NGA Center for BEST PRACTICES

Issue Brief

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Retooling Career Technical Education

Executive Summary

Career technical education (CTE) rests at the nexus of governors' efforts to improve their states' K–16 education system and develop an economy supportive of innovation.

Traditional CTE programs, such as carpentry, which emphasized employment in a specific trade, are evolving into programs that now educate students for a range of careers in the broader construction industry. New CTE 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. Today, more than half the students who choose to concentrate in CTE also take a college preparatory curriculum.

Despite CTE's past reputation as a less-demanding track, research proves that career technical education engages and motivates students by offering them real-world learning opportunities, leading to lower dropout rates and greater earnings for high school graduates. When CTE courses also incorporate more academic rigor, research shows that student achievement significantly increases. These findings suggest that CTE should be an important aspect of a state's broader high school redesign strategy.

A handful of states have already begun to incorporate CTE into their high school reform and economic competitiveness efforts, making learning both more challenging and relevant to students' interests. The following plan can help governors accelerate this trend by reorienting state CTE programs to reflect more demanding academic expectations:

- Connect education to economic growth industries.
- Use the bully pulpit to promote CTE.
- Include the skills employers demand in state standards, assessment, and accountability systems.
- Base CTE curricula around state standards.
- Improve the quality of CTE teaching.
- Design quality-control measures to promote more rigorous programs.
- Require high school students to declare a course of study.
- Eliminate duplicated coursework between high school and postsecondary systems.

By providing the leadership to strengthen state policies and improve coordination across agencies and systems, governors can improve the outcomes for both high school students and the workforce. Those states that undertake this strategic approach to retooling CTE programs can expect more engaged and persistent graduates who have added earning potential and are better prepared to enter high-wage/high-skill occupations.

The Unfinished Work of High School Reform

At the 2005 National Education Summit on High Schools, Microsoft Chairman Bill Gates challenged governors to redesign the nation's obsolete high schools. He noted that the United States has one of the highest high school dropout rates in the industrialized world and has a stagnant college completion rate. Seventy percent of students who drop out of high school say they would have finished if their classes had given them more interesting, real-world learning opportunities.[1] One third of students who do go to college must take remedial classes.

After the summit, governors took action. Following the recommendations put forth by NGA and Achieve, Inc., in *An Action Agenda for Improving America's High Schools*,[2] governors in more than half the states increased graduation requirements by demanding students take a more rigorous course of study. Numerous states also enacted policies to increase rigor by aligning high school standards to college expectations and expanding high school students' access to college-level courses through Advanced Placement courses and dual enrollment programs. The changes were often dramatic. Two years ago, for example, only **Arkansas** and **Texas** required all students to take Algebra II to graduate. Now, 13 states do so[3]. Signs of progress abound, but the problems are deep seated and will not be fixed over night.

Increasing academic rigor is a necessary and worthwhile response to redesigning obsolete high school structures. And yet this focus on rigor only represents half the equation. Policymakers also must design strategies that make learning interesting and relevant to today's students.

Career technical education has the power to engage and motivate all students by giving them chances to learn in applied settings. The reach of CTE is well documented—in most states, half of all high school students enroll in at least one CTE course, and 25 percent to 40 percent complete the three or four courses that comprise a typical program of study.

Although CTE has always brought relevance to the high school curriculum, it struggles to provide sufficient rigor. In the latest report of 12th-grade mathematics scores, two-thirds of CTE concentrators scored below basic on the National Assessment of Education Progress (NAEP). Historically, these types of challenges have led reformers to view CTE as a second-tier track that offers students few options and little preparation for the future.

However, there are examples that show applied learning does not always come at the expense of academic rigor. In **Maryland**—a pioneer in developing a new vision for CTE—51 percent of CTE concentrators now meet the state university system's entrance requirements, up from 14 percent a decade earlier. Maryland's example shows that CTE, when at its best, can help high schools draw on the advantages of applied learning while equipping students to meet college and career expectations.

The New CTE: Preparing Students for College and Careers

Career technical education, formerly known as vocational education, emerged in the 1920s as America transitioned from an agriculture-based economy into a manufacturing economy. The new science of measuring IQ also advanced the notion that intelligence was innate: Some students were tracked into manual-labor trades while others followed an academic curriculum and entered managerial careers. Despite efforts to reform vocational education, with programs such as School-to-Work and Tech Prep, it continued to be perceived as a set of less-demanding classes taken by students who were not interested or able to go to college.

In the last two decades, the source of a state's competitive advantage has become rooted in its workforce's ability to apply knowledge globally. High-wage/low-skill manufacturing jobs have moved abroad, and technological innovations are incorporated into every facet of the workplace. In this new economy, all workers need to have a good formal education, be able to apply theoretical and analytical knowledge, and have the capacity to engage in continuous learning.[4] A strong vocational education system is again critical to a state's economic success, but it remains

saddled by a second-class image. To combat this perception, leaders have changed the name to career technical education.

This name change has been anything but cosmetic. It signals the need to couple a rigorous academic platform with elective CTE courses that help students apply their knowledge. The new CTE is responsive to the demands of the innovation economy and grounded in the belief that the skills and abilities students need to succeed in college *and* careers are virtually identical.[5] High school students now face multiple paths of study—some will follow a purely academic track, whereas others may choose a more applied course of study. Regardless, both pathways should help students develop the same set of knowledge and skills reflected in state standards.

Under CTE, traditional vocational programs such as carpentry have been transformed into a construction and development "career cluster." In this cluster, students are introduced to the major functions of the industry— planning projects, using automated design tools, constructing physical structures, and performing maintenance and operations. Students see sample career options within construction and development and the various levels of postsecondary education these industries require. Students learn skills such as risk management and marketing that are transferable across other career clusters.

Each career cluster encompasses a broad group of related courses within an occupational interest area. Students can then choose to concentrate on one of several programs of study, which link what they learn in high school with the knowledge and skills they need in college and the workplace. For example, the finance career cluster developed by the National Academy Foundation contains four programs of study: financial planning, business management, banking, and insurance services.

Often, a state can bundle a program of study's curriculum, assessments, and professional development into one package. In **Maryland**, for example, students in the finance and accounting program of study also must complete four years of college-preparatory math and take end-of-course exams in these subjects. Relevant private sector industries provide teachers with state-of-the-art materials and syllabi and train them before they teach the course.

Figure 1: Tennessee, Sample Business Management Program of Study (9-14)

Grade	English	Math	Science	Social Studies	CTE Courses
9	English 1	Algebra I	Physical Science	American Government	
10	English 2	Geometry	Biology	World History	Spreadsheet Applications
11	English 3	Algebra II	Chemistry	US History	Principles of Business & Financial Planning
12	Composition/ Journalism		Environmental Science	Sociology	American Business Legal Systems Business Marketing
1st Year College	ENGL 1010: English Composition SPE 2311: Fund. of Speech	ACC 101: Principles of Accounting MATH 1530: Probability & Statistics		MGMT 101: Intro to Management MGMT 213: Small Business Management ECON 201: Macroeconomics	MIS 160: Excel Spreadsheet Applications MKT 101: Marketing
2nd Year College	MGT 102: Human Relations	ACC 102: Principles of Accounting 2		ECON 202: Microeconomics	FIN 101: Personal Finance BUS 201: Business Law

CTE programs of study now extend beyond high school, linking curriculum to industry certification or a community college degree, which helps students transition to postsecondary education and careers. Figure 1 shows an example of a business management program of study for CTE students in **Tennessee** that recommends a sequence of high school and college courses based upon a student's career interests and goals. Compared with traditional vocational education, these broader clusters may lack depth in specific job skills; however, students are now encouraged to understand both the broader industry and to explore more flexible career options, which typically includes postsecondary education.

Few realize that the largest source of federal funding in America's high schools—the Carl D. Perkins Career & Technical Improvement Act—directly supports CTE programs. The Act's recent reauthorization in 2006, known as Perkins IV, now offers states unprecedented latitude to align CTE with a broader set of high school redesign policies, programs, and funding. Each state must now define programs of study that lead to a degree or industry certification.

Moreover, the legislation strongly encourages states to develop programs in science, technology, engineering, and math (STEM) fields. Under Perkins IV, states are now held accountable for advancing both academic and technical achievement. The technical assessments should align to industry-recognized standards, where applicable. As is the case under the federal No Child Left Behind Act, states remain accountable for high school graduation rates.

The legislation also encourages Perkins IV funds to:

- Target dropout prevention and recovery efforts as well as serve adults in need of career training.
- Combine Tech Prep and Basic state grant funds.
- Link to comprehensive high school reform programs.
- Improve the instruction of CTE teachers and help them work with academic teachers to integrate their curricula.

Impact of Career Technical Education on Student Outcomes

Past research on the impact of CTE upon academic performance was not encouraging. When students took vocational courses that lacked academic elements, their academic achievement did not improve. This should not be surprising, as until recently, most CTE programs were not designed to teach academic skills.[6]

This trend is obviously changing. Several recent studies find that CTE has a positive impact upon high school graduation rates, labor market outcomes, and postsecondary enrollment. Students who take CTE courses are less likely to drop out, especially students who are most at risk for doing so. A review of the more recent research suggests that taking three CTE courses for every four academic courses will have the greatest impact, cutting the dropout rate for students taking these courses by up to four times more than for those students taking only academic courses.[7] Students who take at least three CTE courses also earn 18 percent, or $212, more a month than comparable high school graduates after high school.[8] The National Assessment of Vocational Education found that higher proportions of CTE students are moving on to some form of postsecondary education or training.[9]

When students take a curriculum that integrates rigor and relevance, they perform better on standardized academic tests. Twelfth graders in the CTE-focused High Schools That Work program who took four years of math and applied technology courses outperformed the average student on the 12th-grade NAEP exam.

Research by the University of Minnesota also shows the powerful promise of integrating academic rigor into CTE courses. The typical auto shop teacher can teach students how piston displacement works in a car engine; however, he will likely be unable to teach the abstract mathematical formula to calculate the volume of a cylinder. In response, the "Math in CTE" experiment was created. This randomized trial involved 131 teachers and 3,000 students across

12 states and asked CTE and mathematics teachers to collaboratively develop lesson plans that integrated math content within the real-world context of CTE courses. The results were impressive. On average, CTE students scored 21 points higher on the TerraNova math exam, compared with those students in the randomized control group.[10] These findings show the advantage of integrated curricula. Students respond when they learn math as a tool to solve a workplace problem rather than merely as an abstract concept.

These research findings also lend support to the new paradigm. At its best, CTE programs that combine rigor and relevance are a promising high school redesign strategy. Today's high schools cannot continue viewing CTE courses as separate from the rest of the school; rather, these applied programs must be integrated into the broader curricular framework. To effectively capitalize on this promise, states must consider changes in public policy.

The Challenges that Remain

Although CTE programs are shifting away from an old voc-ed mentality to embrace the demands of the innovation economy, several challenges remain. Too often, state education and economic systems have few linkages, making the educational response to emerging growth industries slow or nonexistent. Deeply held ideological differences about student capabilities and expectations further delay needed reforms.

Even when reforms occur, state leaders still confront structural challenges. State assessment systems rarely measure the workplace and industry-specific skills that employers demand. These skills are largely absent from state education standards as well. As a result, CTE curricula typically fit poorly with state standards and assessments.

In addition, incoming CTE teachers face few academic or industry requirements. These teachers are eight times more likely than academic teachers to lack a bachelor's degree or specific subject knowledge.[11] Moreover, few, if any, professional development opportunities help teachers integrate academic knowledge with applied content.

Students also need help choosing a course of study to prepare them for the careers they want. Upon entering high school, students encounter a morass of bewildering choices for which they need guidance and support. This is especially the case for students interested in CTE programs of study.

Students need to know that what they study in high school has direct relevance to postsecondary coursework. Even upon graduation, students are often surprised to find their credits do not transfer to the local community college or university, leading them to retake similar courses. These challenges all point to several critical policy changes that are needed to retool and transform state CTE systems.

Policy Changes that Integrate CTE into High School Redesign

As education leaders in their states, governors possess many unique policy levers to accelerate the transformation of CTE. Wherever possible, governors and other policy leaders should consider using state P-16 councils—governance structures comprising both high school and postsecondary leaders—as the vehicle to accomplish this work. The following offers a starting place for retooling CTE programs.

Connect Education to Economic Growth Industries

*S*tate leaders should begin with a careful examination of the growth industries present in their state to ensure CTE programs of study accurately reflect emerging job opportunities. Several states have already undergone this process, using a set of career clusters identified by the National Association of State Directors of CTE as a guide.

Identifying these career clusters requires collaboration between multiple state agencies and private industry. In **Maryland**, for example, the departments of education, business, labor, and

the governor's workforce investment board joined together to select 10 career clusters that reflected high-growth areas of Maryland's economy. More than 350 employers designed and validated the new clusters that then became programs of study. In 1993, only 14 percent of CTE completers qualified for entry into the University of Maryland; following the state's educational review, 51 percent of the CTE completers did so in 2006.

The state of **Oklahoma** went one step further in its review by categorizing its growth industries as at-risk, new, and emerging; those that must be sustained statewide; and those that must be grown to benefit urban or rural communities. Regardless of approach, states should frequently examine their growth industries. A periodic review of career clusters and the development of programs of study in these clusters will ensure the CTE programs remain connected and responsive to a state's high-wage/high-skill industries.

Use the Bully Pulpit to Promote CTE

In speeches and other public gatherings, governors can promote CTE programs as one of the many pathways that prepare students for college and a high-paying career. Governors can bring new programs, such as Project Lead the Way, which may help a state eliminate its shortage of engineers and biomedical professionals.

Gubernatorial leadership can also counter and reshape the long-held notion that CTE is a terminal endpoint for less academically able students. Governors set a needed tone by demanding high expectations of all students, conveying that CTE benefits both college and work-bound students, and demanding that the new CTE embrace 21st-century realities.

In March 2007, **California** Governor Arnold Schwarzenegger hosted the state's first Career Technical Education Summit, which gathered education, business, labor, foundation, and political leaders to form strategies for CTE to help fill the need for qualified workers in fast-growing, high-demand fields. The governor noted that "to keep competitive, we must expand opportunities for high school and community college students to take academically rigorous courses *and* ensure that we are keeping pace with other forward-looking nations in career technical education." Governor Schwarzenegger's proposed 2007–08 budget includes $52 million in new funding to reform CTE instruction by:

- Expanding the number of available courses and ensuring that classes are designed to prepare students for emerging growth industries
- Eliminating coursework duplication between high school and community college requirements
- Increasing professional development opportunities for teachers and counselors
- Raising CTE's academic profile by increasing the number of high school courses that meet the course requirements for admission to California state universities.

More recently, governors in states as varied as **Indiana** and **Alaska** have echoed the call to retool CTE. Offering this crucial leadership also has encouraged business and industry to actively support improvements in state CTE programs.

Include the Skills Employers Demand in State Standards, Assessment, and Accountability Systems

States periodically review high school academic standards to gauge whether they reflect sufficient rigor. Too often, though, the standards are misaligned with college and workplace demands. Governors can, and should, encourage the state education agency to consult with industry and postsecondary leaders so academic standards better reflect workplace expectations. Often termed "soft" or "21st century," these skills include problem solving, critical thinking, and communications—abilities important for academic achievement as well as traits demanded by employers. In particular, the new CTE can play an important role in helping encourage students to develop important life skills.

Governors and other state leaders should consider broadening state standards and accountability systems to focus on both hard industry-specific skills and soft 21st century skills. All students are now measured against whether they meet state standards. At first glance, this suggests that state leaders should simply continue measuring CTE student achievement using current state assessments. Indeed, this is an essential first step. However, CTE proponents maintain that current state standards and assessments fail to reflect both the 21st-century skills and industry-specific skills taught by CTE courses.

Recognizing that students often fail to develop life skills on their own, **Pennsylvania** explicitly integrated these skills into its core academic subjects. In late 2006, the state unveiled new academic standards for career education and work that begin in 3rd grade and extend through 11th grade. These standards help students develop skills as varied as personal attitudes, work habits, and conflict resolution.

The goal of this activity should be to offer multiple pathways that allow students to achieve clear standards at each grade level. Leading states such as **New York** are encouraging schools and districts to make CTE more academically rigorous by allowing students to receive half an academic credit and half a CTE credit for one course.

Kentucky has taken this approach one step further by developing 10 interdisciplinary courses that merge the CTE content into state academic standards. This means, for example, that computer-aided drafting/geometry and construction geometry courses now cover all 23 state geometry standards.[12] In **Tennessee**, students in these construction geometry courses now outperform students in regular geometry on the state's math test.

Still, this integration is largely one way. It encourages CTE courses to inject academic rigor but fails to make academic classes such as Algebra II more relevant to the lives of students. A true integration effort will not only result in state standards that strengthen CTE programs but also reflect the applied learning value of career technical education.

State assessments systems can help gauge whether this integration or rigor and relevance has occurred. One starting place for those states interested in measuring 21st-century skills is Assess21. This online database contains a broad range of assessments that measure various 21st-century skills such as problem solving skills, civic literacy, and information-technology savvy. States can search this repository by content area, assessment format, grade level, and delivery method to find the assessment tool that fits their needs.

Project Lead the Way: An Example of the New CTE

In 1997, Project Lead the Way (PLTW) was created to address the nation's shortage of science, technology, engineering and math (STEM) professionals. Today, there are 1,700 PLTW schools in 46 states. **Indiana** alone has 336 schools that feature PLTW. Research shows that PLTW students are more likely to persist in engineering and related fields in college. As of 2005, 80 percent of graduates went on to college; of these, 68 percent majored in engineering.

PLTW has designed a tightly aligned system of curricula, professional development, and assessments. All courses are project- and problem-based learning experiences, where students apply math and science to real-life engineering situations. After taking foundation courses in the 9th and 10th grades, students move into specialized courses such as civil engineering and architecture in the 11th and 12th grades while completing a full sequence of math and science courses.

Each course offers entire curriculum units built upon national math, science, and technology standards. Teachers must become certified during a two- week summer workshop at an affiliated university before teaching the program.

Project Lead the Way also has developed a series of standardized end-of-course examinations that can result in early college credit. Other PLTW programs exist in aerospace engineering programs of study and will soon include a new program of study in biomedical sciences.

Other assessment tools can measure CTE students' skills within specific industries. Some CTE programs, such as Project Lead the Way, already include specific end-of-course exams that measure mastery of pre-engineering course content. Other CTE programs take a different tack and lead to a recognized industry certification. **Connecticut**, for example, assesses the impact of the trade-technology programs in its technical high schools by using an occupational competency assessment developed by the National Occupational Competency Testing Institute.

Still other assessments seek to measure the skills required of students in a particular field. Students in various graphic arts specialties can be assessed using the National Council for Skills Standards in Graphic Communications, an industry-specific exam that lets students gauge their level of skill and that industry managers use for credentialing or job placement.

What is tested does matter. Standards and assessments offer policymakers important tools to prove the value of CTE programs in today's economy while they encourage the programs to become more academically rigorous.

Base CTE Curricula around State Standards

The next step to strengthen actual CTE programs is to develop curricula around state standards. In **Arizona,** for example, CTE teachers have developed curricula based upon the state's high school math and science content standards. The results are impressive—**Arizona** students who took two or more CTE courses outperformed the general high school population on the reading, writing, and math portions of the state's 2004 high school graduation tests.[13]

States can encourage this development. As a state participating in the American Diploma Project, **Michigan** has developed new graduation requirements and curricula standards called the Michigan Merit Core. To complement this effort, state leaders have asked specialists in CTE and academic content areas to collaboratively develop instructional units in CTE courses that mirror the new academic content expectations. Soon, for example, **Michigan** students enrolled in a CTE marketing program can expect to read a series of core texts that also will meet state English standards.

As **Michigan** has shown, developing rigorous standards is merely a beginning. Curriculum drives content, and states need to design curricula and course sequences for each program of study. A state that offers finance as an important career cluster also must denote the sequence of courses—spanning both high school and at least two years of college—and demonstrate alignment with state standards. The state must then develop model curricula to help ensure students meet the standards.

In clusters such as finance, pre-engineering, and biomedical science, various national initiatives such as Project Lead the Way have already completed this integration work. Other clusters, though, will likely demand that state leaders develop similar packages on their own or in collaboration with other states. Often, industry can aid states in this process. Experiences such as Project Lead the Way show that teachers will embrace externally developed curricula if they think they are high-quality programs.

A more ambitious response, called ConnectEd, is underway in **California**. At the California Center for College and Career, this effort is dramatically transforming core academic curriculum using the best of CTE teaching. ConnectEd staff are pioneering groundbreaking school programs such as biomedical and health sciences, engineering, advanced manufacturing, law and government, and hospitality and tourism. These career paths meet admission requirements to both the University of California and the California State University systems. "We can prepare young people for college and career," says ConnectEd's president, Gary Hoachlander; "it is not an either/or choice."[14]

Another process that states now use to encourage CTE teachers to integrate more academic rigor is the Surveys of Enacted Curriculum. Developed by the University of Wisconsin and the Council on Chief State School Officers, this highly reliable approach helps CTE teachers complete an online survey about their instruction and then offers charts and content maps that show the degree

of alignment between their instruction and state academic standards and assessments. As of the 2005-06 school year, almost 10,000 teachers across 18 states and school districts have completed surveys. This process also allows for a valid comparison of CTE teaching across districts and states.

Improve the Quality of CTE Teaching

States can improve the quality of CTE teaching by revising the teacher certification process, changing investments in professional development, and developing integrated curricula. The first step is to reduce the wide variation that exists in alternative certification programs by requiring all CTE teachers to have at least an associate's degree and/or to regularly update their industry certification. Currently, many CTE teachers come from industry and enter the classroom through alternative certification routes.[15] In their zeal to secure teachers who bring vital experience, states often hire CTE teachers who lack a bachelor's degree or test lower than those who plan to teach elementary school.[16]

Revising the teacher certification process will ensure that teachers know the knowledge and skills of their profession. This approach is particularly effective when paired with an induction program to support the next generation of teachers' entry into the profession.

Today's CTE programs ask teachers to know and merge academic content, industry-specific knowledge and experience, and effective instructional methods. For example, instructors of those students seeking to enter the automotive-repair field must not only convey the technical expertise of the profession but also help the students develop strong math and reading skills and computer proficiency. This is clearly a challenging skill set. Closing the loophole that allows non-degreed teachers into CTE classrooms will help strengthen the instruction that students in CTE courses receive.

To truly integrate academic content and applied learning, however, states need to change how they invest in teacher professional development. On the one hand, academic teachers are seldom able to explain how course content is used in the real world. Technical teachers, on the other hand, often lack the ability to do such things as enhance a health science lesson with biology and chemistry content. **Maine** is trying to change this by combining professional development sessions for CTE and academic math teachers. The Math-in-CTE study also proves that integrating academic content and applied learning can lead to impressive academic benefits *if* integrated curricula exist and ongoing training is offered.

Design Quality Control Measures to Promote Rigorous Programs

For CTE to serve as a viable high school reform strategy, state leaders must weed out weaker programs and promote rigorous programs. Three types of mechanisms have been used to control quality: offering financial incentives, using an approval process, or focusing on student credit.

Maryland offers an example of the power of the purse. After developing criteria for a high-quality CTE program, the state redirected all Perkins Tech Prep funds to only support those programs with goals that mirrored the high school redesign goal of increasing academic achievement, high school graduation rates, and postsecondary completion rates. **Pennsylvania** embraced a similar approach by developing an innovation fund that awards additional funds to school districts that develop rigorous CTE courses. Similarly, **Indiana** has recently shifted Perkins funds to specifically promote science, technology, engineering, and math programs such as Project Lead the Way and FIRST Robotics at the middle and high school level.

Other approaches use external approval to determine funding. Programs hoping to receive CTE funds in **Vermont,** for example**,** must either result in industry certification; meet industry-approved standards for curriculum, facilities, and instruction; or offer dual credit from a higher-education partner.

A dual quality-control strategy to address both the demand and supply side is underway in the state of **New York**. On the demand side, students in courses that combine academic and CTE

content can now be granted dual credit in both areas (e.g., English and marketing) once they have passed both the state Regents exam and a technical skill assessment. On the supply side, these courses must be jointly planned and delivered by both academic and CTE teachers. To ensure course quality, the program must be approved by one of the state's 38 regional education offices.

Regardless of chosen approach, states should carefully consider deploying a strategy that encourages CTE programs to reorient around high-wage/high-skill industries. If successful, states will soon have a variety of high-quality options for students to pursue. Of course, this success comes with its own challenges.

Require High School Students to Declare a Course of Study

In today's high schools, students are presented with myriad pathways to graduation. Governors and other state leaders should consider employing state policy to help students focus on a course of study. These policies range from requiring students to declare majors upon entering high school to using technology to explore education and career options. Given that many states have recently eliminated the college prep and vocational tracks, the same high expectations now apply to all students. Without formal help to chart a preferred course through high school, students are often overwhelmed by the many choices, which can result in poor decisions and planning.

Following a gubernatorial-level review of **South Carolina's** high school system, the state enacted a new policy that requires freshmen to choose a "career major" with the help of a guidance counselor. Students map out an academic and career-oriented course sequence over four years. The state plans to add more than 400 career counselors to support this activity. Other states have chosen a more flexible approach.

Eighth graders in **North Carolina** select from among four courses of study—Advanced Placement/International Baccalaureate, Arts, Career Technical Education, or Second Language—prior to entering high school. Beginning in 2008–09, students will have to complete 21 units for graduation. Students are not locked into one course of study but rather are encouraged to combine courses across several of them. Should their interests or postsecondary aspirations change, they can transfer across courses of study.

Technology can enable student choices. Both **Louisiana** and **Delaware** have developed individualized electronic plans to help entering ninth grade students navigate their way through the many educational and career choices in high school. Like South Carolina, the state of **Florida** also requires all ninth graders to select a major. However, the state has turned to an online advising system to support these student choices. Majors include both traditional subjects such as English as well as more career-oriented studies such as nursing. Students must earn 16 core academic credits and 8 elective credits.

Policy can aid and guide students through a career exploration process, helping to connect their interests to the academic curriculum. Even upon graduation, though, students are often surprised to find their credits do not transfer to the local community college or university, leading them to retake similar courses.

Eliminate Duplicated Coursework between High School and Postsecondary Systems

The new CTE programs strongly encourage students to attend a postsecondary institution by linking high school programs with those at the community college level. This linkage is logical, as states increasingly turn toward community colleges to generate a competitive workforce. State leaders can, and should, aid student transitions by creating articulation agreements between high schools and two- and four-year colleges that eliminate duplicative coursework between these education systems.

Once students enter the postsecondary systems, their course credits may fail to transfer. To minimize student confusion and frustration, states should assign common course numbers across all two- and four-year campuses and require that certain courses transfer to bachelor's degree programs.[17] For the first time, **Minnesota** leaders now require their high school and community

college CTE programs to jointly develop plans of action. Their hope is this effort will lead to policies that ease the transition of students across institutions.

Economic demand is a similarly effective driver. The economies of **Arizona** and **Texas** are desperate for workers certified in the semiconductor industry. In response, the state of Arizona has created a nationally recognized advanced technology program at Maricopa Community College that serves as a regional hub for preparing workers in the semiconductor industry.[18] Texas now has more than a thousand unfilled positions for semiconductor technicians. Through a partnership with Advanced Micro Devices, Texas Instruments, and other employers, Austin Community College has created a semiconductor manufacturing program that leads to an industry certificate or an Associate Applied Science degree. Both programs rely upon a steady supply of high school students, many of whom take CTE courses in high school and expect their credits to remain intact upon transferring to community college.

Universities often worry that community college faculties have not properly prepared students. As a result, CTE students who eventually enroll in a four-year college are often forced to retake classes although they had mastered their content earlier. This expense is unnecessary in both time and cost. By asking postsecondary institutions to develop articulation agreements, state leaders can help students and institutions avoid these expenses.

Looking Ahead

Proponents of career and technical education face a stark choice: either adapt to the new 21st-century landscape or risk obsolescence. Various state improvement efforts are beginning to respond. A handful of forward-looking states have eliminated less-compelling CTE programs, and new CTE programs are emerging to take their place. For example, CISCO has created more than five thousand network academies that have trained and certified 750,000 North American students to work in the information technology industry. The CISCO academies prepare students to start working as IT network administrators, and provide a foundation for postsecondary study in engineering and computer science, thereby filling a state's pipeline with students ready to meet the demands of the 21st century.

Bill Gates famously declared today's high school "obsolete." At the heart of his critique was the belief that schools were designed for an earlier era that accepted the lack of academic rigor and relevant learning experiences. As states continue to grapple with high school redesign, they are well positioned to reorient CTE programs into a valuable reform strategy.

The danger is that too many CTE programs remain unequal and inequitable. In the same vein, there is a similar risk that college prep curricula continue to lack real-world authenticity and meaning. Those states that undertake a strategic approach to retooling CTE programs can expect more engaged and persistent graduates who have added earning potential and are better prepared to enter high-wage/high-skill occupations.

Resources

Math curriculum: states looking for technical assistance on how to teach math skills in the context of CTE classes can turn to the National Research Center for Career Technical Education.

Assessment: Assess21is a database that contains a variety of assessment tools used to measure 21st-century skills.

State CTE Profiles: an in-depth examination of information and statistics about different state's career and technical education systems.

Federal Legislation: a detailed side-by-side comparison of the 1998 Perkins III and 2006 Perkins IV legislative language.

Best Practices and Programs: this site, developed by the Association for Career Technical Educators, highlights career and technical education programs in community colleges, high schools, and career centers across the country that are providing outstanding education, superior technical skills, and innovative opportunities to their students.

Career Technical Education Statistics: This revamped site from the National Center for Education Statistics now features new data sets, course offerings, and student outcomes.

Surveys of Enacted Curriculum: CTE teachers complete an online survey about their instruction and then receive charts and content maps that show the degree of alignment between current CTE instruction and state academic standards and assessments.

Career Clusters: This strategy helps group occupations and industries based upon commonalities. A total of 16 clusters have been identified and serve as an organizational framework for schools, districts, and states.

Endnotes

[1] John M. Bridgeland, John DiIulio, and Karen Burke Morison, *The Silent Epidemic: Perspectives of High School Dropouts*, A report by Civic Enterprises in association with the Peter D. Hart Research Associates (Washington, DC: March 2006).

[2] National Governors Association and Achieve, Inc., *An Action Agenda for Improving America's High Schools* (Washington, D.C.: 2005).

[3] Achieve Inc., *Closing the Expectations Gap 2007*. (Washington, DC: April 2007.)

[4] Peter Drucker, "The Age of Social Transformation," *Atlantic Monthly* (November 1994).

[5] ACT, *Ready for College and Ready for Work: Same or Different?* (Iowa City, Iowa: ACT, 2006).

[6] Betsy Brand, "What a 21st Century Career and Technical System Could Look Like," in *Remaking Career and Technical Education for the 21st Century*, ed. R. Kazis (Boston, MA: Jobs for the Future, 2005).

[7] Michael E. Wonacott, "Dropouts and Career and Technical Education," in *Myths and Realities*, ERIC Clearinghouse on Adult, Career, Vocational Education (Columbus, OH: Center on Education and Training for Employment, 2002).

[8]. James Kemple, *Career Academies: Impacts on Labor Market Outcomes & Educational Attainment* (New York: MDRC, 2004).

[9] Marsha Silverberg, et al., *National Assessment of Vocational Education: Final Report to Congress* (Washington, D.C.: U.S. Department of Education, Policy and Program Studies Service, June 2004).

[10] James R. Stone III, et al., *Building Academic Skills in Context: Testing the Value of Enhanced Math Learning in CTE* (Minneapolis, MN: University of Minnesota National Research Center for Career and Technical Education, July 2006).

[11] National Center for Education Statistics, *Vocational Education in the United States: Toward the Year 2000* (Washington, DC: National Center for Education Statistics, February 2000).

[12] Association for Career and Technical Education, *Issue Brief: Career and Technical Education's Role in American Competitiveness*, 2006.

[13] Ibid.

[14] "Blending Academic and Real-World Learning: An Interview with Gary Hoachlander," *IQ: Irving Quarterly* vol. 6, no.1 (Summer 2006).

[15] Teacher Development in CTE, "Fast Facts in Policy and Practice," *Issue Brief*, no. 21 (Minneapolis, MN: Career Technical Education National Dissemination Center , 2003).

[16] Silverberg, Marsha, et al., *National Assessment of Vocational Education: Final Report to Congress* (Washington, D.C.: U.S. Department of Education, Office of the Undersecretary, 2004).

[17] Katherine L. Hughes and Melinda Mechur Karp, *Strengthening Transitions by Encouraging Career Pathways: A Look at State Policies and Practices*, Brief No. 30 (New York, NY*:* Community College Research Center, February 2006).

[18] Madeline Patton, ed., *ATE Centers Impact: 2006-2007* (Tempe, AZ: Maricopa Community College, 2006).