



Career and Technical Education's Role in American Competitiveness

IN THIS BRIEF:

This issue brief will explore the dynamic role that career and technical education plays in economic competitiveness. High-quality career and technical education can ensure America's future in the global economy through increased 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.

In May 2005, Thomas Friedman's *The World is Flat* reached the top of *The New York Times* best seller list and alerted the nation to the issue of increasing global competitiveness. No longer was the "flattening" of the world only of importance to economists and business leaders, but to policymakers, educators and the public at large.

Today, America's economic competitiveness is at the forefront of a national policy debate, with federal, state and local leaders examining ways to keep the country at the top of international innovation as other countries make technological and economic gains.

In February 2006, President Bush announced an American Competitiveness Initiative, focusing on tax credits, research and development investments, and math and science education. Members of Congress have followed by introducing initiatives ranging from increasing the number of temporary visas to highly skilled international professionals (H-1B visas) to providing grants to postsecondary institutions to increase the number of students in

science, technology, engineering and math (STEM) fields. More than 300 bills from the 109th Congress contained the word "competitiveness," but a consensus policy approach has yet to emerge.

When passing the recently reauthorized Carl D. Perkins Career and Technical Education Improvement Act, Members of Congress recognized that one area missing from almost all of these policy proposals is a focus on career and technical education (CTE). They added a new purpose to the Act: "Providing individuals with opportunities throughout their lifetimes to develop, in conjunction with other education and training programs, the knowledge and skills needed to keep the United States competitive."¹

President Bush has stated, "The bedrock of America's competitiveness is a well-educated and skilled workforce."² Strong CTE programs are critical to preparing this well-educated and skilled workforce. Expanded investments in CTE are essential to meeting the Administration's goals of:

- A system of education through the secondary

level that equips each new generation of Americans with the educational foundation for future study and inquiry in technical subjects and that inspires and sustains their interest;

- Institutions of higher education that provide American students access to world-class education and research opportunities in STEM fields; and
- Workforce training systems that provide more workers the opportunity to pursue the training and other services necessary to improve their skills and better compete in the 21st century.³

percent in 2004. Asia (excluding Japan) grew 8.2 percent, Latin America, 5.6 percent, and the U.S. lagged behind at 4.4 percent, just below the global average.⁴

Europe, Canada, South Korea, and many other countries around the world have launched ambitious competitiveness agendas to increase innovation, develop technology, and make it easier for businesses to invest in new research and development to spur economic growth.⁵ In order to stay on top of the economic productivity around the world, America must continue to innovate and evolve, as it has many times throughout history.

The Concerns

CHANGING GLOBAL ECONOMY

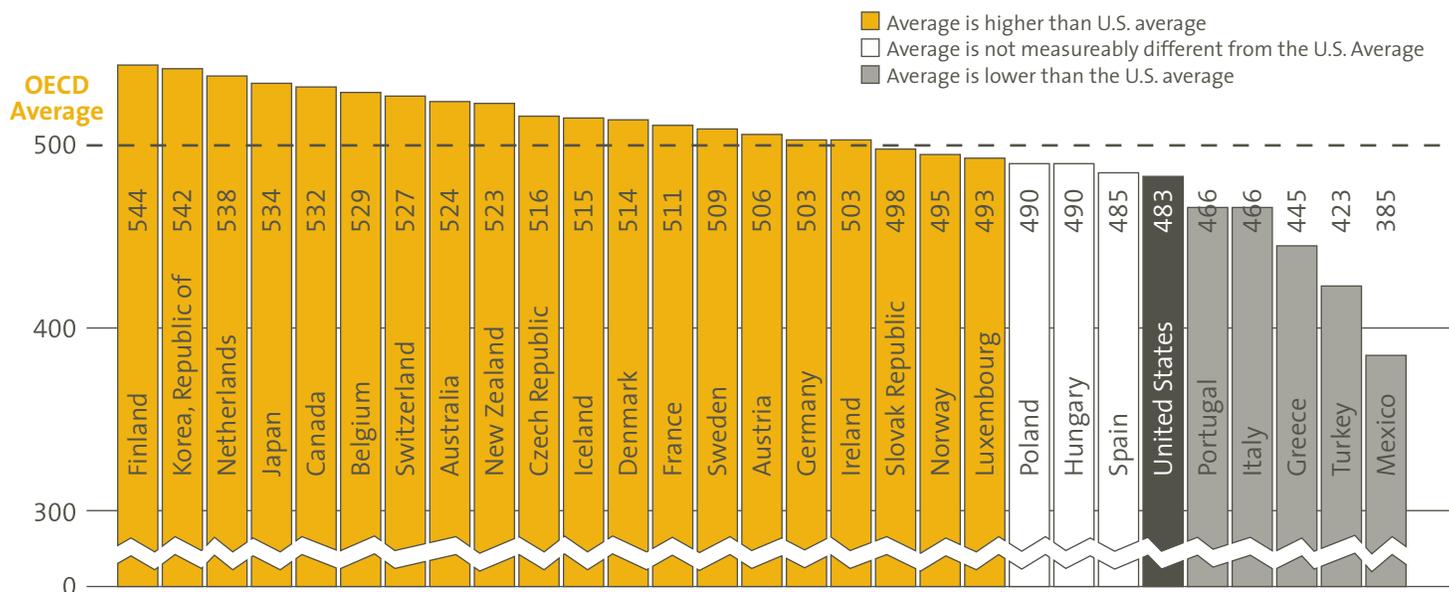
In a very short time, America has evolved from an industrial economy to a knowledge economy. Since the early 1990s, the pace of change in the global economy has accelerated even further. Around the world, global lines are blurring, and companies once associated with American innovation are just as prominent in Bangalore as in Silicone Valley. Economists reported that the global economy grew 4.7

INCREASING SKILLS DEMAND

The globalization of business and industry requires workers to acquire core knowledge and skills that can be applied—and quickly upgraded and adapted—in a wide and rapidly changing variety of work settings. There continues to be a strong demand and an inadequate supply of employees with these skill levels. A recent Chamber of Commerce survey showed that almost half of employers are having a hard time finding qualified job applicants,⁶ and more than 90 percent of respondents in a 2005 National Association of Manufacturers (NAM) study reported shortages of skilled workers.⁷ The talent shortage being



Average PISA Mathematics Literacy Scores of 15-year-olds, By Country: 2003



From U.S. Student and Adult Performance on International Assessments of Educational Achievement: Findings from The Condition of Education 2006, National Center for Education Statistics, p. 16.

reported is not a theoretical or distant problem. In fact, 83 percent of respondents to the NAM study indicated that these shortages are currently impacting their ability to serve customers.

Many experts predict that this problem will only grow more acute as the Baby Boom generation reaches retirement and contributes to a “brain drain” in the American workplace. While debates continue about the shortage of engineers, the need for additional STEM workers, and the impact of H-1B visas; it is clear that there will be an increased need in the future for employees with strong technical and analytical skills.

DECLINING PERFORMANCE OF AMERICAN STUDENTS

The American education system is key to ensuring that students obtain the skills employers need to compete in the 21st century economy and remain highly innovative and competitive. In recent years, studies finding that American students are failing to keep pace with their international counterparts have given serious cause for concern and attention.

The recent Program for International Student Assessment (PISA) placed U.S. 15-year-olds 24th in math performance among developed countries, down from 18th in 2000.⁸ The PISA is an assessment focused on problem-solving skills in a real-world context. It defines mathematics literacy as “an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual’s life as a constructive, concerned and reflective citizen.” This is exactly the kind of math that students will need to apply in their future employment roles.

Most careers in the 21st century will require students to engage in some type of postsecondary education,⁹ yet too many students leave school without even earning a high school diploma. Recent analyses have put high school graduation rates at around 70 percent.¹⁰ Of students who do graduate, many are not prepared for further education or careers. One estimate finds that, given projected retirements, postsecondary education enrollment and job growth, the U.S could experience a shortage of 12 million too few college-educated workers by 2020.¹¹

CTE Provides a Solution

High-quality CTE can ensure America’s future competitiveness through increased 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.

CTE prepares both youth and adults for a wide range of careers in the 21st century economy. These careers may require varying levels of education—from high school and postsecondary certificates to two- and four-year college degrees. According to the U.S. Department of Education’s Office of Vocational and Adult Education (OVAE), 97 percent of all high school students take at least one CTE course, and one in four students take three or more courses in a single program area. One-third of college students are involved in CTE, and as many as 40 million adults engage in short-term postsecondary occupational training.¹²

CTE programs help students achieve academic success, experience increases in earnings and improved employment outcomes, reduce dropout and absentee rates, and achieve postsecondary success. Nations enrolling a large proportion of upper-secondary students in vocational programs that include heavy doses of work-based learning have significantly higher school attendance rates, upper-secondary completion rates and college attendance.¹³

CTE supports strong economic competitiveness by helping secondary and postsecondary education programs meet the following goals:

1. INCREASE STUDENT ENGAGEMENT

The first step toward ensuring that each individual is able to contribute to the success of the American economy is making sure that every student is engaged in the education process and completes high school. Too many students leave school without the skills and knowledge necessary to be successful in the 21st century workplace. Several decades ago, students who did not complete high school could still find good jobs paying family-supporting wages, but that is no longer the case. High school dropouts are 15 percent less likely to be employed and earn almost 30 percent less than their diploma- or GED-holding peers.¹⁴ Annual losses to the U.S. economy exceed \$50 billion in federal and state income taxes for all 23 million U.S. high

school dropouts ages 18–67.¹⁵ Increasing high school graduation rates would not only help put more individuals on the path to success, but would also ensure that the American economy stays strong.

 “Making learning relevant is one of the best ways to ensure students stay interested in their coursework, while also preparing them for college and the workforce.”

—SEN. MIKE ENZI, WYOMING

Recent studies have shown that while low academic achievement may play a role in high school dropout rates, a lack of motivation plays a key role as well. CTE can provide the relevance lacking for many high school students in traditional courses and help to increase graduation rates, thus increasing students’ future earnings. A poll of at-risk California ninth- and 10th-graders found that six in 10 respondents were not motivated to succeed in school. Of those students, more than 90 percent said they would be more engaged in their education if classes helped them acquire skills and knowledge relevant to future careers.¹⁶

Other researchers have shown that taking CTE courses is strongly related to persisting to graduation.¹⁷ Career academies (smaller learning communities with a focus on CTE) have also been found to increase the likelihood of staying in school through the end of the 12th grade year and the attendance rate for students who entered the programs at high risk of dropping out.¹⁸ By providing relevance and supporting relationships, CTE can help more students persist in and complete high school, preparing them for the postsecondary education and training that will be critical to future economic successes.

2. IMPROVE MATH, SCIENCE AND LITERACY SKILLS

Higher levels of knowledge and skills for our young people in academic content areas are absolutely necessary, but education leaders will make a serious miscalculation if they just add more challenging courses without changing the way courses are taught. Today, many students who take a full complement of college preparatory classes

in high school still need college level remedial classes. Although college preparatory course-taking has risen in recent years, reading and mathematics performance by high school students taking the National Assessment of Education Progress has remained flat.¹⁹ We can conclude that the achievement problem is not just one of low-level course-taking; it is also related to unfocused curriculum and weak instructional methods that are not reaching all students.

CTE provides students with opportunities to gain critical math, science and literacy skills in a relevant context—utilizing principles of inquiry-based learning and exploration. A study by the National Research Center for Career and Technical Education discovered that when combining professional development with a pedagogic framework to identify and teach the mathematics that is inherent in CTE curricula, students who received the enhanced instruction scored significantly higher on standardized math tests than students who received their regular curriculum.²⁰ At the same time, scores on technical assessments did not decrease—showing that a high quality contextual approach to improving academics could produce very valuable pay-offs for students and their future employers.

In states like Arizona, where academic content has been made explicit in CTE courses and CTE teachers understand and teach to the state’s academic standards, CTE students have outperformed the general high school population. Arizona conducted a comprehensive review of its CTE curriculum during which specific program standards were written and programs were updated to include reinforcement of state academic standards. As a result, in 2004, CTE graduates who took two or more CTE courses outperformed the general high school student population taking all three of Arizona’s high stakes academic tests (AIMS).²¹

Many states have gone even further to recognize the academic content inherent in CTE programs. Kentucky has developed 10 “interdisciplinary courses” that allow students to meet academic course requirements by taking classes that carefully merge academic standards with career-oriented content. Two courses—computer aided drafting/geometry and construction geometry—are structured so they cover all 23 state standards for geometry. Other courses, such as nutritional and food science and business economics, offer credits toward the state’s life science and economics requirements.²²



“Career and technical education is fundamental to our efforts to improve academic achievement at all levels so our nation remains competitive in the face of a rapidly changing global economy.”

—REP. BUCK MCKEON, CALIFORNIA

In Washington state, the legislature recently approved a bill that would require each school district to adopt academic course equivalencies for CTE courses, for whole or partial credit, that would help students meet state graduation requirements.²³ The state recognized that students in intensive and rigorous CTE programs gain critical academic skills, and should be recognized as such.

In New York, students have the flexibility to enroll in specialized courses that combine academic and career and technical skills and content. These courses must be submitted through a program approval process, and jointly planned and/or delivered by academic and CTE teachers. Courses fulfill both an academic credit and credit toward a recognized CTE sequence if students pass the appropriate Regents exams and technical skill assessments. Examples include business economics, avionics, environmental science, and anatomy and physiology.²⁴

Through the integration of traditional academic and technical skills, CTE programs can serve to greatly enhance students’ exposure to and mastery of important math, science and literacy skills. As the international PISA results showed, American students must not only increase their math and science knowledge, but be able to apply this knowledge to the world around them. By teaching core academic content in the context of careers, students gain the essential skills that will help them achieve success in their futures.

3. MEET AMERICA’S WORKFORCE NEEDS

Over the past decades, CTE has evolved with the economy to focus on high skill careers in high demand and high growth industries. CTE programs help prepare students for all 20 of the fastest growing occupations identified in the U.S. Department of Labor’s 2006–2007 Occupational Outlook Handbook,²⁵ and in all 14 job sectors identified by the Department of Labor’s High Growth Job Training Initiative.²⁶ According to the 2004 National Assessment of

Vocational Education, employment growth in occupations requiring a vocational associate degree is projected to be more than double overall employment growth through 2008.²⁷



Occupations Expected to Grow the Fastest, Corresponding Career Cluster, 2004–2014

Home health aides	Health Science
Network systems and data communications analysts	Information Technology
Medical assistants	Health Science
Physician assistants	Health Science
Computer software engineers, applications	Information Technology
Physical therapist assistants	Health Science
Dental hygienists	Health Science
Computer software engineers, systems software	Information Technology
Dental assistants	Health Science
Personal and home care aides	Human Services
Network and computer systems administrators	Information Technology
Database administrators	Information Technology
Physical therapists	Health Science
Forensic science technicians	Law, Public Safety & Security
Veterinary technologists and technicians	Agriculture, Food & Natural Resources/ Health Science
Diagnostic medial sonographers	Health Science
Physical therapist aides	Health Science
Occupational therapist assistants	Health Science
Medical Scientists, except epidemiologists	Health Science
Occupational therapists	Health Science

New courses in areas such as biotechnology, DNA forensics, robotics, turf management, engineering and aquaculture help expose students to career opportunities that did not even exist for previous generations. These programs can help attract students to careers where their interests and talents are critically needed. For example, in the late 1990s, a new pre-engineering program called Project Lead the Way (PLTW) was introduced to form partnerships among public schools, higher education institutions and the private sector to increase the quantity and quality of engineers and engineering technologists graduating from

the education system. PLTW is now offered in more than 45 states and the District of Columbia, and continues to expand its programs and course offerings to middle school and high school students.²⁸

CTE programs are engaging students in projects that will shape the future of innovation and productivity in the American economy. Examining alternative energy sources, learning how to maintain vegetation in varied climates, growing cell tissue cultures and working with stem cells, maintaining water quality, designing computer programs and building robots are just a few of the activities students in CTE programs around the country are participating in as they hone their academic and technical skills and prepare to lead the country into the 21st century.



The Project Lead the Way Pre-engineering-Technology Program at Cleveland High School in Cleveland, Tenn., is a four-year sequence of courses that is designed to help students explore engineer-

ing-technology and bio-technology careers and to prepare successfully for two- or four-year college/university engineering-technology programs. Each course uses state-of-the-art technology and is taught in a laboratory environment that includes projects, lectures, guest speakers and field-trip activities. Students may earn college credit through special agreements with local and state colleges and universities. More than 200 students are enrolled in engineering courses at the school.

The program is a partner in a grant with the local community college to promote solar energy, and seniors compete annually in the Solar BikeRayce USA. In 2005, the team placed first in its division at the national level. Students must engage in highly technical research and experimentation during the completion of the entry vehicle.

4. MEET EMPLOYER NEEDS FOR HIGHLY SKILLED WORKERS

In addition to helping increase math, science and literacy skills, and meeting the needs of the economy as a whole for skilled workers, CTE programs provide students with the employability and technical skills that individual employers need most.

In its 2005 Skills Gap report, the NAM reported that nearly half of survey respondents indicated their current employees have inadequate basic employability skills, such as attendance, timeliness and work ethic, while 46 percent reported inadequate problem-solving skills.²⁹ The National Association of State Workforce Board Chairs also suggests

that the education and workforce development systems must focus substantial effort on developing strong employability foundation skills, including problem solving and teamwork.³⁰ By exposing students to workplace skills through project-based learning, internships, school-based enterprises, and career and technical student organization activities, these “employability” skills become part of the overall CTE curriculum.

CTE programs are also linked directly to the technical skills that employers require. By working directly with business and industry, and offering students at the secondary and postsecondary level the opportunity to gain industry-based certifications in computer science, automotive technology, health care and other high demand areas, CTE programs provide a benefit to students and their future employers. Clare Dolan, vice president, Oracle Education Initiatives, says, “By partnering with Oracle, the world’s leader in business and information software, schools ensure that students graduate with the IT skills necessary for 21st century employment.”

Especially at the postsecondary level, CTE programs have the added ability of being able to quickly adapt to meet the changing needs of employers in local communities. According to Erin Riehle, director of Project Search at Cincinnati Children’s Hospital Medical Center, this is extremely important. “For Children’s, the real positive about working with CTE programs is that Great Oaks Institute of Technology and Career Development can be flexible and respond to our requests. We took them our ideas, and within a couple of months, we had a program to train adults to meet our needs for skilled employees.”

In Austin, Texas, there are almost 1,000 unfilled positions for semiconductor technicians and skilled operators. In response to the need for a large number of new semiconductor technicians, Austin Community College has partnered with local semiconductor manufacturing companies to create the top ranked two-year semiconductor manufacturing program in the nation. This program leads to a certificate or Associate in Applied Science degree in electronic technology, and directly to a job in the industry. It was designed locally in partnership with AMD, Applied Materials, Motorola, SEMATECH and Texas Instruments, but is recognized throughout the U.S.³¹ Programs like this one exist all around the country to meet the needs of employers in individual communities.



A new educational program at A.W. Beattie Career Center in Allison Park, Pa., offers high school students a career pathway into robotics to meet increasing demands of the state's world-class robotics, cyber-security and digital technologies industries. This partnership will offer seamless transitions from a high school robotics program to associate and baccalaureate degree programs at the California University of Pennsylvania, with guidance and support from Carnegie Mellon University and local industry to meet the growing technician and technologist needs of the region's robotics companies.

The new program will train students to use, manufacture, evaluate and repair commercial and military robots. Students who successfully complete the program will receive 15 credits of advanced placement into an engineering technology associate degree program at California University.

The partners received a \$200,000 grant from the Pennsylvania Department of Community and Economic Development Workforce Leadership program to support this effort. "Our goal is to open doors for our students to follow a career path that would lead to work in the robotics field," said Kathryn E. Bamberger, director, A.W. Beattie Career Center. "Because this program will work to meet training needs for robots used in civilian markets and by the armed forces, which is indeed a noble goal, we are committed to working with California University to produce the most highly skilled robotics workforce in the country."

Conclusion

Substantial increased investment in CTE will play an integral role in strengthening the American economy. By increasing student engagement, helping students apply core academic skills, and meeting employer needs, CTE programs can generate the knowledge and innovation that will spark economic growth.

Students must be exposed to future career opportunities during their formal education, and it is critical to get students interested in STEM-related occupations early in their educational careers. Even in areas that are not traditionally considered STEM fields, all jobs in the 21st century will require increasing levels of technical knowledge. CTE programs can provide this exposure to technical skills to all students, regardless of their future career goals.

High-quality CTE 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.

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