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Does Raising High School Graduation Requirements Improve Student Outcomes?

SUMMARY

CONTENTS

Technical appendices to this report are available on the PPIC website.

The abrupt shift to distance learning at the onset of the COVID-19 crisis exacerbated inequalities in California's K–12 system and added urgency to an ongoing discussion about the role of high school graduation policy in promoting equitable student outcomes.

More rigorous graduation requirements, particularly in math and science, can improve access to college by increasing enrollment in advanced courses, which might enhance college readiness and performance on standardized assessments. While high school graduation rates in California have increased in the past decade, nearly 40 percent of California high school graduates do not enroll in college; the disruptive impact of the pandemic has heightened this concern.

In this report, we review district graduation policies for the 2018–19 school year and examine the relationship between math and science requirements and student outcomes. Overall, we find:

- Most districts have graduation requirements that exceed state minimums, which include two years of math and two years of science. During the 2018–19 school year, 59 percent of districts—enrolling 66 percent of the state's K–12 population—required three or four years of math; 22 percent required three or four years of science.
- Descriptively, districts with larger shares of Latinos, African Americans, low-income students, English Learners, and students with non-college educated parents are about as likely to have higher math requirements (three or four years) as are other districts.
- Higher math graduation requirements are associated with better outcomes, particularly for students in high-need, high-poverty, and high-minority schools. These requirements do not appear to lead to lower high school graduation rates or higher dropout rates. Outcomes for students in rural schools and the lowest-performing schools do not appear to be affected.
- The overall impact of science requirements is less certain: higher requirements are associated with a lower dropout rate, but enrollment in advanced courses and proficiency on standardized tests do not appear to be affected. Notably, students in high-poverty schools with higher requirements are 31 percent more likely to take advanced science courses and 2 percent more likely to graduate. Outcomes for students in rural schools appear unchanged.

Given the disruption caused by COVID-19, the first priority should be for districts to set up support systems to mitigate learning loss and prevent backtracking on improvements in high school graduation and college

enrollment. After the pandemic ends, the state and its K–12 system could take several steps to ensure that graduation requirements have an equitable impact on college readiness:

- The state should consider raising its minimum math requirements. Most districts already require three or four years of math and most students are already subject to a higher standard. The state will need to reimburse district expenditures such as additional staff and instructional materials, but such a policy change could benefit both individual students and the state, and the equity gains could be a long-term investment in the state's economy.
- In collaboration with the county offices of education, the state should provide more comprehensive support and technical assistance to rural and low-performing schools, where higher math and science standards are not associated with better academic outcomes.
- The state should collect data on local graduation policies so that researchers and policymakers can evaluate their impact and identify areas for improvement, especially when it comes to ensuring such policies benefit Latinos, African Americans, low-income students, English Learners, and students with non-college educated parents.

Introduction

Only 63 percent of California students enroll in college following high school graduation; and the rate is lower among Latino and Black students, and students from socioeconomically disadvantaged backgrounds (Kurlaender et al. 2018). Rigorous math and science curricula have been shown to improve student outcomes in high school, college, and the labor market (Long, Conger, and Iatarola 2012; Joensen and Nielsen 2009; Rose and Betts 2004; Levine and Zimmerman 1995; Hao and Cowan 2019; Goodman 2019). California's statewide minimum graduation requirements, which include two years of math and two years of science, are among the lowest in the nation—the vast majority of other states require three or four years of math and science (Gao and Johnson 2017). California's complex governance structure allows school districts to adopt higher standards, but the state does not collect or report data on local graduation requirements.

Over the past several years, a growing number of California districts, including six of the state's largest, have aligned or considered aligning their graduation policies with the A–G requirement, a set of college preparatory courses that students must complete in order to be eligible for the University of California (UC) and the California State University (CSU). Many districts have adopted an A–G curriculum—all courses in core academic areas are A–G approved. CSU recently considered a proposal to add one year of quantitative reasoning (e.g., math) to its admissions requirements, while UC considered expanding its science requirement from two to three years.

Then came COVID-19. The pandemic had a significant impact on the graduating class of 2020. The abrupt move to distance learning left many schools scrambling: many students did not have internet access or computing devices at home; many teachers did not have adequate training to deliver instruction remotely; and not all parents were able to help their children learn (Garet et al. 2020; Gao, Lafortune, and Hill 2020). As a result, some high school students were not able to meet course or GPA requirements for high school graduation.

In spring 2020 the state waived its minimum graduation requirements, which include two years of math and two years of science,[1] and many districts passed emergency waivers exempting high school seniors from local graduation requirements. As COVID-19 continues to flare across the state, some districts are considering extending the waiver for the class of 2021.

The pandemic's inequitable impact has heightened an existing focus on the role of high school graduation policy in promoting equitable student outcomes. In California and many other states, there has been little connection in coursework and standards between high school and college (Venezia, Kirst, and Antonio 2003). This misalignment has hampered many students with college aspirations. Recently, a number of states have raised high school graduation requirements, particularly in math and science, in an effort to improve student achievement.

Students who take at least one rigorous math or science course are more likely to graduate from high school and attend a four-year college; they also earn more college credits, have higher college grade point averages, and are more likely to earn bachelor's degrees (Long, Conger, and Iatarola 2012). However, findings are more mixed on the impact of graduation policies on course-taking, high school graduation, and college outcomes, particularly among students with greater needs (Betts et al. 2016; Teitelbaum 2003; Plunk et al. 2014; Schiller and Muller 2003; Costrell 1994; Lillard and DeCicca 2001; Asim, Kurlaender, and Reed 2019). One possible explanation is that many schools do not strictly enforce their graduation policies—students have been allowed to graduate even if they have not earned enough credits (Teitelbaum 2003).

[1] Assembly Bill 1350 retroactively grants a high school diploma to students who were on track to graduate on March 1, 2020.

This report uses data on all regular high schools from the 2018–19 school year to examine the connection between higher graduation requirements and student outcomes in California, including enrollment in advanced courses, high school graduation, A–G completion, and SAT enrollment.[2] It analyzes the association between high school graduation requirements and student outcomes, and examines the equity implications of higher standards. These findings form the basis of several recommended steps that state and local policymakers could take to ensure that graduation requirements are effective and equitable.

How Might Higher Graduation Standards Affect Student Outcomes?

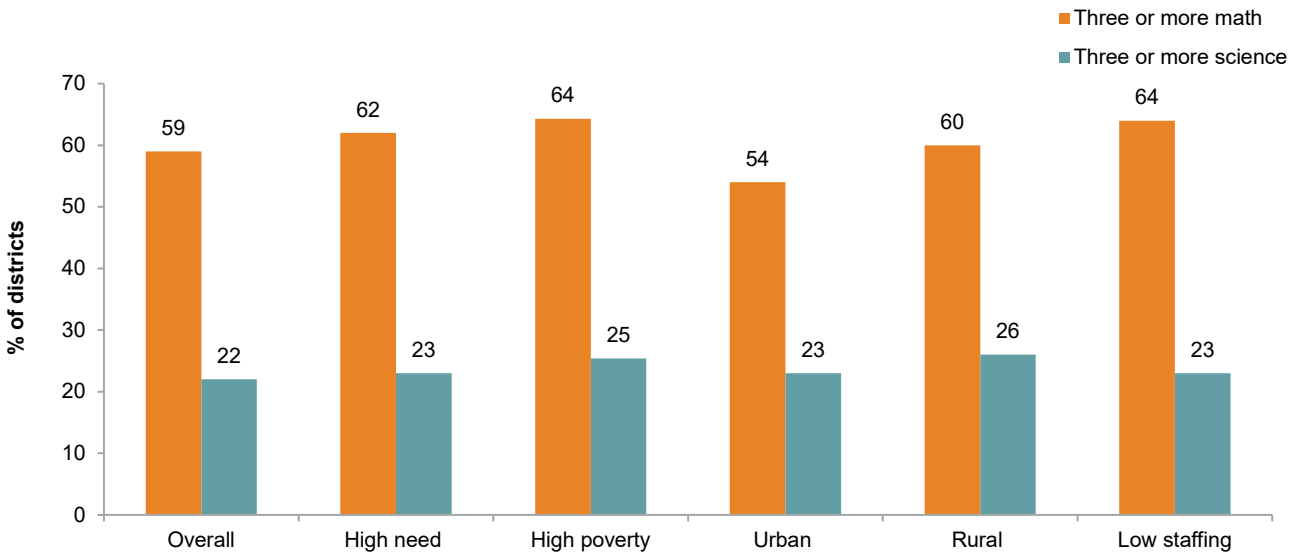
During the 2018–19 school year, 59 percent of California districts (serving 66% of the student population) supplemented statewide minimum requirements by requiring three or four years of math, while 22 percent required three or four years of science (Figure 1). The prevalence of higher graduation standards does not vary widely across districts according to poverty rates, geographic location, or staffing levels. In particular, high-need districts, in which more than 55 percent of students are low income, English Learners, homeless, or foster youth, are just as likely to have higher graduation requirements as other districts. So are low-staffing districts, where student-staffing ratio is at the top quartile. Among districts with higher science standards, 90 percent also have higher math standards.[3]

[2] We excluded alternative schools because students in those schools may not be subject to the regular high school graduation requirements. We also exclude charter schools, which have more authority in implementing their own graduation policy.

[3] Because there is no statewide data, we built a simple scraper to scan the websites of 420 districts serving high school grades in spring 2019, and to search and extract data on high school graduation policy. We then merged the file with publicly available data on student enrollment, demographics, educational needs, teacher qualifications, and student outcomes (including high school graduation rate, dropout rate, enrollment in advanced science/math courses, A–G completion rate, meeting the state's college- and career-ready standards, AP and SAT exam rate).

FIGURE 1

California school districts are more likely to require three or four years in math than in science



SOURCE: Author's calculation.

NOTES: Sample includes 420 districts (which contain 1,007 regular high schools) in 2018–19 school year. High need: districts where more than 55 percent of students are low income, English Learners, homeless, or foster youth. High poverty: districts where at least 75 percent of students are eligible for free/reduced-price lunch. Low staffing: districts with student-teacher-ratios in the top quartile. Students in alternative high schools and/or charter schools are not subject to the district's graduation policies. For more detailed comparisons of student characteristics between high- and low-standard districts, see Technical Appendix Table 1.

Higher graduation requirements are intended to improve student proficiency in standardized assessments and increase college readiness; but they may also increase drop-out rates or prevent students from graduating. Some studies have identified unintended consequences of raising high school graduation requirements. Graduation rates may decline for low-income students, Latinos, African Americans, and students with disabilities once these requirements are in place (Betts et al. 2016; Schiller and Muller 2013). The fact that high-need districts tend to have higher graduation standards raises concern that these unintended consequences could create inequitable outcomes. However, as we show in the next section, higher standards do not prevent students in California from graduating or increase their likelihood of dropping out.[4]

Rigorous Math Standards Are Associated with Positive Effects

Figure 2 summarizes the relationship between higher math graduation requirements and several student outcomes. These relationships account for factors such as the share of students eligible for free or reduced-price lunch, teacher qualifications (including average years of experience and the share of teachers with advanced degrees), the quality of math and science curricula (the share of courses that are A–G approved), and share of career technical education (CTE) courses. These factors may affect district decisions to adopt and implement more rigorous graduation requirements.

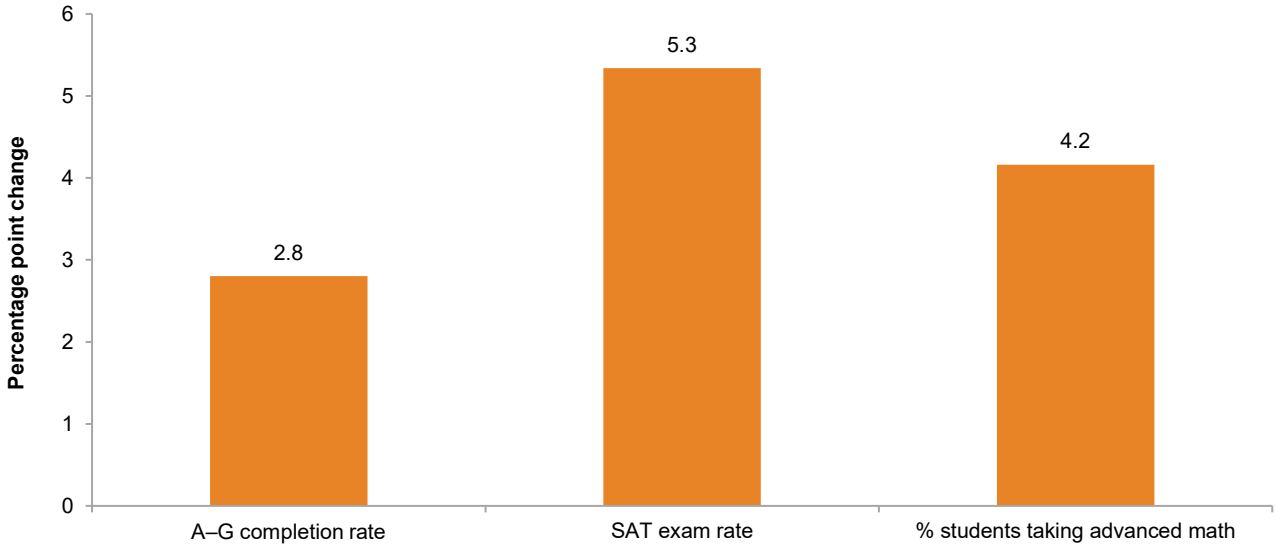
Higher math standards are associated with a significant improvement in most student outcomes. In particular, higher standards are associated with a 4.2 percentage point (12%) increase in student enrollment in advanced

[4] It is possible that some students might be more negatively impacted. A more in-depth investigation would require student-level administrative data, which we unfortunately do not have.

math courses (algebra 2 or higher). Higher math standards are also associated with a 2.8 percentage point (6%) increase in the A–G completion rate, because the A–G math requirement includes algebra 2 (or equivalent).[5] Students in schools with higher math requirements are also more likely to take the SAT, a standardized college admissions test (12%, or 5.3 percentage points). Notably, higher math standards are not associated with any significant changes in dropout rates.

FIGURE 2

Higher math standards are associated with significant student gains



SOURCE: Author's calculation.

NOTES: Sample includes 1,007 regular high schools in 2018–19 school year. Students in alternative high schools and/or charter schools are not subject to the district's high school graduation policies. Each bar represents OLS coefficient of higher math requirements (3 or 4 years) in a model that controls for student demographics (race/ethnicity, % eligible for free/reduced-price lunch), educational needs (% English Learners), teacher qualifications (average experience, and % with advanced degree), school geographic location (urban, rural), and quality of math/science courses (% of math and science courses A–G approved). Standard errors are clustered at the district level. All estimates are significant at the 10 percent level or lower; non-significant results are not shown. Full results are included in Technical Appendix Table 2. The regressions are weighted by student enrollment.

Higher Science Standards Are Associated with Mixed Results

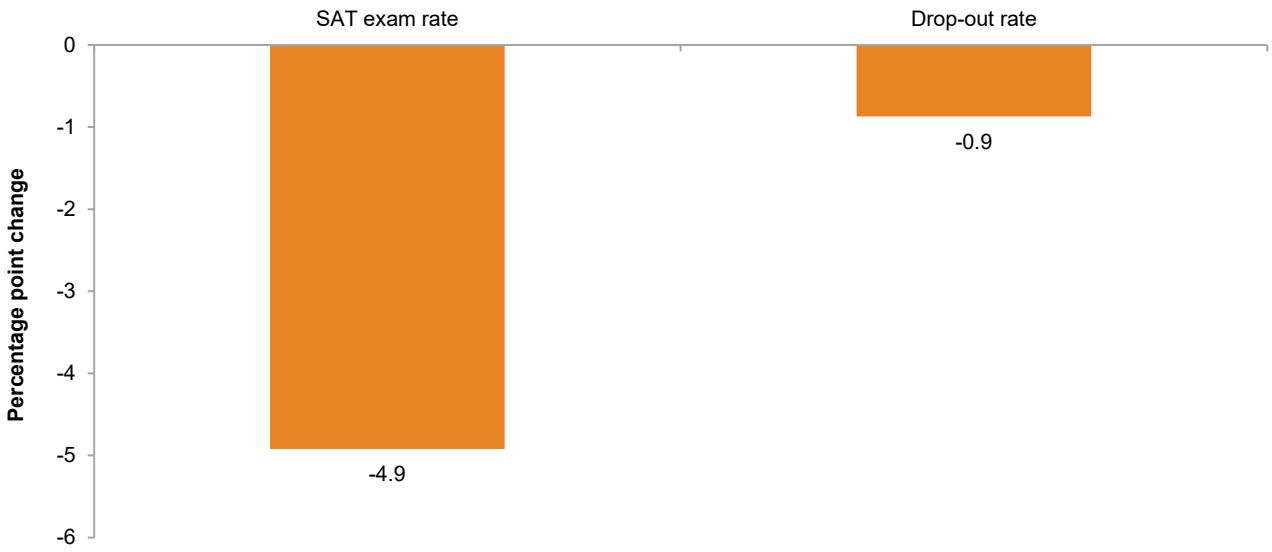
Our findings about more rigorous science requirements are more mixed (Figure 3). Dropout rates are 0.9 percentage points (18 %) lower in schools with higher science requirements, suggesting positive changes in student engagement. However, there does not seem to be any difference in student enrollment in advanced science courses or proficiency rate in the California Science Tests (CAST). This cannot be attributed to differences in course-offerings: districts with and without higher standards offer the same share of science courses that meet UC/CSU admission standards (e.g., area D requirements). Higher science standards are also associated with 4.9 percentage point (11%) lower SAT participation rate.[6]

[5] These estimates are consistent with Betts et al. (2016), which found that the A–G completion rate went up by 10 percent after San Diego Unified implemented its A–G graduation policy. Our estimates are smaller because not all math courses are A–G approved.

[6] To safeguard against selection problems, we performed a set of regressions on outcomes that in theory should not be affected by changing graduation policies, for instance, student enrollment or school size, which is typically a function of parental preference. Although changing graduation policies may attract more students, it should not affect school size within the same district (because all are subject to the same set of graduation requirements). As expected, higher math or science requirements do not have any association with student enrollment, which is reassuring (Technical Appendix Table 5).

FIGURE 3

Higher science requirements are associated with improved engagement but worse academic outcomes



SOURCE: Author's calculation.

NOTES: Sample includes 1,007 regular high schools in 2018–19 school year. Students in alternative high schools and/or charter schools are not subject to the district's high school graduation policies. The bars represent OLS coefficients in a model that controls for student demographics (race/ethnicity, % eligible for free/reduced-price lunch), educational needs (% English Learners), teacher qualifications (average experience, and % with advanced degree), school geographic location (urban, rural), and quality of courses (% of math and science courses that are A–G approved). Standard errors are clustered at the district level. All estimates are significant at the 10 percent level or lower; non-significant results are not shown. Full results are included in Technical Appendix Table 3.

Higher Standards Can Have an Equitable Impact

We have seen that districts with large shares of high-need students are just as likely to have higher science and math requirements as districts with fewer high-need students. However, to evaluate the equity implications of graduation requirements, we need to look at the impact of higher standards on students in schools with lower performance levels. In the next set of analyses, we discuss the following types of schools, which have been the focus of recent policy efforts to close the opportunity gaps:

- High-need schools: more than 55 percent students are eligible for free/reduced-price lunch[7]
- High-poverty schools: more than 75 percent of students eligible for free/reduced-price lunch
- High-minority schools: African American and Latino students make up more than 75 percent of student population
- Schools designated for comprehensive support and improvement (CSI): lowest-performing schools, per the Every Student Succeeds Act[8]

[7] Under the state's Local Control Funding Formula, high-need students also include English Learners and foster youth, most of whom are also eligible for free/reduced-price lunch (CDE LCC Snapshot, 2019–20).

[8] The federal Every Student Succeeds Act (enacted in 2015) requires state educational agencies to determine school eligibility for comprehensive support and improvement. California uses the California School Dashboard to determine school eligibility based on low graduation rate and the lowest-performing 5 percent of Title I schools. In 2017–18, 198 high schools were identified as CSI, and these schools collectively enroll 21 percent of the high school population.

- Rural schools: schools designated as rural based on the National Center for Education Statistics definition
- Urban schools: schools designated as urban based on the National Center for Education Statistics definition

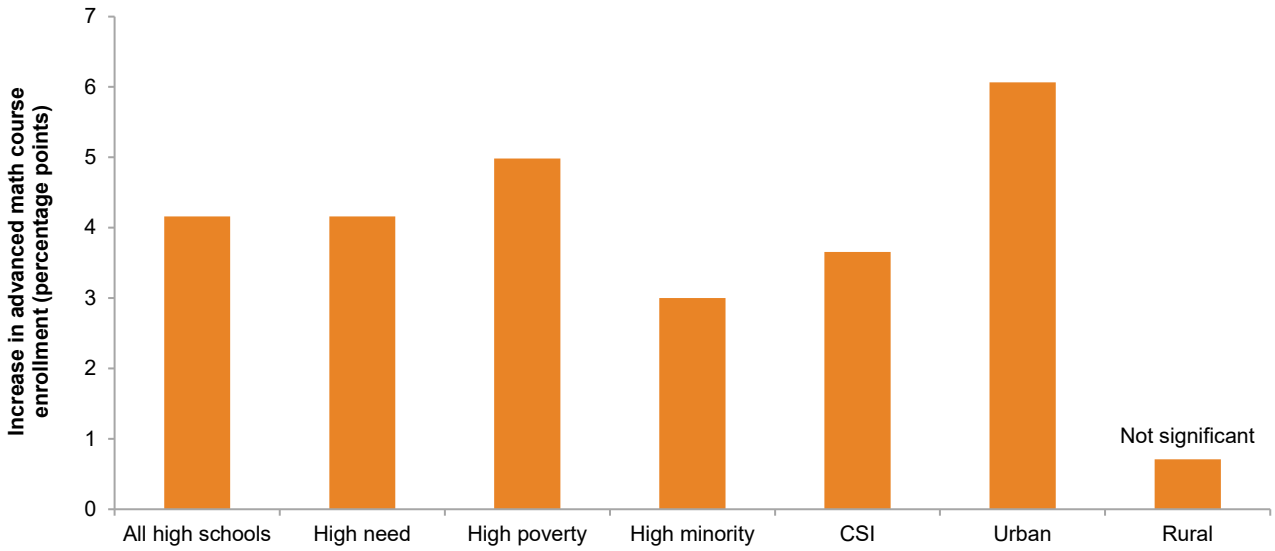
Virtually all high-minority schools are also high-need schools; so are 78 percent of CSI schools and 56 percent of rural schools. Half of CSI schools are also high-poverty schools, while most of rural schools are not (Technical Appendix Table 6).

Our analysis finds no negative relationship between higher math or science graduation requirements and high school graduation rates across school types (Technical Appendix Table 4). Higher math graduation requirements are associated with a 12 percent increase in the likelihood of students taking advanced math courses; the estimate is larger among students in high-need (14%), high-poverty (16%), and urban schools (17%) (Figure 4). The share taking the SAT is also larger at high-need, high-poverty, and high-minority schools.

Students in rural schools do not appear to benefit at all from the higher standards, while those in urban schools are more likely to take advanced math courses, complete the A–G requirement, and take the SAT (Technical Appendix Table 4).

FIGURE 4

Higher math requirements are associated with increased enrollment in advanced math courses at high-need, high-poverty schools



SOURCE: Author's calculation.

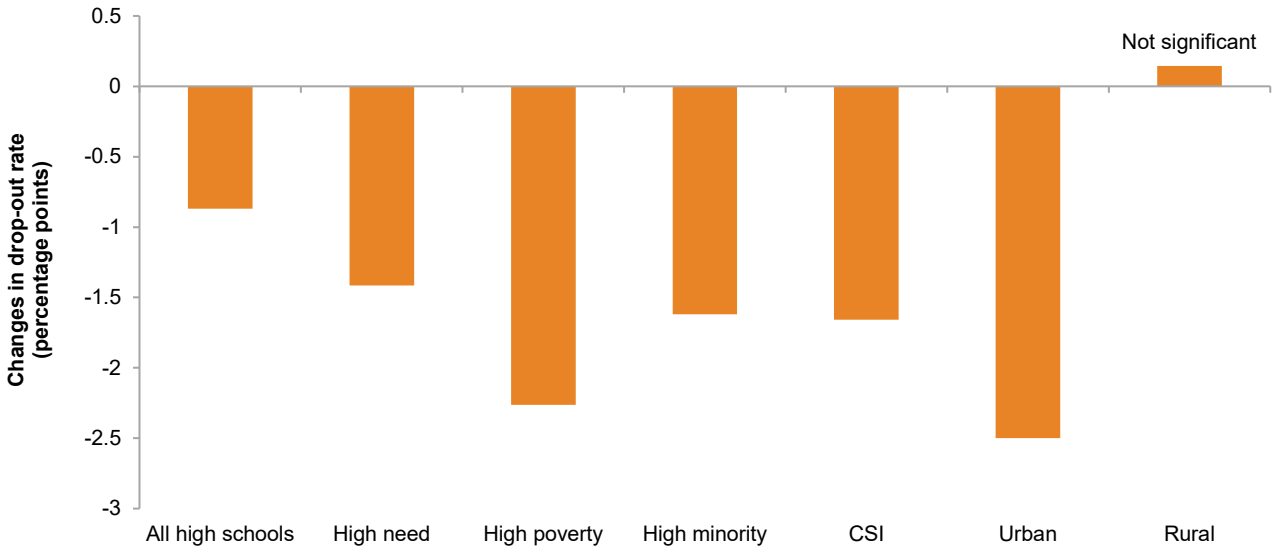
NOTES: Sample includes 1,007 regular high schools in 2018–19 school year. Students in alternative high schools and/or charter schools are not subject to the district's high school graduation policies. The numbers represent OLS coefficients in a model that controls for student demographics (race/ethnicity, % eligible for free/reduced-price lunch), educational needs (% English Learners), teacher qualifications (average experience, and % with advanced degree), school geographic location (urban, rural), percentage of math and science courses that are A–G approved. Standard errors are clustered at the district level. Estimates are significant at the 10 percent level or lower except for rural schools. Estimates for other outcomes are included in Technical Appendix Table 4.

Higher science requirements are associated with an overall dropout rate that is 18 percent lower than the rate for schools with lower requirements; this association is stronger among schools that are high-need (21%), high-poverty (28%), high-minority (22%), CSI (21%), and urban (38%) (Figure 5). Associations with other academic outcomes, such as enrollment in advanced science courses, are by and large negative, although the graduation rate

is 2 percent higher and advanced science course-taking is 31 percent higher at high-poverty schools (Technical Appendix Table 4).

FIGURE 5

Higher science requirements are associated with lower drop-out rates among high-poverty, high-need students



SOURCE: Author's calculation.

NOTES: Sample includes 1,007 regular high schools in 2018–19 school year. Students in alternative high schools and/or charter schools are not subject to the district's high school graduation policies. The numbers represent OLS coefficients in a model that controls for student demographics (race/ethnicity, percentage eligible for free/reduced-price lunch), educational needs (% English Learners), teacher qualifications (average experience and % with advanced degree), school geographic location (urban, rural), percentage of math and science courses that are A–G approved. Standard errors are clustered at the district level. Estimates are significant at the 10 percent level or lower except for rural schools. Estimates for other outcomes are included in Technical Appendix Table 4.

Taken together, these findings suggest that raising academic expectations in high-need, high-poverty, and high-minority schools benefits the students attending those schools, while students in rural and CSI schools are less likely to benefit. These differences could be explained by several factors. CSI and rural schools tend to have more acute teacher turnover and shortages, which may affect the quantity and quality of math and science courses (Le Floch et al. 2016). These schools also have the worst student outcomes (Technical Appendix Table 5).

Although the CSI designation is meant to be temporary, most CSI schools remain in the category for several years. It has also been well documented that these schools have limited resources, inadequate facilities, and insufficient supplies, and that they struggle with overcrowding and student discipline and are frequently affected by low morale and disorganized learning environments (Herman et al. 2008).

Decades of research have documented the extraordinary challenge of turning around persistently low-performing schools (Calkins et al. 2007; Le Floch et al. 2016). A more systematic and significant transformation is needed to help these schools succeed.

California Can Take Steps to Improve Student Outcomes Equitably

In the past two decades, many school districts have increased high school graduation requirements—particularly in math and science—in order to improve student outcomes such as enrollment in advanced courses, high school graduation, A–G completion, and college readiness, while closing equity gaps. California has not changed its minimum math or science graduation requirements since the early 2000s, but most school districts today require three years of math or science. This report shows that raising graduation requirements may improve college readiness, including in high-need schools.

However, it is important to assess these requirements in the context of the COVID-19 crisis, which forced schools to shift to distance learning in 2020. As a result, some students were not able to complete the minimum course requirements due to lack of access to internet and/or devices, course counseling, and support services. Because some students could not meet the pre-pandemic minimum GPA requirements, many districts changed their grading policies to credit/no-credit. In addition, teachers were not able to cover as much material as they would have in the classroom (Hamilton et al. 2020; Gao, Lafortune, and Hill 2020).

State and local policymakers can make sure that graduation policies have an equitable impact on college and career readiness by taking the following steps.

- **Consider raising minimum math requirements.** Higher math standards would require additional spending for staff, instructional materials, and support programs. Most students (66%) are already in schools that require three or four years of math, but the remaining schools could consider raising requirements to support student success in college and beyond. The state could consider raising standards, but such a mandate could require additional funding to schools (even those that already have higher standards). The tradeoff of supporting schools that are cost-constrained with the higher cost overall of a mandate needs to be considered. If such a change can bring about an equitable improvement in student outcomes—and benefit both individuals and the state in generating more college graduates—the cost could be thought of as a long-term investment in California's economy. Regardless, in order to mitigate unintended consequences, districts that raise math standards need to monitor the implementation closely so that additional math coursework does not absorb resources from other subject areas.
- **Provide comprehensive support and technical assistance to rural and CSI schools.** The state should work with the county offices of education to build capacity in these schools. Rural and CSI schools need more resources and targeted assistance to improve school climate, educator effectiveness, and parental involvement, and to sustain growth over time. One possibility is to leverage the state's System of Support to assess local needs, identify effective interventions, monitor local implementation, and provide the support and resources local districts need in order to improve student outcomes.
- **Mitigate the learning loss caused by COVID-19.** The abrupt move to distance learning was especially difficult for students at lower-performing schools. To ensure that higher math standards have an equitable impact on student outcomes, state and local districts need to provide more resources to address the challenges faced by low-income, and/or high-need students, who have lower levels of access to internet and computing devices, parental involvement, and live contact with teachers (Gao, Lafortune, and Hill 2020).
- **Collect data on local graduation policies.** Currently, the state does not collect or report data on local graduation requirements. This makes it difficult to assess and evaluate the efficacy of those policies. More comprehensive data on local requirements—including the number of years required, specific course requirements, GPA requirements, changes over time, and fidelity of implementation—are needed to evaluate the effects of graduation policies, particularly among students in underserved communities, and identify areas for improvement. More granular data, such as the individual-level longitudinal student records that the state is planning to build, could greatly enhance this evaluation.

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