LEARNING *for the* 21ST CENTURY




A REPORT *and* MILE GUIDE *for*
21ST CENTURY SKILLS

PARTNERSHIP FOR
21ST CENTURY SKILLS

About the Partnership *for* 21st Century Skills

The Partnership for 21st Century Skills is a unique public-private organization formed in 2002 to create a successful model of learning for this millennium that incorporates 21st century skills into our system of education.

Members

AOLTW Foundation
Apple Computer, Inc.
Cable in the Classroom
Cisco Systems, Inc.
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National Education Association
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Partnership for 21st Century Skills

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Partnership for 21st Century Skills

Letter to America's education leaders

From the Board of the Partnership for 21st Century Skills

How can we best prepare students to succeed in the 21st century? This is a question of paramount importance to America's educators, employers, parents and the public. Our community vibrancy, personal quality of life, economic viability and business competitiveness depend on a well-prepared citizenry and workforce. Public education provides the bedrock from which our national and individual prosperity rise together.

The No Child Left Behind Act of 2001, which reauthorizes the Elementary and Secondary Education Act of 1965, emphasizes student achievement and requires assessments in core subjects, which are the foundation for learning. This federal law is focusing the attention of schools and educators on fundamental knowledge and skills.

This is an excellent start. We can do even more. The nation needs a compelling vision for education that will inspire education leaders, teachers, parents and students alike. Clearly, we must work together to fully prepare people for the challenges of work and life in the 21st century.

The Partnership for 21st Century Skills, a unique public-private organization of leaders and educators in business and education, has come together to help schools fully address the educational needs of the 21st century. With this, our first report, we articulate a unified, collective vision for education and a framework for action. We also provide a companion guide for getting started, our Milestones for Improving Learning and Education (MILE) Guide for 21st century skills. We developed both the report and the MILE Guide through a comprehensive process involving hundreds of educators, researchers and employers across the country.

We recognize that we are calling on schools to change dramatically even as they face difficult economic challenges and a vigorous discussion of student achievement and assessments. However, while current budget constraints eventually will subside, the long-term need for 21st century learning will not: Accelerating technological change, rapidly accumulating knowledge, increasing global competition and rising workforce capabilities around the world make 21st century skills essential.

We are committed to promoting a national dialogue about 21st century skills — and to resolving issues about teaching *either* basic skills *or* 21st century skills. Both are essential and, when done concurrently, each reinforces the other. We urge you to join this discussion and help us build consensus and momentum for education that integrates knowledge and skills that are relevant to the 21st century. To that end, we are launching a public awareness campaign to engage people in this national dialogue. We are exhilarated by the progress educators, employers and public leaders have made in promoting 21st century skills and contributing to this vision. As you read this report, we hope you will share the Partnership's excitement about the educational opportunities made possible by the prospect of communities using and adapting this vision to make real progress for children in the 21st century.

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Executive Summary

In recent years, educators at the local, state and national levels have focused on improving student achievement — the perennial top priority of public concern. States and school districts have established rigorous academic standards, assessments and accountability measures — a concerted effort that has involved thousands of educators, employers and community members nationwide. Schools have responded with strategies to improve teaching and learning.

Today's education system faces irrelevance unless we bridge the gap between how students live and how they learn.

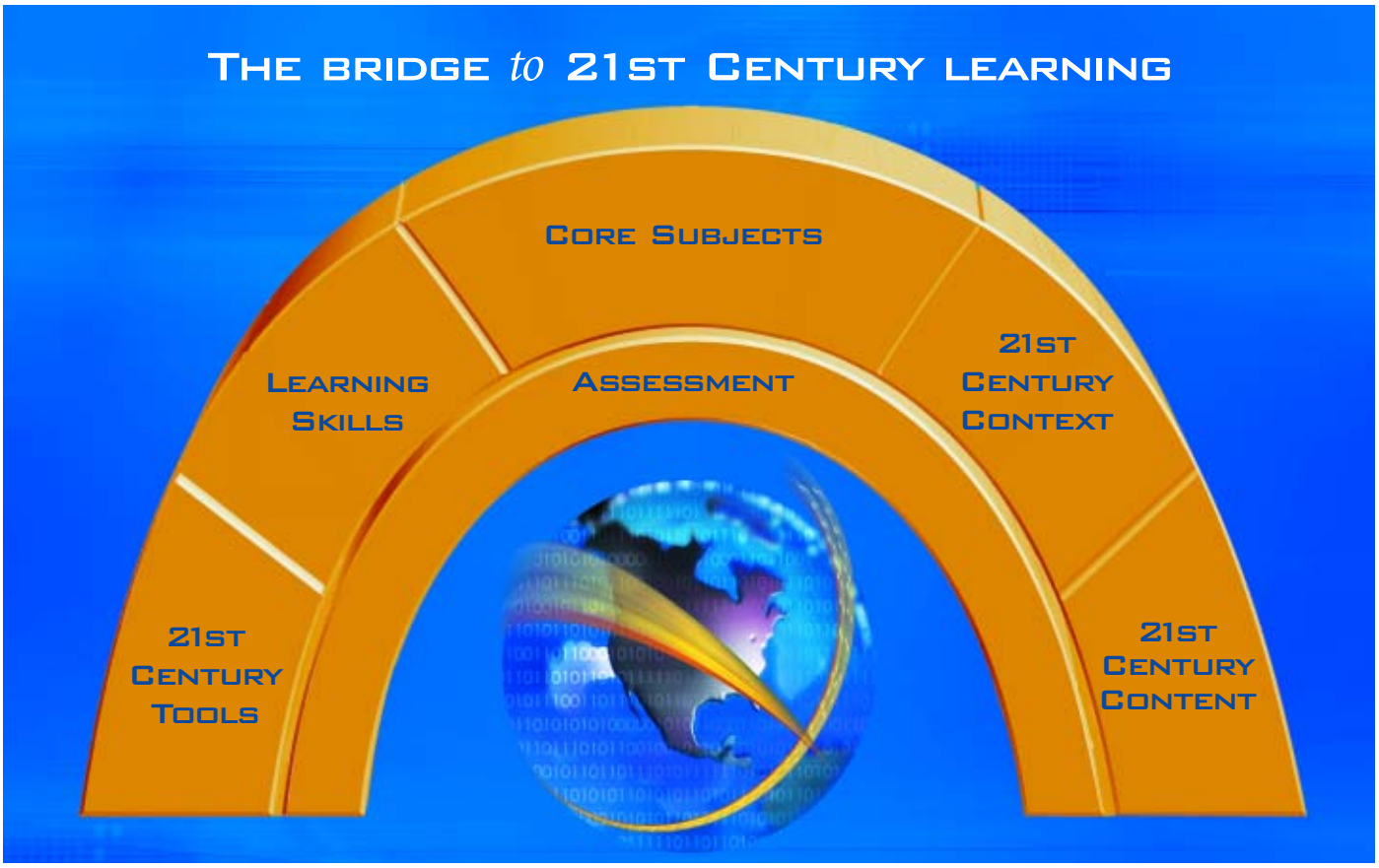
There remains, however, a profound gap between the knowledge and skills most students learn in school and the knowledge and skills they need in typical 21st century communities and workplaces. The Partnership for 21st Century Skills, a group of major business and education organizations, formed in 2002 to work on closing this gap. The Partnership is committed to promoting a national dialogue about 21st century skills, integrating them into K–12 schools and encouraging the development of curriculum and assessments that reflect 21st century realities.

This Partnership's work builds on the significant progress of recent years. In fact, the recommendations in this report complement No Child Left Behind and provide a vision for capturing the full range of 21st century skills in the assessments the law requires. This initiative is a broad-based public-private partnership in the finest sense.

The Partnership is contributing to improving education in several distinct ways:

- Synthesizing research, insights and best practices about 21st century knowledge and skills into a powerful vision and sharing this information broadly.
- Defining a framework and creating a common language for understanding and promoting 21st century skills.
- Providing education leaders with tools, examples and a strategy for action, not more rhetoric.
- Building consensus in the public and private sectors about the nature and need for 21st century skills.

In our first year, we focused on creating a common framework and language for 21st century skills. This report captures the findings of a comprehensive effort to identify the essential skills that people need today — and tomorrow. To reach this point, the Partnership conducted a National Forum on 21st Century Skills in 2002; held



outreach sessions with educators, employers, parents, community members and students; and built consensus for a common framework and language in this report. (To learn more about our outreach efforts, see Appendix A on page 26.) We also conducted extensive research on 21st century skills, which is reflected in this report.

Defining the need for change

Economic, technological, informational, demographic and political forces have transformed the way people work and live. These changes — and the rate of change — will continue to accelerate. Schools, like businesses, communities and families, must adapt to changing conditions to thrive.

Today's education system faces irrelevance unless we bridge the gap between how students live and how they learn. Schools are struggling to keep pace with the astonishing rate of change in students' lives outside of school. Students will spend their adult lives in a multitasking, multifaceted, technology-driven, diverse, vibrant world — and they must arrive equipped to do so. We also must commit to ensuring that all students have equal access to this new technological world, regardless of their economic background.

Moreover, we know more today than ever about how students learn. Researchers and educators in recent years have made great strides in mapping the remarkable territory of the human mind. We now have scientific insights that can inform educators about the cognitive processes of learning, effective teaching strategies for engaging students in learning and motivating students to achieve. We must incorporate this understanding into classroom teaching and learning on a broad scale.

Against this backdrop, literacy in the 21st century means more than basic reading, writing and computing skills. It means knowing how to use knowledge and skills in the context of modern life. As writer Alvin Toffler points out, "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn."

Six key elements *of* 21st century learning

- 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.

What is the Partnership's vision for education and 21st century skills?

Standards, assessments and accountability measures set by states, implemented by school districts and underscored by No Child Left Behind are the starting point for strong schools and student achievement. To complement these efforts, schools need to increase emphasis on the additional knowledge and skills students will need for the 21st century. This is an opportune time to align standards, assessments and accountability measures with 21st century skills.

Critical elements for creating 21st century skills

There are six key elements for fostering 21st century learning:

1. Emphasize core subjects. Knowledge and skills for the 21st century must be built on core subjects. No Child Left Behind identifies these as English, reading or language arts, mathematics, science, foreign languages, civics, government, economics, arts, history and geography. Further, the focus on core subjects must expand beyond basic competency to the understanding of core academic content at much higher levels.

2. Emphasize learning skills. As much as students need knowledge in core subjects, they also need to know how to *keep learning* continually throughout their lives. Learning skills comprise three broad categories of skills:

- information and communication skills,
- thinking and problem-solving skills, and
- interpersonal and self-directional skills.

Good teachers always have fostered these skills. The challenge now is to incorporate learning skills into classrooms deliberately, strategically and broadly. (For more on learning skills, see the chart on page 9.)

3. Use 21st century tools to develop learning skills. In a digital world, students need to learn to use the tools that are essential to everyday life and workplace productivity.

Skilled 21st century citizens should be proficient in ICT (information and communication technologies) literacy, defined by the Programme for International Student Assessment (PISA) as "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."[1]

4. Teach and learn in a 21st century context. Students need to learn academic content through real-world examples, applications and experiences both inside and outside of school. Students understand and retain more when their learning is relevant, engaging and meaningful to their lives. In the global, networked environment of the 21st century, student learning also can expand beyond the four classroom walls. Schools must reach out to

their communities, employers, community members and, of course, parents to reduce the boundaries that divide schools from the real world.

5. Teach and learn 21st century content.

Education and business leaders identified three significant, emerging content areas that are critical to success in communities and workplaces:

- global awareness;
- financial, economic and business literacy; and
- civic literacy.

Much of this content is not captured in existing curricula or taught consistently with any depth in schools today. An effective way to incorporate this content is to infuse knowledge and skills from these areas into the curriculum.

6. Use 21st century assessments that measure 21st century skills.

States and districts need high-quality standardized tests that measure students' performance of the elements of a 21st century education.

However, standardized tests alone can measure only a few of the important skills and knowledge we hope our students will learn. A balance of assessments — that is, high-quality standardized testing for accountability purposes and classroom assessments for improved teaching and learning in the classroom — offers students a powerful way to master the content and skills central to success in the 21st century. To be effective, sustainable and affordable, sophisticated assessment at all levels must use new information technologies to increase efficiency and timeliness.

How can school leaders move forward with this vision?

The Partnership's work emphasizes learning — not simply *what* students are learning, but *how* they are learning as well. Our vision is not a daunting list of "add-ons" to educators' already full job responsibilities. Incorporating 21st century tools more effectively into administrative routines and school classrooms, for example, will give educators more time to concentrate on teaching and learning. Infusing dynamic, real-world contexts into classroom learning will invigorate teacher and student engagement. Modernizing assessment methods will give educators real-time information they can use to help their students *today*, instead of months after students have moved on to another classroom or school. In short, educators can expect positive results for themselves and for their school systems.

This is the right time for states and school districts to begin integrating 21st century skills into education. States and school districts already are thinking seriously about improving the quality of teaching and learning as they respond to No Child Left Behind. Skills for the 21st century are central to this important endeavor. While states and school districts now face a challenging economic environment, the need for 21st century skills is not going away. Indeed, it will only become more important with time. Strategic, long-term planning now to integrate 21st century skills into standards, curricula, assessments and professional development will be more effective in the long run than adding them piecemeal later.

This report complements the work of the CEO Forum on Education and Technology, which developed the STaR (School Technology and Readiness) Chart. That work focused on building a technology infrastructure and support system in schools. The challenge now is to emphasize other key elements of learning and leverage existing technology to truly make a difference in student achievement. This is an ambitious challenge, but one that should engage and energize education leaders, teachers and parents alike. In the Partnership's view, nothing is more important for education today than beginning to make 21st century skills a reality.

Education leaders can start today with ideas in *Implementing 21st century skills: Nine steps to build momentum*, which begins on page 20, and in *Making a difference: How key stakeholders can support the effort*, which begins on page 24. Educators can also refer to the foldout *MILE Guide for 21st Century Skills*, which provides practical guidance for assessing schools now and envisioning how they can prepare for the future.

Visit our Web site to learn more and to share your experiences in implementing a 21st century education.
www.21stcenturyskills.org

Nine steps *to* build momentum

- Embrace a powerful vision of public education that includes 21st century skills.
- Align leadership, management and resources with educational goals.
- Use this tool to assess where schools are now.
- Develop priorities for 21st century skills.
- Develop a professional development plan for 21st century skills.
- Make sure students have equitable access to a 21st century education.
- Begin developing assessments to measure student progress in 21st century skills.
- Collaborate with outside partners.
- Plan collectively and strategically for the future.

Part I

Defining the need for change

Successful businesses are looking for employees who can adapt to changing needs, juggle multiple responsibilities and routinely make decisions on their own.[2] Today's economy "places value on broad knowledge and skills, flexibility, cross-training, multi-tasking, teaming, problem-solving and project-based work."[3] According to Federal Reserve Board Chairman Alan Greenspan, there will be an evolving demand for 21st century skills in our economy: "Workers in many occupations are being asked to strengthen their cognitive skills; basic credentials, by themselves, are not enough to ensure success in the workplace. Workers must be equipped not simply with technical know-how but also with the ability to create, analyze and transform information and to interact effectively with others. Moreover, that learning will increasingly be a lifelong activity."[4]

The world in which students live has changed dramatically — and schools must change as well, as they have in the past, to meet the demands of the agricultural, industrial and Cold War eras.

The explosion of powerful technology has altered traditional practices in workplaces and communities. Fifty years ago, factory and office workers worked on a single machine, performing the same task day after day. Technology has simplified and, in some cases, eliminated such routine tasks, which means there are increasingly fewer positions available to workers with minimal skills. By contrast, there are more opportunities for highly skilled workers. Today, factory and office workers perform multiple tasks on much more sophisticated machines and electronic equipment in workplaces that are constantly evolving to respond to market expectations for customized products and services.

Today, it is not only business that demands a dramatically different set of skills. Rapidly evolving technologies have made new skills a requirement for success in everyday life. Effectively managing personal affairs, from shopping for household products to selecting health care providers to making financial decisions, often requires people to acquire new knowledge from a variety of media, use different types of technologies and process complex information. Participating effectively in communities and democracy requires people to use more advanced knowledge as well. To decide whether to support a transportation bond issue, for example, voters may need to understand its scientific, environmental, technological, political and economic ramifications.

In the 21st century, Americans "need to be better educated to fill new jobs and more flexible to respond to the changing knowledge and skill requirements of existing jobs…. Lifelong skills development must become one of the central pillars of the new economy."[5] Further, as a recent study indicated, the narrow job skills that most employees learn today will be obsolete within three to five years.[6] Workers need the learning capacity to become lifelong learners, updating their knowledge and skills continually and independently.

Technology and advanced communications have transformed the world into a global community, with business colleagues and

> *A simple question to ask is,*
> *'How has the world of a child changed*
> *in the last 150 years?'*
> *And the answer is, 'It's hard to imagine any way in*
> *which it hasn't changed.'*
> *Children know more about what's going on in*
> *the world today than their teachers,*
> *often because of the media*
> *environment they grow up in.*
> *They're immersed in a media environment*
> *of all kinds of stuff that was unheard of*
> *150 years ago, and yet if you look at school*
> *today versus 100 years ago,*
> *they are more similar than dissimilar.*
>
> — Peter Senge, senior lecturer at the Massachusetts Institute of Technology

competitors as likely to live in India as in Indianapolis. Moreover, flattened hierarchies in competitive businesses require employees to make business decisions, work productively in teams and communicate directly with customers. In this environment, employers value job candidates who can acquire new knowledge, learn new technologies, rapidly process information, make decisions and communicate in a global and diverse society.

Education that connects to students' lives

For many students, the impact of technology on everyday life is no surprise. They connect with their friends via e-mail, instant messaging and chat rooms online; search the Web to explore their interests; express themselves fluently using new media; learn with educational software; play video and computer games in virtual realities; manipulate digital photos; go behind the scenes on DVDs; channel surf on television; and chat on and take photographs with cell phones. Through the media, they identify with their peers in the global culture through music, games, toys, fashion, animation and movies.

Likewise, today's students already are immersed in 21st century communities and lifestyles. For example, an increasing proportion of the student population speaks a language other than English. In 2000, 17 percent of all public school students were Hispanic, according to the National Center for Education Statistics; for many of these students, English is a second language.[7] By 2025, nearly one in four school-age children will be Hispanic.[8] Students live in increasingly diverse communities; in many urban school districts, it is not unusual to find more than 100 different native languages and home cultures among student populations whose extended families may span the globe.

21st century skills at a technology company

In the digital economy, one U.S. technology company[9] expects current and prospective employees to bring this set of skills to the workplace:

Set business direction
- Business acumen
- Customer focus
- Financial acumen
- Strategic agility

Align and motivate others
- Build effective teams
- Develop direct reports
- Hire and staff
- Motivate others

Deliver results
- Command skills
- Deal with ambiguity
- Drive for results
- Intellectual horsepower
- Integrity and trust

Education that prepares students for learning in this complex, digital society will be more meaningful to students and, ultimately, more effective in preparing them for the future. A powerful vision of public education is critical for closing the gap between how students live and how they learn in school. Students who have access to technology outside of school will find schools without access to and integration of technology into their coursework to be antiquated and irrelevant to their world. Students without this access at school or at home may find themselves on the periphery of 21st century society. For these reasons, 21st century skills must be a local, state and national priority.

Education that reflects how people learn

Another important development underscores the need to adapt education for the 21st century: a deeper understanding of how people learn. A 2000 report of the National Research Council, *How People Learn: Brain, Mind, Experience, and School*, synthesized this body of research into these key findings:

1. Students come to the classroom with preconceptions about how the world works. If teachers do not use this prior knowledge to build new understanding, students may fail to grasp the new concepts and information they are taught, or they may learn them for purposes of a test but revert to their preconceptions outside of the classroom.

2. To develop competence in an area of inquiry, students must have a deep foundation of knowledge, understand facts and ideas in the context of a conceptual framework, and organize knowledge so they can retrieve and apply it.

3. A metacognitive approach to instruction, in which students are taught to think deliberately about how they are learning, can help students take control of their own learning, monitor their own progress and improve their achievement.[10]

These findings have profound implications for teaching and learning in the 21st century. It is incumbent on this generation of leaders and educators to incorporate the insights of research into teaching strategies for K–12 classrooms. While many schools gained from using some of these approaches to help students learn, the challenge today is to make these approaches the norm in all U.S. schools. The vision for education presented in the next section will help policymakers and educators align student achievement with 21st century expectations — by building on the good work they already have started in many places.

Part II

The key elements of 21st century learning

The Partnership for 21st Century Skills supports federal, state and local initiatives to give students a solid foundation in core subjects and core content and to monitor progress with assessment and accountability measures.

However, the Partnership feels strongly that other necessary pieces of an effective education are needed for the 21st century as well. Adding these key elements where they are missing — and measuring them with 21st century assessments — will make the core subjects relevant to the world in which students live and eventually may work. Moreover, these key elements will help improve student achievement; more effectively address the needs of students with special challenges, such as English language learners and students with disabilities; and help schools meet the intent of No Child Left Behind. This section outlines the framework the Partnership recommends to make this happen.

Six elements of a 21st century education

To strengthen core subjects and move toward a 21st century education, there are six elements schools can incorporate:

- 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.

One key competency that employers across-the-board value in employees is the ability to think creatively and logically in order to solve problems.

Such employees are most likely to be promoted in an unforgiving global economy that requires flexibility and an ability to develop new skills. The ability to think, speak, and write logically, to solve problems, and to synthesize information are also priority competencies cited by postsecondary faculty members from all disciplines.

— The American Diplomacy Project

Emphasize core subjects

Core academic subjects remain the foundation of a good education. This is as true today as it was 100 years ago. In the words of noted educator Jerome Bruner, learning core subjects makes it possible for students "to participate in the process that makes possible the establishment of knowledge … and to take part in the process of knowledge-getting."[11]

Our understanding of core subjects and students' course-taking patterns in these subjects continue to evolve to respond to changing times. In past decades, core subjects were defined as English language arts, mathematics, science and social studies. In its 1983 report *A Nation at Risk*, the National Commission on Excellence in Education recommended that high school students take four years of English, three years of mathematics, three years of science and three years of social studies. College-bound students were encouraged to add two years of a foreign language. Today, more students are taking these courses, which the Commission called the "new basics." In 1982, less than 14 percent of graduates took this sequence of courses, compared to 56 percent in 1998.[12]

A Nation at Risk also called for computer programming to be included as a "new basic," but since then, the world has gone through a technology revolution. This revolution has led to the need for all students to be technology literate. Recognizing this, No Child Left Behind requires that students be technology literate by the end of the eighth grade.

Moreover, to position themselves to take the recommended course sequences in high school, students must start learning core subjects early. "Several studies have shown that instruction in the core curriculum at the earliest level is important, as exposure to subjects at the elementary level is related to courses students take at the secondary level," according to the National Center for Education Statistics at the U.S. Department of Education. "The more content they are taught early on, the more they learn and the better they perform on later achievement tests."[13]

No Child Left Behind identifies the core subjects as English, reading or language arts, mathematics, science, foreign languages, civics, government, economics, arts, history and geography.[14] This expanded list more accurately reflects the demands of 21st century workplaces and communities. For example, in a global economy, a foreign language, economics and geography are "new basics" for functioning effectively.

In a knowledge economy, core subjects continue to be relevant and they continue to open doors to opportunity. Recently, for example, researchers Anthony Carnevale and Donna Desrochers of the Educational Testing Service identified geometry as the benchmark course for students intending to work in well-paid, blue-collar jobs and low-skilled jobs and algebra II as the benchmark course for students aspiring to highly paid professional jobs or well-paid, white-collar jobs.[15]

Over the past decade, states and school districts have strengthened their focus on core subjects by developing academic content standards. Standards are a positive development in that they spell out clearly what students should know and be able to do. Schools must now make sure these standards are aligned with assessments. Measures and systems of accountability are only effective if they truly assess what people value.

Emphasize learning skills

To cope with the demands of the 21st century, people need to know more than core subjects. They need to know how to use their knowledge and skills — by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions. Philosopher John Dewey believed "the aim of education is to enable individuals to continue their education. … The object and reward of learning is continued capacity for growth."

Of course, these higher-level thinking skills, or learning skills, are not new, but they are increasingly important in workplaces and community life. In its 1991 report, *What Work Requires of Schools*, the U.S. Secretary of Labor's

Learning Skills

Information and Communication skills	**Information and media literacy skills** Analyzing, accessing, managing, integrating, evaluating and creating information in a variety of forms and media. Understanding the role of media in society. **Communication skills** Understanding, managing and creating effective oral, written and multimedia communication in a variety of forms and contexts.
Thinking and problem-solving skills	**Critical thinking and systems thinking** Exercising sound reasoning in understanding and making complex choices, understanding the interconnections among systems. **Problem identification, formulation and solution** Ability to frame, analyze and solve problems. **Creativity and intellectual curiosity** Developing, implementing and communicating new ideas to others, staying open and responsive to new and diverse perspectives.
Interpersonal and self-directional skills	**Interpersonal and collaborative skills** Demonstrating teamwork and leadership; adapting to varied roles and responsibilities; working productively with others; exercising empathy; respecting diverse perspectives. **Self-direction** Monitoring one's own understanding and learning needs, locating appropriate resources, transferring learning from one domain to another. **Accountability and adaptability** Exercising personal responsibility and flexibility in personal, workplace and community contexts; setting and meeting high standards and goals for one's self and others; tolerating ambiguity. **Social responsibility** Acting responsibly with the interests of the larger community in mind; demonstrating ethical behavior in personal, workplace and community contexts.

Adapted from the work of the American Library Association,[16] Association of College and Research Libraries,[17] The Big6,[18] Center for Media Literacy,[19] Educational Testing Service,[20] National Skill Standards Board,[21] North Central Regional Educational Laboratory's enGauge,[22] and the Secretary's Commission on Achieving Necessary Skills (SCANS).[23]

Commission on Achieving Necessary Skills (SCANS) identified these kinds of skills, as well as the "personal qualities" of responsibility, self-esteem, sociability, self-management and integrity/honesty.[24] Many states and school districts already incorporate learning skills into their standards and assessments for core subjects, but the Partnership and many employers and educators believe schools should emphasize them strategically and comprehensively.

Learning skills are cognitive skills that the Partnership defines in three broad categories:

- information and communication;
- thinking and problem solving; and
- interpersonal and self-directional skills.

Learning skills enable people to acquire new knowledge and skills, connect new information to existing knowledge, analyze, develop habits of learning and work with others to use information, among other skills. (For more details on learning skills, see the chart on page 9.)

These "knowing how to learn" skills provide both flexibility and security in an era characterized by constant change. People who can learn new information, new software programs or new ways of doing things, for example, have much better prospects in the world than people who cannot. Business leaders want employees who can continually update their skills, communicate effectively and work independently to get things done. In its publication, *Why Business Cares About Education*, the Business Coalition for Education Reform noted: "Today's economy is vastly different from fifty years ago, fueled now by brains rather than brawn. In order to survive, businesses need individuals who possess a wide range of high-level skills and abilities, such as critical thinking, problem solving, teamwork, and decision-making skills."[26]

> *During the past decade, our nation came to the widespread realization that technology was the driving force in the economy, and increasingly important to most of our human endeavors. All around us we see the information technology revolution in progress — in communications, business and commerce, how we educate and train our people, and how we manage our personal lives.*[25]
>
> — U.S. Under Secretary of Commerce for Technology Phillip J. Bond

Studies show the proportion of the labor force employed in occupations that make extensive use of interactive and analytic cognitive skills has increased substantially.[27] One recent study conducted over a 40-year period found that more and more jobs demand workers who do more than routine work.[28]

Learning skills are equally valuable outside the workplace. Making intelligent consumer choices, raising children, participating in civic affairs, evaluating media perspectives — all of these endeavors require people to access and assess information to solve problems, act constructively and make decisions. The world in which we live is increasingly sophisticated, multifaceted and nuanced. People need high-level learning skills to act, respond, learn and adjust to ever-changing circumstances. As the world grows increasingly complex, success and prosperity will be linked to people's ability to think, act, adapt and communicate creatively.

21st century tools

Current 21st century tools include:

- Information and communication technologies, such as computers, networking and other technologies
- Audio, video, and other media and multimedia tools

This list is a snapshot of current 21st century tools. The mix of tools will change and evolve rapidly in the future. Today's technology may be obsolete tomorrow. It is impossible to predict the tools that will be essential for learning and working in the years to come. This is why it is important for people to acquire the learning skills that will enable them to learn to use next-generation technology — and why businesspeople and educators need to continue collaborating so schools will stay abreast of new technology.

Use 21st century tools to develop learning skills

As this report makes clear, technology is and will continue to be a driving force in workplaces, communities and personal lives in the 21st century. "Technology helps prepare students for the workforce when they learn to use and apply applications used in the world of work. … Workforce skills are mastered with technology use. When content and strategies meet accepted education standards, research shows that technology increases mastery of vocational and workforce skills and helps prepare students for work when emphasized as a problem-solving tool (Cradler, 1994)." [29]

In this environment, the need for technologically literate citizens and workers increases every year. Skilled people in the 21st century need to understand how to use technology tools. The Partnership defines these as information and communication technologies (ICT) tools. Current 21st century tools include computers, networking and other technologies, plus audio, video, and other

media and multimedia tools. These tools enable people to perform effectively at work and in their daily lives, by using such tools as spreadsheets for calculation, budgeting and building scenarios; graphic and multimedia programs for presentations; databases for research; and networks for communicating with others.

Students need to learn how to use 21st century tools beginning in elementary school to take full advantage of the vast array of research and multimedia resources, digital content and communications options available to them.

Dream how technology can not only improve education but also transform what we think of as education.

— U.S. Secretary of Education Rod Paige

The importance of integrating ICT literacy

Together, learning skills and 21st century tools — knowing how to use these tools to perform learning skills — represent ICT literacy. Many learning skills may have nothing to do with technology, such as communicating effectively in face-to-face social or workplace situations or juggling personal responsibilities. ICT literacy, on the other hand, means harnessing technology to perform learning skills, such as communicating effectively with presentation software or juggling personal responsibilities with a personal digital assistant. In these situations, technology enables people to perform.

Developing ICT literacy requires good leadership, a strong technology infrastructure, adequate and equitable access to technology and the Internet in schools, integration of technology with classroom learning, and adequate methods for assessing ICT literacy.

ICT literacy is an effective way of teaching core subjects. Indeed, educators and employers believe that integrating ICT literacy into core subjects is the best way to teach. After all, this is how students use these key elements in the world outside of school, not as separate, stand-alone strands.

Effective teachers always have incorporated learning skills into their repertoire of instructional strategies; many now incorporate 21st century tools as well. Today, educators have the opportunity to integrate learning skills, 21st century tools and core subjects to create a vibrant education for their students. For a glimpse of how states already are integrating ICT literacy into their standards, see page 18.

The table below outlines our framework for ICT literacy. It is important to keep in mind that learning skills may have nothing to do with 21st century tools. People can communicate or collaborate, for example, without using technology. However, 21st century tools increasingly are critical *enablers* of learning skills. ICT literacy is the mastery of learning skills by using 21st century tools, according to the Educational Testing Service.[30]

ICT Literacy Framework of the Partnership for 21st Century Skills

Learning Skills +	21st Century tools =	ICT Literacy
Thinking and problem-solving skills	Problem-solving tools (such as spreadsheets, decision support, design tools)	Using ICT to manage complexity, solve problems and think critically, creatively and systematically
Information and communication skills	Communication, information processing and research tools (such as word processing, e-mail, groupware, presentation, Web development, Internet search tools)	Using ICT to access, manage, integrate, evaluate, create and communicate information
Interpersonal and self-direction skills	Personal development and productivity tools (such as e-learning, time management/calendar, collaboration tools)	Using ICT to enhance productivity and personal development

Sources: American Library Association,[31] Association of College and Research Libraries,[32] The Big6,[33] Center for Media Literacy,[34] Educational Testing Service,[35] International Society of Technology Educators,[36] International Technology Education Association,[37] National Skill Standards Board,[38] North Central Regional Educational Laboratory's enGauge,[39] the Secretary's Commission on Achieving Necessary Skills (SCANS),[40] and the State Educational Technology Directors Association.[41]

Teach and learn in a 21st century context

Good teachers have always helped students discover the value and relevance of new skills and knowledge. Because children now live in a world of almost unlimited streams of trivial and profound information, of enormous opportunity and difficult choices, helping students make vital practical, emotional and social connections to skill and content is more important than ever. To help students make these meaningful connections, teachers can create a 21st century context for learning by:

- Making content relevant to students' lives;
- Bringing the world into the classroom;
- Taking students out into the world;
- Creating opportunities for students to interact with each other, with teachers and with other knowledgeable adults in authentic learning experiences.

Here in New Jersey, we are making a coordinated effort by working together with educators, the business community, and leaders from around the state to build a better New Jersey, where students are trained for success, and where our companies have the tools and the workforce they need to lead the way in research, development, innovation and new technologies.

— Gov. James E. McGreevey, NJ signing 2003 legislation integrating technology with the state's core curriculum

Teachers can use examples, applications and settings from students' lives, communities and modern workplaces to frame academic content. They can expand the classroom experience by bringing in outside experts from the community. They can use the community as a learning laboratory. Today, technology makes it possible to bring the world into the classroom and to get students out into the world with "virtual" outreach and excursions into the physical world. Technology also makes it possible to change the dynamic between students and teachers, allowing students to pursue topics in depth and, at times, become experts in charge of their own learning.

In these ways, students can see the connections between their schoolwork and their lives outside the classroom, now and in the future. These connections are critical to developing students' engagement, motivation and attitudes about learning. Moreover, research shows that this kind of contextual learning in rigorous school-to-career programs in Boston, New York, Philadelphia and other communities leads to positive results for students as well, including higher academic achievement, lower dropout rates, better attendance and better college preparation.[42]

By teaching in a 21st century context, educators can create a balanced education that reflects both national concerns and local needs.

Teach and learn 21st century content

Every generation of Americans, beginning with the Founders, has turned to our public schools to prepare young people for their world. The Founders believed that a free society needed well-educated people who would be active and informed citizens and, thus, sustain the newly established government. In 1789 Benjamin Rush, a signer of the Declaration of Independence, recommended that future citizens of the new republic learn foreign languages, arts, sciences, history, government and logic. He also believed that education should reflect global influences on the republic.[43] The framers of the U.S. Constitution made education a priority, hoping to

Learning skills contribute to student achievement

The scores of students at Wayne Central High School near Rochester, N.Y., taking the New York regents exam in history increased dramatically in one year after the school reworked the history curriculum to follow the Big6™ information literacy principles: task identification, information seeking strategies, location and access, use of information, synthesis and evaluation. Before these learning skills were integrated, 58 percent of students passed the exam. A year later, after these skills were integrated, 91 percent passed.

For more information, visit www.big6.com.

Information literacy in Illinois

The Maine Township, Illinois High School District 207 has formally adopted information literacy goals and systematically integrated them into core academics in the high school. The school district developed curriculum and assessment rubrics based on the American Librarians Association's Toolkit to assist teachers and students in infusing benchmarks for managing information in all core subject classes.

By their senior year, students are expected to know how to formulate questions efficiently to meet the requirement of a problem, identify appropriate resources, analyze and organize identified resources, build arguments and problem solve based on the resources.

For more information, contact Jim Flanagan at jflanagan@maine207south.k12.il.us.

develop civic-minded citizens who were committed to the fundamental values and principles of American society.

This generation of Americans is no different. We want our schools to prepare students for the world. We expect the next generation to preserve and strengthen our democracy. Today, though, business and education leaders agree that some content is missing from state and local standards and requirements for most students. This new content represents essential knowledge for the 21st century global community, workplaces and lifestyles.

Now more than ever, we need a generation of Americans that understands the obligations of citizenship and the responsibilities that come with democracy.

— U.S. Under Secretary of Education Eugene W. Hickok

Schools need to increase their emphasis in three content areas.

1. Global awareness. Americans live in increasingly diverse communities and many work for businesses involved in global commerce. Technology is obliterating geographic boundaries and time zones; collaboration and communication across these boundaries is now commonplace. In this environment, people need a deeper understanding of the thinking, motivations and actions of different cultures, countries and regions. Global awareness promotes understanding, tolerance and acceptance of ethnic, cultural, religious and personal differences as they play out in communities and workplaces. It also helps people work through the complexities of different points of view that spring from different parts of the world.

2. Financial, economic and business literacy. Both personally and professionally, people are responsible for making sophisticated economic and business choices that will affect their futures profoundly: "Will a college degree improve my earnings?" "Where should I invest my money?" "Is it smarter to buy or lease a car?" "Should I consolidate my debt with a home equity loan?" "Why save for retirement now?" These everyday choices can result in personal prosperity — or in poor financial decisions, debt or even bankruptcy. Yet most people receive no schooling in these topics. As a result, "the cumulative effect of millions of financially illiterate Americans, unable to meet financial goals for themselves and their families, has large-scale national implications,"[44] according to the National Endowment for Financial Education®.

Similarly, most people enter workplaces after high school or college without even a rudimentary understanding of the business processes, entrepreneurial spirit or economic forces that shape their lives. "How does my performance affect my company's success?" "How can I support and contribute to my organization's goals?" "What value do I add to the enterprise?" "Can I evaluate a proposal

ICT literacy

In 2004, the Partnership will release a report and leadership tools on ICT literacy. Knowing how to use 21st century tools to perform learning skills comprises ICT literacy. Learning skills are not a novel concept in education — but using modern tools to teach and assess them is a new approach. Recognizing the importance of technology literacy, No Child Left Behind requires that students be proficient in it by the eighth grade.

Boosting ninth-grade results with 21st century skills

Houston County High School, a Blue Ribbon school in Warner Robins, Ga., features an innovative Ninth Grade Academy to help ease the transition to high school. Ninth graders enroll in a semester-long elective, High School 101 is a course that emphasizes 21st century skills, such as time management, decision making, and diversity and social tolerance. Students develop computer and Internet research skills as they use online resources to hone their study and test-taking techniques. They also focus on building an electronic portfolio of their work that will support them, just as these skills do, throughout their high school careers.

Houston County has made a major commitment to providing 21st century tools for its learning community, including wireless mobile computer labs that move from classroom to classroom to provide technology resources where needed. For example, in ninth-grade geometry classes, teachers use math visualization tools to help students make the essential connection between graphical representations and numerical equations. Teachers use results from electronic testing equipment to establish math tutorials and identify weaknesses.

For more information, visit www.hcbe.net/presentation.htm

and determine if it is a good business opportunity?" "Will this person be a good fit on my team?" Again, understanding these business issues can help people move ahead or fall behind in their careers. Financial, economic and business literacy will help people better manage their personal finances and contribute more productively in workplaces.

3. Civic literacy. The United States needs informed, responsible citizens to participate in the political process. Today, fewer and fewer Americans are exercising their civic rights and responsibilities; just 51 percent of the voting age population turned out to vote in the 2000 presidential election, according to the Federal Election Commission. Civic literacy can help students understand, analyze and participate in government and in the community, both globally and locally. Citizens should make decisions that reflect an understanding of historic implications, the role of leaders and a broader sense of political awareness.

Schools do not necessarily have to create new courses to incorporate this 21st century content into their classrooms. Rather, they can infuse this content into core subjects or use it in contextual learning experiences.

> *As IT has become ubiquitous throughout organizations and central to mission-critical operations, employers have placed an increasing emphasis on IT workers' business skills and soft skills, such as the ability to communicate effectively and to work in a collaborative environment.*[45]
>
> —U.S. Department of Commerce

Other new content may be relevant in states and communities

State and local education leaders may work with business and community leaders to develop their own new content areas to reflect community, industry or regional economic development needs. Some communities are making this move already, convening educators, employers and public officials to engage in dialogues about community challenges and opportunities. Content areas such as the humanities, character education, and the visual and performing arts are among those that many communities believe are essential to a quality education.

From these collaborations, community leaders are working together to focus education programs and teacher professional development on local business and industry needs.

For example, some school districts offer school-to-career experiences in high school academies or programs in health care and medicine; math, science and engineering; manufacturing; robotics; biotechnology; and communications and the arts. Students learn core subjects through the lens of business contexts, settings and applications. In the best of these programs, students and their teachers have opportunities to learn about workplaces through visits, work experiences and collaboration with businesspeople.

Use 21st century assessments that measure 21st century skills

Improving student achievement has resulted in a national focus on assessment. Standardized tests are here to stay. As countless observers have noted, "What gets measured gets taught." In light of this reality, the Partnership has three overarching points to make

21st century assessments yield results

Launched in 2000 by an industry-education coalition, the Gary and Jerri-Ann Jacobs High Tech Middle and High Charter Schools in Napa, Calif., incorporate three design principles: personalization, adult world connection and a common intellectual mission. The schools feature performance-based assessments, daily shared planning time for staff, state-of-the-art technical facilities for project-based learning, internships for all students and close links to high-tech workplaces.

High school students do much of their best learning outside of school. Through community internships and projects, they collaborate with adults on work that has meaning well beyond a graded course. They routinely confront unpredictable problems and situations. They develop intellectual perspectives that cut across subject areas, mingling chemistry with civics or mathematics with the arts. And they form working relationships with adults, who model real-world problem solving and standards for excellence. This 21st century learning pays off on standardized assessments as well. For both 2000–01 and 2001–02, High Tech High ranked 10 on a scale of 1 to 10 in California on the Stanford 9 assessment.

For more information visit www.hightechhigh.org

21st Century Content	
Global awareness	➢ Using 21st century skills to understand and address global issues ➢ Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts ➢ Promoting the study of non-English language as a tool for understanding other nations and cultures
Financial, economic and business literacy	➢ Knowing how to make appropriate personal economic choices ➢ Understanding the role of the economy and the role of business in the economy ➢ Applying appropriate 21st century skills to function as a productive contributor within an organizational setting ➢ Integrating oneself within and adapting continually to our nation's evolving economic and business environment
Civic literacy	➢ Being an informed citizen to participate effectively in government ➢ Exercising the rights and obligations of citizenship at local, state, national and global levels ➢ Understanding the local and global implications of civic decisions ➢ Applying 21st century skills to make intelligent choices as a citizen

Sources: American Forum for Global Education,[46] International Education and Resource Network (iEARN),[47] The Business Roundtable,[48] National Council on Economic Education,[49] National Skill Standards Board,[50] U.S. Department of Commerce,[51] U.S. Department of Labor,[52] Center for Civic Education,[53] CivNet[54] and American Political Science Association.[55]

Civic literacy to strengthen communities

CIVITAS is a curriculum framework designed to revitalize civic education in schools nationwide and foster a renaissance in civic thinking, learning and action. It sets forth national goals for a civic education curriculum, primarily for K–12 public and private schools but with extended applications in communities and in higher education, specifying the knowledge and skills citizens need to perform their roles in democracy.

As part of its social studies program, the Allentown (Pa.) School District has implemented and continues to develop a curriculum package based on the Center for Civic Education's School Violence Prevention Demonstration Program. The curriculum package is benchmarked with state standards in civics, literature, math, reading and writing for elementary students. Plans are to create a K–12 program as well. This interdisciplinary strategy to integrate civics literacy into the core curriculum also supports students' critical thinking skills, information literacy and problem-solving skills as they work through simulations of real-world problems in a project-based environment. The Center for Civic Education designed the original framework for this program in 1999 to promote ways in which civic education can be used as a strategy to prevent violence in school settings.

For more information, visit
www.civiced.org/civitasexec.html.
www.civiced.org/yoder_strategies.pdf.

about assessments and accountability:

- Standardized tests must measure both core subjects *and* 21st century skills. We must measure what we value — or it won't be taught.
- Standardized tests must be balanced appropriately with classroom assessments to measure the full range of the students' skills in a timely way.
- Classroom assessments must be strengthened and integrated with the instructional process to reinforce learning, provide immediate feedback and help students learn core subjects and 21st century skills.

Accountability doesn't cause failure; it identifies failure. And only by acknowledging poor performance can we ever help schools to achieve. You can't solve a problem unless you first diagnose the problem.

— President George W. Bush

As pervasive as assessment seems to be today, it remains an emerging and challenging field that demands further study and innovation. For example, as important as they are, standardized tests can measure only a few of the critical skills and knowledge that we hope our students will learn. Standardized tests alone do not provide the immediate diagnostic information that teachers, parents and students need to make decisions in the classroom or improve learning in real time.

Similarly, while education research literature documents the success of classroom assessment in improving student achievement, these assessments typically are not valid or reliable for broad comparisons across classrooms or schools. Effective classroom assessments integrate classroom teaching and learning, going beyond tests at the end of a lesson and providing immediate feedback to teachers and students on performance. Project-based assessments, for example, feature such characteristics as real-life contexts, everyday problems, the application of content to solve problems and the use of appropriate technologies. Teachers can specify the criteria for success through rubric development and make them known to students before the assessment.

Further, while employers and educators alike value learning skills, schools are not measuring them either on standardized tests or in classroom assessments.

Clearly, we must tackle these assessment issues now — or we risk the same kind of gap between how students learn and how they are tested as we have already between how students live and how they learn. For example, "there is increasing evidence that tests that require students to produce written responses on paper underesti-

Global awareness in a 21st century context

As a lead teacher for the International Education and Resource Network (iEARN), Kristi Rennebohm Franz created the Schools Outfitting Schools (SOS) curriculum as a first step to developing an ongoing learning community connecting at her school, Sunnyside Elementary School in eastern Washington, and an Afghan elementary school. To raise money for school supplies for their Afghani counterparts, Kristi's first and second graders honed their math, language arts and technology skills by giving presentations, creating promotional materials and tracking donations. What's more, they developed greater global and cultural awareness by relating their efforts to current events and corresponding with students at their sister school.

The White House and the U.S. Department of Education highlighted SOS as an exemplary program in the Friendship through Education Consortium.

For more information, visit
www.iearn.org/afghan/iEARNAfghanistan.html

Examples of new industry, local content

The American Film Institute (AFI) worked with educators in Montgomery County (Md.) Public Schools to develop an educational guide to screen literacy, which is defined as the ability to read and write for the screens of computer, television, cinema and the Internet. Then AFI piloted a Screen Education Initiative, using an experiential pedagogy that combines state standards, academic curriculum and real-life professional evaluation and feedback, in six Los Angeles public schools.

The Pittsburgh Technology Council, a trade group with 1,500 members, offers several programs to help local schools prepare students for the future. For example, a partnership with a local high school exposes students — and teachers — to robotic technologies, digital logic, computer applications, technical writing and drawing, all integrated into core subjects.

mate the performance of students who are accustomed to writing with computers," says researcher Mike Russell of Boston College.[56]

Technology holds the promise of helping to solve some of the challenges of assessments today. Already, 12 states and the District of Columbia are administering computer-based assessments in the 2002–03 school year. Six of these tests are pilots. Of the states with computer-based tests, five report that they designed the exams partially to meet requirements of No Child Left Behind, which requires annual testing of students in English and math in grades three through eight and once in high school. Florida and Oklahoma are planning computer-based testing pilots for the 2003–04 school year.[57] Digital scoring systems may dramatically increase the speed with which results are available and reduce the costs and time required for human scorers. Test-taking and test results may be nearly simultaneous.

Clearly, we must tackle these assessment issues now — or we risk the same kind of gap between how students learn and how they are tested as we have already between how students live and how they learn.

Technology may give schools the ability to create broader and smarter assessments that can provide accurate, timely measurements of student proficiency. When aligned with standards and curriculum such assessments can be a powerful tool to improve teaching and learning. The CEO Forum on Education and Technology encouraged alignment of standards, assessments and accountability with technology and data analysis.[58]

To be sure, developing technology-driven assessments for a 21st century world demands research, flexibility and financial commitments from the public and private sectors, including higher education, schools of education, K–12 education, test developers and business. But decreasing costs for hardware, networks and delivery make this linchpin of a 21st century education more possible every day.

The program aims to increase the number of teachers who can integrate information technology basic skills into their K–12 curriculum; improve the quality of teacher preparation for informational technology courses through professional development; and create mechanisms through which curriculum can be changed to meet the needs of industry.

At the Bergen Academy for Advancement of Science and Technology (AAST) in New Jersey, one of seven industry sector-focused academies within the Bergen County Technical Schools system, computer studies form an integral part of the science department, which also includes mathematics, physics, biology and chemistry. As a high-technology magnet school, AAST requires four years of math, three years each of chemistry, biology and physics, and one year of technology as part of the core curriculum for graduation. Electives within the technology strand include such diverse offerings as computer-aided design, optoelectronics, telecommunications, robotics and instrumental analysis. Other Bergen County academies specialize in business and computer technology, engineering and design, medical science, visual arts and graphic communication, power and transportation, and culinary arts.

For more information, visit:

www.afi.edu.

www.pghtech.org.

www.bergen.org/AAST/about/index.shtml

How states *are* integrating ICT literacy *into* schools

State education leaders are beginning to understand the importance of ICT literacy to their educational agendas. However, policy approaches to integrating these skills into classroom learning vary. Some states incorporate ICT literacy into their core academic standards, others include it in curriculum guidelines. Few, if any states, however, are assessing these skills in their accountability measures.

The examples here illustrate how some states are moving in the right direction to integrate 21st century skills into the curriculum. This is not a comprehensive or exemplary list; rather, it is a sampling of possibilities for education leaders to consider.

Alabama

www.t4alabama.org

T4 Alabama, a project for sixth- to 12th-grade students, addresses staff development and technology infusion. A semester-long T4 class trains students with the technical and collaborative skills necessary to partner with one of their teachers to improve their learning. Each student/teacher partnership creates a technology-infused lesson plan aligned to district or state curriculum standards. Student graduates of this course provide the ongoing technology support lacking in many schools. T4 Alabama involves more than 50 schools in the state.

Illinois

www.ccsd15.net/AboutDistrict15/SuperintendentsMessage/html/StudentsAcquire21stCenturySkills.html

In Illinois, each section of academic standards includes an "Application of Learning" section, which details the applied learning skills needed for mastery of academic standards and benchmarks. As noted on the state department of education's Web site, "Through Applications of Learning, students demonstrate and deepen their understanding of basic knowledge and skills. These applied learning skills cross academic disciplines and reinforce the important learning of the disciplines. The ability to use these skills will greatly influence students' success in school, in the workplace and in the community." The categories for the Applications of Learning are as follows:

Solving problems

- Recognize and investigate problems; formulate and propose solutions supported by reason and evidence.

Communicating

- Express and interpret information and ideas.

Using technology

- Use appropriate instruments, electronic equipment, computers and networks to access information, process ideas and communicate results.

Working on teams

- Learn and contribute productively as individuals and as members of groups.

Making connections

- Recognize and apply connections of important information and ideas within and among learning areas.

North Dakota

www.dpi.state.nd.us/standard/content/tech.pdf

A team of library and technology specialists, assisted by representatives from the department of public instruction, recently developed the library/technology literacy standards for North Dakota. The standards were based on reviewing the standards work of these organizations:

- American Association of School Librarians (AASL)
- Association for Educational Communications and Technology (AECT)
- International Society for Technology in Education (ISTE)

The team also reviewed relevant content standards from all of the states as well as various research process models, such as The Big6™ by Eisenberg and Berkowitz.

The standards reflect the Partnership's view that students must develop the ability to access, evaluate and use a range of information sources in combination with adequate technology knowledge and skills to become critical thinkers and lifelong users of information. The standards define the knowledge and skills students need to be information literate, with the ultimate goal of students learning *with* information and technology, not learning *about* information and technology. Further supporting the Partnership's belief in integrating these skills with core subjects, the board advocates that library and technology specialists collaborate with other educators to integrate the standards into the curricula of academic content areas.

These five library/technology standards are developed through benchmarks, examples of specific knowledge and examples of activities for three grade ranges — K–4, 5–8 and 9–12.

Oklahoma

www.sde.state.ok.us/home/defaultie.html

In 2002, the state board of education adopted Priority Academic Student Skills (PASS), a set of four cross-disciplinary skills standards, including those for information literacy and instructional technology.

Based on the information literacy guidelines of the American Association of School Librarians, the PASS standards for information literacy reflect the view that the ability to find and use information is basic to student learning and that these standards are to be taught as an integral part of the curriculum in science, social studies, language arts, reading and so forth. The board of education recommends that classroom teachers and media specialists provide opportunities for students to use information literacy skills in completing class assignments.

PASS standards in instructional technology were created using the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS). The Partnership supports the position taken by the board of education in integrating these skills within the context of core subjects. As the board's Web site notes, "These standards should not be viewed as stand-alone standards for technology, but as technology that facilitates teaching and learning across the entire curriculum."

Pennsylvania

www.pde.state.pa.us/k12/lib/k12/RWSLStan.doc

Pennsylvania's reading, writing, speaking and listening standards reflect the unique aspects of the processes that students use to learn and make sense of their world. As stated in the introduction to the standards, "Students do not read 'reading'; they read about history, science, mathematics and other content areas as well as about topics for their interest and entertainment. Similarly, students do not write 'writing'; they use written words to express their knowledge and ideas and to inform or entertain others."

Because of their cross-disciplinary nature, reading, writing, speaking and listening standards are used by all teachers in Pennsylvania, regardless of subject or grade. Not surprisingly, these standards reflect many of the learning skills identified by the Partnership. Here is an excerpt from the standards for Grade 5:

Use media for learning purposes

- Compare information received on television with that received on radio or in newspapers.
- Access information on the Internet.
- Discuss the reliability of information received on Internet sources.
- Explain how film can represent either accurate versions or fictional versions of the same event.
- Explain the role of advertisers in the media.
- Use a variety of images and sounds to create an effective presentation on a topic.

Texas

www.tea.state.tx.us/technology/ta.

In Texas, ICT literacy is comparable to Technology Applications literacy. Technology Applications is a required enrichment curriculum specified in law that focuses on the teaching, learning and integration of digital technology skills across the curriculum at all grade levels. The Technology Applications curriculum was built on the premise that students acquire Technology Applications knowledge and skills in a continuum beginning at the elementary level and continuing through the secondary level. Technology Applications standards were developed and adopted for grades K–12. The Technology Applications Texas Essential Knowledge and Skills (TEKS) describe what students should know and be able to do using technology.

Utah

www.usoe.k12.ut.us/curr/EdTech/newcore.htm

www.usoe.k12.ut.us/curr/lifeskills/default.htm

The board of education has developed core curriculum standards in educational technology "to equip students with technology knowledge and skills necessary to successfully live, learn, and work in the 21st century." The objectives are intended not only to teach marketable technology skills but also to apply technology across the curriculum. Consequently, the board advocates that this core be integrated with the core curriculum, not isolated from it.

Furthermore, to help curriculum and assessment developers as well as classroom teachers seeking guidance for teaching subject matter, the board of education also developed guidelines for life skills as part of its state curriculum guidelines, as follows:

- Lifelong learning
- Complex thinking
- Effective communication
- Collaboration
- Responsible citizenship
- Employability
- Character development/ethics

General Adoption of Technology Standards

This link shows the states that have adopted, adapted or referenced the ISTE NETS standards for educational technology:

http://cnets.iste.org/pdf/States_using_NETS_10_09_02.pdf

Part III

Implementing 21st century skills: nine steps to build momentum

Preparing students for the 21st century calls for collective action on many fronts. This report is about getting started. Leaders in education, business and the public sector have been discussing the need for a 21st century education model for at least a decade — but we still have much to accomplish. Now is the time to begin. Here is a strategy for building momentum:

- Embrace a powerful vision of public education that includes 21st century skills.
- Align leadership, management and resources with educational goals.
- Use this tool to assess where schools are now.
- Develop priorities for 21st century skills.
- Develop a professional development plan for 21st century skills.
- Make sure students have equitable access to a 21st century education.
- Begin developing assessments to measure student progress in 21st century skills.
- Collaborate with outside partners.
- Plan collectively and strategically for the future.

1. Embrace a powerful vision of public education that includes 21st century skills. National, state and local leaders can articulate the growing urgency for a vision of education that prepares students for work and life in a knowledge society. The combined wisdom of research, best practices and insights from educators, employers and policymakers points to a vision of education that honors core subjects and integrates

Reshaping professional development for the 21st century

The Metropolitan School District of Lawrence Township (Ind.) recognized the need to develop a human resource infrastructure to promote inclusion of 21st century skills in its schools. To support this process, the district hired a full-time director of professional development and an internal initiative coordinator and trained 40 master teachers to serve as digital age literacy leaders and coaches. In addition, the district created the framework for an online learning environment, a professional development council and a new teacher orientation program.

For more information, visit www.msdlt.k12.in.us

Sharing resources for professional development

The Technology Applications Teacher Network , a collaborative project among the 20 Texas Education Service Centers and the Texas Education Agency provides Texas educators with professional development and resources to integrate technology into the classroom. The project includes professional development academies and online support. Professional development modules focus on integration in grades K–8 and development of advanced technology skills taught in the context of core curriculum content in grades 9–12. The first academies are planned for fall 2003. An objective of this effort is to share resources that are available through education, business and the community that can support educators in gaining the adopted State Board for Educator Certification (SBEC) Technology Applications educator standards.

For more information, visit www.tea.state.tx.us/technology/ta

learning skills and 21st century tools, context, content and assessments. This education model is comprehensive, strategic and foresighted, and it will help the nation fulfill the promise of No Child Left Behind.

2. Align leadership, management and resources with educational goals. Leaders and managers set the tone for action. Policymakers, superintendents and school administrators can promote 21st century education by committing to incorporating 21st century skills in standards and assessments, investing in professional development and technology, and allocating adequate resources to ensure equitable access to 21st century tools. They also can develop their own proficiency in 21st century tools.

3. Use this tool to assess where schools are now. Education leaders can use the MILE Guide for 21st Century Skills in this report to gauge their schools' current capacity for preparing students to succeed. Many schools will discover that they already have begun the journey by focusing on core subjects, incorporating learning skills and technology into classroom expectations, providing teachers and administrators with relevant professional development, or collaborating in meaningful ways with employers and other partners, for example. These existing approaches give schools leverage to move forward more aggressively and develop benchmarks to measure progress.

Quality education for all children is our top priority. Education needs to be a continuum of learning opportunities, from preparing children to start school ready to learn to excellent schools in every community, all in light of the fact that 21st century jobs require 21st century skills. An educated workforce is so intimately connected to economic prosperity that we can't afford to retreat from educational excellence in difficult economic times or we will hinder our recovery.

— Gov. Kathleen Sebelius, Kansas

4. Develop priorities for 21st century skills. The MILE Guide will help education leaders pinpoint their strengths and weaknesses. From this self-assessment, schools can focus on the gaps between current realities and their vision for the future: Which 21st century skills do schools need to focus on? What are the short- and long-term priorities?

5. Develop a professional development plan for 21st century skills. To promote 21st century learning, teachers need to be competent in 21st century skills. They need to use instructional strategies that reflect current research, modern contexts to engage students in learning and classroom assessments that effectively measure what students are learning and how they are learning it. Professional development is critical if teachers are to model lifelong learning. States and school districts also must commit the resources and analysis necessary to guarantee that a teaching degree and license actually represent the skills necessary to teach in this century.

6. Make sure students have equitable access to a 21st century education. The power of core subjects and 21st century skills to make a difference in student learning

Laptops help bridge the digital divide

When it was time for the Henrico County School District in Richmond, Va., to upgrade its hardware, Superintendent Mark Edwards decided to leap into the 21st century by brokering a landmark deal to lease more than 24,000 laptop computers, one for every student and teacher in both middle and high schools. In a district that covers urban and rural areas, and one in which one-third of students have no access to technology at home, the district's initiative bridges some of the divide. The district also developed software that allows students to use technology for classroom activities and assignments and stay in contact with their teachers through the campus-wide wireless network. Students can work collaboratively with up-to-the-minute information constantly at their disposal.

A major element of the initiative has been a commitment to professional development and technical support. Teachers participate in curriculum writing workshops, peer mentoring opportunities and summer institutes and can access training online and through CDs and videotapes. Every school has full-time trainers and technical support personnel who give both students and teachers 24/7 support. The district has been able to pay for this $21.7 million initiative from its operating budget, with some support from federal technology grants.

For more information, visit www.henrico.k12.va.us/

is tempered by the fact that many students do not yet have access to them. All students need highly qualified, effective teachers and regular, reliable access to modern technology. Education leaders and outside partners must be especially vigilant about providing underserved students with equitable access to these learning essentials.

If assessment is to be a positive force in education, it must be implemented properly. It cannot be used to merely sort students or to criticize education. Its goals must be to improve education. Rather than 'teach to the test,' we must 'test what we teach.'[59]

— Robert E. Lockwood and James E. McLean, Alabama educators

7. Begin developing assessments to measure student progress in 21st century skills. Assessments drive instruction, so assessments must measure 21st century skills. States and school districts can work with testing companies to develop standardized assessments that incorporate and measure acquisition of 21st century skills. School districts, schools and educators can develop effective classroom assessments for 21st century skills as well.

8. Collaborate with outside partners. Parents, community organizations, higher education, schools of education in colleges and universities, employers and content providers all have important contributions to make to schools. Education leaders need to reach out to these partners and work with them to improve education.

Parents can be full partners with educators in helping their children learn and their schools improve. Community organizations, such as youth-serving groups, libraries and public service agencies, can promote education in extended learning opportunities outside of school. Colleges and universities can develop formal relationships with K–12 schools to build a seamless transition for students into higher education. They also can enrich the research base in hot topics such as effective instructional practices and methodologies. Schools of education can prepare future teachers with a solid foundation in core subjects, a repertoire of effective instructional strategies and competence in 21st century skills. Employers can work with education leaders and classroom teachers to identify workforce needs and provide learning opportunities for students and educators alike. They can support

Overcoming limits for students with disabilities

NO LIMIT! (New Outcomes: Learning Improvement in Mathematics Integrating Technology) is an Enhancing Education Through Technology grant administered by the Office of the Superintendent of Public Instruction in Washington. The project is beginning its third year of implementation.

The NO LIMIT! project contains an element for addressing the needs of learning disabled students. Under the directorship of Ann Black of the Washington State Special Education Technology Center, the program is designed to:

- Improve reading and writing skills, mathematics and problem solving and higher-order thinking skills among learning-disabled students
- Supplement math curricula and develop classroom learning scaffolds that help learning disabled students become more successful in mathematics, reading, writing and numerous 21st century skills
- Promote development of learning disabled students as technology mentors who are able to collaborate effectively with their peers and with adults.

For more information, visit
www.cwu.edu/~setc/ldmath/proj_desc.html

Community access

In a small, rural community, the Mercedes Independent School District in Texas is maximizing the use of its facilities as both formal schools and community centers with two opportunities for community members to access both technology and training.

With leadership from Superintendent Jesus Gandara, Mercedes ISD designed and built a Community Tech Dome. The 3,600-square-foot facility houses more than 300 computers and a wireless lab for distance learning in a bright, fun and open architectural design. During the day, the multi-use space is used by the junior high school as classrooms and computer labs. After school and on Saturdays, community members take advantage of Internet access, workforce development classes and enrichment activities.

During the summer, Mercedes ISD keeps five of its eight campuses open. Although school funding is sufficient to operate one school for those students required to attend summer school, Mercedes received a competitive grant (21st Century Community Learning Center support from the U.S. Department of Education) to operate year-round out-of-school programming on school grounds. Mercedes will use its partnership with NetDay AmeriCorps to staff many of the summer programs. The services are free to all Mercedes community residents.

For more information, visit
http://www.mercedes.k12.tx.us/

adequate funding for schools to support 21st century skills. Content providers, such as textbook companies and test developers, can embed 21st century skills into their products.

9. Plan collectively and strategically for the future. Education, business and community leaders can use the MILE Guide for 21st Century Skills to understand where they are and where they need to go to transition to 21st century schools and classrooms. Key stakeholders can work collaboratively to articulate a vision that reflects current realities and unique state and local workforce and community needs.

The Partnership makes these recommendations with a deep respect for the challenges facing many states and schools today. Budgets are tight. Demands are intense. Student needs are profound. The challenge of ensuring equitable access to teaching and learning tools for all students remains formidable. At the same time, there is widespread public support for education and an abiding belief in the tradition that Americans must prepare young people to succeed.

We believe that schools can use the provisions of No Child Left Behind to remedy some of these challenges. That said, there is much that other stakeholders can do — and already are doing — to bridge the achievement gap and the digital divide.

The Partnership for 21st Century Skills looks forward to contributing to this effort. We intend to continue to engage in conversations with students, educators, employers, community members and policymakers about education in the 21st century. We will continue to develop reports and tools to help education leaders jumpstart teaching and learning in their schools. As you get started, we encourage you visit our Web site to share your stories and best practices. Collectively, we can learn and take action for generations to come.

This is a dynamic, exciting time for everyone involved in education today. There is a tremendous opportunity to consolidate standards, assessments and accountability; core subjects and 21st century skills; technology and professional development investments; and teaching and learning into a unified vision of a 21st century education. With all of these pieces aligned and integrated into a coherent whole, the nation's 20-year effort to improve student achievement will come together like a vibrant mosaic. This is a holistic vision of education that is worth our collective efforts.

Technology literacy for administrators

The International Society for Technology in Education (ISTE) has formulated and adopted technology standards for school administrators in six areas:

- Leadership and vision
- Learning and teaching
- Productivity and professional practice
- Support, management and operations
- Assessment and evaluation
- Social, legal and ethical issues

For more information, visit www.iste.org.

Experiential learning through community partnerships

In close partnership with school activities and learning standards, Boston-based Citizen Schools aims to meet 21st century demands on students by bolstering after-school learning focused on writing, data analysis and oral communication through apprenticeships, explorations, homework time and team-building activities. The vision of the program is to use schools after hours, on weekends and in the summer for experiential learning opportunities that link children and schools to a larger network.

The Citizen School curriculum stands on four pedagogical pillars aiming to strengthen academic skills, develop personal leadership skills, facilitate access to resources and build community connections. The schools are based in cities across the United States, working with roughly 1,000 students annually.

For more information, visit www.citizenschools.org

Built-in assessments spur students to learn

At Charlestown High School in Boston (Mass.), veteran math teacher Leo Carey has been successful in teaching a rigorous curriculum on technology skills in a self-paced format using real-world context. Assessments built in to the curriculum require students to master concepts before moving on to the next lesson. Many students are non-native English speakers, so the visuals in the curriculum help them learn concepts more quickly. They can review materials in other languages as well, making it more accessible to bilingual students. According to Carey, "A higher percentage of students stay engaged for a longer period of time."

For more information, visit
http://boston.k12.ma.us/teach/technology/

Making a difference: How key stakeholders can support the effort

Improving education for the 21st century is a communitywide endeavor. Education leaders who are ready to get started will want to coordinate their efforts and work strategically with outside partners. Specific steps that people at many levels can take as part of a comprehensive effort are listed below.

In the public sector

Next steps for federal policymakers

- Encourage states and school districts to develop a vision for learning in the 21st century.
- Use No Child Left Behind to encourage states and school districts to incorporate ICT literacy into education.
- Increase the use of research and development on the integration of 21st century education.
- Align the vision and focus of 21st century skills in K–12 schools with after-school, military, workforce, and research and development programs.
- Provide incentives to encourage schools to incorporate 21st century skills.

Next steps for state policymakers

- Make sure standards incorporate 21st century skills.
- Develop assessments that align with 21st century standards.
- Make sure all students have equal access to 21st century tools and instruction.
- Support professional development in 21st century skills for teachers and administrators.
- Make the development of 21st century skills a priority and allocate resources accordingly.

Next steps for local policymakers

- Convene education leaders and employers to begin or continue to talk about preparing workers and citizens for the 21st century.
- Continue to work with schools and businesses to promote excellence in teaching and learning. Emphasize core subjects and 21st century skills.
- Align standards and assessments to 21st century skills.
- Support professional development in 21st century skills for teachers and administrators.
- Support funding for schools to enable them to foster 21st century learning.

In the private sector

Next steps for business

- Reinforce the need for high-skilled, productive workers.
- Work with K–12 schools and higher education to articulate clearly the list of skills and attributes needed for the 21st century workforce.
- Encourage employees to work with and support schools as advisors, mentors or tutors in their communities.
- Partner with educators and community members and work with business coalitions to build support for 21st century schools.
- Share business resources, including talented people and technology, with schools.
- Support a public awareness campaign to build understanding of the significant need for a 21st century education for all children.
- Support funding and investment in schools to enable them to foster 21st century learning.

Next steps for parents and families

- Increase your family's use and understanding of technology tools and learning skills.
- Use your personal or professional skills and contacts to help schools, businesses and community groups work together to improve student achievement.
- Urge schools to integrate ICT literacy into core subjects and develop new 21st century context, content and assessments.
- Partner with teachers to support your children's development of 21st century skills.
- Support funding for schools to enable them to foster 21st century learning.

Assess your parent involvement

The Parent Teacher Association has developed a self-assessment tool for schools to evaluate the quantity/quality of parent involvement, that could serve as a model for developing a 21st century skills assessment for teachers, schools and districts.

For more information, visit www.pta.org

Assess your educational partnerships

Go to http://www.nelc.org/resources/focusonresults.pdf for guidelines for a self-assessment of how well your organization is doing in its educational partnerships.

In education

Next steps for K–12 education leaders

- Examine local learning goals, curriculum, teaching tools, instructional practices and student assessments to make sure they are aligned in support of 21st century skills.
- Provide teachers and administrators with professional development that prepares them to teach 21st century skills.
- Increase your own ICT literacy.
- Provide staff access to 21st century tools.
- Improve assessments to measure 21st century skills.
- Increase teacher knowledge and use of classroom assessment methodologies.
- Seek funding to support 21st century skills.

Next steps for higher education

- Encourage K–12 schools to integrate 21st century skills into their college preparatory programs.
- Develop mentoring relationships with K–12 schools and community leaders.
- Develop ICT literacy among college and university students.
- Support schools of education financially and technologically at the same level as other college and university programs.

Next steps for schools of education

- Foster a vision of a 21st century education.
- Develop programs that comprehensively prepare graduates to teach in the 21st century.
- Develop new pedagogical strategies that are based on research evidence and support 21st century skills.
- Teach prospective educators to use data to drive decisions.

Next steps for researchers

- Study the impact on student achievement of integrating 21st century skills into K–12 schools.
- Develop teaching strategies to effectively teach 21st century skills.
- Create and test assessments that are aligned with 21st century skills.
- Study the best ways to educate, train and evaluate teachers in 21st century skills.

Next steps for youth-serving organizations

- Increase communication and collaboration with K–12 schools and parents to support teaching and learning for the 21st century.
- Integrate 21st century skills into technology programs supported by local, state or federal funding.
- Explore opportunities to use the MILE Guide to support student learning in after-school settings.

Next steps for content providers

- Work collaboratively with educators to modernize content and assessments to reflect 21st century skills and technology.
- Integrate 21st century skills into core content and assessments.
- Develop content that incorporates the use of 21st century tools.

Next steps for professional educational organizations

- Encourage your members or constituents to develop competence in 21st century skills.
- Offer professional development opportunities to your members or constituents.

Aligning standards, curriculum and assessments

The North Central Regional Educational Laboratory has developed a resource for educators working to align standards, curriculum and assessments at local, state and national levels.

For more information, visit http://www.ncrel.org/sdrs/areas/issues/content/currclum/cu300.htm

Appendix A

OUTREACH EFFORTS

One of the most important aspects of the work of the Partnership for 21st Century Skills has been to build consensus among the education, business and policymaking communities on the importance of 21st century skills and to develop a common language for describing these skills. In pursuing these goals, the Partnership conducted an extensive outreach effort to a broad range of individuals and groups within the education community, including education experts, teachers, administrators, students, businesses, community groups, university faculty and researchers, underserved community representatives, after-school program representatives, and policymakers. Below is a description of our efforts in the first year.

Outreach at Conferences and Meetings

The Partnership presented its plan of work to solicit suggestions and feedback at a number of national conferences and meetings.

National School Boards Association Conference, Dallas, Texas Nov. 15, 2002

The Partnership held a briefing at the NSBA T+L convention. More than 600 invitations went out to leaders in the education community and others attending the NSBA conference. Approximately 50 people participated.

State Education Technology Directors Association Meeting, Washington, D.C.

Dec. 8–10, 2002

The Partnership participated in this event with state educational technology directors from all 50 states to discuss technology literacy and 21st century skills.

ICT Literacy Conference, Washington, D.C.

Jan. 24, 2003

The Partnership participated in panel discussions on ICT literacy.

Florida Education Technology Conference, Orlando, Fla. Feb. 4–6, 2003

The Partnership made a presentation to state education technology leaders at this conference.

National Coalition for Technology in Education and Training Conference, Washington, D.C.

Feb. 25, 2003

The Partnership participated in this education conference and gathered input from education experts on 21st century skills and technology literacy.

Consortium for School Networking Conference, Arlington, Va. Feb. 27, 2003

The Partnership staff and two school district practitioners led a panel discussion on Defining and Promoting 21st Century Skills from Theory to Practice. Approximately 100 people attended this session.

National Forum on 21st Century Skills, Tucson, Ariz. March 10–11, 2003

In addition to presenting our work plan and preliminary findings at conferences and meetings, the Partnership convened education leaders to review our draft report and MILE Guide for 21st Century Skills at a two-day forum.

This forum was the Partnership's major event of the year to gather education community feedback on its work. The Partnership organized a national forum on 21st century skills and brought education experts together to discuss the definition, teaching and assessment of these skills. The group reviewed the draft MILE Guide and provided feedback on the MILE Guide and our draft report.

Participants

AEL, Inc.	John Ross
ATEC/CNAC	Art Sheekey
Center for Media Literacy	Tessa Jolls
Community Technology Development, Inc.	Holly M. Carter
Consortium for School Networking	Bob Moore, Ferdi Serim
Corporation for Public Broadcasting	Cheryl Williams
Digital Media Resource Center, University of Arizona	Christopher Johnson
DRA Software Training, ITCAP	Charlene Peters
Education Development Center, Inc.	Tony Streit
Education Development Corporation	Margaret Honey
Harvard Graduate School of Education	Alyson Knox
Idaho State Department of Education	Rich Mincer
ISTE	Don Knezek
Just Think Foundation	Elana Rosen
League for Innovation in the Community College	Mark Milliron
Learning Technology Center	Paul Resta
Learning.com	Mark Tullis
Media Literacy Project	Renee Hobbs
Metiri Group	Cheryl Lemke
Mindplay	Judith Bliss
National Business Education Association	Janet Treichel
National Geographic Society	Chris Shearer
NCREL	Gil Valdez
NetDay	Julie Evans
North Central RTEC	Kristin Ciesemier
Northwest Educational Technology Laboratory	Seymour Hanfling
Office of U.S. Rep. Jim Kolbe	Hassan Hijazi
Ohio SchoolNet Commission	Larry Fruth
Online Learning.net	Alan Arkatov
Pima County School District	Linda Arzoumanian
SETDA	Mary Ann Wolf
Software Information Industry Association	Karen Billings

Tech Corps
Technology and Workforce Development
Texas Education Agency
Tucson Unified School District
WestEd RTEC
The Western Governors University
Wyoming Department of Education
Tomas Rivera Institute
University of Connecticut
University of Kansas
U.S. Congress

Karen Smith
Robert Pearlman
Anita Givens, Karan Kahan
Lorrane McPherson
Bernie Trilling
Bob Mendenhall
Linda Carter
Elsa Macias
Donald J. Leu
Jayne W. James
U.S. Rep. Jim Kolbe (R-Ariz.)

Digital Education Leadership Conversation Conference, Coral Gables, Fla. March 28, 2003

The Partnership presented its draft messages to state departments of education and school district chief information officers, chief technology officers and senior industry executives attending this conference.

Open meeting with national education groups, Washington, D.C. May 21, 2003

The Partnership hosted a discussion with John Bailey, U.S. Department of Education, to discuss the Partnership's materials. Participating education groups included American Association of Colleges for Teacher Education, Consortium for School Networking, National Skill Standards Board, Marco Polo Education Foundation, NetDay, The Cato Institute, CNA Corporation, National PTA, Tech Corps, Federation of American Scientists and Digital Promise.

Outreach to organizations

The Partnership's research and development effort has collected a great deal of information, resources and online tools via our Request for Information (RFI), posted on our Web site at www.21stcenturyskills.org.

Organizations submitting information

ABOTICS
Association of College & Research Libraries
Alabama Supercomputer Authority
Alliance for a Media Literate America
American Association of Colleges for Teacher Education
American Association of School Librarians, a division of the American Library Association
American Foundation for the Blind
Belhaven School, Linwood, N.J.
Benton Foundation, Center for Children and Technology
Bridges.com Inc.
Bristol Local School District, Bristolville, Ohio
California Learning Resource Network
California State University Long Beach
Camanche High School, Camanche, Iowa
Caribou High School, Caribou, Maine
CNA Corporation
The Cato Institute
Center for Media Literacy
CIRCLE (with funding from Pew Charitable Trust)
Cognitive Concepts, Inc.
Colorado Power Libraries
CompTIA
Computer Literacy Project Survey
Computers for Education
Consortium for School Networking
Council of Chief State School Officers
Diagramix
Digital Promise
District of Columbia Public Schools
Durham Elementary School, Durham, Maine
Education Development Center, Inc.
Educational Testing Service
EduCatalyst
Etta J. Wilson Elementary School, Newark, Del.
Evans Newton Incorporated, Scottsdale, Ariz.
Federation of American Scientists
Florida Center for Instructional Technology
Fort Totten Public School District #30, Ft. Totten, N.D.
Generation Yes
Global SchoolNet
Hotmath, Inc.
iEARN-USA
Information Technology Association of America
Institute of Electrical and Electronics Engineers, Inc.
International Center for Leadership in Education
International Tech Ed Association
ISTE
League for Innovation in the Community College
Lee's Summit North High School, Lee's Summit, Mo.
Marco Polo Education Foundation
Media Literacy Project
MILE: Media and Information Literacy Exchange
Morino Institute
Morristown High School Library, Morristown, N.J.
Mt. Olive Public Schools, Budd Lake, N.J.
National Academy Foundation
National Assistive Technology Research Institute (NATRI)
National Business Education Association (NBEA)
National Center for Education Statistics (NCES)
National Geographic
National PTA
National Skill Standards Board
National Workforce Center for Emerging Technologies
North Central Regional Educational Laboratory (NCREL)
NetDay
New Technology Foundation
Ohio Educational Library Media Association
Oliver Wendell Holmes Library at Phillips Academy, Andover, Mass.
Orchard Hill Elementary School, Cedar Falls, Iowa
Pennsylvania State University
SAFARI Technologies, Inc.
School Library Media Programs

SchoolNet, Inc.
Scott County Partnership, Scottsburg, Ind.
Seaford Middle School, Seaford, Del.
Shenandoah Elementary Middle School, Shenandoah, Iowa
Stargazer Foundation
State Educational Technology Directors Association
State of Wisconsin, Department of Public Instruction
Teachers@work Free Resources
Tech Corps
University of Denver Research Institute
WestED
Wilson County Schools, Wilson, N.C.
YouthLearn at Education Development Center

Outreach to individuals and groups with expertise in 21st century skills

In addition to seeking input through the RFI, the Partnership conducted extensive outreach to education experts and organizations to solicit their expertise on 21st century skills.

Alliance for a Media Literate America
American Film Institute
American Forum for Global Education
American Association of School Librarians, a division of the American Library Association
Aspen Institute
Educational Testing Service's International ICT Literacy Panel
Center for Media Literacy
Metiri Group
Cognitive Concepts, Inc.
Computers for Education
Consortium for School Networking
Dr. Susan Curzon, Dean, University Library at CSU Northbridge
EduCatalyst
Education Development Center
Educational Testing Service
The Big6
Faculty at the Harvard Graduate School of Education
The Futures Channel
George Lucas Foundation
iEARN (International Education and Resource Network)
Information Technology Association of America
International Society for Technology in Education
International Technology Education Association
Lawrence Township Schools, Indianapolis, Ind.
Mid-Atlantic Regional Educational Laboratory
Mouse (Making Opportunities for Upgrading Schools and Education)
National Skill Standards Board
North Central Regional Educational Laboratory
NetDay
National Forum on Information Literacy
SchoolNet Inc.
Scott County Partnership, Scottsburg, Ind.
Software and Information Industry Association
State Educational Technology Directors Association
Tech Corps
The League for Innovation in the Community College

Focus groups research on this report and the MILE Guide

The Partnership organized focus groups in April and May 2003 to gather feedback on the draft MILE Guide from teachers, students, administrators, state educational technology directors, after-school program directors and others in the education community:

Lawrence Township, Ind. This group comprised primarily digital literacy coaches in the Lawrence Township Digital Age Literacy Program.

Underserved community groups. In this group, participant affiliations included classroom teachers, after-school programs, corporations and government agencies in the Washington. D.C. area.

Classroom teachers. This focus group convened K–12 public school teachers from around the United States who work with Cable in the Classroom to discuss both the report and MILE Guide.

State Educational Technology Directors Association/American Association of School Librarians, a division of the American Library Association. Members of the State Educational Technology Directors Association and the American Library Association from Florida, Ohio, Texas and Virginia participated.

National Education Association (NEA). The Partnership met with nine NEA board members, all of whom are classroom teachers, representing Alaska, Indiana, Iowa, Louisiana, Massachusetts, Nebraska, Oregon, Pennsylvania, and West Virginia.

Software and Information Industry Association. The Partnership met with a group of 25 software and information industry executives from the education technology field in California for a focus group on the Partnership's materials.

Students. The Partnership met with a diverse group of high school students at Cienega High School, Vail, Arizona, to discuss 21st century learning.

NetDay. The Partnership convened with a group of nine AmeriCorps members from Oakland and Santa Ana in California and the Rio Grande Valley in Texas and three AmeriCorps project directors to discuss implementation of 21st century skills in schools.

Appendix B

References

"21st-Century Skills: Get Them Ready." *Converge Magazine*, vol. 5, issue 6, December 2002–January 2003.

Achieve, Inc. *High Standards: Giving All Students a Fair Shot*. Achieve Policy Brief, Issue 2, Fall 2000.

Achieve, Inc. *Accountability: Turning Around Low-Performing Schools*. Achieve Policy Brief, Issue 4, Summer 2001.

Achieve, Inc. *Measuring Up: A Report on Education Standards and Assessments for Massachusetts*. Achieve's Benchmarking Initiative, October 2001.

Achieve, Inc. *Standards: How High Is High Enough?* Achieve Policy Brief, Issue 3, Spring 2001.

Adler, Richard P. *Information Literacy: Advancing Opportunities for Learning in the Digital Age*. The Aspen Institute Forum on Communications and Society, Washington, D.C., 1999.

Afnan-Manns, Sheila. *Pacific Bell/UCLA Initiative for 21st Century Literacies*, UCLA Graduate School of Education & Information Studies, 2000.

American Association of School Librarians. *Information Literacy Standards for Student Learning. American Library Association*, Chicago, 1998.

American Youth Policy Forum. *High Schools of the Millennium: Report of the Workgroup*, 2000.

Association for Supervision and Curriculum Development. "The World in the Classroom." *Educational Leadership*, vol. 60, no. 2, October 2002.

August, Melissa, Barovick, Harriet, Bland, Elizabeth L., White, Roy B. and Winters, Rebecca. "Getting Testy Over Tests." *Time*, 2002. Available at http://www.time.com/time/magazine/notebook/0,9485,1101020610,00.html.

Autor, David H., Levy, Frank and Murane, Richard J. *The Skill Content of Recent Technological Change: An Empirical Exploration*. National Bureau of Economic Research, Washington, D.C., 2000.

Baldrige National Quality Program. *Education Criteria for Performance Excellence*, 2000. Available at http://www.quality.nist.gov/Education_Criteria.htm.

Barrett, Craig. *Failure Is Not an Option: Solving the Math-Science Crisis in Our Schools*. National Alliance of Business, 2002.

Barton, Paul E. *Meeting the Need for Scientists, Engineers, and an Educated Citizenry in a Technological Society*. Educational Testing Service, 2002.

Bassett, Patrick F. "Testing Accountability, and Independence." *Education Week*, June 19, 2002. Available at http://www.edweek.org/ew/newstory.cfm?slug=41bassett.h21.

Bennett, Randy Elliot. "Inexorable and Inevitable: The Continuing Story of Technology and Assessment." *The Journal of Technology, Learning, and Assessment*. vol. I, no. 1, 2002. Available at http://www.bc.edu/research/intasc/jtla/journal/v1n1.shtml.

Benton Foundation. *NPower. Technology Literacy Benchmarks for Nonprofit Organizations*, 2002.

Berger, Leslie. "Business Intelligence: Insights From the Data Pile." *New York Times*, 2002.

Bernhardt, Victoria L. *Data Analysis for Comprehensive Schoolwide Improvement*. Eye on Education, Inc., 1998.

Bernhardt, Victoria L. *The School Portfolio, A Comprehensive Framework for School Improvement*. Eye on Education, Inc., 1999.

Bernhardt, Victoria L. *Designing and Using Databases for School Improvement*. Eye on Education, Inc., 2000.

Bernhardt, Victoria, von Blanckensee, Leni L., Lauch, Marcia S., Rebello, Frances F., Bonilla, George L. and Tribbey, Mary M. *The Example School Portfolio*. Eye on Education, Inc., 2000.

Bertelsmann Foundation and AOLTW Foundation. *21st Century Literacy Summit*. Conference White Paper, Berlin, March 7–8, 2002.

Bond, Phillip J. "Knowledge Utility in the 21st Century." *American Law Review*, 2002.

Boston's Workforce Investment Board. ProTech: National Academy Jobs Collaborative. The Boston Private Industry Council, 2002.

Bottoms, Gene. *Using Technology to Improve Instruction and Raise Student Achievement*. Southern Regional Education Board, 2001.

Branigan, Cara. "Report: Digital literacy is essential for students." *eSchool News online*, 2002. Available at http://www.eschoolnews.com.

Bransford, J., Brown, A. and Cocking R. (eds.). *How People Learn: Mind, Brain, Experience, and Schools*. National Academy Press, Washington, D.C., 2000.

Bruner, Jerome. *Toward a Theory of Instruction*. Harvard University Press, Cambridge, Mass., 1966.

Burke, Kay. *How to Assess Authentic Learning*. SkyLight, 1999.

Bush, George W. "21st Century Workforce Initiative." Executive Order of the President of the United States, 2001.

Bush, George W. White House Conference on Character and Community, 2002. Available at www.whitehouse.gov/infocus/character/character-community-conf.pdf.

California Media and Library Educators Association. *From Library Skills to Information Literacy: A Handbook for the 21st Century*. Hi Willow Research and Publishing, Castle Rock, Colo., 1994.

Carnegie Corporation of New York. "Seven School Districts and their Communities Awarded Grants in the Schools for a New Society Initiative." Press release, October 11, 2001.

Carnevale, Anthony P. and Desrochers, Donna M.. *Connecting Education Standards and Employment: Course-Taking Patterns of Young Workers*. American Diploma Project: Workplace Study, 2002.

Center for Media Literacy. "Media Literacy: 5 Key Concepts." CML Media LitKit ™. Available at http://www.medialit.org/bp_mlk.html.

CEO Forum on Education and Technology. *Key Building Blocks for Student Achievement in the 21st Century*, 2001.

Chapman, Carolyn H. Becoming a School Superintendent, *Challenges of School District Leadership*. Prentice-Hall Inc., New York, 1997.

Chen, Milton and Armstrong, Sara. (eds). *Edutopia: Success Stories for Learning in the Digital Age*. Jossey-Bass, San Francisco, 2002. Available at http://www.glef.org.

Committee on Information Technology Literacy. *FIT: Being Fluent with Information Technology*. National Research Council, 1999.

Corporation for Public Broadcasting. *Connected to the Future: A Report on Children's Internet Use From The Corporation for Public Broadcasting*, 2002. Available at http://www.cpb.org/ed/resources/connected/.

Coughlin, Edward C. and Lemke, Cheryl. Professional Competency Continuum, *Professional Skills for the Digital Age Classroom*. Milken Exchange on Education Technology, 1999.

Council of 21, The. *Preparing Schools and School Systems for the 21st Century*. American Association of School Administrators, Arlington, Va, 1999.

D'Amico, Carol. "High School and Transition into the Workforce." Statement by the Assistant Secretary for Vocational and Adult Education, 2002.

Dellit, Jillian. *Using ICT for Quality in Teaching-Learning Evaluation Process*. Schools Online Curriculum Content Initiative, Australia, 2001.

Doyle, Denis P. and Pimentel, Susan. *Raising the Standard: An Eight-Step Action Guide for Schools and Communities*. StandardsWork, 1999.

Education Development Center, *Skills for the Twenty-First Century: Supporting Digital Literacy in the Classroom*, 2002.

Educational Testing Service. *Digital Transformation: A Framework for ICT Literacy, a report of the International Information and Communication Technologies (ICT) Literacy Panel*, 2002. Available at http://www.ets.org/research/ictliteracy/index.html.

Elder, Linda and Richard, Paul. "Universal Intellectual Standards." *Foundation for Critical Thinking*. Available at http://www.criticalthinking.org/University/unistan.html.

Ericson, David P. and Ellet, Frederick S., Jr.. "The Question of the Student in Education Reform." *Education Policy Analysis Archives*, vol. 10, no. 31, 2002.

Flanagan, Constance and Gallay, Leslie. *Nurturing Democratic Character in Teens: The Potential of IT*. Teens and Technology Roundtable, 2001.

Friedman, Susan. "New Basic Skills for Today's Economy." Interview with Richard Murnane. *Family Education*. Available at http://www.familyeducation.com.

Fulton, Kathleen. *Closing the Gap: Delivering Quality Educational Content in the Digital Divide*. University of Maryland, National Coalition for Technology in Education and Training, 1999.

Gitelman, Lisa. *Scripts, Grooves and Writing Machines: Representing Technology in the Edison Era*. Stanford University Press, 1999.

Goldberg, Amie, Russell, Michael and Cook, Abigail. "The Effect of Computers on Student Writing: A Meta-analysis of studies from 1992 to 2002." *Journal of Technology, Learning, and Assessment*, vol. 2, no. 1, 2002.

Gould, Marge Christensen. *Developing Literacy and Workplace Skills: Teaching for 21st Century Employment*. National Educational Service, Bloomington, Ind., 2002.

Greenspan, Alan. "The Evolving Demand for Skills." Speech delivered at the U.S. Department of Labor National Skills Summit, April 11, 2000.

Haertel, Geneva and Means, Barbara. *Stronger Designs for Research on Educational Uses of Technology: Conclusions and Implications*. SRI International, 2000.

Haynes, Rachel. "SIIA Brings 35+ Education Technology Companies to Capitol Hill. Focus on 'No Child Left Behind Act.'" Press release. Software & Information Industry Association, May 14, 2002.

Hecker, David E. "Occupational employment projections to 2010." *Monthly Labor Review*, vol. 124, no. 11, November 2001.

Heiman, Marsha and Slomianko, Joshua. *Learning to Learn: Thinking Skills for the 21st Century*, 7th edition. Learning to Learn, Cambridge, Mass., 1998.

Hendricks, Patricia. *Defining Teacher Technology Proficiency in the Mid-Atlantic Region*. Mid-Atlantic Regional Technology in Education Consortium (107), 2002.

Honey, Margaret. *Skills for the Twenty-First Century: Supporting Digital Literacy in the Classroom*. Education Development Center, Inc., 2002.

Houghton, Mary. *State Strategies for Incorporating Technology into Education*. National Governors Association, 1997.

Information Technology Association of America. *Bridging the Gap: Information Technology Skills for a New Millennium*. Arlington, Va., 2002. Available at http://www.itaa.org.

International Society for Technology in Education. *National Educational Technology Standards for Students Connecting Curriculum and Technology*, 2000. Available at http://www.cnets.iste.org.

International Technology Education Association. *Standards for Technological Literacy, Content for the Study of Technology*, 2000. Available at http://www.iteawww.org/TAA/TAA.html.

Jobs for the Future, Southern Regional Education Board. *Using Real-World Projects to Help Students Meet High Standards in Education and the Workplace*. Available at www.sreb.org/programs/hstw/publications/site-guides/usingrealworldprojects.asp.

Jobson, Lisa (ed.). *Connecting Cultures: A Teacher's Guide to a Global Classroom. International Education and Research Network*, iEARN-USA, New York, 2001. Available at http://www.iearn.org.

Jones, Lawrence K. *Job Skills for the 21st Century: A Guide for Students*. Oryx Press, Phoenix, Ariz., 1996.

Kanter, Rosabeth Moss. "IBM and education: a perfect match." *IBM Reinventing Education*, 2002. Available at www.ibm.com/ibm/ibm-gives/grant/education/programs/reinventing.

Lacy, Mark. "The Need for Greater Cultural Literacy." *Houston Institute for Culture*, September 28, 2001. Available at http://www.houstonculture.org/hifc/sept11.html.

Lazear, David. *Multiple Intelligence Approaches to Assessment, Solving the Assessment Conundrum*. Zephyr Press, 1999.

Lemke, Cheryl, Coughlin, Ed, Thadani, Vandana and Martin, Crystal. *enGauge 21st Century Skills, Digital Literacies for a Digital Age*. Metiri Group, 2002.

Lenhart, Amanda, Simon, Maya and Graziano, Mike. *The Internet and Education: Findings of the Pew Internet & American Life Project*. Pew Internet & American Life Project, 2001.

Levin, Douglas and Darden, Cecily. *Forum on Technology in Education: Envisioning the Future*. Office of Educational Technology, U.S. Department of Education, American Institute for Research, 1999.

Levy, Frank. Interview on *PBS Newshour*, January 30, 1997.

Levy, Frank and Murnane, Richard J. "*Are There Key Competencies Critical To Economic Success?*" SFSO, NCES, OECD, 1999.

Livingston, Kay. *Disadvantaged Teenagers and Technology*. Teens and Technology Roundtable, 2001.

Marx, Gary. *Ten Trends: Educating Children for a Profoundly Different Future*. Educational Research Service, Arlington, Va., 2000.

Marzano, Robert J., Pickering, Debra J. and McTighe, Jay. *Assessing Student Outcomes, Performance Assessment Using the Dimensions of Learning Model*. Association for Supervision and Curriculum Development, 1993.

McCombs, Barbara L. *Assessing the Role of Educational Technology in the Teaching and Learning Process: A Learner-Centered Perspective*. University of Denver Research Institute, 2000.

McNabb, Mary L., Valdez, Gilbert, Nowakowski, Jeri and Hawkes, Mark. *Technology Connections For School Improvement. Planners Handbook*. U.S. Department of Education, North Central Regional Educational Laboratory, 1999.

Means, Barbara. *Technology and Education Reform, The Reality Behind Practice*. SRI International, 1994.

Means, Barbara, Penuel, Bill and Quellmalz, Edys. "Developing Assessments for Tomorrow's Classrooms." Secretary's Conference on Educational Technology, 2000.

Moe, M.T. and Blodget, H. *The Knowledge Web: People Power — Fuel for the New Economy*, 2000.

Monsef, Paula. "Students Find Their Voice Through Multimedia." George Lucas Educational Foundation, 2002.

Murnane, Richard J. and Levy, Frank. *Teaching the New Basic Skills: Principles for Educating Children to Thrive in a Changing Economy*. The Free Press, New York, 1996.

National Academy Foundation. *NAF Academy Frameworks 2002, Partnerships for America's Youth*, 2002.

National Academy of Engineering and National Research Council, *Technically Speaking: Why All Americans Need to Know More About Technology*, 2002.

National Alliance of Business, The Business Coalition for Education Reform. *Why Business Cares About Education*, 2001.

National Center for Education Statistics. *Status and Trends in the Education of Hispanics*, 2003.

National Education Association. *Testing Plus Real Accountability with Real Results*, 2001.

National Employer Leadership Council. *Intuitions Confirmed: The Bottom-Line Return on School-to-Work Investment for Students and Employers*, 1999.

National Endowment for Financial Education®. "*Financial Literacy in America: Individual Choices, National Consequences*." A white paper from a symposium, October 2002.

National Institute for Literacy. *Characteristics of the Workforce. Workforce Education*, 2002. Available at http://www.nifl.gov.

National Research Council. *Standards in Science and Technology Education*. National Science Education Standards. National Academy of Sciences, 1996.

National Skill Standards Board, Workforce Excellence Network Report. *Using Skill Standards and Certifications in Workforce Investment Board Programs*, November 2002.

New Standards™. *Performance Standards*. National Center on Education and the Economy and The University of Pittsburgh, 1997.

Organization for Economic Cooperation and Development (OECD). "Programme for International Student Assessment (PISA). The PISA Framework for Assessing ICT Literacy: Draft Report to Network A," 2003.

Osher, Bill and Ward, Joann. *Learning for the 21st Century*. Kendall Hunt, Dubuque, Iowa, 1996.

Pacific Bell/UCLA *Initiative for 21st Century Literacies*. Available at http://www.new-literacies.gseis.ucla.edu/.

Paul, Richard. "Using Intellectual Standards to Assess Student Reasoning." Foundation for Critical Thinking. Available at http://www.criticalthinking.org.

Paul, Richard and Elder, Linda. "The Elements of Critical Thinking." Foundation for Critical Thinking. Available at http://www.critical-thinking.org.

"Pencils Down: Technology's Answer to Testing. Technology Counts 2003." *Education Week*, vol. XXII, no. 35, May 8, 2003.

Porter, Bernajean. *Grappling with Accountability. Resource Tools for Organizing and Assessing Technology for Student Results*. Education Technology Planners, Inc., 1999.

Pritchard, Gail E. *Improving Learning with Information Technology, Report of a Workshop*. National Research Council, 2002.

Quinones, Sherri and Kirshstein, Rita. *An Educators Guide to Evaluating the Use of Technology in Schools and Classrooms.* U.S. Department of Education, 1999.

Romano, Michael T. *Teachers, Learners and Technology: A Fifty-Year Perspective*. Proposing New Strategies for Old Challenges, 2002.

Rosenbaum, James. *School to Work Considerations in Designing Policies for Digital Inclusion for Underserved Youth*. Teens and Technology Roundtable, 2001.

Rothstein, Richard. "Defining Failed Schools Is Harder Than It Sounds." *New York Times*, 2002. Available at http;//www.nytimes.com.

Rush, Benjamin. *Of the Mode of Education Proper in a Republic*, 1789.

Russell, Michael. *It's Time to Upgrade: Tests and Administration Procedures for the New Millennium*. Secretary's Conference on Education Technology, 2000.

Selfe, Cynthia. *Technology and Literacy in the Twenty-First Century: The Importance of Paying Attention*. Southern Illinois University Press, Carbondale, Ill, 1999.

Senge, Peter. *The Fifth Discipline: The Art and Practice of the Learning Organization*. Currency Doubleday, New York, 1990.

Shapiro, Jeremy J. and Hughes, Shelley K.. "Information Literacy as a Liberal Art: Enlightenment Proposals for a New Curriculum." *Educom Review*, vol. 31, no. 2, March/April 1996.

Sheppard, Beverly. *The 21st Century Learner*. Institute of Museum and Library Services, Washington, D.C., undated.

Shrontz, Frank and Krippaehne, Bill. "Let's not get cold feet about improving our schools." *The Seattle Times*, 2002. Available at http://seat-tletimes.com.

Sivin-Kachala, Jay and Bialo, Ellen R. *2000 Research Report on the Effectiveness of Technology in Schools*, Software & Information Industry Alliance.

Software & Information Industry Association. *Redefining Education. Building the Net: Trends Report 2001 Trends Shaping the Digital Economy*, 2001.

Spitzer, Kathleeen, Eisenberg, Michael B. and Lowe, Carrie A. *Information Literacy: Essential Skills for the Information Age*. ERIC Clearinghouse on Information and Technology, Syracuse, N.Y., 1998.

State Educational Technology Directors Association, in conjunction with the U.S. Department of Education. *National Leadership Institute Toolkit: States Helping States Implement No Child Left Behind*. Arlington, VA, 2003. Available at http://www.setda.org/nli2002/CD/index.htm.

Tapscott, Don. *Growing Up Digital: The Rise of the Net Generation*. McGraw Hill, New York, 1998.

Taylor, Todd and Ward, Irene (eds.). *Literacy Theory in the Age of the Internet*. Columbia University Press, New York, 1998.

Education and Training for the Information Technology Workforce: Report to Congress From the Secretary of Commerce, April 2003. p. 54.

U.S. Department of Commerce, U.S. Department of Education, U.S. Department of Labor, National Institute of Literacy, and Small Business Administration. *21st Century Skills for 21st Century Jobs*, 1999.

U.S. Department of Education. No Child Left Behind Act. Available at http://www.nclb.gov/.

U.S. Department of Education Learning Technology Division. *Exemplary & Promising Educational Technology Programs*, 2000. Available at http://www.ed.gov/offices/OERI/ORAD/LTD/newtech_progs.html.

U.S. Department of Education. *eLearning: Putting A World Class Education at the Fingertips of all Children*. The National Education Technology Plan, 2001.

U.S. Department of Labor. *Secretary's Commission on Achieving Necessary Skills (SCANS): What Work Requires of School*, 1991.

Wenglinsky, Harold. *Teacher and Classroom Practices and Student Performance: How Schools Can Make a Difference*, 2001.

Wilson, Cynthia D., Miles, Cindy L., Baker, Ronald L. and Schoenberger, R. Laurence. *Learning Outcomes for the 21st Century: Report of a Community College Study*. League for Innovation in the Community College and the Pew Charitable Trust, 2000.

Appendix C

Endnotes

[1] The PISA Framework for Assessing ICT Literacy: Draft Report to Network A, 2003, p. 11.

[2] U.S. Department of Commerce, U.S. Department of Education, U.S. Department of Labor, National Institute of Literacy, and Small Business Administration. *21st Century Skills for 21st Century Jobs*, Executive Summary, 1999, p. 3.

[3] National Skill Standards Board, *Using Skill Standards and Certifications in Workforce Investment Board Programs,* 2002.

[4] "The Evolving Demand for Skills," remarks by Alan Greenspan at the U.S. Department of Labor National Skills Summit, April 11, 2000.

[5] 21st-Century Skills for 21st-Century Jobs, Executive Summary, p. 3.

[6] Moe, M.T. and Blodget, H. *The Knowledge Web: People Power — Fuel for the New Economy* 2000.[7] Status and Trends in the Education of Hispanics. National Center for Education Statistics, Washington, D.C., 2003, p. 22.

[8] Ibid., p. 6.

[9] Provided by Dell.

[10] *How People Learn: Brain, Mind, Experience, and School*. National Academy Press, Washington, D.C., 2000.

[11] Bruner, Jerome. *Toward a Theory of Instruction*. Harvard University Press, Cambridge, Mass., 1966, p. 72.

[12] "Quality of Coursework Rises Since 1983." *Education Week*, April 23, 2003.

[13] National Center for Education Statistics, U.S. Department of Education. *Time Spent Teaching Core Academic Subjects in Elementary Schools: Statistical Analysis Report*, February 1997. Available at www.nces.ed.gov/pubs/97293.pdf.

[14] No Child Left Behind, Title IX — General Provisions, Part A — Definitions.

[15] Carnevale, Anthony P. and Desrochers, Donna M. *Connecting Education Standards and Employment: Course-Taking Patterns of Young Workers*. American Diploma Project: Workplace Study, 2002, p. 2.

[16] American Library Association. *The Nine Information Literacy Standards for Student Learning*, 1998. Available at http://www.ala.org/aaslTemplate.cfm?Section=Information_Power&Template=/ContentManagement/ContentDisplay.cfm&ContentID=19937.

[17] Association of College and Research Libraries. *Objectives for Information Literacy Instruction: A Model Statement for Academic Librarians*, 2001. Available at http://www.ala.org/Content/NavigationMenu/ACRL/Standards_and_Guidelines/Objectives_for_Information_Literacy_Instruction__A_Model_Statement_for_Academic_Librarians.htm

[18] The Big6™. *Information Literacy for the Information Age*. Available at http://www.big6.com.

[19] Center for Media Literacy. *CLM MediaLit Kit*™. Available at http://www.medialit.org/bp_mlk.html.

[20] Educational Testing Service. *Digital Transformation: A Framework for ICT Literacy, A report of the International ICT Literacy Panel*, 2002. Available at http://www.ets.org/research/ictliteracy/index.html.

[21] National Skill Standards Board. Skills Standards and Initiatives. Available at http://www.nssb.org.

[22] North Central Regional Educational Laboratory and Cheryl Lemke, Metiri Group. *enGauge's 21st Century Skills*, 2003. Available at http://www.ncrel.org/engauge/skills/skills.htm.

[23] Secretary's Commission on Achieving Necessary Skills (SCANS). *What Work Requires of Schools*, 1991. Available at http://wdr.doleta.gov/SCANS/whatwork/whatwork.html

[24] Ibid.

[25] Bond, Phillip J. Address delivered at the U.S. Chamber of Commerce conference, *Before Technology in Education and Training* (NCTET), Washington, D.C., January 25, 2002.

[26] *Why Business Cares About Education*. The Business Coalition for Education Reform, 2001.

[27] Autor, David H., Levy, Frank and Murane Richard J. *The Skill Content of Recent Technological Change: An Empirical Exploration*. National Bureau of Economic Research, 2000, p. 21.

[28] Ibid.

[29] Available at http://caret.iste.org/index.cfm?fuseaction=evidence&answerID=13; Cradler, J. *Summary of Research and Evaluation Findings Relating to Technology in Education*. Educational Support Systems, 1994. Available at http://www.wested.org/techpolicy/refind.html.

[30] Educational Testing Service. *Digital Transformation: A Framework for ICT Literacy, A report of the International ICT Literacy Panel*, 2002. Available at http://www.ets.org/research/ictliteracy/index.html.

[31] *The Nine Information Literacy Standards for Student Learning*, 1998. Available at http://www.ala.org/aaslTemplate.cfm?Section=Information_Power&Template=/ContentManagement/ContentDisplay.cfm&ContentID=19937.

[32] Association of College and Research Libraries. *Objectives for Information Literacy Instruction: A Model Statement for Academic Librarians*, 2001. Available at http://www.ala.org/Content/NavigationMenu/ACRL/Standards_and_Guidelines/Objectives_for_Information_Literacy_Instruction__A_Model_Statement_for_Academic_Librarians.htm.

[33] The Big6™. *Information Literacy for the Information Age*. Available at http://www.big6.com.

[34] Center for Media Literacy. *CLM MediaLit Kit*™. Available at http://www.medialit.org/bp_mlk.html.

[35] Educational Testing Service. *Digital Transformation: A Framework for ICT Literacy, A report of the International ICT Literacy Panel*, 2002.

[36] International Society for Technology in Education (ISTE). *National Educational Technology Standards for Students: Connecting Curriculum and Technology*, 2000. Available at http://cnets.iste.org/.

[37] International Technology Education Association's Technology for All Americans Project. *Standards for Technological Literacy: Content for the Study of Technology*, 2000. Available at http://www.iteawww.org/TAA/TAA.html.

[38] National Skill Standards Board. *Skills Standards and Initiatives*. Available at http://www.nssb.org.

[39] North Central Regional Educational Laboratory and Cheryl Lemke, 2003.

[40] Secretary's Commission on Achieving Necessary Skills (SCANS) report, 1991.

[41] State Educational Technology Directors Association (SETDA). *National Leadership Institute Toolkit*, 2003. Available at http://www.setda.org/nli2002/CD/index.htm.

[42] *Intuitions Confirmed: The Bottom-Line Return on School-to-Work Investment for Students and Employers*. The National Employer Leadership Council, 1999, p. 2.

[43] Rush, Benjamin. *Of the Mode of Education Proper in a Republic*, 1789.

[44] "Financial Literacy in America: Individual Choices, National Consequences." A white paper from National Endowment for Financial Education® symposium, October 2002.

[45] *Education and Training for the Information Technology Workforce: Report to Congress From the Secretary of Commerce*, April 2003. p. 54.

[46] American Forum for Global Education, http://www.globaled.org/.

[47] International Education and Research Network (iEARN), http://www.iearn.org.

[48] The Business Roundtable, http://www.brtable.org/index.cfm.

[49] The National Council on Economic Education, http://www.ncee.net/.

[50] National Skill Standards Board, Skills Standards and Initiatives, http://www.nssb.org.

[51] *Education and Training for the Information Technology Workforce: Report to Congress From the Secretary of Commerce*, April 2003. p. 54.

[52] U.S. Department of Labor. *The Secretary's 21st Century Workforce Initiative*. Available at http://www.labor.gov/21cw/.

[53] Center for Civic Education, http://www.civiced.org/.

[54] CivNet, http://www.civnet.org.

[55] American Political Science Association, Civic Education Network, http://www.apsanet.org/CENnet/.

[56] Russell, M., Goldberg, A. and O'Connor, K. "Computer-Based Testing and Validity: A Look Back and Into the Future." *Assessment in Education* (in press).

[57] "Technology Counts 2003." *Education Week*, May 8, 2003. Available at http://www.edweek.org/sreports/tc03/tables/35impact-t1.cfm.

[58] *Key Building Blocks for Student Achievement in the 21st Century*. CEO Forum on Education and Technology, 2001.

[59] Lockwood, Robert E., and McLean, James E. *Assessment and Instruction: United They Stand, Divided They Fail: The Elements of an Effective Educational Assessment Program*. Available at http://www.emtech.net/source/vol3no3/J_McLean.htm.

Appendix D

Acknowledgments

The Partnership for 21st Century Skills would like to thank all of the people who have helped to make this report possible. Specifically, we would like to express special thanks to the following:

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CPB
GCI
Learning.com
Southern Regional Education Board

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We would like to thank members of our Education Advisory Committee who provided invaluable guidance and assistance.

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We would also like to thank the teams at Infotech Strategies and JES & Co for their diligence and support. Additionally, many special thanks to:

Gil and Lynne Leigh, Modern Media

Susan Saltrick, Proteus Consulting

Martha Vockley, Vockley•Lang

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