

California's Math Pipeline: Many Routes Through and Around College-Prep Courses

This brief is one of three on K-12 student achievement in mathematics for educators and policymakers wanting to strengthen science, technology, engineering, and mathematics (STEM) education in California.

- The Grade 7 Pivot Point
- Success Begins Early
- **Many Routes Through and Around College-Prep Courses**

This EdSource brief was prepared with input and advice from:



CSLNet is a non-profit organization working to catalyze innovation in STEM teaching and learning in the State of California. CSLNet, in collaboration with a diverse range of partners, champions policies and practices that prepare all students for success in postsecondary education, work, and life.

EdSource takes full responsibility for the content and accuracy of this brief.

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Opportunities in science, technology, engineering, and mathematics (STEM) fields are constrained for the many students who leave high school without, at a minimum, mastery of basic algebra concepts.

Six in ten public high school graduates in California who go on to a public college or university go to community college. For many, arriving unprepared in math costs them valuable time and increases the chance that they will leave college without completing degree-applicable or transfer-level math courses. It also limits their success in STEM-oriented career training programs.

In California, the typical college-prep course sequence in math includes Algebra I, Geometry, and Algebra II.* Students advance through these courses at different rates. A number proceed at a quick pace, with some completing Algebra II by the end of 10th grade and a few even earlier. At the other end of the spectrum, some students struggle with 7th grade math content and/or Algebra I for years. The largest portion falls somewhere in the middle.

A better understanding of students' trajectories through college-prep math courses in high school can help state leaders and local K-14 educators identify potential leverage points for improving students' prospects in math and STEM courses and careers after high school.

California students get through college-prep math at different paces

Earning a C or better in the three-course, college-prep math sequence (or equivalent)

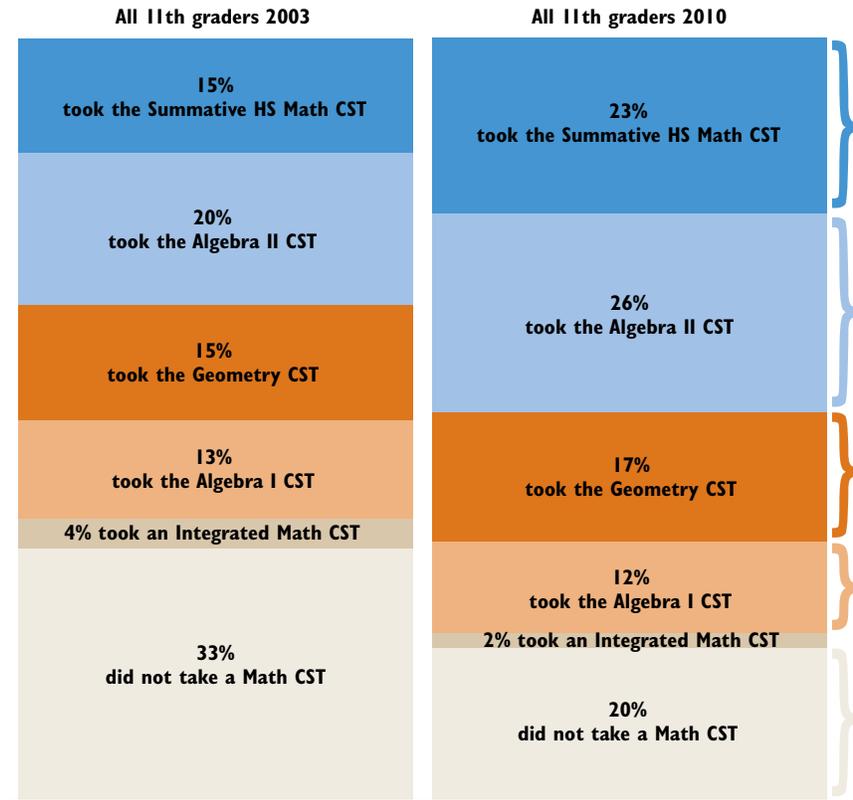
is among the eligibility requirements for admission to the University of California (UC) and California State University (CSU). These course expectations go beyond the state's minimum requirement for high school graduation: California's students must pass only Algebra I to receive a high school diploma, and that has only been required since 2004.

The end-of-course California Standards Tests (CSTs) in math provide a picture of how many students are enrolled in Algebra I, Geometry, and Algebra II in a given year, and in what grades students take these courses. However, the last year that students take CSTs is 11th grade. High school students who have already completed the college-prep sequence through Algebra II (or an integrated equivalent) in a prior year take the Summative High School Math CST.

CST data provide a limited but helpful overview of how 11th grade students have advanced through the college-prep math sequence—and they show significant increases in college-prep course-taking among high school juniors between 2003 and 2010. For example, the percentage of 11th graders who had already completed Algebra II (i.e., took the Summative High School Math CST) increased from 15% to 23% during this time period. (See the first chart on page 2.)

* Although districts are free to establish other sequences, such as integrated math, these are uncommon in California.

11th graders' progress through the college-prep math sequence has improved, but only half had reached at least Algebra II in 2010



Assuming students followed a traditional course sequence and took the CSTs based on state guidelines:

These students would have completed Algebra II by the end of 10th grade and Algebra I by the end of 8th grade.

These students could complete the college-prep sequence in their junior year, and they likely completed Algebra I by the end of 9th grade.

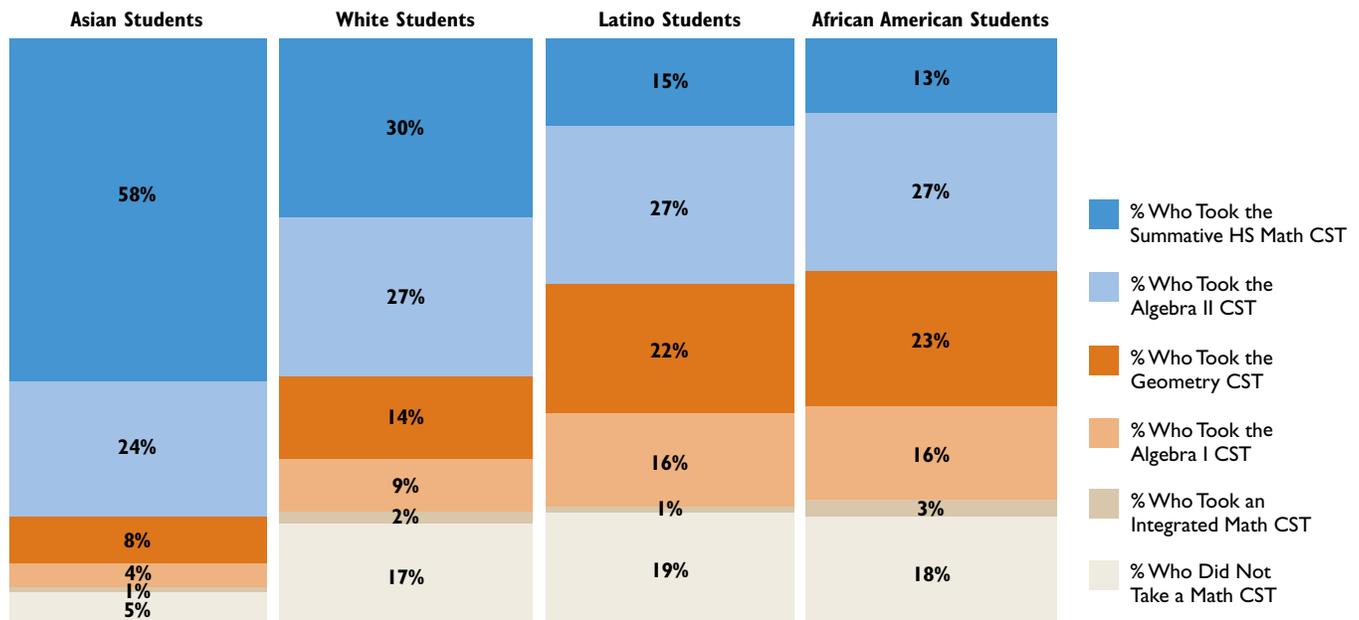
These students could still take Algebra II in 12th grade if successful in Geometry in 11th grade.

These students probably could not complete the math courses required for UC and CSU admission unless they complete both Geometry and Algebra II in their senior year.

The trajectories of these 11th graders are unknown.*

*These students likely had not yet completed Algebra II. Had they done so, they should have taken the Summative High School Math CST. However, they may have already completed the Algebra I requirement for high school graduation.

11th graders' progress through the sequence varies tremendously across California's four major ethnic groups



California's Asian students are far more likely than their peers to complete Algebra I successfully by the end of 8th grade and move through Geometry and Algebra II well ahead of high school graduation.

Note: Percentages for subgroup participation in the various CSTs are calculated by dividing the number of students in a subgroup who took each CST by the number of students in that subgroup who were tested on the Grade 11 English Language Arts CST. Student counts from the English Language Arts CST were used as a proxy for 11th grade enrollment because STAR does not report enrollments for each grade level by ethnicity. In addition, as reported on the next page, 58% of white 11th graders took either the Summative HS Math or Algebra II CST. This differs slightly from the chart above due to rounding.

Few students test as ready for college-level math at the end of 11th grade

Many 11th graders participate in the Early Assessment Program (EAP), a college-readiness test that augments students' Grade 11 English and math CSTs. The EAP is jointly administered by the California Department of Education and CSU. Students who do well are exempted from placement tests if they enroll at a CSU, and the state's community colleges increasingly accept the results as well.

The EAP in math was developed to assess readiness for CSU, which requires successful completion of Algebra II. As a result, the EAP in math is only available to 11th graders who take the Algebra II or Summative High School Math CSTs. The many students who have not advanced this far in the math sequence by 11th grade are not eligible to participate. In 2010, only 49% of 11th graders were EAP-eligible in math, as is clear from the blue boxes in the chart on page 2.

Large differences in EAP eligibility in 11th grade exist among ethnic groups. (See the blue boxes in the chart on page 2.) In 2010, the wide range of EAP-eligibility rates included:

- 82% of Asians;
- 58% of whites;
- 42% of Latinos; and
- 40% of African Americans.

Of the roughly half of all 11th graders who were eligible to take the EAP in math in 2010, about three-quarters (77%) chose to do so—representing only 38% of all California 11th graders.

As a result, there are two ways to think about college readiness as assessed by the EAP in math:

- **Considering only the 11th graders who actually took the math EAP**, 15% were designated ready for college-level mathematics. Another 42% were “conditionally” ready for college-level mathematics, meaning they can be exempted from math placement testing at CSU if they successfully complete another year of rigorous math during their senior year. Finally, 43% of these test-takers were designated “not ready.”

- **Considering all 11th graders**, only 6% were assessed as college-ready and 16% as conditionally college-ready.

Among EAP participants, students from different ethnic groups also differed in their success on the test. Asian EAP test-takers were much more likely to achieve a college-ready score than their white, Latino, and African American peers.

CST data can help clarify priorities for improving students' math performance

Although some high school students who are EAP-eligible in math will go on to a community college, many will attend UC, CSU, or another four-year college. Those students who are not EAP-eligible are the ones who are more likely to depend on the California Community Colleges for postsecondary education. These students will also be more likely to need remediation in math upon college entry.

Strengthening the math proficiency of these students while they are still in middle and high school is vital to reducing community college remediation rates and shortening the time students require to complete an associate degree or transfer to a four-year university. This is especially important for Latinos and African Americans. Even improving the proportion of these students who complete Algebra I successfully by the end of 10th grade could have a strong positive effect if students continue to take mathematics thereafter.

CST data can help illuminate which high school students are taking which courses, when, and with what success. Schools, districts, and regional stakeholders can use that information to develop clear, measurable, and meaningful goals for improving students' math preparation. For example:

- In a region, increasing the percentage of students who are eligible to take the EAP could be a key goal, and achieving it might include getting more students to succeed in Algebra I by the end of 9th grade and to continue moving forward in math successfully.
- In contrast, schools, districts, or regions with a high percentage of students

already eligible for the EAP might want to improve student performance on the EAP itself, perhaps by strengthening instruction within the college-prep sequence.

To the extent that large differences in math success exist among different student groups, local educators may need to address several goals at the same time.

Districts can explore important questions that cannot be answered with statewide data

Statewide data on when students take different high school math courses and how they perform are limited. For example, CST data cannot account for the roughly 20% of 11th graders who did not take a math CST in 2010. At the state level, all that is known about these students is that they have not already completed the college-prep sequence through Algebra II. It is unclear if they have failed Algebra I multiple times and dropped out of math altogether, if they are taking a year off between Geometry and Algebra II, or if they are taking a remedial course or a math course for which there is no CST, such as Business Mathematics.

But districts have access to student-level data that can provide local answers to some vital questions. For example, because districts have complete records on their students, they can look for commonalities and differences among high school students who do not take math CSTs and, depending on the underlying story, respond appropriately.

District data can also provide a clear picture of course-taking in 12th grade. High school seniors do not take CSTs, and other statewide course-taking data are not reported by grade level. As a result, district records are a vital source for finding out whether students are using their senior year to make further strides toward college readiness and how they are doing it. For example, what happens with students who take Algebra I or Geometry in 11th grade? Do they continue taking math in 12th grade? If so, what measures of performance can be used to evaluate their progress?

Finally, to the extent that these questions have important implications for local community colleges, the California Partnership for Achieving Student Success (Cal-PASS) can provide a forum for sharing data. Cal-PASS is a system of regional partnerships through which K–12 teachers and post-secondary faculty work together to improve student transitions, informed by longitudinal data that bridge students' K–12 and post-secondary experiences.

For example, prompted by a local discovery that many community college and university students take math courses they have already passed or exceeded in high school, faculty partnering within Cal-PASS developed Standards Deconstruction Guides that examine California's content standards in Algebra I, Geometry, Algebra II, and

Pre-Calculus. The guides break down the prior and new knowledge students will need in order to master each standard, discuss the kinds of results teachers might assess to gauge student understanding, and provide model assessment items. The guides provide a resource for high school teachers to better understand the standards and to discuss best practices in teaching them.

CST data alone provide important insights but raise more fruitful questions. Districts and their regional partners are best positioned to uncover deeper insight into how students progress through the college-prep sequence. Using this better understanding to answer the questions raised by statewide data can help improve students' potential for success in math and STEM courses in high school and beyond. [ff](#)



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To Learn More

- California Partnership for Achieving Student Success (Cal-PASS). www.cal-pass.org
- Early Assessment Program, California Community Colleges Chancellor's Office. www.cccco.edu/eap/
- Early Assessment Program, California State University. www.calstate.edu/eap/
- EdSource. *Something's Got To Give*. Mountain View, CA. www.edsource.org
- EdSource. *High School to Community College: New Efforts to Build Shared Expectations*. Mountain View, CA. www.edsource.org

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