
E = ħω
ω = 2πf
E = mc²

Telltale Signs of Rigor and Career Readiness in High School

State boards can take a lesson from schools that already dish up rigorous assignments in college- and career-ready courses alike and ensure more schools do it.

Gene Bottoms

Most states claim academic rigor and career readiness as goals for all their students. But as school systems continue tracking students into higher or lower levels of academic coursework and into career and technical courses that lack rigorous, real-world assignments, they reflect an apparent underlying belief that their students' abilities are fixed—and fixed early in life.[1]

There are districts and schools that instead operate from an assumption that most students can learn at high levels when engaged in meaningful, challenging assignments in both academic and career pathway courses. What does that look like? I encourage members of state boards of education to visit high schools in their state and beyond, where they can see these effective strategies:

- students are required to meet graduation standards higher than those the state requires and require every student to take a solid academic core—no exception;
- students are able to make connections between college-ready academic standards and rigorous assignments in their career pathway courses;
- teachers receive the professional development needed to shift instruction toward rigor and relevance;
- ninth graders receive strong support and extended time to ensure that many more have the literacy and math knowledge and skills to succeed in college preparatory and challenging career pathway courses; and
- students set education goals and get help from counselors, teachers, and parents in choosing careers and an academic focus that are aligned with those goals.

High Graduation Requirements

Setting high requirements for graduation is the most powerful practice for getting more high school students college and career ready.[2] This high bar requires all students to complete college-ready English, mathematics, science, and social studies and three or more rigorous career pathway courses in a coherent sequence or three advanced academic courses in a focus area. Students should also meet standards in computer science, information technology, and digital fluency.[3]

In 2015, Georgia passed a law eliminating a state requirement that students pass, at a basic level or better, end-of-course exams in four core academic areas. Several districts had complained that the tests were depressing graduation rates. Camden County High School, however, opted to keep the requirement. They also required their graduates to complete 28 credits and complete at least three career-focused courses.

At the same time, the school reorganized around six career-themed academies. Academic and career pathway teachers collaboratively developed connected lessons in which students applied academic skills to assignments in career pathway classes.[4] School and teacher leaders provided students with extra time and support. Using federal funds, the school engaged 15 certified teachers to engage students who were not on track to pass end-of-course exams at either college or career readiness benchmarks in effective relearning strategies.

The school's graduation rate subsequently rose across almost all student populations. In 2022, the rate for Black students was 94.8 percent, 95.7 percent for Hispanic students, White students 93.4 percent, multiracial 95.8 percent, students

with disabilities 90 percent, and 90.3 percent for students with economic disadvantages.

Rigorous CTE Courses

Interesting, rigorous, open-ended, project-based assignments engage students in productive struggle like nothing else, and such work motivates them to persist to completion. Having such assignments is the second most powerful predictor that schools will increase the percentage of their students who are college and career ready.[5]

In CTE classrooms, such assignments should require students to apply high school–level literacy, math, and science in order to complete the assignment. They ought to engage students in doing background research that draws on technical documents and the knowledge of highly skilled workers in their field. Students should learn to use new software and technology, apply technical skills, and work both independently and in teams to address the project or problem.[6]

Interesting, rigorous, open-ended, project-based assignments engage students in productive struggle like nothing else.

Such projects allow students to explore and gain insights into their interests, aptitudes, and options for careers and further education. Such projects often require students to keep a journal that documents their work, reflects on acquired knowledge and skills, and identifies gaps to be addressed in their readiness. These are the most effective instructional strategies for advancing students' readiness for both postsecondary studies and careers.

High school career and technology centers that help their CTE teachers prepare rigorous assignments see a significant increase in the percentages of students pursuing postsecondary studies, passing high-level industry certification exams, and of parents recognizing the value of intellectually demanding projects for careers and postsecondary studies. After a five-year project to enable all their CTE teachers to design assignments that met this high bar, more than 80 percent of seniors who had attended classes at the CTE center in Columbia, Missouri, agreed that their assignments were rigorous, and 90 percent had earned dual credit and were pursuing postsecondary studies.[7]

Instructional Shifts in Math and Literacy

Few teachers in the middle grades and high schools are prepared to create assignments that require students to use math knowledge and skills to solve complex, real-world, abstract, multistep problems. Many math teachers will need help making this shift away from teaching procedures alone. But such a shift can increase the percentage of students who leave high school meeting postsecondary and career math readiness standards.[8] It requires that teachers receive 60 to 80 hours of professional development with on-site coaching.

Principal participation is also essential. Principals must stop pressing teachers to use procedure drill sheets, which fail to prepare students to use math to solve problems, and they need to understand why this shift is needed. They also must be ready to give teachers planning time to collaboratively design quality math assignments, and they need to use valid rubrics when they provide math teachers feedback after classroom observations.[9]

A similar level of professional development and principal involvement is needed to advance literacy instruction. Schools that are using literacy-based assignments to engage students in reading complex texts in all disciplines—across all academic and career pathway courses—have more students graduating with college and career readiness literacy skills.

Literacy and Math Readiness in Grade 9

Educators and policymakers alike recognize that the transition into ninth grade is critical for setting students on the path to success and that coursework focused on remediation has not proved effective in helping students who struggled in the middle grades.

Polytech High School in Dover, Delaware, uses a lottery system to select their students, who come from several middle schools. Many come to high school unprepared for a college-ready core. The school principal believes intensive extended time with special instructional support in the ninth grade is essential.

Students needing more time to master college-prep Algebra I in the ninth grade are also enrolled year-long in an extended session with a teacher who is prepared to engage them in multistep, abstract, real-world problems that advance their understanding, reasoning, and use of math in their career pathway labs. At the end of ninth grade, 97 percent of Polytech

students are ready for the next math class in the sequence.

All ninth graders take college-ready English, but those who lack skills in reading comprehension and oral and written communications take an additional foundational class that includes time management, organization, and study skills.

Polytech requires 28 credits to graduate: 16 college-prep classes and 10 CTE credits.[10] And they graduate 97 percent of their diverse student body, with 76 percent enrolling in college—44 percent in a four-year college and 32 percent in a two-year college, with 82 percent returning the second year. Only 16 percent needed remedial college math, and 11 percent needed remedial English.

Involvement of Counselors, Teachers, Parents

Successful districts and schools provide all their students with counseling, career exploration, and advising. When coupled with effective parent and guardian engagement, more students set career and educational goals, earn higher grades, graduate, and earn a credible credential or degree, while demonstrating better social and study skills and fewer behavioral problems.[11]

There are many effective approaches. At Fort Mill High School in South Carolina, students take an "introduction to high school" course in which they develop a program of studies linked to their career and postsecondary goals. The principal credits this course with a dramatic reduction in the ninth-grade failure rate, and he believes it has contributed to the school's 95 percent graduation rate and its ranking as the state's seventh best high school.

At Polytech in Dover, ninth graders rotate through all 20 career pathway programs for at least three days. In addition, the same assistant principal and counselor remains with a group of students throughout high school so that they have personal relationships with at least two adults who they know care about them and will help them persist through complex tasks.

At Camden County High School in Georgia, the school's career counseling and advisement system connects each student to a teacher advisor, who meets with them weekly. Sessions focus on helping students make critical grade-level decisions in support of their career and educational goals. Whenever possible, each student has the same teacher-advisor throughout high school.[12]

In Steubenville, Ohio, the high school in 2014 consulted with parents and convened industry and postsecondary leaders to bolster career pathways for its graduates. They picked advanced-career curricula in aerospace engineering, innovations in science and technology, health informatics, and global logistics and supply change management. A sequence of four courses in each are organized around project-based assignments connected to a college-ready core. The school in 2019 had a 99 percent graduation rate and a 95.4 percent daily attendance rate.

Actions State Boards Can Take

Set bold goals. The state board can set bold goals and work with willing districts and school leaders to achieve them. This work involves helping districts, schools, and teacher leaders discover—with their own eyes, ears, minds, and hearts—how changing school and classroom practices can prepare more students to graduate ready for college, careers, or both.

If I may also be bold, here are some goals I believe could truly accelerate career and college readiness:

- At least 95 percent of students who enter the ninth-grade graduate from high school on time.
- At least 95 percent of high school students complete a college-ready core aligned with an academic or career focus.
- At least 90 percent of students graduate college-ready, career-ready, or both, having mastered power standards in literacy and math.
- At least 80 percent of students earn a credential or degree of value by age 25 that can lead to a middle-class income.

Working with other agencies, the state board can establish indicators for determining whether students are meeting these goals.[13]

Encourage districts to set higher graduation requirements. To achieve bold statewide goals, districts and schools ought to be able to set graduation requirements higher than the state requires. Schools using this approach have

The state board can set bold goals and work with willing districts and school leaders to achieve them.

Box 1. Earning Industry-Approved Certifications in Tennessee

State boards can improve the quality of career pathways by paying attention to the credentials students can receive. Tennessee has long been recognized for approving industry credentials that matter to students and employers. The state scores three tiers of credentials: preferred, recognized, and valued. Preferred credentials are those that employers value and can lead to an advanced credential or degree and a middle-class income. Valued credentials are linked to specific high-demand jobs but not as likely to lead to an advanced credential or middle-class income. Recognized credentials may or may not lead to a middle-class income or postsecondary credit.

The Tennessee State Department of Education has approved 97 preferred, 51 valued, and 42 recognized credentials, and they receive applications for more each year. In review of these applications, agency staff receive support from the departments of agriculture, labor, department of economic and community development, the Tennessee Board of Regents, and the Tennessee Higher Education Commission.

Source: Tennessee Department of Education, "Tennessee Promoted Student Industry Credentials," web page, https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html.

Local schools acting in isolation are not likely to achieve bold statewide goals.

greatly increased the percentage of graduates meeting college and career readiness academic standards. Districts should be able to phase in these requirements, increasing the percentages of their students enrolled in rigorous academic courses by 10 to 20 percent annually.

To succeed with this approach, schools often create a coaching support class for students that helps in completing rigorous assignments. In addition to aiding students, this strategy helps teachers recognize how many more students who had been enrolled in low-level classes are capable of higher level work when they see meaning and purpose in their assignments.

Promote CTE as a different way of learning. State boards can work with CTE leaders to leverage federal vocational dollars so that comprehensive high schools, career academies, and/or career tech centers can redesign assignments in career pathway courses. Professional development support for CTE teachers is essential, as they revamp their instruction to include rigorous, real-world, project-based assignments that require academic and technical knowledge and skills.

State boards can also establish accountability systems for career and technical readiness. Such systems could track district and schools' performance on how many of their students achieve the following:

- passing an **industry certification exam or state license exam**, vetted by employers and higher education agencies, that carries transferrable postsecondary credit in a field with economic value to state or local economies; provides students an advantage in the hiring process; and leads to good jobs. Tennessee has an excellent system for approving such credentials that merits other states' attention (see box 1);
- completing **CTE dual-credit courses** that shorten students' time to complete a credential or degree;
- passing valid **end-of-course exams in career pathway courses** at a level that carries college credit; and
- participating in structured **work-based learning experiences** that include completion of a complex, long-term capstone project.

Provide incentives for networks of schools. Local schools acting in isolation are not likely to achieve bold statewide goals. The state board and state education agency can provide a small amount of incentive funds annually and expert assistance to districts and high schools for developing and implementing comprehensive

improvement plans that draw in district and school board leaders, business and community members, and parents.[14] Such an approach must include annual accountability indicators and measures that would weigh in decisions about continued funding.

In addition, engaging a cross-section of students in focus groups can provide school and district teams great insights into what is working and not working in a school and some of its best ideas for continuous school improvement.

States can help set up networks of willing schools to learn from each other. Using a cohort model, state boards and SEAs could convene cross-sectional teams led by state education agency staff to help get districts, school, and teacher leaders on the same page. SEA staff could report findings from curriculum and instructional reviews of participating schools to the state board, or members could participate in review teams themselves to get a good grounding in current school practices.

Assess assignments for rigor and relevance. The state board can contract with an outside qualified entity to study the rigor and meaningfulness of assignments in career-pathway, advanced academic, and low-level academic courses. Only rigorous assignments will lead to the good outcomes that state boards hoped to see when they set bold goals for student success. By studying the variety in rigor and relevance across districts, schools, and within schools, state boards can focus attention on what is and is not being expected of students.

It is not enough for a state board to adopt learning standards. Teachers must then translate a mix of those standards into challenging grade-level assignments that will motivate students to make the effort necessary to achieve at a higher level. Lower-level classes, in contrast, tend to assign work that focuses on a single standard. A network of schools can use the results from a study of assignments to inform their efforts, and the state can provide them professional development resources to increase assignment complexity and rigor.

Questions State Board Can Ask

Differences in school experiences account for a significant portion of the gap between disenfranchised students and those who meet college and career readiness standards.[15] The state board is in an excellent position to question the assumptions on which many current practices are based:

- How do academic course sequences differ for students meeting academic readiness indicators for college and careers and those who do not?
- How do assignments differ in career pathway and academic courses for students who meet both college and career readiness standards and those who do not?
- What high school experiences best predict a student's achievement by age 25 of an advanced credential or degree in a field that leads to middle-class earnings?
- Which career pathways prepare the highest percentage of students to earn an advanced postsecondary credential or degree, and which do not?
- Which high school students graduate having met computer science, information technology, and digital-fluency standards? How do their experiences differ from students who graduate without such skills?
- Which groups of students receive the most assistance early in high school in selecting course sequences and experiences aligned to their postsecondary goals? Are their families involved?
- For all of the above, how do the differences break down by ethnic, socioeconomic, and demographic groups?
- How many students who complete three or more courses in a career pathway also complete a college-preparatory academic core and in which pathways?
- Looking at success rates in the first year of college, how do students who completed a coherent sequence of at least three career pathway courses and a true academic core compare with students who completed only the traditional college preparatory program? How about students who completed neither?

All students learn more when completing rigorous assignments that require them to think, reflect, analyze, do background research, synthesize information, and produce a product demonstrating their learning. The status quo in too many schools reserves these learning tasks for the "best" students.[16]

cont'd on page 37

Only rigorous assignments will lead to the good outcomes that state boards hoped to see when they set bold goals for student success.

Gene Bottoms, past director of the High School That Works initiative at the Southern Regional Education Board, is the author of *Tomorrow's High School: Creating Student Pathways for Both College and Career* (Alexandria, VA: ASCD, 2021). His book details how districts can implement the strategies he describes, and he would be glad to help states further explore their role in incentivizing districts.

adamant that if you do everything right, you will go to college, but that's just about all school can do for you.

I'd shift to more holistic preparedness. I'd shift it to something that incorporates not only life skills but mental health strategies, that incorporates spiritual health and finding a purpose and fulfillment in life so you don't leave high school feeling aimless. That's what happens with a lot of people. They go to high school, and even college sometimes, and say, "So what? What do I have to do now?" High school should be about showing people that it's not all about the rat race; it's about educating you, and some part of that is, why do I want to do this? What is there after? ■

---

cont'd from page 7...A New Architecture for High School Learning

our democracy, and our social fabric. We have seen pockets of progress. But it is time for the entire nation to embark on this work. It will require bold plans, new policies, courage, and commitment.

State boards hold a unique position that afford them an opportunity to lead the way. As the citizen's voice, state board members are on the frontlines, both in and above the political fray, working with communities and convening stakeholders to craft policies that deliver for young people. If every state addresses the three questions above, the entire nation will be stronger for it. The Carnegie Foundation and XQ stand ready to partner on this journey.

[1]Gallup, "2016 Gallup® Student Poll: A Snapshot of Results and Findings," web page, 2017, http://www.gallupstudentpoll.com/home. aspx; Ulrich Boser, "Revisited: Do Schools Challenge Our Students?" (Washington, DC: Center for American Progress, March 7, 2017).

[2]College Board, "SAT Suite of Assessments 2022 - Reports," https://reports.collegeboard.org/sat-suite-program-results.

[3]Raj Chetty et al., "Social Capital and Economic Mobility," Opportunity Insights (Cambridge, MA: Harvard University, August 2022), https://opportunityinsights.org/wp-content/uploads/2022/07/socialcapital_nontech.pdf.

[4]Richard V. Reeves and Eleanor Krause, "Raj Chetty in 14 Charts: Big Findings on Opportunity and Mobility We Should All Know," Brookings Institution blog, chart 1 (January 11, 2018), https://www.brookings.edu/blog/social-mobility-memos/2018/01/11/raj-chetty-in-14-charts-big-findings-on-opportunity-and-mobility-we-should-know/.

[5]The Nation's Report Card, "NAEP Report Card: 2022 NAEP Reading Assessment," https://www.nationsreportcard.gov/highlights/reading/2022/; "NAEP Report Card: 2022 NAEP Mathematics Assessment," https://www.nationsreportcard.gov/highlights/mathematics/2022/.

[6]See, e.g., Jenny Nagaoka et al., "Foundations for Young Adult Success: A Developmental Framework," Concept Paper for Research and Practice (Chicago: University of Chicago Consortium on Chicago School Research, 2015).

[7]Valerie Norville, "States Sketch Portraits of a Graduate," *State Innovations* 27, no. 1 (Alexandria, VA: NASBE, October 2022).

---

cont'd from page 17...Telltale Signs of Rigor and Career Readiness in High School

It is time to help schools engage all students in assignments that connect to their interests and give them ownership in their own learning. No one strategy will be sufficient. The combination of strategies outlined in this article—when implemented effectively—will engage students in rigorous, relevant assignments with teachers who let them take greater responsibility for their learning, who see their potential, and let them know they care about their progress.

[1]Stephen W. Raudenbush, Brian Rowan, and Yuk Fai Cheong, "Higher Order Instructional Goals in Secondary Schools: Class, Teacher, and School Influences," *American Educational Research Journal* 30, no. 3 (Fall 1993): 523–53; Jeannie Oakes, *Keeping Track: How Schools Structure Inequality* (Yale University Press, 1985).

[2]Gene Bottoms, Alice Presson, and Lingling Han, "High School Reform Works—When Implemented: A Comparative Study of High- and Low-Implementation Schools" (Southern Regional Education Board, 2004); Jeannie Oakes, *Keeping Track: How Schools Structure Inequality* (Yale University Press, 1985).

[3]Marisa Castellano, Sam Stringfield, and James R. Stone III, "Secondary Career and Technical Education and Comprehensive School Reform: Implications for Research and Practices," *Review of Educational Research* 73, no. 2 (2003): 231–72; Southern Regional Education Board, "Bridging the Computer Science Education Gap: Five Actions States Can Take," Report of the SREB Commission on Computer Science and Information Technology (November 2016).

[4]Jeannie Oakes and Marisa Saunders, *Beyond Tracking: Multiple Pathways to College, Career, and Civic Participation* (Harvard Education Press, 2008), p. 256.

[5]Gene Bottoms, *Tomorrow's High School: Creating Student Pathways for Both College and Career* (Alexandria, VA: ASCD, 2021), figure 4.2.

[6]National Research Council and Institute of Medicine, *Engaging Schools: Fostering High School Students' Motivation to Learn* (Washington, DC: National Academies Press, 2004), pp. 80–81.

[7]Bottoms, *Tomorrow's High School*, sidebar on pp. 87–88.

[8]Karen C. Fuson, Mindy Kalchman, and John D. Bransford, "Mathematical Understanding: An Introduction," in M. Suzanne Donovan and John D. Bransford, eds., *How Students Learn: History, Mathematics, and Science in the Classroom*, Committee on How People Learn: A Targeted Report for Teachers (National Research Council of the National Academies Press, 2005); Asha K. Jitendra, et al., "Teaching Mathematical Word Problem Solving: The Quality of Evidence

for Strategy Instruction Priming the Problem Structure," *Journal of Learning Disabilities* 48, no. 1 (2015): 51–72.

[9]The Southern Regional Education Board's program director for literacy and mathematics, Jason Adair, has helped school leaders develop such rubrics. SREB also has a cadre of professional development staff to help schools implement effective literacy and math strategies.

[10]Michael D. Rettig and Robert Lynn Canady, "High Failure Rates in Required Mathematics Courses: Can a Modified Block Schedule Be Part of the Cure?" *NASSP Bulletin* 82, no. 596 (1998): 56–65.

[11]Jack Jennings, *Fatigued by School Reform* (Rowman and Littlefield, 2020), p. 95.

[12]Gene Bottoms, Alice Presson, and Lingling Han, "Rigor, Relevance, and Relationships Improve Achievement in Rural High Schools: High School Reform Works When Schools Do the Right Things" (Southern Regional Education Board, 2004).

[13]Bottoms, *Tomorrow's High School*, chapter 2.

[14]In *Tomorrow's High School* (ASCD, 2021), I detail ways schools and districts can develop year-by-year plans for implementing transformative, practical actions in support of bold goals.

[15]Bottoms, Presson, and Han, "High School Reform Works—When Implemented" (2004) and "Students Can't Wait: High Schools Must Turn Knowledge into Action" (2006).

[16]National Research Council and Institute of Medicine, *Engaging Schools*, 80–81.

---

cont'd from page 21...How Rhode Island Increased the Value of a High School Diploma

not have to choose between academics, family responsibilities, and economic security. To ease the burden on these students, Rhode Island schools will add flexibility in their support, which might include valuing caregiving work as community service hours, flexible class schedules, skill-building and support groups, and work-based learning for academic credit. Additionally, these changes eliminate seat time as a criterion for awarding academic credit. Rhode Island students will earn credit based on subject mastery and student proficiency. The Carnegie unit is no longer the driver of student learning in Rhode Island high schools.

RIDE developed these priorities by genuinely listening to community members and embracing difficult conversations. After the initial proposal to revise graduation requirements was presented to the K-12 Council last year, there was a period of public comment that included seven hearings and four town halls across the state. Students and families were present at each of the seven public hearings. With over 400 comments, this set of regulations received the most public comment in the history of Rhode Island K-12 education.

Conclusion

Today, there is much to celebrate and feel hopeful about in Rhode Island. On November 15, 2022, the K-12 Council unanimously approved the final proposed graduation requirements. It is no easy feat to implement a statewide partnership, yet a focus on community voices and patience enabled Rhode Island to change the framework for high schools completely and reorient the entire educational system to ensure that every student graduates with open doors to create their own future.

To get to this point, Rhode Island parents and community leaders joined state education leaders to dig beneath the surface of the toughest questions in a collaborative process. That makes me optimistic about the future. If there is any piece of advice for other states that seek to make high schools better for their students, I would say that it is important to lead with vulnerability. RIDE's goal was to get the requirements right for kids, even if it meant admitting that we did not always have easy answers to difficult problems. We were open to change and were guided by the voices of the community. I also credit the K-12 Council itself for giving the department the mandate to implement changes, as well as their pushing forward on solutions mutually agreed upon.

RIDE opted to phase in the new requirements over the next five years. We could have implemented these changes more quickly, but sustainable, transformational change will take the same sort of inclusive community leadership that got us this far. Over the next two years, RIDE will ensure that all students are automatically enrolled in courses required at Rhode Island's state colleges. The implementation of these requirements will inform the next phase of the work and may hold lessons for other school systems and communities hoping to transform their high schools to build the future our students so rightfully deserve. ■

[1]Rhode Island Department of Education, "Educational Opportunity Audit RIDE Final Report" (April 2020).

[2]Ibid.

[3]RIDE, "Educational Opportunity Audit" (October 2017).

[4]Chenoa S. Woods et al., "How High School Coursework Predicts Introductory College-Level Course Success," *Community College Review* 46, no. 2 (February 2018).

[5]Tim Hodges, "School Engagement Is More Than Just Talk," (Gallup, October 2018), https://www.gallup.com/education/244022/school-engagement-talk.aspx.

[6]RIDE, "Educational Opportunity Audit" (April 2020).