Policy Brief

High School – Graduation Requirements

Education Commission of the States • 700 Broadway, Suite 810 • Denver, CO 80203-3442 • 303.299.3600 • Fax: 303.296.8332 • www.ecs.org

Dispelling the Myths About the Negative Effects of Raising High School Graduation Requirements

By Jennifer Dounay

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Introduction

In the last several years, a number of states have raised high school graduation requirements, particularly in mathematics and science, in an effort to:

- **Improve student achievement at the high school level**.
- **Address postsecondary institutions' and employers' complaints** that high school graduates are inadequately prepared for life after high school graduation.
- **Respond to research on the link between high school curriculum and baccalaureate attainment**. The Answers in the Tool Box and The Toolbox Revisited studies by Cliff Adelman suggest that the high school curriculum is the best pre-collegiate indicator of a student's likelihood of completing a four-year degree within six to eight years of high school graduation.[1],[2]
- **Respond to recent surveys of high school graduates and dropouts**. High school graduates and high school dropouts report they were not challenged in high school, and would have worked harder had more been expected of them.
- **More closely align high school exit requirements and college entry requirements**. Findings of the Bridge Project at Stanford University indicate that many students — especially traditionally underserved students — and their parents are unaware of college entrance course requirements.

The negative impacts of raising high school graduation requirements are often raised by well-intentioned individuals as counter arguments to discussions in favor of raising students' course requirements; however these counter arguments are often based on misperceptions, or "myths." While the purpose of this policy brief is not to stifle public debate, it should be noted that when arguments are not backed by research and state and local experience, no one is well served —not students, their families, postsecondary institutions or employers. Taxpayers who help cover the costs of postsecondary remediation also are not well served, nor communities, states and regions who are unable to drive economic development due to an inadequate supply of well-trained high school and college graduates.

This policy brief presents the potential consequences commonly raised by critics of increased high school graduation requirements:

- #1: If we raise requirements, more students will drop out
- #2: We don't have teachers to teach these courses
- #3: Additional course requirements are an unfunded mandate
- #4: Increasing course requirements will push out the arts, foreign language, and other "non-core" disciplines
- #5 Career/technical education will be sidelined
- #6: Not everybody needs to go to college
- #7: Most students don't need to take four years of math — or advanced math — or lab science

Each "myth" is followed by relevant research and/or experience, as well as guiding principles for best policy in establishing more challenging curricular expectations for all students.

Myth #1: If we raise requirements, more students will drop out

Critics of raising high school graduation requirements fear that significantly increasing the number of courses or difficulty level of courses all students must complete for high school graduation will drive students to drop out of school.

Caveats

Admittedly, up till now, no state has graduated a class for which the default high school curriculum was aligned with college admissions expectations–Texas will be the first state to do so, effective with the Class of 2008. Therefore, the extent of the impact on graduation rates will only become clear a few years from now — once a few cohorts have completed the more challenging requirements — and that's only if Texas does not change its methodology of calculating graduation rates between now and then.

Recent experience

At the district level, experience to date does not bear out the claim that an increase in graduation requirements results in an increase in dropout rates. Based on parental and community support, the school board of **San Jose**, **California** — a large ethnically and economically diverse district — moved in the 1990s to make the "A-G" curriculum the district's default high school curriculum, beginning with the graduating Class of 2002. The so-called "A-G curriculum," aligned with the course admissions requirements to the University of California (UC) and California State University (CSU) systems, includes:

- Four years of college preparatory English composition and literature
- Three years of mathematics (four years recommended), including Algebra I, geometry and Algebra II
- Two years of lab science (three years recommended by the UC system), including one biological science and one physical science
- Two years of history and social science, including one year of U.S. history (or one semester each of U.S. history and civics or American government) and one year of social science (must be one year of world history for the UC system)
- Two years of the same foreign language (three years recommended by the UC system)
- One year of visual/performing arts
- One "college preparatory elective" (additional year of any subject from the above list).[3]

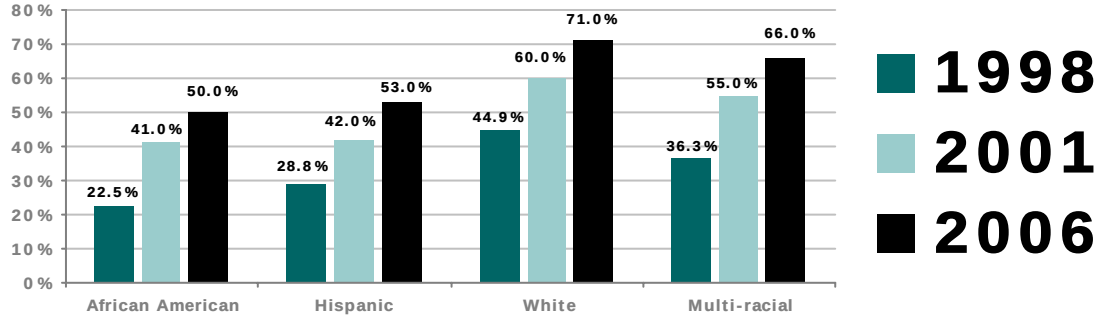
The district saw positive results once completion of the A-G curriculum became expected of all students, including:

- The high school graduation rate rose slightly, rather than fall, as critics had feared.
- The number of students taking Advanced Placement (AP) exams rose, as did the number of students scoring at least a "3" (the minimum score required by many colleges for students to be awarded AP credit).
- Scores on state reading and mathematics assessments rose at rates higher than the state average.
- The White/Latino achievement gap narrowed considerably, and pass rates for Latino students in A-G courses increased.
- Nearly two out of three San Jose district graduates met eligibility requirements to enroll in the CSU or UC system. Not only did they complete the requisite high school courses with a "C" or better, but they met the minimum grade point average threshold. Prior to the reform, about 40% of district students completed the A-G curriculum, and very few were traditionally underrepresented students.[4]

Based on the success of the efforts of San Jose Unified School District, the Los Angeles Unified School District has decided to make the A-G curriculum the default high school curriculum, effective with the Class of 2012. Furthermore, the Education Consortium of San Diego County held a forum in March 2008 to evaluate what districts in the county would need to do to successfully implement an "A-G for All" policy.[5]

At the state level, **Indiana** introduced the rigorous Core 40 diploma option in the 1993-1994 school year. Effective with the high school freshmen of the 2007-2008 school year (Class of 2011), all students will be required to complete the Core 40 curriculum and related end-of-course assessments. Though time will tell what the actual impact of the increased statewide graduation requirements will be, the results from the

first decade-plus of the curriculum's existence are encouraging. The number of students voluntarily selecting the Core 40 or academic honors diploma option has grown substantially – with the largest increases in Core 40 completers among African American and multiracial students, and significant gains among Hispanic students (see graph below). In the Class of 2006, 67% of Indiana graduates completed the Academic Honors or Core 40 diploma. The state has risen from 34th (in 1992) to 10th (in 2002) nationally in the number of high school graduates enrolled in college the following fall. Sixty-four percent of Core 40 graduates who are first-time full-time students earn four-year degree at a selective Indiana university within six years, as opposed to 47% of their peers who held a general high school diploma.



Source: PowerPoint, "Advancing College Preparation in Indiana," Indiana Commission for Higher Education, September 2007

Avoiding the pitfalls with essential policy components

Based on the research — and the positive results in San Jose Unified School District and Indiana — it appears likely that states that hold all students to a college/work-ready high school curriculum will see improved student outcomes, provided that supportive structures are in place. Such supportive structures would make sure that:

- **Middle grades curricula are adequately rigorous** to ensure students are ready for more advanced coursework when they enter high school. "Backmapping" of standards, curricula and assessments from grade 12 back to grade 6, and vertical team efforts between middle and high school content-area teachers can support this middle/high school alignment.
- **Teacher preparation and professional development programs** are at a level to ensure teacher capacity to teach to the higher expectations.
- State policy ensures the **early identification of high school students** (and middle grade students) falling behind, and requires students to participate in targeted remediation provided in a timely fashion.
- **Remediation offerings are evaluated** to ensure quality and consistency across schools and districts.
- **State policy provides alternatives**–such as proficiency-based credit opportunities–for students struggling to demonstrate competency in a traditional classroom setting.

States should also consider implementing measures to ensure that the content of "rigorous" courses meets commonly-held expectations. The 2006 ECS policy brief, "Ensuring Rigor in the High School Curriculum: What States Are Doing," provides further detail on several such state approaches.

Myth #2: We don't have teachers to teach these courses

Critics of increasing high school graduation requirements, particularly mathematics and science requirements, often put forward the argument that the state cannot provide an adequate supply of teachers in these subject areas to staff the additional classrooms needed.

Recent experience

The reality tends to fall into two categories: (1) Graduation requirements have had a limited impact on teacher recruitment/professional development demands — either because of a limited difference between the "old" and "new" requirements or because the state is already preparing an adequate supply of teachers; or (2) States are using creative means to ensure supply.

Changes don't always equate with "more"

In some states, the difference between the "old" and "new" graduation requirements is minimal, resulting in nominal staffing changes. The table below illustrates the course requirement changes in **Oklahoma**, which will make a "college preparatory/work ready curriculum" the default curriculum effective with the Class of 2010. Because the new policy requires that certain Carnegie units align with college admissions requirements, teachers need to be prepared to teach potentially higher-level knowledge and skills, but more of them are not necessarily needed.

Subject	Graduation requirements pre-Class of 2010	Graduation requirements effective Class of 2010
English	4 units, incl. 1 unit grammar and composition	4 units, incl. grammar, composition, literature or any course approved for college admission reqts.
Math	3 units, incl. Algebra I	3 units, limited to Algebra I or any course with content/rigor above Algebra I and approved for college admission reqts.
Science	3 units, incl. Biology I	3 units lab science, limited to biology, chemistry, physics or any lab science with content/rigor equal to or above biology and approved for college admission reqts.
Social Studies	3 units, incl. 1 unit U.S. history, .5 or 1 unit U.S. govt., .5 unit OK history	3 units, incl. 1 unit U.S. history, .5 unit U.S. government, .5 unit OK history, and 1 unit approved for college admission reqts.
Arts	2 units	1 unit fine arts or speech
Other	0	2 units foreign language or 2 units computer technology approved for college admission reqts.
Electives	8	1 unit chosen from English, math, lab science, social studies, foreign language, computer technology or career and technology education approved for college admission reqts., plus 6 units general electives
TOTAL	23 units	23 units

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Professional development can potentially trump recruitment

2006 **Michigan** legislation replaced the almost-entirely locally established graduation requirements with a rigorous default high school curriculum, the Michigan Merit Curriculum. Because Michigan's postsecondary institutions prepare an adequate supply of teachers for the state, the focus has been on aligning teacher preparation and professional development with the new statewide content expectations.

To better prepare pre-service educators to teach challenging content, the state department of education has crosswalked the new graduation requirements with teacher preparation requirements. As content expectations have evolved, these have been shared immediately with teacher preparation institutions, so that courses and certification exams can be adjusted accordingly. The department actually involved representatives from colleges and universities, including teacher preparation programs, in the development of high school content expectations. This inclusive approach not only assisted in alignment, but helped develop buy-in from teacher preparation programs.

State, ISD and LEA professional development is addressing the need to equip teachers with deeper and differentiated instruction skills in teaching a broader population of Algebra II students, who demand real-world applications and need teachers to explain complex concepts in multiple ways. The Office of School Improvement and Office of Professional Preparation Services are coordinating teacher professional development throughout the state to meet these and other demands raised by the new graduation requirements.[7]

Increases in core requirements are often offset by reductions in electives

Many states are raising graduation requirements, but are not making drastic changes to the total number of courses students must complete. Instead, they are reducing the number of electives and increasing the number of required Carnegie units (i.e., increasing two units math to three, or three units science to four).

Getting creative

Staffing is often difficult in rural states — particularly for advanced coursework. **South Dakota**'s new default high school curriculum (effective with the Class of 2010) includes an Algebra I, geometry, Algebra II sequence, and three units of lab science including biology and chemistry or physics. Graduates in 2010 and beyond will have the option of completing a "distinguished" curriculum that requires a fourth unit each in math and science.

To meet the demand these increases pose, South Dakota is following a multitiered approach:

- **Using technology**. South Dakota is building capacity through a statewide online learning pilot program to begin in fall 2008. Funded by a $2 million National Math and Science Initiative grant, supported by ExxonMobil, the program will provide seven online Advanced Placement (AP) courses in English, science and math through the South Dakota Virtual School. Teachers selected to teach the courses will be chosen based on their success in integrating technology into instruction. And as an added bonus for student motivation to take challenging AP courses and do well on coursework and exams, students earning a "3" or higher on an exam will earn $100, as will the student's teacher.[8]
- **Starting prior to high school**. Students need to enter high school with the mathematics knowledge and skills they need to succeed in rigorous courses in math (and by extension, science). Through the South Dakota Counts program, the state is developing the capacity of K-5 teachers through a "train the trainer" approach. South Dakota Counts provides training for a Mathematics Teacher Leader at each elementary school in the state, who in turn will establish a model classroom as a learning model for fellow educators in the building. Building principals likewise attend training each year of the program in providing support for high-quality mathematics instruction. Additional supports are provided through the placement of a Mathematics Specialist at each of the seven Education Service Agencies (ESAs), plus an additional specialist for the Sioux Falls district.[9][10]

Arkansas, which will require all graduates to complete its rigorous "Smart Core" curriculum effective with the Class of 2010, is also using innovative approaches to ensure adequate and well-prepared teachers at the high school level.

- **Using professionals on a part-time basis**. The "Professional Teaching Permit" is but one example of a state alternative certification program to encourage professionals in non-teaching careers to teach part-time in their area of expertise (see the ECS Teacher Recruitment and Retention State Policy Database at http://www.tqsource.org/randr/policy/index.asp). The one-year permit allows a working or retired professional with a bachelor's degree plus three or more years work experience in a field to teach one to two classes per semester in that content area in grades 9-12. Candidates must pass the appropriate content test, be subject to a background check, and complete 40 hours of training in pedagogy during the first year of teaching.[11]
- **Promoting a licensure for 8th grade Algebra I teachers.** The state department has developed an additional "Algebra I Endorsement, Grade 8" teaching endorsement. Eligible teachers must have achieved at least a minimum score on the PRAXIS II Middle School Mathematics test, have been certified in Middle Childhood Math/Science (4-8) since 2002 or Middle Childhood Mathematics (5-8) before 2002, and must have completed a 15-hour program of study (not including the six semester hours for elementary/early childhood educators) that includes "content in numeration, computation, number theory and number sense, algebraic concepts, probability, data analysis, statistics, geometry, and concepts of advanced math and calculus."[12]
- **Sharing teachers across schools/districts.** The "Arkansas Traveling Teacher Program," created in 2007 and launched in the 2007-2008 school year, authorizes teachers of grades 9-12 to teach one or more courses in a receiving district. A "host" and "receiving" school district must serve under 8,000 students and sign an approved written agreement. Up to 45 traveling teachers may be active in any school year. Priority is given to agreements in which the receiving district is requesting services in a critical shortage area, and affected courses must count toward accreditation. Travel costs are reimbursed, and the traveling teacher earns a $2,000 bonus for teaching one semester or $4,000 for teaching two semesters. Legislation authorizes the department to establish an online registry of teachers willing to provide traveling teacher services, each teacher's employing school district, and any course the teacher is qualified to teach.[13]

North Dakota likewise enacted legislation in 2007 providing that (1) if a local board has a vacant position at the end of a school year and is unable to find a highly qualified candidate 45 days before the beginning of the new school year, (2) the board has notified the state superintendent of the vacancy, (3) "has done all things necessary and proper … to find a suitable and highly qualified candidate" and (4) "will be unable to meet the statutory requirements for school approval if the position remains unfilled," the state superintendent must authorize the board to increase compensation for the vacant position to a level the

board deems necessary to attract a highly qualified candidate. Compensation for an individual hired under these circumstances may not be reduced in future years.[14]

Online learning enhances access and expertise
According to the ECS Virtual High Schools database (last updated December 2007), 28 states had developed virtual high schools to provide broad access to high-quality, rigorous high school instruction across the state. **Alabama**'s ACCESS initiative provides not only online courses, but video conferencing technology, which will be available in all 371 high schools in the state by the beginning of the 2009-2010 school year.[15] **Michigan** is likewise seeing an increase in the number of students taking online courses for high school credit, both through districts, as well as through Michigan Virtual University. The Michigan Department of Education plans to post a list of providers of inexpensive or free online courses aligned with state standards, thus facilitating district access while ensuring quality. And according to anecdotal evidence in the state, many students are taking math and credit recovery courses online, thereby reducing teacher demand.[16]

Avoiding the pitfalls with essential policy components
To ensure that teacher recruitment and preparation programs provide the people and skills a rigorous high school curriculum demands, states should consider policies that:

- Calibrate certification exam cut scores (PRAXIS II or otherwise) with graduation requirements to indicate that candidates have a solid grasp of essential knowledge and skills
- Leverage high-quality virtual courses, particularly courses in hard-to-staff subject areas.
- Provide support lines to recredentialed or alternatively certified teachers who need assistance with pedagogy, classroom management and other essential issues.
- Accommodate a certain number of exceptions to the teacher salary schedule to fill hard-to-staff positions.
- Provide incentives for teachers to cover multiple schools or for schools to share multiple positions.
- Remove bureaucratic barriers to the teaching profession by reducing timelines and streamlining processes.
- Provide access to short-term, quality online tutoring to help teachers who barely miss meeting highly-qualified status get over the content proficiency hump.

Myth #3: Additional course requirements are an unfunded mandate

Critics frequently raise the concern that schools and districts do not receive additional allocations to cover the costs associated with making more units of particular courses available. As most policymakers know, any new mandate requires either a shift in existing resources, or an increase in resources. While most districts will be able to reallocate existing resources, some districts will be required to seek supplemental funding.

Recent experience
As noted by department of education staff in multiple states, the new high school graduation requirements generally maintain the same number of Carnegie units — and simply redesign which courses must fulfill those unit requirements — or raise the required courses by a marginal amount (by .5 or 1 Carnegie unit). As noted by Michigan Department of Education staff, when the statewide graduation requirements were approved in 2006, most districts were already requiring students to complete 24 Carnegie units. State legislators acknowledged that they had been providing foundation funding amount for every student in every district, and that how each district used that funding was up to them. With the enactment of the Michigan Merit Curriculum, they were still providing the foundation funding — the state was just specifying which courses had to fulfill those 24 units.

Policymakers also should realize that in many middle- and upper-income high schools, the majority of students are likely already taking the majority of the rigorous courses that will be required of all students. In these schools, in other words, it is a question of transferring a proportionately small number of seats in lower-level math and science courses, for example, to seats in upper-level math and science courses. The real challenge lies in those buildings — often serving poor and minority students — in which fewer sections of advanced math, advanced science (or other courses in the new graduation requirements) are made available.

Cliff Adelman, addressing the inequitable "opportunity-to-learn" among "[p]oor and working-class students, students from rural areas, and minority students," proposes dual enrollment as a potential solution: "Under dual enrollment, high school students who do not have access to trigonometry or physics or third year Spanish at the high school take those courses at the local community college and receive both high school and college credit for them. Direct provision can also fill curricular gaps at those high school districts willing to accept college faculty who provide the instruction on site."[17] Alternatively, a school might choose to reallocate existing resources by transferring staff assigned small higher-level courses (that are not included in the increased graduation requirements) to courses included in the increased graduation requirements, and making the higher-level course available through a dual enrollment agreement.

And it's important to remember that it isn't all about money. It is possible to do many atypical things when there is the belief that it is the right thing to do. For example, schools can stagger teacher schedules at the high school, so that they can offer a longer day for students who need it without a huge added cost.

Portable labs and shared lab space
Creative and cost-effective approaches such as portable labs and shared lab space can increase the number of lab science courses available, particularly in rural or small high schools and districts. In addition, an increasing number of states are making available–and students are flocking to–online courses through state-administered virtual high schools. Virtual high schools can offer far more students access to advanced courses than traditional brick-and-mortar classrooms can.[18]

Myth #4: Increasing course requirements will push out the arts, foreign language, and other "non-core" disciplines

The argument is often made that additional high school course requirements will force schools to reduce or eliminate offerings in the visual and performing arts, foreign languages, and/or other subjects not included in the more challenging graduation requirements. In fact, many states' increased high school graduation requirements are either approaching or in line with the course admissions requirements to four-year institutions in their states. In many cases, students must complete two or more credits of foreign language — and in some cases, credits in the arts — to apply to public four-year institutions.

Even in states that are implementing the most rigorous expectations, increasing math, science, English and social studies requirements need not exclude other student options. For example, by 2011 Indiana students must complete 4 English, 3 math, 3 science, 3 social studies and 1.5 units of physical education/health. With a total of 20 units required, that leaves 6 other units of coursework among which students can choose. And students could choose to exceed the 20 unit requirement, leaving even greater flexibility in including foreign language or arts courses. In fact, a number of states require a greater number of credits — ranging from 21 to 24. Also of note is the fact that many of the students keenly interested in the arts and foreign language will seek admission to a four-year postsecondary institution to continue their studies in those areas. Such students are placed at a disadvantage when they do not complete the high school courses required for admission to four-year institutions.

Avoiding the pitfalls with essential policy components

Policymakers should seriously consider evaluating their college/work-ready graduation requirements, and if these do not include the arts and/or foreign languages, reduce the number of electives required and replace with a commensurate number of units in these disciplines. By doing so, policymakers are helping ensure that (1) the increased graduation requirements are truly "college-ready" and aligned with four-year postsecondary admissions requirements and (2) students are guaranteed a well-rounded curriculum, including the academic, cognitive, and other benefits that are associated with studying the arts and foreign languages. Policymakers also should consider the potential for online learning as a way to expand the school day — so that students can participate in band, chorus, etc., and additional academic courses can be taken outside the school day and school year.

Myth #5: Career/technical education will be sidelined

In debates on increasing high school graduation requirements, two questions are often raised in regards to career/technical education (CTE):

- Won't increasing course requirements diminish or push out CTE offerings?
- Should students on the CTE track be forced to take these "academic" courses?

Recent experience

Graduation requirement policies in 21 states explicitly allow CTE courses to be substituted for traditional academic courses.[19] And in **Michigan**, as in a growing number of states, a high school student will be considered to have completed a Carnegie unit if the student successfully completes the department's subject area content expectations or guidelines. Michigan Department of Education staff note that permitting credit to be completed through a student's demonstration of proficiency has opened the opportunity for CTE and academic subject area teachers to be creative in how and when students can take various credits. For example, a math instructor may partner with an auto mechanics instructor to teach more students with available resources — adding the real-world learning that surveyed students demand/want.

Recent research

Not only can integrating academics and career/technical education make the most of existing human resources, but it can positively impact student achievement. A 2006 study by the National Research Study on Career and Technical Education reported on the positive impact of the "Math in CTE model," in which CTE teachers in five occupational areas (agriculture, auto technology, business/marketing, health, and information technology) teamed with math teachers to identify math concepts embedded in CTE curricula and to create "CTE instructional activities that would enhance the teaching of mathematics that already existed (but was previously not emphasized) in the CTE curriculum." In comparison to a control group of CTE students whose teachers did not change their CTE curricula, students of teachers in the Math in CTE model performed significantly better on the Accuplacer Elementary Algebra and TerraNova assessments (and slightly better on WorkKeys Applied Mathematics Math). Students in both groups performed equally well on occupational tests of their technical knowledge and skills.[20]

A 2001 analysis of NELS 88 data also supports a balance between academic and CTE coursetaking. The study found that "the risk of dropping out is estimated to be at its lowest near the point at which a student completes three Carnegie units of CTE for every four Carnegie units of academic subjects[,]" and that this outcome was "especially salient for individuals who are otherwise at risk of dropping out due to low prior grades, or low prior test scores, or other risk factors." Students with a greater ratio of CTE to academic courses were more likely to drop out. And while "academic concentrators" earned the highest scores on 1992 assessments, "dual concentrators" — students who completed at least three Carnegie units in any of 11 CTE areas, plus the academic concentrator curriculum — posted the second-highest performance, an outcome that the author suggests is owing to the fact that academic concentrators took more advanced courses that CTE students simply didn't have time to take, due to the CTE courses in their schedules. "CTE concentrators" — students who had completed three or more Carnegie units in one of the vocational areas but not the courses in the academic concentration — ranked fourth, after the students who had completed neither the academic nor the dual concentration. Dual concentrators were the second most likely group to hold a "purely or primarily student" status in 1993, their first year after high school graduation.

The author proposes, "If a middle-range mix of CTE and academic course-taking can lower the risk of dropping out for some students, educators and policymakers might be wise to encourage such a mix, even if it brings slight reductions in standardized test scores in core academic subjects. Given the importance of a high school diploma in our society, slight reductions in test scores might be found acceptable in exchange for higher graduation rates."[21]

Avoiding the pitfalls with essential policy components

Given these findings, state policymakers should consider policy approaches that:

- Ensure that CTE courses are included as an option in completing graduation requirements
- Provide content standards in reading, writing, math (and other academic courses as applicable) that can be integrated into CTE courses
- Allow students to demonstrate mastery of content standards through CTE courses in lieu of academic courses
- Provide professional development and other supports for CTE and core academic teachers to team teach – not only in math, but in other subject areas as well.

Myth #6: Not everybody needs to go to college

In states that have proposed a "college-ready" or "college/work-ready" curriculum for all students, the argument has been raised that not all students should be expected to complete a high-level curriculum, since not everybody needs to go to college, or in more blatant terms, "These kids aren't college material."

Caveats

Some observers worry that public two- and four-year postsecondary institutions at their current levels of funding would be unable to absorb the additional students if more academically prepared young people sought to finish college, and would be forced to ration seats in postsecondary programs. And similar questions exist with regard to workforce demand for more college graduates: Would inadequate workforce demand for college graduates force some degree-holders to take low-paying jobs, or will the approaching retirement of millions of baby boomers provide job openings for these additional workers with postsecondary credentials? Again, these questions have not yet been resolved.

Recent research

Research suggests that (1) State and local policies establishing lower expectations for some students or creating barriers (unintentional or otherwise) to rigorous coursework have negative outcomes for students; (2) Students (and their parents) need clear signals on which courses students need to take and when they should complete them to be eligible to apply to four-year postsecondary institutions, and need to be aware that even so-called "open admissions" postsecondary institutions have admissions requirements in the form of placement tests; and (3) "College-ready" and "work-ready" are more similar than previously believed.

Lower expectations and barriers to rigorous coursework have negative outcomes for students

In a 2007 study, researchers examined the mathematics coursetaking patterns in two geographically distant districts. In District A, a narrower range of math course options are available, such that approximately half of 9th graders take Honors Algebra/Geometry 2, and a fourth take Integrated Algebra/Geometry 1. Perhaps not surprisingly, the most common course sequence in grades 9, 10 and 11 is Honors Algebra/Geometry 2, Honors Algebra/Trig 3, and Honors Algebra Precalculus 4 — providing students with the rigorous content they need to meet postsecondary course admissions requirements and achieve the ACT's college readiness benchmark in math.[22] In District B, a wide array of math courses at all levels are offered. Thirty-eight percent of 9th graders are enrolled in Integrated Math I, 17.5% in Integrated Math II, and 16% in Geometry. As a result, a smaller proportion of students in District B complete trigonometry, other advanced math, and calculus associated with a student's greater likelihood of attaining ACT's college readiness benchmark in math — or even complete the equivalent of the Algebra I, geometry, and Algebra II sequence often required for admissions to four-year postsecondary institutions. The researchers conclude that "different content trajectories offer very different opportunities to learn within and between school districts. … Early differential placement can channel students away from rigorous programs of study and such curriculum differentiation has several attendant consequences. … The variety of course options available to fulfill graduation requirements are bewildering for students who have no knowledge about the implications of their course choices. … This confusion is shared by parents who may not realize the full impact of curriculum differentiation and placement on future academic choices."[23]

A study of school-level tracking policies in a set of North Carolina high schools found that school policies made it relatively easy for students in higher-track courses to stay in these tracks, but made it difficult, if not impossible, for lower-track students to move up the ladder. Because minority and disadvantaged students "often begin secondary school in the low tracks and negative effects of low-track placements are cumulative (Gamoran, 1992), policies that reduce upward mobility produce additional barriers to the success of these students." Meanwhile, policies that reduce students' capacity to self-select into various tracking groups (i.e., requiring teacher recommendation or minimum GPA in an earlier course to enter an elite course) "tend to put an upper limit on the total enrollment of students in rigorous courses," though case-by-case exceptions can be found.[24]

Students (and their parents) need "signaling" on what's required for college

As identified by Stanford University's Bridge Project and others, students, their parents and their teachers all too often have limited awareness of the courses students must take in high school to be eligible to apply to four-year postsecondary institutions.[25] The course selection and tracking research

presented above makes this point all the more important, in that students who are either pushed or self-select into lower-track math, science and other courses — or who do not know that the state-set admissions requirements include two years of foreign language, for example, are unable to rectify their position by their junior or senior year of high school.

According to the Bridge Project's research, one of the "Ten myths that students believe about college" is "Community colleges don't have academic standards."[26] But in spite of their labeling as "open admissions" institutions, two-year institutions, along with their four-year brethren, have entrance expectations — in the form of placement exams. As stated by Michael Kirst, writing on recent research by David Conley, "Research on the content, reliability, and necessary preparation for placement exams is scant, and placement standards are not well publicized to prospective students or secondary school teachers. The content, cognitive demands, and psychometric quality of placement exams are a 'dark continent' in terms of the assessment research literature. Students are admitted to the postsecondary institution under a low standard, but placed in credit courses or remediation on another higher standard."[27] The gap in knowledge and research on placement exams makes it all the more important that students complete a high school curriculum challenging enough to prepare them to pass these exams. Those who do not will likely spend precious dollars on non-credit-bearing remedial courses.

A 2006 report on Chicago students' aspirations states, "Ask any high school student in Chicago today what he wants out of high school, … and the answer is almost without fail, "to graduate and go to college."[28] And in fact, federal data as well as state and local surveys of high school students confirm that some eight out of 10 young people aspire to go to college.[29, 30] Adult perceptions of student abilities should not drive which students receive clear messages about courses required for college enrollment, and which students do not. Opportunities should reflect student effort, not well-intentioned but misguided efforts to discourage "those kids" from taking the necessary courses to be eligible to apply to four-year postsecondary institutions.

"College-ready" equals "work-ready"

A growing body of research supports the affirmation that the knowledge and skills needed to succeed in college or the workforce immediately after high school are nearly identical. Building upon the findings of the 2004 Ready or Not report, Achieve has released the "Math at Work" series. This series identifies the advanced math skills needed for jobs with career potential in five fields — aerospace, construction, health care, information technology and manufacturing — that require either a high school diploma or some education/training less than a four-year degree. The compilations demonstrate that the algebra, geometry, trigonometry and other math skills workers need for these growing industries resemble those needed for entry into postsecondary education.

Myth #7: Most students don't need to take four years of math — or advanced math — or lab science

Some critics oppose graduation requirements that impose four years of math (including advanced math courses such as Algebra II) and "lab" sciences (as opposed to general science courses) on students, claiming that most students' college or career trajectories will not require them to use advanced math or science in the "real world."

Recent research

In both the 1999 and 2006 "Toolbox" studies, Cliff Adelman found that the pre-collegiate factor most closely associated with a student's likelihood of finishing high school, entering a four-year institution, and completing a bachelor's degree within a reasonable amount of time was the "academic intensity" of the high school curriculum. The Carnegie units at the highest end of the academic intensity variable included two or more units of core lab science — biology, chemistry and physics — (or 2.5 or more units of all science). ACT research also indicates that students who take biology, chemistry and physics in high school had the greatest chances of success in college biology, a common course requirement for the general academic core in postsecondary institutions.

The mathematics courses at the highest end of the academic intensity variable in both "Toolbox" studies included 3.75 math units (with no remedial math), and math coursetaking culminating at trigonometry or higher. Adelman adds, "Of all the components of curriculum intensity and quality, none has such an obvious and powerful relationship to ultimate completion of degrees as the highest level of mathematics

one studies in high school. … And the precise point at which opportunity to learn makes the greatest difference in long-term degree completion occurs at the first step *beyond* Algebra 2, whether trigonometry or pre-calculus. To be sure, some Algebra 2 courses in high school include trigonometry, but the preponderance of evidence for the period in which the [students in the sample] went to high school suggests that most trigonometry classes were discrete and distinctly labeled. … If we asked simply what percentage of students at each rung on the math ladder earned a bachelor's degree, the largest leap also takes place between Algebra 2 and trigonometry: a nearly 23 percent increase among all high school graduates, and a 21 percent increase among those whose who continued on to postsecondary education."[31, 32] Requiring four years of math increases the likelihood that students will complete some math beyond Algebra II while still in high school.

ACT research likewise indicates that students who complete some math beyond Algebra II are more likely to be prepared for college algebra, a common requirement in the general academic core required of undergraduates in two- and four-year institutions. The table below indicates the chance a student who has completed specific high school math courses has of meeting ACT's readiness benchmark for college algebra.

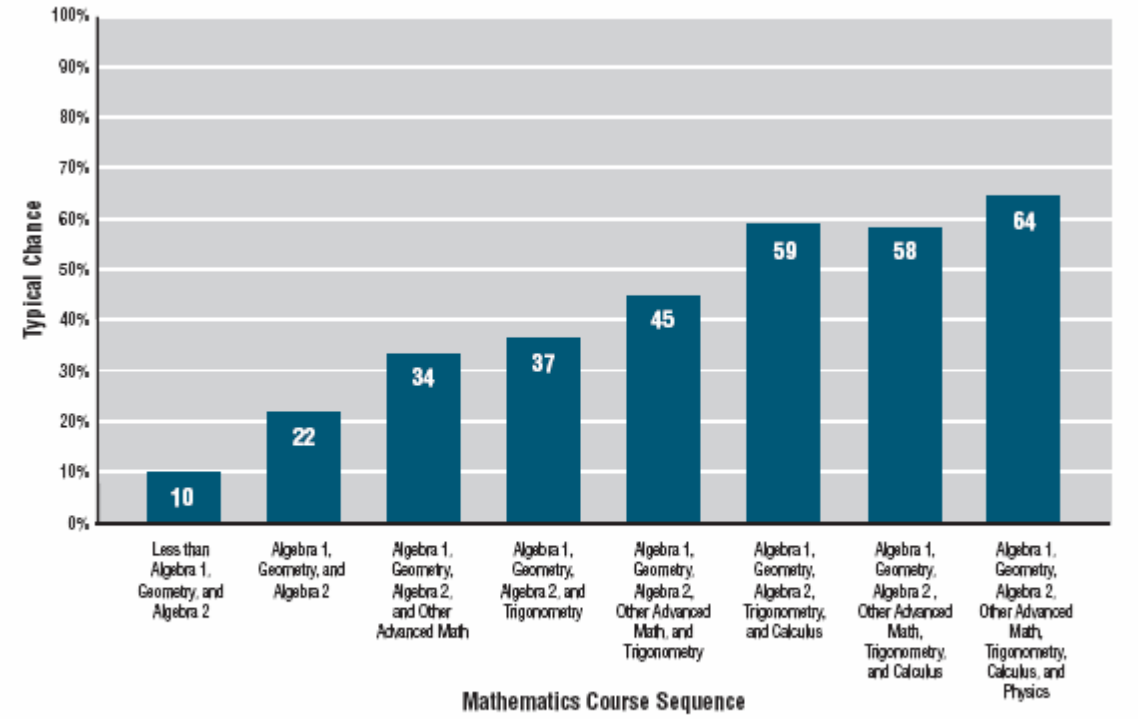

Figure 2: Typical Chances of Meeting the Readiness Benchmark for College Algebra

Source: *Courses Count: Preparing Students for Postsecondary Success*, ACT, 2005

Meanwhile, anecdotal evidence suggests that many students who complete three years of math in high school require remediation their first year of college, simply because they forgot so much when not enrolled in a math course their senior year. Taking four years of mathematics in high school keeps the "math muscles" active and reduces the likelihood that students will forget enough to require developmental math upon college entry.

And some theorize that the value of algebra extends beyond its applicability in school or career, but is helpful in the day-to-day world. In a 1995 essay on the importance of algebra, Zalman Usiskin, the director of the University of Chicago School Mathematics Project, pointed to numerous real-life applications in which many adults make financial and other decisions without using algebra, likening them to travelers to a foreign country who do not speak the native language and do not realize what they've missed. "You can live without it," Usiskin writes, "but you will not appreciate as much of what is going on around you. … You will be more likely to make unwise decisions, and you will find yourself with less control over your life than others who have this knowledge."[33]

Avoiding the pitfalls with essential policy components

Policymakers must keep in mind that certain advanced courses will prove an insurmountable stumbling block to some students with disabilities. If a student with a disability is unable to complete a particular course with proficiency, state policies should provide some options so that students challenged by just one course are not forced to complete an occupational diploma.

Conclusion

No matter what policy options state education leaders pursue, best practice indicates they should always revisit data to see how well state policy approaches are working — and to retool policies as necessary. But policymakers should not let myths dissuade them from approaches that research and experience suggest have positive implications for student success.

Jennifer Dounay, project manager for ECS' High School Policy Center, can be reached at 303.299.3689 or jdounay@ecs.org

Equipping Education Leaders, Advancing Ideas

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