NACFAM
NATIONAL COUNCIL FOR ADVANCED MANUFACTURING

America's 21st Century Learning System

December 3, 2008

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AMERICA'S 21ST CENTURY LEARNING SYSTEM

Executive Summary

A highly skilled workforce is the lifeblood of any successful company, industry, or national economy. The U.S. has been the breeding ground for the world's most innovative economy, companies, and products in large part because it offered a diverse pool of talented, highly educated workers. But evidence of a decline is surfacing, precipitated by three gathering trends: an increasingly ill-prepared domestic workforce … a steadily depleting stock of highly skilled and educated foreign nationals … and an aging population.

During most of the 20th century, the U.S. economy provided Americans with a high quality of life that was unparalleled across the globe. This vitality was the result of the rising productivity of our skilled workforce, increasing technological advances, and many successfully commercialized innovations.

Eight years into the 21st century, the tide seems to be turning in large part because of the impact of globalization, growing dependency on foreign oil, and the expanding economies of Asia. Many American workers today are competing with lower-wage workers in Asia and Central Europe and seeing jobs disappear as American companies move plants and research facilities off-shore.

The advantages American workforce members had in the 20th century are eroding, especially as many small and medium-sized companies find it more difficult to compete with foreign companies both at home and abroad.

Equally disturbing is the fact that the U.S. education system is not keeping pace with the nation's changing knowledge needs and is not providing students and workers with the knowledge and skills they need to compete successfully in the ever more technical 21st century global economy.

Too many middle and high school students lack the reading, writing, and STEM skills they need to succeed in postsecondary education and/or the ever-changing world of work … too many students drop out of high school before graduating … and too many high school graduates never enroll in postsecondary schools.

If American students and workers are to compete successfully in the 21st century workforce, they must have access to a learning system that provides them with the knowledge and skills built on world-class academic and workforce standards.

To address these growing challenges and to help U.S. students gain access to the knowledge and skills they need to function successfully in the global economy, NACFAM recommends that business, education, government, labor, trade and professional associations and the non-profit sectors collaborate at the federal, state, regional and local levels to incorporate the **six basic principles** contained in the recommendations for ***America's 21st Century Learning System*** in any future public policies.

Learning system policies will be built on **six basic principles** to:

- **Promote and support the adoption of appropriate, validated and rigorous world-class learning standards, assessments and curricula for PreK – 16 students;**

- **Include applied learning in the curricula for all students in grades PreK – 12, leveraging business/education partnerships to ensure workplace-relevant learning activities;**
- **Require all graduating high school students to demonstrate mastery of the *academic and workplace competencies* outlined in the ETA Competencies Model;**
- **Strengthen career counseling for students in grades 7-12 to help ensure that graduates gain access to postsecondary schools or productive employment;**
- **Assist adult workforce members master nationally-recognized academic and workplace competencies and commit themselves to lifelong learning by upgrading their skills and/or acquiring new skills to remain in productive employment for as long as they wish to do so.**
- **Periodically rethink and change existing learning paradigms to ensure these principles are achieved.**

America's 21st Century Learning System recommendations include many ideas and suggestions from studies conducted by other national organizations concerned with the need to improve the U.S. learning system -- *National Association of Manufacturers, Achieve, Inc, National Governors' Association, National Center on Education and the Economy, National Conference of State Legislatures, Partnership for 21st Century Skills, Jobs for the Future, Center for American Progress, Association for Career and Technical Education, Alliance for Excellent Education, National Center for Education Statistics, American Electronics Association, SCI/MATH mn, TIME and BusinessWeek.*

By focusing on the realities of the 21st century global economy and taking a long-term view of America's role in the expanding global marketplace, NACFAM's Learning System recommendations go beyond those offered by the aforementioned entities. NACFAM recommendations envision a learning system that equips *all students and workers* for jobs and careers that will keep this nation innovative, productive and economically secure for years to come.

AMERICA'S 21ST CENTURY LEARNING SYSTEM

RECOMMENDATIONS

Providing Americans with the Knowledge and Skills Needed to Work in the 21st Century Economy

The U.S. and the global economies are coming to a crossroads that no one could have imagined just a few years ago. Globalization and technology together are creating the potential for startling changes in how we do our jobs and the (places) we do them in.(BusinessWeek)*

Innovation and technology today are changing everything we do, how we think, and how we work. They have special impact on the way we learn, what we learn, and how we learn.

Our economy increasingly depends on high-skill jobs that require education and training beyond high school, but too few high school students graduate prepared for the demands of postsecondary education and/or the world of work. (Achieve, Inc)

Manufacturing jobs are changing dramatically, requiring advanced technical and interpersonal skills to support our growing industries and value-chain requirements, but small and medium-sized manufacturing (SMM) executives see many potential hires lacking the most basic employment skills. (NAM)

While the SMM economy employs more than 8 million people, companies are in a perpetual search for skilled workers who can perform in the more sophisticated workplace environments of today's manufacturing.

About 7 million skilled manufacturing workers in the baby boomer generation will retire over the next decade, meaning that just keeping a savvy workforce will become more challenging than ever before.

American students, workers, previously employed and older people wanting to work or continue to work find that they must "keep on learning" if they are to have the knowledge and skills needed to qualify for the ever more technical and demanding jobs in the global world of work.

Just attending classes or casually preparing for new jobs no longer works because the knowledge and skills needed for 21st century jobs and careers are higher and more complex than those required by employers in the 20th century job market.

The 21st century economy operates worldwide and places new demands on U.S. employers … and it requires U.S. workforce members to be as skilled, if not more skilled, than the foreign workers with whom they compete in the global job market.

The Problems We Face

There is broad recognition today that the U.S. education system is not keeping pace with the nation's changing education needs and is not providing students and workers with the knowledge and skills they need to compete in the ever changing global 21st century economy.

In a national survey of 800 registered voters conducted for the *Partnership for 21st Century Skills* on September 10-12, 2007, 60% of the respondents said that U.S. schools have done a "*fair/poor job* in keeping up with the changing education needs to ensure students have the skills they need to succeed."

For American students and workers to function successfully in the global economy of the 21st century, they must acquire knowledge and skills built on world-class academic standards. As of 2007, there are at least 50 sets of academic standards in the U.S. … and they are not world-class.
Too many middle and high school students are being taught by teachers who are not credentialed in the subjects they teach, especially in subjects such as math, science, economics, technology, literacy, and international and language studies.

Too many guidance counselors in middle and high schools give too much attention to college-bound students and too little to non-college bound students. Every student needs guidance and advice on career options and the learning process as it relates to the world of work.

Too many U.S. middle school students never ask themselves, "What kind of a job or career do I want to prepare for so that I can afford to raise a family and earn a decent living?" Consequently, they do not ask themselves the important "future job or career" questions that will help them make good use of their education experiences.

Too many ninth graders never finish high school. Nationally, for every 100 students who start ninth grade, only 67 will graduate from high school. (ACTE) Every school day, nearly 7,000 American high school students drop out. (AEE)

Too many middle and high school students lack the reading, writing, and STEM skills they need to succeed in college, compete in the workforce, or even understand their daily newspaper. Many do not have the opportunity to explore career options or apply what they learn in the classroom to what they need to know when and if they enter postsecondary education and/or the world of work. All too often they go through education experiences in which academic standards and curriculum are not aligned with the knowledge and skills needed to succeed in postsecondary education and/or the world of work.

The vast majority of Title I funds provided by *No Child Left Behind (NCLB)* goes to assist low-income students in elementary schools. Only 17% goes to assist low-income middle school students and 8% goes to assist low-income high school students. (AEE)

Too many high school graduates never enroll in postsecondary programs ... and too many entering postsecondary education never stay long enough to get a degree.

In comparisons with students in developing nations, American 15 year-olds rank 23rd in math, 15th in reading, and 30th in problem solving skills. America's graduation rate has slipped to 17th among developed nations. (AEE)

More than 40 percent of employers report that high school graduates lack basic foundational skills, including reading and math, to be successful in jobs for which they apply. (AEE)

About 67% of today's new jobs require some postsecondary education or training, and that percentage is expected to rise. (Achieve, Inc.)

More than 80% of the companies responding to a Deloitte Consulting research study conducted for the National Association of Manufacturers (NAM) indicate they are experiencing a "shortage of qualified workers," making it difficult for them to achieve production levels, increase productivity, and meet customer demands.

Seventy-five percent of the respondents to the Deloitte study replied that high-performance workforce requirements have significantly increased as a result of the "skills gap shortage." Deloitte and NAM find

that the current "human capital performance gap" threatens the ability of the U.S. to compete in the fast-moving and increasingly demanding global economy of the 21st century. (NAM)

While many Americans assume that the U.S. will always be a world leader in science and technology, they must keep in mind that great minds and great ideas exist throughout the world. There is growing concern by many experts about the abruptness with which a lead in science and technology can be lost – and the difficulty of recovering a lead once lost. (The National Academies)

The National Academies' *Committee on Prospering in the Global Economy of the 21st Century* identified two key challenges that are tightly coupled to scientific and engineering prowess: *creating high-quality jobs for Americans …* and *responding to the nation's need for clean, affordable, and reliable energy*. To address these challenges, the Committee structured its ideas according to *four basic recommendations* that focus on human, financial and knowledge capital necessary for U.S. prosperity: PreK-12 education, research, higher education, and economic policy. Implementing some actions will involve changes in law. Others will require financial support that would come from the reallocation of existing funds or, if necessary, from new funds. These investments are relatively modest when compared to the magnitude of the return the nation can expect in high-quality jobs and in responding to energy needs.
(The National Academies)

Part of our dilemma can be seen in the increasing difficulty American schools have in helping students master math and science in high school. The performance of American students in international math and science tests is declining as they reach higher grades and is significantly below that of many of our international competitors. U.S. 12th grade students recently performed below the international average of 21 countries on a test of general knowledge in mathematics and science. The result is that U.S. students, currently ranking 16th out of 17 countries in the share of science and engineering degrees awarded, are far less likely to earn undergraduate science or engineering degrees than those in other countries.

To address these growing problems and to help U.S. students acquire the knowledge and skills they need to function successfully in the global economy, NACFAM proposed that the **six basic principles** contained in our recommendations for ***America's 21st Century Learning System*** be included in any future legislation to improve and/or enhance the nation's education system. The **six basic principles** are intended to:

- **Promote and support the adoption of appropriate, validated and rigorous world-class learning standards, assessments and curricula for PreK – 16 students;**
- **Include applied learning in the curricula for all students in grades PreK – 12, leveraging business/education partnerships to ensure workplace-relevant learning activities;**
- **Require all graduating high school students to demonstrate mastery of the *academic and workplace competencies* outlined in the ETA Competencies Model;**
- **Strengthen career counseling for students in grades 7-12 to help ensure that graduates gain access to postsecondary schools or productive employment;**
- **Assist adult workforce members master nationally-recognized academic and workplace competencies and commit themselves to lifelong learning by upgrading their skills and/or acquiring new skills to remain in productive employment for as long as they wish to do so.**
- **Periodically rethink and change existing learning paradigms to ensure these principles are achieved.**

SIX NEW APPROACHES TO LEARNING

The concept of learning is facing fundamental changes in the context of the global knowledge economy. One major source of change is the accelerating speed of scientific and technological advancement, and the resulting changes in society, the economy and the labor market. Another is the fact that diverse and innovative approaches to learning are increasingly available to accommodate the needs of people with different backgrounds, skills levels, and competencies. Learning beyond traditional education, training, and vocational education is increasingly important for individuals wanting to update their skills and competencies and remain productive workers. (The World Bank)

Since the late 1980's, education reform in the United States focused on setting academic standards that spotlighted what students should know and be able to do. In 1996, the New York State Board of Regents adopted learning standards for all subject areas. Since then, the New York State Education Department has issued a series of core curricula, providing an additional level of specificity to their learning standards. Today, New York has 28 learning standards.

In 1997, Illinois adopted learning standards for seven core areas. Currently they contain 30 goals, 98 standards and over 1,000 benchmarks

By 1998, most states had adopted academic standards in at least math and reading, authorizing high schools to issue diplomas only to students who met these standards.

With the enactment of *No Child Left Behind* in 2002, all 50 states were required to develop their own standards if they wanted to be eligible for federal education funds.

Building on the earlier standards reforms, the standards-based focus of NCLB, and the solid foundation for STEM education provided by the ***America COMPETES Act***, NACFAM recommends that the **six basic principles** outlined in ***America's 21st Century Learning System*** recommendations be included in any future legislation to address the growing challenges Pre K-14 American students face in preparing for jobs and careers in the global economy.

Using these **six basic principles** to shape new education policies and practices, policy makers can help American students acquire the knowledge and skills they need to function successfully in the global economy and its more technical workforce.

1. Promote and support the adoption of world-class learning standards, assessments, and curricula for PreK – 14 students.

- Ensure that PreK-14 learning is based on world-class learning standards, including more focus on STEM, that clearly define the knowledge and skills all students need in the 21st century to succeed in postsecondary schools and/or the U.S. workforce.
- Develop world-class assessments to measure students' performance against world-class learning standards, allowing graduates to demonstrate they have the knowledge and skills needed to qualify for entry into postsecondary schools and/or 21st century jobs and/or careers.
- Ensure that all students have access to rigorous curricula providing them with learning experiences that prepare them for entry into postsecondary schools and/or 21st century jobs or careers.
- Align learning standards, assessments, and curricula with postsecondary and workforce expectations of what graduates should know and be able to do.

- Provide states with incentives to align their curricula, assessments, accountability systems, teacher preparation and accreditation, and graduation requirements to meet changing world-class learning standards and international benchmarks.
- Require teachers in grades 7-14 to be credentialed in the subjects they teach.
- Amend teacher certification regulations to permit the certification of expert private sector volunteers, retirees, and retied military members.
- Review and update standards, assessments, and curricula periodically to keep them current with the changes taking place in the 21st century economy.

World class standards begin with focused, coherent and non-repetitive content, covering a small number of attainable topics at each grade – topics that can be taught effectively at that grade. SCI/MATHMN)

Indiana, Minnesota, and California for example have endeavored to establish world-class academic standards:

Indiana: Indiana's Education Roundtable is charged with ensuring Indiana has world-class academic standards. Through the work of the Roundtable and State Board of Education, Indiana adopted new standards for English/Language Arts in 2006, Math and Science in 2000 and for Social Studies in 2001. These academic standards rank among the very best set of expectations for student learning in the country. To ensure this continues to be the case, Indiana follows a six-year cycle to review and update the standards that coincides with text-book adoption. Because Social Studies text-book adoption takes place in 2008, the process to complete a review of the Social Studies academic standards was begun by the Education Roundtable in July 2007 with work progressing according to the outlined process.

Minnesota: Minnesota high school graduates need to be well grounded in the mathematics that elevates them from being among the best in America to being among the best in the world. To reach this goal, the state needs world class standards to support the state economy and prepare future citizens. To be effective, standards must be part of a world class system, which also includes text books and learning materials, instruction, assessments, preparation of teachers, and on-going professional development for practicing teachers – all aligned with the standards.

There is no international definition of high quality mathematics standards for students. However, we should examine the goals for learning and the system for delivery of that learning in those countries whose students demonstrate outstanding performance on international assessments, especially those countries that have been consistently high performing over time – *Singapore, Japan, Korea, Finland, the Netherlands and the Czech Republic.* (SCI/MATH MN)

California: Two national consensus documents have been at the core of science education reform -- *Benchmarks for Science Literacy*, developed by the AAAS, and *National Science Education Standards*, developed under the leadership of the National Research Council. These studies represent years of work by thousands of leading scientists and educators. Both documents demand that the understanding of scientific concepts, not the simple recall of facts, be the goal. Both documents make a very conscious effort to reduce the total amount of content in order that students have time to develop mastery of the most important concepts. The importance of this approach was reinforced by the results of the Third International Mathematics and Science Study (TIMSS), a massive study of science education in more than 40 countries. This study found that science and mathematics courses in the US cover far more topics with far less time per topic than curricula in other countries, and that the achievement of US students in these subjects is comparatively very weak. (American Physical Society)

2. Include applied learning in curricula for all PreK–12 students, leveraging business/education partnerships to ensure workplace-relevant learning activities.

- Help students succeed in school by understanding the relevancy of how learning can be applied to life beyond school.
- Allow students to test academic theories through real world applications.
- Permit students to process new information so that it makes sense to them in their own frames of reference.
- Enhance students' interest and achievement in learning by making connections between new information and real-life experiences.
- Recognize learning is a complex and multifaceted process that goes far beyond drill-oriented, stimulus-and-response methodologies.
- Encourage increased employer involvement in business/education partnerships and the use of employer tools and equipment in PreK-12 schools.

Private employers have for years stated their dissatisfaction with the quality of education provided American students by the nation's PreK-12 system. While quality, high-wage jobs are available across the U.S. job market, many high school graduates do not have the knowledge or skills needed to qualify for those most of these jobs.

Companies have been saying for more than 20 years that schools should focus on preparing students for college *and* the workplace. Many corporate CEOs have asserted that *all* students should take career and applied learning courses that integrate contextual and technical learning with core academic courses. Integrated academic and technical training can provide a clear link between *what they are learning and how that knowledge will be used*. The ultimate goal of PreK-12 education is to ensure that *all* students graduate from high school with the knowledge and skills they will need in postsecondary education and the world of work. (NAM)

PreK-12 students must discover meaningful relationships between abstract ideas and practical applications in the context of the real world. In addition, they must be exposed to current and future career opportunities during their formal education since all jobs in the 21st century will require increasing levels of problem-solving skills and technical knowledge. The addition of contextual learning to the PreK-12 curricula will provide *all* students whether they are college- or workforce-bound with the workforce readiness skills they will need to make future career decisions. The integration of contextual learning into the PreK-12 education system will ensure America's future competitiveness through student engagement, the innovative integration of math, science and literacy skills, and by meeting the needs of both employers and the economy as a whole. (ACTE)

Applied learning rests at the nexus of governors' efforts to improve their states' PreK-16 education systems and develop economies supportive of innovation. New applied learning programs, such as computer networking and pre-engineering, are being created to educate and prepare students for careers involving sophisticated scientific and technological skills and knowledge. A handful of states have already begun to incorporate applied learning into their high school reform and economic competitiveness efforts, making learning both more challenging and relevant to students' interests. (NGA)

According to the contextual learning theory, learning occurs only when students (learners) process new information or knowledge in such a way that it makes sense to them in their own frames of reference, e.g. their own inner worlds of memory, experience, and response). This approach to learning and teaching assumes that the mind naturally seeks meaning in context – that is, in relation to the person's current environment – and that it does so by searching for relationships that make sense and appear useful. (Center for Occupational Research & Development)

In such an environment, students discover meaningful relationships between abstract ideas and practical applications in the context of the real world. Concepts are internalized through the process of discovering, reinforcing, and relating. (Texas Collaborative for Teaching Excellence)

Research shows that not all people learn best abstractly. In fact, most people learn best through informal, contextual experiences. Therefore, accommodating the learning styles of all learners requires the use of a variety of learning strategies, multiple ways of organizing curriculum, and diverse contexts for learning opportunities. (National Conference of State Legislatures)

3. Require all graduating high school students to demonstrate mastery of the academic and workplace competencies outlined in the ETA Competencies Model.

- Represents the knowledge, skills, and abilities that serve as the foundation for success for high school graduates no matter what their choice of career or continuing education.
- Provides students with the rigorous *academic and workplace competencies* needed to succeed in postsecondary learning or jobs and/or careers after graduation from high school.
- *Academic* competencies include mastery of subjects such as reading, writing, math, science & technology, listening & speaking, critical & analytic thinking, active learning, and basic computer skills.
- *Workplace* competencies include mastery of skills related to teamwork, adaptability, planning & organizing, creative thinking, problem solving & decision making, working with tools & technology, sustainability, checking/examining/recording, workplace computer applications, scheduling & coordinating, and business fundamentals.

If American high school graduates are to qualify for the evermore technical careers and jobs opening up in the 21st century economy, they will need a broader range of knowledge, skills and competencies than those offered in the typical U.S. secondary school.

Recognizing that manufacturers need help in attracting and training skilled workers, the Employment and Training Administration (ETA) of the U.S. Department of Labor convened a group of researchers to study workforce-training issues faced by advanced manufacturers. This group was given the task of devising a framework for reviewing existing industry standards and curricula. In its final report, the research group identified common elements that apply across manufacturing sectors, which were subsequently used by ETA in designing its *Competencies Model.*

When introducing the *Competencies Model*, former Assistant Secretary of Labor Emily DeRocco noted, "In a global economy, American workers need strong academic, workplace, and technical skills to maintain our innovative edge. Employers need workers with skill sets that match each industry's demand for talent."

Industry-based competencies models can serve as organizing vehicles that employers can use to specify the skills and competencies that are critical to their companies or organizations. They can help pinpoint the knowledge and skills that new and incumbent workers need to advance in their chosen fields or move into new and more challenging career/skill areas.

Competencies models also form the foundation for developing curriculum and selecting teaching and training materials as well as licensure and certification requirements. The ETA Competencies Model contains three distinctive tiers – foundational competencies, industry-related competencies, and occupation-related competencies.

In developing this recommendation, NACFAM has concluded that the "foundational competencies" in tiers 2 & 3 of the DOL/ETA Competencies Model can serve as the basis for demonstrating that a high school graduate has mastered the essential ***academic and workplace competencies.***

These "foundational competencies" are both basic for all job candidates and universal in terms of what an individual must know to begin a career or get a job in 21st century global economy.

Acceptance of this recommendation will mean that every U.S. school system will require graduating seniors to demonstrate that they have mastered the Competencies Model's eight *academic competencies* – reading, writing, mathematics, science & technology, communication/listening/speaker, critical & analytic thinking, active learning, and basic computer skills – and eleven *workplace competencies* – teamwork, adaptability/flexibility, customer focus, planning/organizing, creative thinking, problem solving/decision making, working with tools & technology, workplace computer applications, scheduling/coordinating, checking/examining/recording, and business fundamentals.

These "foundational competencies" serve as the starting point for workforce candidates entering the world of work and being able to upgrade their skills and/or acquire new skills needed to remain productive and competitive in an ever changing workforce environment.

4. Strengthen career counseling for students in grades 7-12 to help ensure that graduates gain access to postsecondary schools or productive employment.

- Enhance career counseling for all middle and high school students so they know and understand the options they have for entering postsecondary education and/or the world of work.
- Assist all high school students develop and implement career plans that identify postsecondary education and/or employment opportunities following graduation.
- Incent school systems to track graduates' progress at least five years after receiving their high school diplomas.
- Review, evaluate, and update career counseling strategies and programs every five years to make sure students are receiving the help they need in developing and implementing their career plans.

5. Assist adult workforce members master nationally-recognized academic and workplace competencies and commit themselves to lifelong learning by upgrading their skills and/or acquiring new skills to remain in productive employment for as long as they wish to do so.

- Requires a system of lifelong learning that provides every citizen with multiple routes to learning opportunities, including all levels and/or forms of education and training.
- Needs mechanisms that permit people to move from one skill level or form of learning to another and provides certification of that accomplishment.
- Requires federal and state incentives to assist adult workforce members (incumbent workers and dislocated workers) meet 12th grade literacy standards and acquire the new skills needed to qualify and hold jobs in the 21st century workforce for as long as they wish to work.
- Requires the removal of barriers in federal and state education financial aid systems that make it difficult for part-time, financially independent, and/or non-traditional students as well as older and/or retired workers wishing to pursue lifelong learning to qualify for financial aid.

Lifelong learning begins at birth and ends at death. It's a concept that sees individuals taking advantage of learning opportunities at all ages, whether at home, in school, on the job, or during retirement. It is accomplished through distance learning or e-learning, PreK-20 education programs, continuing education, employer training, apprenticeships, federal/state/local government education and training programs, and

non-profit organization/trade association education and training programs, and community-based organization education and training programs.

Lifelong learning is increasingly important in the 21st century because of the rapid pace of change taking place in the global economy. This is seen in the additional knowledge and skills individuals must have to function successfully in the workplace because of the acceleration of science and technology. In spite of the more than 14-18 years many students spend in primary, secondary and post secondary education, the knowledge and skills acquired there are usually not sufficient for the five or more career changes that will be made during three to four decades in the world of work.

The U.S. Department of Labor reports that average job tenure for all workers is less than seven years. The typical product development team in the high technology sector stays together for 18 to 36 months. The useful life of most software application packages is three years. As a result, technical professionals must continuously upgrade their knowledge and skills to remain employable. The alternative is technological obsolescence, job loss for younger workers, and displacement or early retirement for older workers. Employees in less technical sectors of the economy face similar but slightly less pressing challenges, needing to upgrade their knowledge and skills every five to seven years but on a continuing basis throughout their lives.

Employers and employees recognize the critical importance of continuing education or lifelong learning. Most large employers routinely provide or pay for instructional opportunities for their workers. However, many mid-sized and smaller firms do not – either because they can't afford to or because they fear losing trained employees to their competitors.

Since human capital is one of the most valuable resources a company has, employers and employees must take advantage of the financial incentives available to them through various sections of the Internal Revenue Code. These incentives include tax deductions, tax credits, and exclusions from income of certain kinds of educational expenses.

In view of the accelerating change taking place in the workplace and the need for individuals to continuously upgrade their knowledge and skills to qualify for new or changing jobs, the federal government must quickly address the problem of financing needed education and training investments, providing additional tax incentives for continuing education by individuals and employers, and incentivizing lifelong learning. (Institute of Electrical and Electronics Engineers)

6. Periodically rethink and change existing learning paradigms to achieve these goals.

- Review and update these recommendations every five years to make sure they are accomplishing their objective of providing the United States with a 21st Century Learning System that effectively prepares American citizens for learning and work in the 21st century global economy.
- Conduct these reviews and updates recognizing that the U.S. is part of an ever more complex global marketplace in which the only certainty is *continuous change*.
- Understand that failure to improve and change learning paradigms could result in the decline of the United States as a world economic power … and a decline in the standard of living of many American citizens.

SUMMARY OF KEY ELEMENTS OF AMERICA'S 21ST CENTURY LEARNING SYSTEM RECOMMENDATIONS

- All U.S. PreK-20 school systems will adopt appropriate, validated, and rigorous world-class learning standards and assessments.
- Curricula for all middle and high schools will use "applied learning" methods to help students see and understand the relationship between "what they learn in the classroom" and "what they do with their knowledge and skills" in the world of work.
- All high school seniors will demonstrate a mastery of basic *academic* and *workplace* competencies prior to graduation as a condition for receiving their high school diplomas.
- All teachers in grades 7-14 must be credentialed in the subjects they teach so they are better able to provide students with the knowledge and skills in their respective subject areas.
- State teacher certification regulations must allow the recruitment and certification of STEM-oriented private sector volunteers and retirees as well as retired U.S. military members to teach STEM-related courses in secondary schools and inculcate applied learning examples in these courses to better help students see the relationship between what they learn and how they apply this knowledge to the work they will do in future jobs or careers.
- Federal education laws and regulations must be aligned so they relate to, support, and build on each other to meet both the employment driven goals herein and broader traditional education goals.
- The federal government must provide financial incentives to states to help them align their curricula, assessment, accountability systems and teacher accreditation requirements to the world-class academic standards of the recommendations in ***America's 21st Century Learning System*** … and to increase credentialed teacher and counselor supply and retention to better implement world-class academic standards and assessments.
- States must create seamless curricula to permit PreK-20 students to acquire the knowledge they need to function successfully in the 21st century economy.
- The federal and state governments must provide *lifelong learning incentives* to all U.S. citizens who want to enhance their knowledge and skills so they can continue to be productive workers in the 21st Century global workforce.

IMPLEMENTATION ROLES OF KEY STAKEHOLDERS

If the U.S. is to effectively educate its youth and workers so they qualify for ever more technical jobs in the 21st century economy, key stakeholders must take action now on the recommendations contained in **America's 21st Century Education System.**

Role of the Federal Government

- The Congress will enact legislation based on the principles enunciated in **America's 21st Century Learning System** recommendations. The principles include the development of validated *world-class learning standards* for use in all U.S. public schools, the inclusion of *applied learning* in middle and high school curricula, and the requirement that high school seniors demonstrate a mastery of *academic and workplace competencies* as a condition of receiving their high school diplomas.

  New federal legislation will require alignment of existing federal education laws* so they support the establishment of world-class curriculum, assessments, accountability systems, and teacher accreditation requirements, thereby guaranteeing that all high school students will have access to high-quality guidance and instruction, the knowledge and skills needed to enter postsecondary schools and/or the world of work, and productive employment in the 21st century economy.

  ***Federal Education Laws: No Child Left Behind Act, Higher Education Act, Head Start, Individuals with Disabilities Education Act, and the Carl D. Perkins Career and Technical Education Act**

- Federal funds will be appropriated annually to the National Academies, the National Science Foundation, and other national education entities, working in cooperation with the Departments of Education and Labor, for the development of the recommendations (see above) of **America's 21st Century Learning System**.

- The Congress will authorize and appropriate new incentive funding on an annual basis to help states align their academic standards, curricula, assessments, accountability systems, and teacher accreditation principles of **America's 21st Century Learning System** recommendations… create seamless public education systems for students from preschool through post-graduate school (PreK-20) … include applied learning in teaching all students in middle and high schools … increase teacher supply and retention … and promote capacity building through research, technical assistance, and regulatory and statutory alignment.

- The Congress will strengthen and broaden higher education by expanding access to all high school students and workers of any age … making postsecondary education more affordable through grants, loans and tax credits …and opening up access to part-time, financially independent, or nontraditional students who may need financial aid to pay for higher education costs.

- Congress will mandate stronger collaboration between local employers, workforce investment programs and postsecondary education entities so they can meet the 21st century knowledge and skill needs of employers … and better coordination by the U.S. Department of Education, the U.S. Department of Labor, and other knowledge-based federal agencies to assure that the new education system accomplishes its objectives.

- The Congress will authorize and appropriate funding for "lifelong learning incentive grants" that states can make available to U.S. citizens enrolling in career-related courses at community/technical colleges, 4-year colleges or universities, and/or private education and training entities to enhance the knowledge and skills they need to keep their jobs, qualify for new jobs, and/or make career changes.

Role of State Governments

- States will align their educational standards and systems with the principles of **America's 21st Century Learning System** recommendations, giving priority to 1) the adoption of validated *world-class learning standards* to better prepare students with real-world knowledge and skills related to the 21st century workplace, 2) the inclusion of *applied learning* in middle and high school curricula for all students, and 3) the requirement that high school seniors demonstrate a mastery of *academic and workplace competencies* as a condition of receiving their high school diplomas.

- States will guarantee a seamless public education system for all students from preschool through postsecondary graduation … and for all U.S. citizens from early childhood through lifelong learning opportunities.

- States will incorporate applied learning into high school curriculum, making learning both challenging and relevant to every student's future career interests ... connect high school education programs to the state's economic growth industries … and include in-demand skills needed in growth industries in state standards, assessment, and accountability systems.

- States will expand the availability of flexible learning opportunities for students of all ages to address special education needs.

- States will build their education accountability systems to measure more effectively how students are assessed for academic proficiency and postsecondary readiness.

- States will increase their investments in professional development opportunities to 1) establish stricter state standards for teacher preparation and performance … 2) increase the number of qualified secondary school teachers and school leaders working in hard-to-serve schools and/or shortages in critical-subject areas ... 3) guarantee career guidance and counseling services to all secondary school students … 4) attract STEM-oriented career professionals and retirees from the private sector into STEM-related teaching positions in grades 7-12 ... and 5) better integrate applied learning into the curriculum for all secondary students.

- States will support strategies to 1) improve enrollment in postsecondary education by high school graduates … 2) make postsecondary education more affordable for all enrollees … 3) increase alignment between secondary and postsecondary institutions to improve postsecondary student completion … 4) remove barriers in state financial aid systems that make it difficult for part-time, financially independent, or nontraditional students to qualify for financial aid … and 5) assure the availability of curricula that provides postsecondary students with the knowledge and skills required by the state's private sector employers who seek to compete successfully in the 21st century economy.

- States will provide incentives to 1) attract properly certificated teachers and school leaders into hard-to-staff schools, schools in need of improvement, or critical subject-shortage areas such as math, reading, science, and literacy ... 2) increase teacher supply and retention … and 3) explore new models of teacher and school leader compensation based on merit.

Role of the Education Community

- National, state, regional and local education entities (postsecondary institutions, state and local school systems, education unions, and educational professional associations) will collaborate with federal and state government entities to develop and gain support for the principles spelled out in **America's 21st Century Learning System** recommendations … and broaden public understanding of the long-term economic benefits of the new system for students, parents, communities, the private sector, labor unions, associations, government at all levels, and the nation.

- Education entities will encourage teachers and education leaders to help achieve the principles contained in **America's 21st Century Learning System** recommendations in their communities, school systems, and classrooms.

- Teacher training institutions will redesign and enhance secondary teacher training programs so that their graduates are better prepared to help secondary students acquire the knowledge and skills they will need to be accepted at postsecondary institutions and/or qualify for careers and/or jobs in the 21st century economy.

- State school systems will require the introduction of applied learning into the curricula of secondary schools to permit students to explore career/job options in the 21st century economy.

- Secondary teachers and education leaders will integrate applied learning into their instruction plans so that students can better understand how the knowledge and skills learned in the classroom can be applied to future careers/jobs following graduation from high school, a community or technical college, a 4-year college or university, or a graduate school.

Role of the Private Sector

- Companies and trade associations will collaborate with education entities to achieve the principles outlined in **America's 21st Century Learning System** recommendations ... and will promote these recommendations with federal and state policy makers as they develop new strategies to improve and enhance the nation's workforce.

- Companies and trade associations will participate in public/private advisory groups at the national, state, and local levels to advise policy makers on the major improvements needed in the nation's learning system … with special focus on the knowledge and skill enhancements students and workers will need to qualify for jobs/careers in the 21st century economy.

- Companies will encourage STEM-oriented volunteers and retirees to volunteer to teach in secondary schools and to inculcate applied learning examples in the courses they teach to better help students see the relationship between learning and the work they will do in their jobs of choice.

- Companies will provide teachers and education leaders with access to summer internships and short-term job opportunities in which they can experience the world of work and become familiar with the knowledge and skill requirements of the 21st century economy.

- Companies and trade associations will establish advisory relationships with postsecondary schools to shape new education and training programs that help students prepare for the ever-changing needs of the private sector job market in the 21st century economy.

- Companies and trade associations will periodically assess the progress being made by state and local school systems and postsecondary institutions to enhance the 21st century knowledge and skills of workforce members … and will collaborate with education entities to recommend appropriate improvements and/or changes in these initiatives.

Role of the Non-Profit Sector

- Non-profit entities (trade and professional associations, foundations, state and community organizations concerned with education/training/workforce preparation, research entities, and think-tanks) will be encouraged to collaborate with education entities to achieve the principles outlined in **America's 21st Century Learning System** recommendations & promote these recommendations with policy makers at the federal and state levels as they develop new strategies to improve and enhance the nation's workforce.
- Non-profit entities will be invited to serve on public/private advisory groups at the national, state, regional, and local levels to advise policy makers on the major improvements needed in the nation's learning system, thereby helping students and workers acquire the knowledge and skills they need in the careers/jobs of the 21st century.
- Non-profit entities will be urged to inform their members of **America's 21st Century Learning System** recommendations … and to request them to communicate their support for Learning System recommendations to federal, state, regional and local policy makers.
- Non-profit entities will be encouraged to join business organizations and private employers to periodically assess the progress being made by school systems and postsecondary education institutions in helping students/workers acquire the knowledge and skills they need to successfully compete for careers/jobs in the 21st century economy ... and present their findings to federal and state policy makers.

MOST RECENT FEDERAL LEARNING INITIATIVE
America COMPETES Act

In the summer of 2007, President George Bush signed into law the **America COMPETES Act**, establishing as public policy many of the recommendations contained in the *Rising Above the Gathering Storm* report prepared by The National Academies.

The Act authorizes a comprehensive strategy to keep America the most innovative nation in the world by 1) increasing research investment, 2) strengthening educational opportunities in science, technology, engineering and mathematics (STEM) from elementary through graduate school, and 3) developing an innovation infrastructure for the U.S. In strengthening STEM educational opportunities, the Act:

- Authorizes competitive grants to states to promote better alignment of elementary and secondary education with the knowledge and skills needed for success in postsecondary education, the 21st century workforce, and the Armed Forces … and grants to support the establishment or improvement of statewide P-16 education longitudinal data systems.
- Strengthens the skills of thousands of math and science teachers by establishing training and education programs at summer institutes hosted by the National Laboratories and by increasing support for Teacher Institutes for the 21st Century program at NSF.
- Expands the Robert Noyce Teacher Scholarship Program at NSF to recruit and train individuals to become math and science teachers in high-need local educational agencies.
- Assists states in establishing or expanding statewide specialty schools in math and science that students from across the state would be eligible to attend … and provides expert assistance from National Laboratories' staff at those schools.
- Facilitates the expansion of Advanced Placement (AP) and International Baccalaureate (IB) programs by increasing the number of teachers prepared to teach AP/IB and pre-AP/IB math, science, and foreign language courses in high-need schools, thereby increasing the number of courses available and the number of students who take and pass AP/IB exams.
- Develops and implements programs for bachelor's degrees in math, science, engineering and critical foreign languages with concurrent teaching credentials and part-time master's in education programs for math, science, and critical foreign language teachers to enhance both content and teaching skills.
- Creates partnerships between National Laboratories and local high-need high schools to establish centers of excellence in math and science education.
- Expands existing NSF graduate research fellowship and traineeship programs, requiring NSF to work with institutions of higher education to facilitate the development of professional science master's degree programs … and expanding NSF's STEM talent program.
- Provides Math Now grants to improve math instruction in elementary and middle grades and provide targeted help to struggling students so that all students can master grade-level mathematics standards.
- Expands programs to increase the number of students from elementary school through postsecondary education who study critical foreign languages and become proficient.

Federal and state public policy enhancements of the nation's Pre-K-16 education system must be systemic, coordinated and aligned so the system will provide secondary and postsecondary graduates with the knowledge and skills they need to compete for work in the ever-changing American job market that is part of the global economy.