-12 schools.

Aside from technology integration research, Mr. Marvin has facilitated gaming research with elementary school students and has developed several websites. He holds a Master's degree in Education from Harding University, along with a California teaching credential and Bachelor of Arts degree from Fresno Pacific University.



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