

California's Math Pipeline: **Success Begins Early**

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.

EdSource thanks the **S.D. Bechtel, Jr. Foundation** for the project grant that supported this work with CSLNet.

Ensuring that students have a strong foundation in mathematics by the end of 7th grade is essential if they are to move successfully into an advanced math curriculum that begins with algebra.

But student achievement at the end of 7th grade varies widely in California—and this has consequences. Some 7th graders are taking a full Algebra I course; others are well positioned to take the course in 8th grade. But still others struggle with 7th grade content and could continue to do so for years.

To improve students' chances to achieve in science, technology, engineering, and mathematics (STEM) fields in high school and beyond, schools must make sure that students succeed in math well before 7th grade. One measure of readiness is the

California Standards Tests (CSTs) in mathematics, which students in grades 2–7 take at the end of each school year.

Across the early grades, more students are meeting the state's expectations

The CSTs allow educators and policymakers to benchmark achievement in a particular grade across multiple years—for all students, different student groups, different schools, and so forth. This provides important insight into the performance of California's K–12 education system and its students over time.

7th grade math achievement has improved over time

In 2003, only 30% of 7th graders scored *proficient* or *advanced* on the grade-level math CST. By 2010, 46% did so, and an additional 7% took the Algebra I CST.

The percentage of students scoring *below* or *far below basic* on the grade-level test has been cut nearly in half between 2003 and 2010.

Achievement in 7th grade has also improved for each of the state's four largest ethnic groups—though achievement varies widely between groups. (See *The Grade 7 Pivot Point* brief for more information.)

All 7th Graders

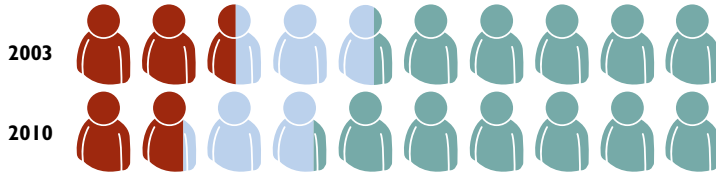


Note: For 2010, the percentages shown above for student achievement on the Grade 7 Mathematics CST differ from those reported by the state because they account for 7th graders who took the Algebra I CST. See the accompanying *The Grade 7 Pivot Point* brief at www.edsource.org for detailed notes on how these percentages and the percentage of students taking the Algebra I CST were calculated. Because 7th graders taking the Algebra I CST have performed extremely well to date—85% scored *proficient* or *advanced* in 2010—we count these students as “high achievers” in this graphic.

As in later grades, 2nd grade math achievement shows steady improvement

■ % Scoring Below Basic/Far Below Basic on Grade-level CST
 ■ % Scoring Basic on Grade-level CST
 ■ % Scoring Proficient/Advanced on Grade-level CST

All 2nd Graders



In 2003, 53% of 2nd graders scored *proficient* or *advanced*. By 2010, 62% did so.

2nd grade math achievement has improved across all ethnic groups but varies dramatically among them

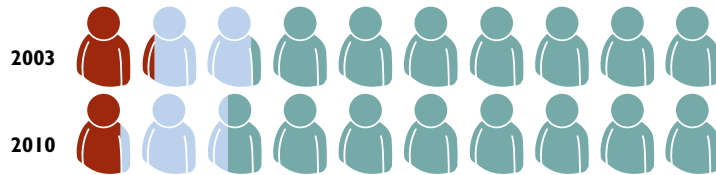
2nd Graders by Ethnicity

Asian



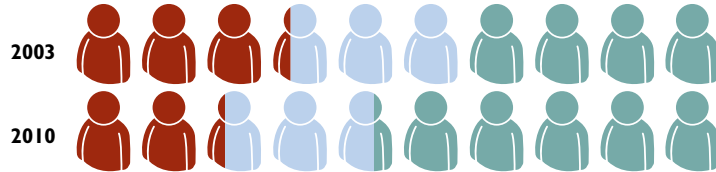
The percentage of Asians scoring *proficient* or *advanced* improved by 10 points (74% to 84%).

White



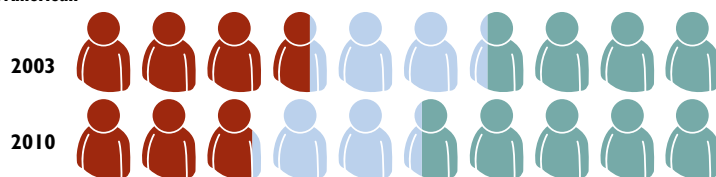
White 2nd graders scoring *proficient* or *advanced* grew from 71% to 76%.

Latino



Latinos scoring *proficient* or *advanced* rose from 40% to 53%.

African American



The percentage of African Americans scoring *proficient* or *advanced* grew by 10 points (37% to 47%).

But Latinos and African Americans were more likely to score *below* or *far below basic* in 2010 than Asians or whites were in 2003.

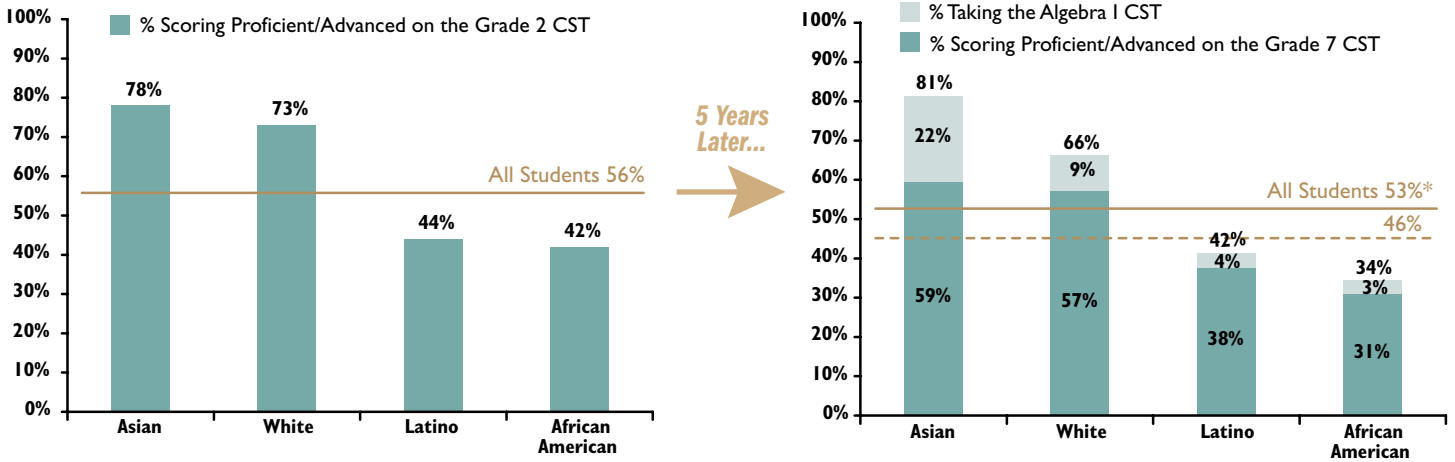
Gaps in student performance that exist in 2nd grade persist

Longitudinal CST data that follow individual students from 2nd to 7th grade are not publicly available. But multiple single-year snapshots of student math achievement provided by available CST data—though they provide no guarantee that the same students were assessed from year

to year—permit limited insight into how different groups of students within a single cohort compare as they move through these grades.

Consider California’s class of 2015. This class of students was in 2nd grade in 2005 and in 7th grade in 2010.

Student groups that were higher achieving in math in 2nd grade were still ahead five years later



Differences in 2nd grade math achievement were pronounced among the state’s largest ethnic groups in 2005.

Asian students still outperformed their counterparts, with 22% of Asian 7th graders taking the Algebra I CST.

Latino and African American students were far less likely to score proficient or advanced on the 7th grade test or take the Algebra I CST.

* The unbroken line (53%) represents the percentage of all 7th graders who either scored *proficient* or *advanced* on the Grade 7 CST or took the Algebra I CST. The dotted line (46%) represents only the percentage who scored *proficient* or *advanced* on the Grade 7 CST.

Note: For Grade 7 data in 2010, the percentages shown above for students scoring *proficient* or *advanced* on the Grade 7 Mathematics CST differ from those reported by the state because they account for 7th graders who took the Algebra I CST. See the companion brief, *The Grade 7 Pivot Point*, at www.edsource.org for detailed notes on how these percentages and the percentage of students taking the Algebra I CST were calculated.

DATA: CALIFORNIA DEPARTMENT OF EDUCATION (CDE), STANDARDIZED TESTING AND REPORTING (STAR), 2005 AND 2010

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The data shown here support the holistic observation that, for the class of 2015, those ethnic groups that experienced more widespread success in math in 7th grade had also done so in 2nd grade.

But the limitations of the available CST data prevent definitive conclusions regarding the extent to which these differences between ethnic groups changed over time.

Grade-level California Standards Tests in math are an important but limited data source

The mathematics CSTs for grades 2–7 provide snapshots of student achievement in a given year, as measured by a particular test and aligned with a particular set of grade-level standards.

Unfortunately, these tests do *not* show whether math achievement gets “better” or “worse” as students move through these grades over time, whether in general or for a particular group of students. Although the scale score cut-point for scoring *basic* is always 300 and the cut-point for scoring *proficient* is always 350, the difficulty and content represented by these scores are not the same across tests.

CSTs taken once per year are also not sufficient to fully describe how student performance in math develops through the elementary and middle grades. From a curricular and instructional perspective, regular local assessments—*informed by a clear vision of how key math skills and understanding build over time*—are essential to diagnose when and how students excel or struggle and to inform conversations about curricular alignment across grades.

Gaps in school readiness foreshadow later achievement gaps

Currently, California does not have a common standardized measure or any statewide data regarding school readiness in kindergarten. However, compelling evidence suggests that the achievement gaps that exist between student groups in 2nd grade are foreshadowed at kindergarten entry.

For example, a 2007 study by the RAND Corporation examined four data sources that measured student readiness and achievement in kindergarten and first grade in parts of California. School readiness encompasses not only young students' early academic skills, but also their expression and interaction with others, self-regulation, and motor skills. The data sources included:

- A Reading Lions Center Skills Assessment of students in 17 school districts in 12 counties implementing the Reading First program. The data were not representative of all students in California and only tested one skill—reading.
- The Early Childhood Longitudinal Study, with data on students' readiness to enter kindergarten based on behavioral assessments of the entering class of 1998–99. It included data on students throughout California, though not a truly representative sample.
- A 2007 evaluation of the First 5 School Readiness Program conducted by SRI International that used a representative sample of students in some low-performing districts.
- A 2006 study of kindergarten readiness in San Mateo and Santa Clara counties by Applied Survey Research that used a representative sample of students from these two California counties.

The RAND researchers, while acknowledging the limitations of these individual data sources, found that they presented a relatively consistent story. The researchers concluded that the same groups of students who are lower performing on the early CSTs are also less prepared when they enter kindergarten.

These gaps in school readiness matter because of what they could portend for

students' subsequent achievement in mathematics. A 2010 report by Applied Survey Research used longitudinal student-level data to examine the relationship between school readiness and 3rd grade English language arts and math CST results in Santa Clara and San Mateo counties. The report found that students who entered kindergarten stronger in the areas of kindergarten academics (e.g., recognizing letters of the alphabet, counting 10 objects correctly) and self-regulation (e.g., staying focused during activities) achieved better results on the 3rd grade tests.

Early interventions could help close gaps in student performance

The RAND study discussed above examined the potential for intervening in preschool to address differences in school readiness. The researchers found strong evidence that well-designed preschool programs improved school readiness and affected later student academic performance, in particular for disadvantaged students who are at greatest risk of poor school performance. But subsequent RAND research published in 2008 found that these disadvantaged students are least likely to participate in high quality preschool programs. Children Now also reports that California's Latino children are least likely to attend preschool, compared with their white, Asian, and African American peers.

Although preschool can narrow readiness gaps that foreshadow later achievement gaps, the RAND researchers caution that preschool alone is not likely to close them. Instead, preschool should be combined with other interventions and supports as students transition into kindergarten and move through elementary school.

Fragmented data provide an incomplete picture of readiness at the state level

First 5 County Commissions have been important actors in understanding school readiness in their local areas, and select counties have been leaders in collecting data. For example, San Mateo and Santa Clara counties have used results from multiple years of kindergarten readiness studies—including a longitudinal study of kindergarten students

through third grade—to guide community organizations in strategic planning to improve children's school readiness and subsequent success in early elementary school.

But, Children Now points out, because different readiness assessments are used in different counties and school districts, it is impossible to aggregate school readiness data at the regional and state level.

The California Department of Education (CDE) is working to address this fragmentation through the development of a common school readiness assessment. Upon completion, the Desired Results Developmental Profile-School Readiness (DRDP-SR) assessment will be available for voluntary use by schools to inform classroom instruction and better support students as they transition into kindergarten. The state is currently piloting the assessment and working to develop systems to collect data from the assessment at the county and state levels.

Local educators and leaders are in the best position to examine students' progress in math

When it comes to instructional improvement, statewide data is of limited use. Local school districts and their regional partners have other data they can use to develop a more sophisticated and actionable understanding of how students are progressing in mathematics through 7th grade, and which content is most troublesome. Districts typically have longitudinal data that makes it possible to follow individual students from year to year, and they have measures beyond the CSTs that can provide a more comprehensive understanding of how student performance evolves.

For example, publicly available CST data do not clarify whether the students who score at the lowest levels in 2nd grade are the same individuals who score at these levels in 7th grade. But local districts could answer this question and, through data derived from other assessments, develop a deeper understanding of the nature of students' particular challenges. These data could also be connected with prior school readiness data, where available.

As local educators and their partners ask deeper questions like these, they should keep some considerations in mind.

First, improving math proficiency in the early and middle grades requires careful attention to the academic language of instruction and assessment—particularly for the state’s many English learners. According to the CDE, nearly four in 10 California 2nd graders were English learners in 2009–10, with the vast majority of them being Spanish speakers. Specialized vocabulary, words with meanings in mathematics that differ from everyday use, and narrative word problems are examples of the linguistic challenges that English learners—and native English speakers—must master to succeed in math.

Second, more is being learned—in California and the nation—about how to organize math curricula to ensure that more students develop the strong skills and understanding they need to be successful in more advanced math courses. As with anything in the realm of school improvement, this is

a work in progress. As recently as 2008, the National Mathematics Advisory Panel called for instruction through the middle grades to pay particular attention to “critical foundations of algebra,” such as fluency with whole numbers and fractions and aspects of geometry and measurement. Similar topics were the focus when, several years earlier, California established expectations for instructional materials intended to improve the algebra readiness of students not yet ready to take Algebra I in 8th grade.

The recently adopted Common Core content standards in math are an important context for future action in this respect. The standards were developed with the intention of increasing the focus and coherence of math instruction over time—in part so that students develop not only skill in carrying out mathematical procedures, but also strong understanding of math concepts and how they relate to one another. New assessments aligned with these standards will gradually be implemented at the state and local levels. These new tools should further

California’s understanding of its students’ mathematics progress and achievement.

Finally, improvements in math achievement and learning in the elementary and middle grades will ultimately hinge on the capacity of local educators. Looking ahead to the Common Core standards, some experts in the state counsel that extensive professional development—of a kind California has not typically invested in—will be needed to prepare teachers to more explicitly teach mathematics for understanding.

In addition, the preparation of teachers with multiple-subject credentials in the elementary and early middle grades is an ongoing concern in California. Those teachers play a crucial role by providing students a secure foundation in math and a positive disposition toward the subject.

One policy response to the latter concern is the Teaching Mathematics Advisory Panel convened by the California Commission on Teacher Credentialing (CTC). The panel’s recommendations are resulting in CTC action, including standards and regulations for a new Mathematics Instructional Added Authorization that multiple-subject teachers can pursue, as well as a Mathematics Instructional Leadership Specialist Credential. Both are intended to strengthen instructional and leadership capacity in mathematics at the elementary and middle grades levels. The panel also recommended improvements to the state’s program standards for the mathematics preparation of those seeking multiple-subject credentials. [\[f\]](#)

To Learn More

- Applied Survey Research. (2010). *School Readiness and Student Achievement: A Longitudinal Analysis of Santa Clara and San Mateo County Students*. Watsonville, CA. www.appliedsurveyresearch.org
- Cannon & Karoly. (2007). *Who Is Ahead and Who Is Behind? Gaps in School Readiness and Student Achievement in the Early Grades for California’s Children*. Santa Monica, CA: RAND. www.rand.org
- Children Now. (2011). *California Report Card 2011: Setting the Agenda for Children*. Oakland, CA. www.childrennow.org
- Children Now. (2009). *Kindergarten Readiness Data: Improving Children’s Success in School*. Oakland, CA. www.childrennow.org
- Children Now. (2009). *Kindergarten Readiness Data Efforts: Survey of California First 5 County Commissions*. Oakland, CA. www.cde.ca.gov/sp/cd/re/documents/first5survey.pdf
- Cronin, Dahlin, Adkins, & Kingsbury. (2007). *The Proficiency Illusion*. Washington, D.C.: Thomas B. Fordham Institute. www.edexcellence.net
- Ho. (2008). The Problem With “Proficiency”: Limitations of Statistics and Policy Under No Child Left Behind. *Educational Researcher* 37(6), pp. 351–360.
- Karoly, Ghosh-Dastidar, Zellman, Perlman, & Fernyhough. (2008). *Prepared to Learn: The Nature and Quality of Early Care and Education for Preschool-Age Children in California*. Santa Monica, CA: RAND. www.rand.org

Acknowledgments

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