

Preparation, Placement, Proficiency

Improving Middle Grades Math Performance



Highlights from the follow-up analysis to
Gaining Ground in the Middle Grades: Why Some Schools Do Better



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EdSource is grateful to the **S.D. Bechtel, Jr. Foundation** and to **Reed Hastings**, CEO of Netflix, Inc., for their support of this follow-up analysis.

Suggested Citation

Williams, T.; Haertel, E.; Kirst, M.W.; Rosin, M.; Perry, M. (2011). *Preparation, Placement, Proficiency: Improving Middle Grades Math Performance*. Policy and Practice Brief. Mountain View, CA: EdSource.

This policy and practice brief, and the full technical follow-up report and its appendices, are available to download for free at www.edsource.org, as are all materials from the original *Gaining Ground in the Middle Grades* study.

Gaining Ground in the Middle Grades

EdSource released *Gaining Ground in the Middle Grades* in February 2010.

The research process for that study involved three surveys with a combined total of more than 900 items that asked teachers, principals, and superintendents about district and school policies and practices in the middle grades. The survey participants included 303 principals, 3,752 English and math teachers, and 157 district superintendents and charter management organization (CMO) leaders.

Among the 303 schools in the sample, one-quarter were K-8 schools, one-quarter served grades 7-8, and the rest served predominantly grades 6-8. The schools—including 28 charter schools—were located throughout the state and varied widely in size.

These schools represented both low- and middle-income communities. California's School Characteristics Index (SCI) summarizes multiple factors associated with student performance on state tests and can be understood as a proxy for the average socioeconomic status of a school's students. We used it to define two groups of schools in our sample:

- 144 schools in the 20th–35th percentile band of the SCI served predominantly students from lower-income families. In 2008–09, these schools were more likely than the California average to serve middle grades students who were socioeconomically disadvantaged, Latino, English learners, and/or whose parents had not gone to college.
- 159 schools in the 70th–85th percentile band of the SCI served predominantly students from middle-income families. In 2008–09, these schools were more likely than the California average to serve middle grades students who were white and/or whose parents had completed at least some college. At the same time, however, nearly three in 10 middle grades students in these schools, on average, were socioeconomically disadvantaged.

The study was designed to identify middle grades policies and practices that differentiated higher-performing schools from lower-performing ones serving similar students. Controlling for school and student characteristics, survey responses were analyzed against 2009 scores on the California Standards Tests (CSTs) in English language arts and math for almost 204,000 students in grades 6, 7, and 8, including the Algebra I CST in grade 8—both for the single year and after accounting for several years of prior student achievement.

The follow-up analysis highlighted in this policy and practice brief used the *Gaining Ground* longitudinal data file.

HIGHLIGHTS: A follow-up analysis to *Gaining Ground in the Middle Grades*



Early in 2010, EdSource released a landmark study on middle grades education in California. *Gaining Ground in the Middle Grades* looked at the critical 6th- to 8th-grade years in the context of standards-based education. The analysis identified a comprehensive set of practices that differentiated higher from lower schoolwide academic achievement among a sample of 303 middle grades schools.

As we began that study in 2008, the California State Board of Education passed a controversial motion—subsequently blocked through legal action—to make the state's Algebra I test the “sole test of record” for grade 8 math for federal accountability purposes. And in the course of conducting the *Gaining Ground* study, we observed that schools in our sample differed widely in how they placed students into Algebra I in grade 8. This raised questions requiring a different, more in-depth analysis than we could complete within the scope of the original study.

This brief presents highlights and implications from *Improving Middle Grades Math Performance*. That follow-up analysis uses the *Gaining Ground* data to take a more in-depth look at middle grades math practices and policies—in particular, 8th grade mathematics placements. In addition, it uses longitudinal data linking the California Standards Tests (CSTs) in mathematics that students in the original study sample took in grade 7 (in 2008) and grade 8 (in 2009) to analyze their relationship.

We wanted to know which students in our sample were—or were not—placed in Algebra I in grade 8, and how successful students were as measured by grade 8 CSTs.

Selected findings from the placement analysis

- Eighth graders' incoming math preparation varied widely, yet many with low levels of preparedness were placed into a full Algebra I course.
- Schools serving mostly low-income students placed higher percentages of students into Algebra I than did schools serving mostly middle-income students.
- The most-prepared students typically took Algebra I in grade 8, and they generally scored *proficient* or higher on the Algebra I CST.
- Moderately prepared students, if placed in Algebra I, generally did not score *proficient* or

We asked:

- How do students' placements in grade 8 relate to their prior achievement in grade 7?
- How does the placement of students into Algebra I in grade 8 vary among schools?
- Does prior achievement matter for students' test scores in grade 8?

In addition, we conducted new analyses of the survey responses of the superintendents, principals, and mathematics teachers in our *Gaining Ground* study to identify policies and practices that correlate with higher school achievement in grade 8 mathematics, controlling for key school variables and students' prior test scores.

higher on the Algebra I CST in 8th grade—though most scored at least *basic*.

- The least-prepared students, if placed in Algebra I, generally did not even score at the *basic* level.

Thus, placement in Algebra I in grade 8 for the state's most prepared math students appears to have served them well. And some students score highly on the Algebra I CST despite having relatively low prior-year scores. However, placing all 8th graders into Algebra I, regardless of their preparation, sets up many students to fail.

Selected findings on district and school practice

- Districts often leave key aspects of policymaking about student placement to school sites.
- School sites, in turn, vary in their placement practices—but ensuring wide access to rigorous curricula is the most common goal.
- Schools with higher math achievement in grade 8 are intentional in their efforts to ensure curricular coherence and to evaluate student outcomes and instructional needs, other things being equal.

These findings come as California revisits its math expectations for grade 8

In August 2010, California adopted Common Core State Standards in mathematics but made significant adjustments to the standards related to algebra in the middle grades. Our findings have implications for state policymakers and for local educators as California implements the Common Core in the

next few years. In the interim, our findings clarify steps that can be taken now to ensure that the placement of middle grades students into mathematics courses is done more thoughtfully to achieve both the widest appropriate access to challenging courses and the greatest likelihood of student success.

STATEWIDE TRENDS: Increasing numbers of middle grades students in California take Algebra I



Two decades ago, a central question related to algebra was *which* students should even take the course. Today, *all* California public school students are expected to complete Algebra I, as defined by the state's 1997 mathematics content standards, to earn a high school diploma. But ideally they complete it early enough to enroll in at least two more years of college preparatory math before they graduate. Moreover, state policies—discussed in detail later—have pressured California schools to place more students in Algebra I by grade 8.

That said, state policy has not technically required schools to place all or any 8th graders in the course. The way California tests 8th graders in math reflects this distinction:

- Eighth graders positioned to complete the Algebra I course defined in California's 1997

mathematics content standards take the end-of-course Algebra I CST;

- Eighth graders enrolled in more advanced classes (e.g., Geometry) take the corresponding end-of-course test; but
- Eighth graders *not* yet enrolled in a full Algebra I course—e.g., those enrolled in a pre-algebra course or the first year of a two-year Algebra I course—take the General Mathematics CST, which assesses student achievement related to grades 6 and 7 content.

Testing data show that the proportion of 8th graders taking Algebra I increased between 2003 and 2010, from 32% to 57%. And some California middle graders undertake an even more accelerated path. Almost 7% of 7th graders took Algebra I in 2010, and nearly 5% of 8th graders took Geometry.

Testing data show that the proportion of 8th graders taking Algebra I increased between 2003 and 2010, from 32% to 57%.

Statewide data leave vital questions unanswered

Unfortunately, publicly available statewide CST data provide no insight into the *preparation* of 8th graders who take Algebra I, nor into how a student's level of prior achievement in math relates to their placement in the course and their prospects for success. The longitudinal student CST data file constructed and analyzed for

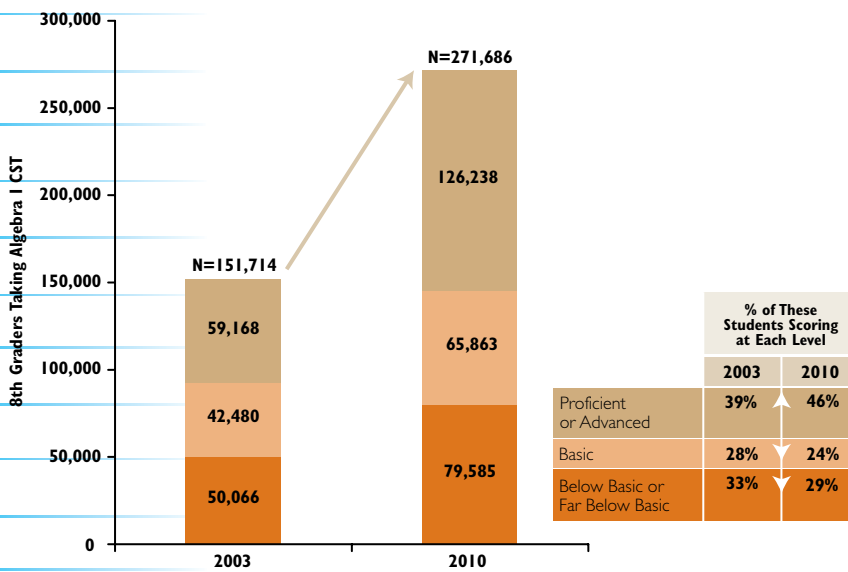
the *Gaining Ground in the Middle Grades* study provides an opportunity to inquire into these questions.

Before reviewing our findings, however, statewide data provide context for considering the benefits and the unintended consequences of California's emphasis on Algebra I in grade 8.

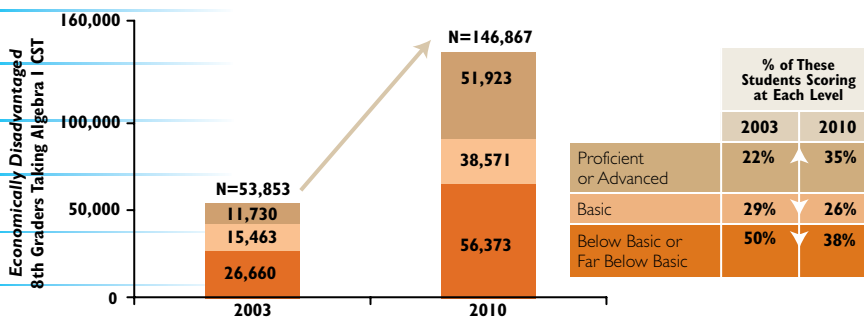


Statewide data reveal dramatic changes in Algebra I participation and performance among California's 8th graders

A: Participation and achievement on the Algebra I CST among all California 8th graders, 2003 versus 2010



B: Participation and achievement on the Algebra I CST among economically disadvantaged California 8th graders, 2003 versus 2010



Note: The counts of 8th graders shown for each performance level are estimates. These were calculated for 2003 and 2010 by multiplying the state-reported portion of grade 8 Algebra I CST-takers who scored at a given performance level by the state-reported number of 8th graders who were tested on the Algebra I CST. The total number shown at the top of each bar is the sum of these estimates.

Because state-reported percentages for each performance level do not always sum exactly to 100%, our estimated totals do not always match the state-reported number of 8th graders tested. At the time these data were accessed, the corresponding state-reported numbers of 8th graders tested on the Algebra I CST were: for **all** 8th graders, 151,714 (2003) and 274,431 (2010); and for **economically disadvantaged** 8th graders, 53,320 (2003) and 148,351 (2010).

DATA: CALIFORNIA DEPARTMENT OF EDUCATION (CDE), STANDARDIZED TESTING AND REPORTING (STAR), ACCESSED 12/10

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On the positive side of the ledger, earlier placement in Algebra I has served a large number of 8th graders well, including groups of students who previously had limited access to the course.

- The proportion of 8th graders taking the course who scored *proficient* or higher on the Algebra I CST increased from 39% in 2003 to 46% in 2010. (See Figure A.)
- Nearly four-and-a-half times as many economically disadvantaged 8th graders scored *proficient* or higher on the test in 2010 as in 2003. (See Figure B.)
- In addition, *three times* as many African American 8th graders and *more than four-and-a-half times* as many Hispanic/Latino 8th graders scored *proficient* or higher on the Algebra I CST in 2010 as in 2003.

However, the same testing data show that many 8th graders appear to struggle in the course.

- Fully 29% of 8th graders who took the Algebra I CST in 2010—nearly 80,000 California students—scored *below basic* or *far below basic*. (See Figure A.) Of these students, nearly 51,000 were Hispanic and more than 8,000 were African American (representing 46% of African American 8th graders taking the test).
- More economically disadvantaged 8th graders scored *below basic* or *far below basic* on the Algebra I CST in 2010 than took the test *at all* in 2003. (See Figure B.)

In addition, evidence from a variety of sources indicates that many students repeat Algebra I as 9th graders, including students who do well in the course the first time around. Statewide, data released by the California Department of Education showed that 38% of 9th graders who took the Algebra I CST in 2008 had already taken the test in a prior year. Better understanding is needed of why Algebra I repetition in high school occurs and whether it improves students' mastery of content and prepares them to continue taking more advanced math courses. But it is outside the scope of our analysis and this brief because our data file did not include high school test scores.

PLACEMENT ANALYSIS: Some students are well positioned for Algebra I in grade 8, but one placement does not fit all



California needs to better understand how 8th graders are placed into Algebra I and their preparation for the course. *Thanks to longitudinal testing data that link students' math CST scores in grades 7 and 8, our follow-up analysis to Gaining Ground in the Middle Grades provides new insight.*

Most of the 8th graders considered in our analysis took the Algebra I CST in 2009; altogether 57% of 8th graders took it for the first time. Another 36% of 8th graders took the General Mathematics CST, meaning they were enrolled in a course below California's full Algebra I course. More than 6% of 8th graders in the sample schools, having already taken the Algebra I CST in grade 7, either repeated the test for a second consecutive year or moved on to Geometry; these students are not discussed in what follows.

To better understand students' incoming preparation, their grade 8 placements, and their chances of scoring *proficient*, we focused on almost 70,000 students from our 303 sample schools who took the Grade 7 Mathematics CST in 2008 and then took either the Algebra I CST or the General Mathematics CST in 2009 as 8th graders.

In This Section

A total of **69,663** students in the sample took the Grade 7 Mathematics CST in 2008 and then took either the Algebra I CST or the General Mathematics CST in 2009 as 8th graders. **In this section of the brief, we ask the following questions about these students:**

PREPARATION:

- What was each 8th grader's incoming level of preparedness, defined in terms of his or her score on the Grade 7 Mathematics CST during the prior year?

PLACEMENT:

How did prior preparation relate to placement in Algebra I? In particular:

- What percentage of similarly prepared 8th graders was placed into Algebra I, defined as taking the end-of-course Algebra I CST rather than the General Mathematics CST?
- Were similarly prepared 8th graders more likely to be placed into Algebra I in schools serving predominantly low-income students or in schools serving predominantly middle-income students?

PROFICIENCY:

- Given students' preparedness and placements, what percentage of 8th graders scored *proficient* or higher on the Algebra I CST and on the General Mathematics CST, respectively?

CST scores are only one measure of academic achievement, representing a single moment in time. But this section shows that considering CST scores in these ways provides a powerful window into why local placement decisions matter.

Note: This section does **not** show whether schools actually used students' grade 7 CST scores to make placement decisions. Although schools often consider CST scores, in many places scores from the previous year become available only after schools have set up class rosters. (That said, many students likely took periodic, standards-based benchmark tests during the previous year.)

Eighth graders' preparation in mathematics varied widely

We used 8th graders' prior-year scores on the Grade 7 Mathematics CST as a measure of their incoming preparedness. To better understand variations in student preparedness, we defined *seven performance levels* on the grade 7 test. These are based on California's five established performance levels, with the *basic* and *proficient* levels each subdivided into two categories in order to better understand differences among students who scored at these widely discussed, policy-relevant levels.

Students' preparedness varied widely:

- At one end of the spectrum, roughly 25% of students entered grade 8 with scores at the *far below basic* or *below basic* levels.
- At the other end of the spectrum, 13% entered grade 8 with scores at the *advanced* level.

- The incoming achievement of the remaining students was fairly evenly distributed across the *low-basic*, *high-basic*, *low-proficient*, and *high-proficient* levels.

Prior-Year (2008) Achievement on the Grade 7 Mathematics CST, Among 69,663 8th Graders Enrolled in the 303 Sample Schools in 2009

Five State-Defined CST Performance Levels	Seven Performance Levels Considered in Our Analysis	Percent of 8th Graders in the Sample (in 2009) Who Scored at Each Level on the Grade 7 Mathematics CST in 2008 (n=69,663)
Far Below Basic	Far Below Basic	5%
Below Basic	Below Basic	19%
Basic	Low-Basic	15%
	High-Basic	16%
Proficient	Low-Proficient	15%
	High-Proficient	16%
Advanced	Advanced	13%

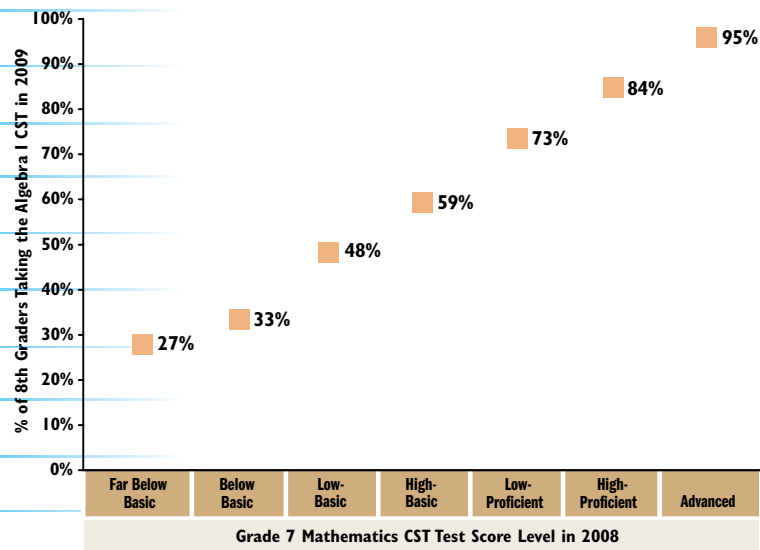
Note: Percentages do not sum to 100% due to rounding.

DATA: CALIFORNIA DEPARTMENT OF EDUCATION, RESTRICTED-USE LONGITUDINAL RESEARCH FILE

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Many 8th graders at low levels of preparation were placed into Algebra I

Proportion of 8th graders taking the Algebra I CST, based on their incoming Grade 7 Mathematics CST score levels, full sample of schools



DATA: CALIFORNIA DEPARTMENT OF EDUCATION, RESTRICTED-USE LONGITUDINAL RESEARCH FILE

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Next we wanted to understand how often students at different levels of preparedness were placed into Algebra I in 8th grade. Our analysis found:

- Students at higher levels of preparedness were more likely to be placed in Algebra I in grade 8 (i.e., take the Algebra I CST rather than the General Mathematics CST). Indeed, 95% of students who had scored *advanced* in grade 7 were so placed.
- However, many 8th graders with low scores in grade 7 were also placed in a full Algebra I course. This was the case for 27% of students who scored *far below basic* in grade 7, 33% of students who scored *below basic*, and nearly half of students who scored *low-basic*.

Schools serving mostly low-income students placed greater percentages of 8th graders into Algebra I than did schools serving mostly middle-income students

The two groups of schools in our sample—identified based on their School Characteristics Index (SCI)—differed in how frequently they placed 8th graders into Algebra I.

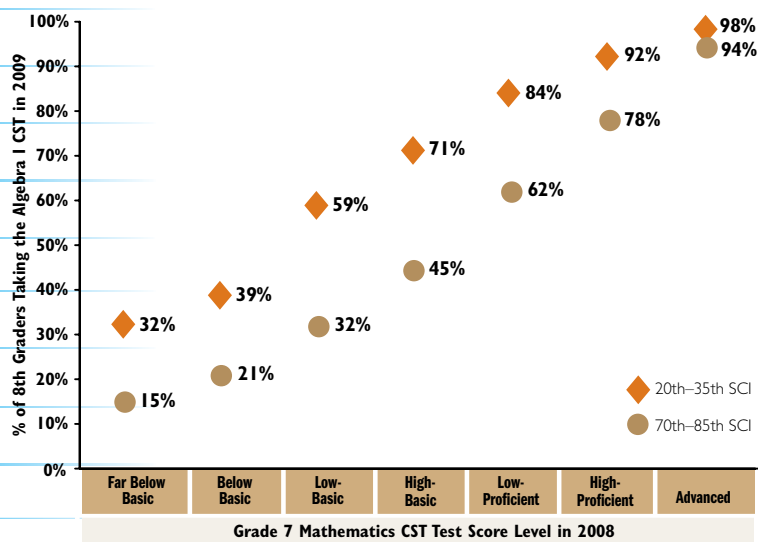
Our analysis found:

- Whatever a student's level of preparedness, the schools serving mostly low-income students (in the 20th–35th percentile SCI band)

placed greater percentages into Algebra I in grade 8 than did the schools serving mostly middle-income students (in the 70th–85th percentile SCI band).

- At each of the three lowest levels of preparedness, 8th graders in the 20th–35th percentile SCI band were **roughly twice as likely** to be placed in a full Algebra I course as were similarly prepared 8th graders in the 70th–85th percentile SCI band.

Proportion of 8th graders taking the Algebra I CST, based on their incoming Grade 7 Mathematics CST score levels, by SCI band



DATA: CALIFORNIA DEPARTMENT OF EDUCATION, RESTRICTED-USE LONGITUDINAL RESEARCH FILE

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Because these two groups of schools do not serve the same profile of students, their different approaches to Algebra I resulted in some **notable differences in how similarly prepared 8th graders from different backgrounds were placed**. Our analysis found that overall, and contrary to what might be expected:

- Eighth graders whose parents were not high school graduates were more likely to be placed in Algebra I than were similarly prepared 8th graders whose parents were college- or graduate school-educated.
- African American and Hispanic/Latino 8th graders were more likely to be placed in Algebra I than were white 8th graders who were similarly prepared.

Students' scores in grade 7 were a strong predictor of their grade 8 scores the following spring

Given how many 8th graders with low levels of preparedness were placed in a full Algebra I course, we wanted to better understand students' subsequent achievement in grade 8. We examined how frequently 8th graders at different levels of prior preparation scored *proficient* or higher, whether on the Algebra I CST or the General Mathematics CST—acknowledging that the two tests set different expectations, and that students who take one or the other test differ in ways not captured by their 7th grade scores. (The high content standard posed by the Algebra I CST is discussed later in this brief.)

Students who scored at the *two highest levels in grade 7*—particularly those who scored *advanced*—generally scored highly in grade 8, regardless of which test they took. Even so, 37% of 8th graders who had scored *high-proficient* in grade 7 and were placed in Algebra I scored no higher than *basic* on the Algebra I CST.

The students who scored *high-basic* and *low-proficient* in grade 7 present an ambiguous case.

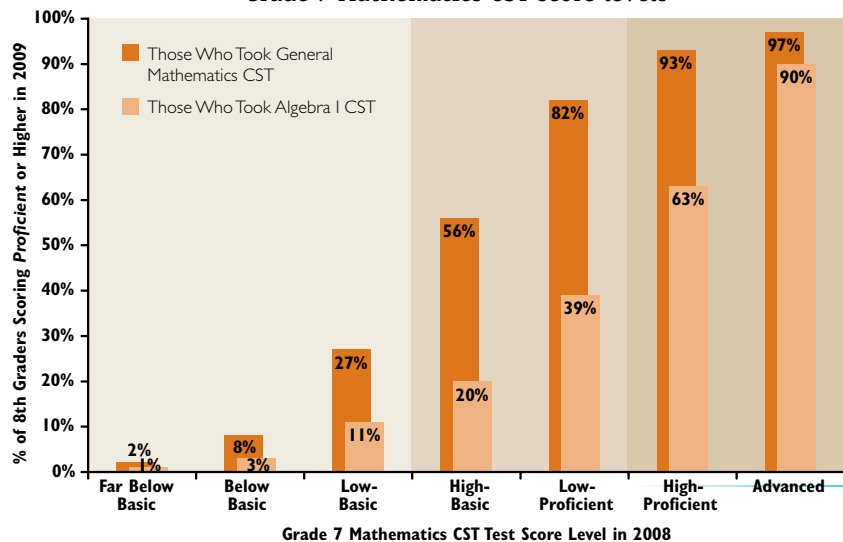
- On the one hand, the General Mathematics CST likely posed too low a challenge for many of these students: 82% of 8th graders who scored at the *low-proficient* level in grade 7 and then took the General Mathematics CST scored *proficient* or higher.
- On the other hand, these students generally did not succeed in scoring *proficient* or higher when they took the Algebra I CST in 8th grade. That said, roughly 40% of those who took the Algebra I CST scored *basic*. (Unfortunately, the available data do not clarify what content assessed by the test might have prevented these students from achieving at higher levels.)

Students who scored at the *three lowest levels in grade 7* were *very unlikely* to score highly on either test in grade 8. Those who took the Algebra I CST generally did not even score at the *basic* level. And the low rates at which these students—particularly those at the lowest two levels—scored *proficient* or higher on the General Mathematics CST suggest that most had not mastered the foundational skills taught in earlier grades.

These findings have several implications:

- Placement in Algebra I in grade 8 for the state's most-prepared math students appears to have served them well.
- In addition, some students score highly on the Algebra I CST despite their relatively low

Proportions of 8th graders scoring *proficient* or higher on the General Mathematics and Algebra I CSTs, based on their incoming Grade 7 Mathematics CST score levels



DATA: CALIFORNIA DEPARTMENT OF EDUCATION, RESTRICTED-USE LONGITUDINAL RESEARCH FILE

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prior-year scores. For example, among 8th graders who were placed into Algebra I after scoring *low-basic* in grade 7, 11% successfully scored *proficient* or higher on the Algebra I CST. Understanding the conditions under which this occurs would be powerful knowledge for districts and schools.

- However, a “one size fits all” approach of placing all 8th graders into Algebra I, regardless of their preparation, sets up many students to fail—even though their prospects could be predicted based on their 7th grade CST scores. Understanding the immediate impact of such failure on students as they enter high school and make decisions about math coursework is crucial for both districts and state policy leaders.

These findings underscore the importance of the placement decisions local schools and districts make. They also leave much to learn about what course placements, with what support, can provide different students the best prospects for both challenge and success.

A “one size fits all” approach of placing all 8th graders into Algebra I, regardless of their preparation, sets up many students to fail.



SURVEY RESPONSES: A closer look at district and school placement practices

The *Gaining Ground in the Middle Grades* data file includes survey responses related to placement decisions from superintendents, principals, and mathematics teachers in the sample schools. These data suggest that California districts often leave to school sites key aspects of policymaking for middle grades mathematics placements. These data also show that schools vary widely in how they make placements, with student access to a rigorous curriculum being a particularly strong consideration in these decisions.

Many districts leave key aspects of placement policy to school sites

Despite California's longstanding focus on getting more students into Algebra I in grade 8, our survey of **superintendents** shows that

California districts often leave to individual schools key aspects of policymaking related to student placements.

Survey Items: Please indicate which of the following apply to your district's or CMO's Algebra I placement policies. (Check all that apply.)

The district annually evaluates the effectiveness and appropriateness of its Algebra placement policies.	39%
The district has explicit written placement criteria.	34%
The district requires student placements to be reviewed by school department chairs for academic appropriateness.	38%
The district requires student placements to be reviewed by school administrative teams to ensure wide student access to a rigorous curriculum.	47%

Note: Responses are for 152 district superintendents and no charter management organization (CMO) leaders.

DATA: EDSource SUPERINTENDENT SURVEY

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- Only one in three superintendents reported that their districts have explicit written placement criteria for Algebra I, and only slightly more reported annual evaluation of the effectiveness and appropriateness of their algebra placement policies.
- Superintendents reported that they require school administrative teams to review placements to ensure wide access to a rigorous curriculum more often than they reported requiring school department chairs to review placements to ensure their academic appropriateness. Review for academic appropriateness was more commonly required in unified and high school districts than in elementary districts.

Schools vary in their placement practices, but ensuring wide access to rigorous curricula is the most common goal

At the school level, 58% of responding **principals** reported that their schools

had explicit written criteria for placement in mathematics. Larger proportions of

principals reported that student placements are reviewed, *with wide access to a rigorous curriculum more frequently cited as a topic for review than the academic appropriateness of placements.*

Survey Items: Please tell us about your school's placement policies (in mathematics).

Does your school have explicit written placement criteria? (N=294)	58%
Are student placements reviewed by department chairs for academic appropriateness? (N=243*)	65%
Are student placements reviewed by the administrative team to ensure wide access to a rigorous curriculum? (N=290)	82%

* About half of K-8 principals did not answer this item.

DATA: EDSource SUPERINTENDENT SURVEY

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Schools in the sample varied considerably in the specific criteria they consider when placing students, judging from the survey responses of **mathematics teachers**. Students' prior academic achievement, student CST scores, and teacher recommendations were the most common sources of information schools used when placing 7th and 8th graders into general mathematics and Algebra I courses. That said, no particular criterion was strongly and consistently reported by math teachers in more than 58% of schools.

REGRESSION ANALYSIS: Beyond placement, higher-achieving schools ensure curricular coherence and evaluate instructional needs and outcomes

Achieving more widespread student success in middle grades mathematics is not only a matter of effective placements. Moreover, middle grades educators do not make placement decisions in a vacuum. Although our follow-up analysis cannot provide explicit guidance as to forms of instructional support that might better enable students to succeed in their math courses, it does draw attention to other school and district practices that might be expected to facilitate higher student achievement.

The original *Gaining Ground in the Middle Grades* study specified a comprehensive set of actionable practices that differentiated higher middle grades achievement among the 303 schools in the sample.

- Schools with better student outcomes than peer schools serving similar students reported an intense, schoolwide focus on such improvement, with a strong future orientation toward enabling students to succeed in high school.
- Educators also reported close alignment of instruction with state academic standards, such as through frequent use of standards-based curricula and teacher collaboration around pacing and benchmarks.
- They also reported extensive use of assessment and other student data to improve student learning and instructional practice, and to quickly identify students' academic needs and intervene proactively.

For this follow-up analysis, the research team identified policies and practices that correlated with higher school achievement in grade 8 mathematics in particular among the schools in the sample. We did this by analyzing schools' survey responses on relevant items against school-level achievement on the Algebra I and General Mathematics CSTs taken by 8th graders. The analysis controlled for a wide range of school and student characteristics, for differences in algebra placements among schools, and for students' prior test scores.

Our findings underscore that middle grades schools with higher student achievement in mathematics are intentional in their efforts to

ensure curricular coherence and to evaluate student outcomes and instructional needs. The practices that set apart schools with higher grade 8 mathematics achievement include:

- **Schools emphasize select key standards** as a focus for instruction, and teachers collaborate more extensively to “break down” state standards to do such things as identify prerequisite student skills.
- The school's **instruction and curriculum program are designed to ensure all students are “high school ready”**—that is, prepared to begin taking the courses required for University of California and California State University eligibility and on track to pass the California High School Exit Exam.
- **Schools emphasize and set measurable goals** for student achievement by grade level, by subject area, and across all performance levels. They also set goals for increasing the number of students prepared to succeed in Algebra I and the proportion that score *proficient* or higher on the Algebra I CST.
- School leaders' and teachers' **instructional decisions are informed by review and use of student assessment data.** Principals meet frequently with teachers individually, by grade level, and by department to review CST results, including for student subgroups. And using data, teachers collaborate to identify effective instructional practices.
- The **district prioritizes early identification of students needing academic support** and addresses the needs of students who are two or more years behind grade level. And the district allows schools to take an active role in diagnosing students' academic needs, such as by doing their own analysis of diagnostic assessment results.
- Finally, **student placements into general mathematics courses in grade 7 and/or 8 take into account students' prior CST scores.** The original *Gaining Ground* study also found that a **multifactorial approach** to deciding such mathematics placements was associated with higher school achievement.

The practices that set schools with higher grade 8 mathematics achievement apart could possibly enable districts and schools to carefully evaluate their approaches to placement. For example, schools cannot meaningfully evaluate student preparation for different mathematics content without a shared understanding among educators of how key skills and concepts build from one grade level to the next. Middle grades educators also need to understand how placements relate to high school and students' particular areas of instructional need.



DISCUSSION: The Common Core gives California an opportunity to clarify its approach to 8th grade mathematics

The ability of middle grades schools to get more students “high school ready” is an essential step toward the larger goal of getting more students in high school to graduate “college and work ready.” And as this study shows, students’ preparedness to succeed in mathematics varies dramatically by the time they enter grade 8.

Strengthening students’ understanding of mathematics through the middle grades and helping more students become college and work ready are both explicit goals of the Common Core State Standards in mathematics recently adopted by

California. But although the state has officially adopted new math standards, many questions related to curriculum and assessments have yet to be answered. And the issue of algebra in grade 8 remains complex and controversial.

Our study comes at an opportune moment as California begins planning for implementation of the Common Core. In particular, the study findings can increase understanding of the issues around math in grade 8, with which California has grappled for more than a decade.

Students’ preparedness to succeed in mathematics varies dramatically by the time they enter grade 8.

Multiple math tests for 8th graders reflect the choices state policy has left to local discretion

The California State Board of Education (SBE) first adopted academic content standards in mathematics in 1997. California differed from many other states in that it established grade-level mathematics standards only in grades K–7. For grades 8–12, California’s standards were organized by *course*, and the minimum formal standard for 8th grade was Algebra I.

Although these standards made clear the SBE’s aspiration that more students take Algebra I in grade 8, state policy did not require schools to place all or any 8th graders in the course. California’s assessment system specified each 8th grader take the CST in math that corresponds with his or her course placement. Eighth graders who are not yet positioned to complete the full Algebra I course take the General Mathematics CST, which focuses on content standards from grades 6 and 7.

That said, California’s school accountability policies have encouraged Algebra I in grade 8. Schools are penalized on the Academic Performance Index (API) when 8th graders take the General Mathematics CST. For example, if an 8th grader scores *proficient* on the General Mathematics CST, the student’s school only gets credit for a

score of *basic*—one level lower—for state school accountability purposes.

Public pressure to provide broader and earlier access to Algebra I as a gateway to college (particularly the most competitive public universities) has also steadily increased. Supporters of this emphasis on Algebra I in grade 8 believe that schools had unnecessarily and unfairly limited the number of students—particularly low-income and minority students—who could take and succeed in the course. Schools throughout the state, particularly those serving low-income students, have responded, as our analysis shows.

However, detractors worry that too strong an emphasis on Algebra I in grade 8 could set up many unprepared students for failure in the course. This could lead students to believe they are “not good at math” and take fewer math courses in high school. In addition, students can take Algebra I in 9th grade and still exceed the math courses required for admissions eligibility to the University of California or California State University systems. Student success in these courses on the first attempt and other criteria help determine a student’s position for college admissions.

Disagreement between California and federal education policy underscored ambivalence about Algebra I in grade 8

In July 2008, California's multitest approach in 8th grade contributed to a heated controversy about when students should take Algebra I. The spark was the SBE's response to a finding by the U.S. Department of Education that California's General Mathematics CST does not comply with federal testing requirements under the No Child Left Behind Act because it tests 8th graders on 6th and 7th grade standards.

State policymakers and education leaders disagreed about how California should respond. One possibility was a replacement grade 8 test that would assess a subset of the state's Algebra I standards, excluding content such as factoring

and quadratic equations. Ultimately, the SBE passed a motion in July 2008 that called for the current Algebra I CST to become "the sole test of record" for grade 8 mathematics for federal school accountability purposes.

A legal challenge filed about two months later successfully blocked this policy. But the conflict exposed deep disagreement in the state about when students should take Algebra I and under what conditions. The underlying tension between federal and state education policy regarding testing in grade 8 mathematics has not been resolved as of this writing.

California's 1997 Algebra I standards—and the corresponding Algebra I CST—set a high bar for 8th grade by including content such as quadratic equations that seems to typically be emphasized in high school standards elsewhere in the nation.

Implementation of Common Core standards provides California an opportunity to revisit and clarify its expectations for grade 8 math

In June 2010, the National Governors Association and the Council of Chief State School Officers released Common Core State Standards in mathematics. In California, consideration of these standards rekindled arguments about the state's content expectations for grade 8 and the nature of the Algebra I course that accompanied the 1997 standards adoption.

California's 1997 Algebra I standards outline the course now required for high school graduation. These Algebra I standards—and the corresponding Algebra I CST—set a high bar for 8th grade by including content such as quadratic equations that seems to typically be emphasized in high school standards elsewhere in the nation. Indeed, about a quarter of the items on California's Algebra I CST assess student understanding of content related to quadratic equations. In comparison, for example, although Minnesota lawmakers decided in 2006 that students beginning with the class of 2015 must complete an algebra course by the end of grade 8, Minnesota's 2007 standards do not call for mastery of quadratic equations until high school.

The Common Core State Standards for grade 8 mathematics include algebra content such as

linear equations and some aspects of geometry. But standards related to more advanced algebra content are reserved for high school. This provides students more time to master the basics of algebra as a foundation for further study.

In August 2010, California joined the majority of states in adopting the Common Core State Standards in mathematics, but a state commission made notable adjustments largely focused on the issue of algebra in 8th grade. The Common Core gives the state, for the first time, a clear set of grade 8 standards that provides an alternative to Algebra I as California has long defined it. However, California's version of the Common Core also includes a *separate* set of standards for Algebra I beginning in grade 8, again including more advanced content.

In effect, with many decisions related to California's implementation of the Common Core yet to be made, **state officials still have not decided** what content should constitute the *minimum* grade 8 standard for purposes of state assessment and accountability, or what mathematics courses will be considered normative in state education policy for 8th graders.

A one-size-fits-all approach to 8th grade math placement is not supported by our analysis

As California looks forward to implementation of the Common Core, our study makes clear that the state's current approach has had mixed results, in part because students differ dramatically with respect to their incoming preparation.

The about 30% of 8th graders discussed in this brief who scored *high proficient* or *advanced* on the Grade 7 Mathematics CST appear, for the most part, to have been well-prepared for California's Algebra I course. But we know less about the extent to which they needed and received additional support in order to succeed in Algebra I, or about the experiences of the portion of these students who scored below *proficient* on the Algebra I CST.

The more than 30% of 8th graders who scored *high basic* or *low proficient* in grade 7 present a mixed picture, and there is much to still learn:

- A portion of these students does well on the Algebra I CST. State policymakers and local educators need to learn more about the conditions under which, for example, 20% of the 8th graders in our sample who had scored *high basic* in grade 7 and were placed in Algebra I succeeded in scoring *proficient* or higher on the Algebra I CST.
- Equally important is a better understanding of the extent to which these students are placed into California's full Algebra I course before

they are ready, and whether this has detrimental effects on students' attitudes toward math and their long-term prospects for success in the subject in high school.

- From a longer-term perspective, the Common Core grade 8 math standards provide an important option for these students. Such a course of study could be more rigorous than the content assessed by the General Mathematics CST, but would give students more time to master basic algebra content before taking on the more advanced content in high school—and still leave ample time to complete a rigorous high school math curriculum.

The nearly 40% of 8th graders who scored *low basic* or lower in grade 7 are clearly not ready for California's full Algebra I course in 8th grade. But perhaps more alarming is these students' poor performance on the General Mathematics CST. This indicates that the Common Core grade 8 math standards would currently present a formidable target for many of these students. This is a long-term challenge that California can only fully address by improving all students' preparation in mathematics in earlier grades so that they have a better foundation before 8th grade. This is one explicit goal of the Common Core standards.



IMPLICATIONS: What this study means for state and local leaders—now and looking forward to the Common Core



Today in California, it is a given that all students should learn rigorous algebra content before they leave high school. And the tremendous growth in Algebra I participation in the middle grades during the past 13 years in California—in particular among low-income, African American, and Latino students—underscores the powerful role state education policy can play in providing a vision and incentives for local action.

California education is now undergoing another transition. The state has adopted the Common Core, but the curricula, assessments, and accountability policies that will align with these new standards are still unclear. In the short term, our study provides guidance to state leaders and local middle grades educators as they continue to operate within the framework of the state's previous content standards and assessments. In particular, the placement of middle grades students

into mathematics courses can and should be done more thoughtfully today, and this has implications for both state policy and local practice.

But the Common Core standards provide the standards-based framework through which California districts and schools will refine their approaches to middle grades mathematics in future years. Implementing the Common Core will take years, and along the way state leaders will make some crucial and potentially controversial decisions. **The transition to and implementation of Common Core standards is an opportunity for California—from mathematics teachers to the State Board of Education—to ask what particular courses and content, and what forms of instructional support, will challenge each student but also provide a meaningful chance of course success and a potential path toward college- and career-readiness.**

What local educators and state leaders can do now

Local educators need clarity about the state's current testing regime

State education leaders are saying that schools should expect the state's current testing regime—including both the Algebra I and General Mathematics CSTs for 8th graders—to remain in place for the 2011 testing cycle. But so far schools and districts have no additional guidance regarding how student achievement will be measured after that.

In addition, the SBE still needs to reconcile with the U.S. Department of Education any lingering conflict between California's current assessments for 8th grade math and federal expectations for what should be tested. If a resolution changes how the state tests 8th graders in mathematics prior to the implementation of Common Core assessments, this will have implications for local decisions about course offerings and placements.

The sooner these decisions are made, the better able local educators will be to begin planning their staffing, support services, and placement processes for their current 7th graders.

The State Board should evaluate its accountability policies related to Algebra I

California's accountability policies currently penalize schools on the Academic Performance Index when 8th graders take the General Mathematics CST rather than the Algebra I CST. Some voice concern that the state's current accountability policies provide schools an incentive to place some 8th graders into California's full Algebra I course before they are ready, when these students might be better served by an algebra readiness course or the first year of a two-year algebra course.

Our analysis demonstrates there is ample reason for concern about too-early placement into a full Algebra I course, particularly given the lack of clarity about how course failure in grade 8 affects students' course taking in high school and their disposition toward the subject of mathematics. The SBE should evaluate the incentives embedded in its accountability policies related to Algebra I in grade 8 and decide whether any revision is warranted.

The tremendous growth in Algebra I participation in the middle grades during the past 13 years in California—in particular among low-income, African American, and Latino students—underscores the powerful role state education policy can play in providing a vision and incentives for local action.

Districts should take a leadership role in facilitating schools' decisions about student placement and support—and should evaluate the results

Our analysis of student placements in grade 8 suggests there is much to learn about what course content, under what conditions, and with which students best challenge and help *all* students succeed and move forward. But the results of our survey suggest that many districts leave key aspects of placement policy to schools.

Districts can support stronger decision-making in their middle grades schools by developing a shared framework for making student placements, including assistance in focusing on and benchmarking key standards from one grade level to the next. Districts can also support school staffs in their capacity to evaluate the results of student placements and can provide district-level perspective on those results.

Such actions are affirmed by the original *Gaining Ground in the Middle Grades* study. The study underscored that middle grades schools that outperform their peers serving similar students—and that are able to raise school-level student scores in math on annual standards-based exams—receive strong leadership from their district or charter management organization. They also have strong school leadership and a professional culture that

values such actions as setting measurable goals for every student in each grade and subject, administering benchmark tests, analyzing the results for each student, and using the results to improve student learning and teacher practice.

District-level evaluations of the results of students' grade 8 mathematics placements can also help clarify future needs that require district planning. For example, a recent report by the California Collaborative on District Reform—a collaboration between researchers, unified school district leaders, and others—notes that analyzing data on anticipated student enrollments in Algebra I and other higher mathematics courses can help a district evaluate and plan for future instructional capacity, such as any need for more appropriately prepared teachers in the face of looming teacher retirements.

Finally, district-level evaluation can help identify both the intended and the unintended consequences for students of different approaches to placement. For example, recent research by the Consortium on Chicago School Research found that a Chicago Public Schools policy to eliminate remedial math courses in grade 9 enabled more students to earn algebra credit by the end of grade 9 without harming graduation rates—but that math course failures and even course absences increased among some groups of students. In another example, researchers in California's Long Beach Unified School District were able to suggest ways to strengthen student transitions and mathematics placements between grades 5 and 6.

What can be done now

The California State Board of Education should:

- Provide clear guidance to local educators on how 8th graders will be tested in math during the remaining years of the current assessment regime.
- Reconcile with the U.S. Department of Education any lingering conflict between California's and federal expectations for assessment in grade 8 math.
- Evaluate the incentives related to Algebra I in grade 8 that are embedded in its school accountability policies.

School districts should:

- Take an active leadership role in facilitating schools' decisions about student placement and support.
- Evaluate the results of schools' placement and support decisions.
- Make prior student achievement—including data regarding student achievement in grade 7—a consideration in student placement and support decisions related to algebra.
- Evaluate whether schools are too conservative or too aggressive in their placements.
- Stay informed about state actions related to consideration and implementation of Common Core-aligned assessments, curricula, and accountability policies.

State assessment results can inform more reasoned placement decisions within districts

Our analysis indicates that schools' responses to the call for broader and earlier access to Algebra I have, to some degree, depended on the students and families they serve. The schools in our sample that serve students from predominantly middle-income families have been relatively conservative in not placing some of their highest-achieving students into Algebra I, even though these students are most often successful when they take it. In comparison, the schools that serve students from predominantly lower-income families have been quite aggressive in placing 8th graders into Algebra I, including many unprepared students whose odds of succeeding in the course are low.

Districts can use student assessment results to evaluate such differences among their own schools

and spur dialogue. And to the extent that Grade 7 CST scores appear to be a powerful predictor of students' prospects for success in 8th grade, schools and districts would benefit from using them *in conjunction with other criteria* to make informed decisions about students' placements

Looking ahead to the Common Core

Implementation of the Common Core will be a considerable undertaking, involving critical policy decisions

California, as well as any other state that has adopted the new Common Core academic content standards for math, needs to recognize the role that middle grades math achievement plays in preparing students to succeed in a college-preparatory curriculum in high school. But California's version of the new standards—which includes both grade-level and Algebra I standards for grade 8—reflects ambiguity about the state's goals.

The SBE needs to clarify its expectations. This includes deciding what grade 8 math standard—whether the grade 8 Common Core or something more like California's existing Algebra I course—will be reflected in state assessments. These decisions will have consequences for how student achievement is judged. For example, recall that students in our sample who scored *high-basic* or *low-proficient* on the Grade 7 Mathematics CST generally did not score *proficient* or higher if they took the Algebra I CST in grade 8, with roughly 40% of these students scoring *basic*. How many of those who scored *basic* would have done better on a test aligned with the Common Core grade 8 standards rather than California's full Algebra I course? What would this mean for students' mastery of algebra content such as linear equations?

Similarly, the SBE will need to decide what incentives for algebra, if any, should be embedded in state accountability policies now that the state has adopted Common Core grade 8 standards that include algebra content. State leaders will then need to quickly explain to local educators the extent to which California's new standards lay out two approaches to 8th grade math that are acceptable in practice.

State leaders also need to ensure that districts and schools understand the timeline and steps required to implement the new standards. The state's process includes adopting new curriculum frameworks, instructional programs, and

and support. In districts or schools where prior-year CST results do not become available until after master schedules are developed—a challenge addressed in the next section—these results can be used to further validate students' placements and/or support.

assessments. State leaders will need to ensure that appropriate professional development is in place so middle grades schools can effectively implement and teach to the new math standards and that student data are available to inform their work.

If the Legislature and governor are serious about the Common Core, they need to provide resources for these efforts. The first step is for lawmakers to decide whether they will remove the legal prohibition, enacted for budgetary reasons, that prevents the SBE until July 2013 from taking action toward adopting new curriculum frameworks and instructional materials. With that restriction in place, the SBE would likely be unable to adopt new instructional materials in mathematics until late 2017. This means the new materials could not make their way into California schools until long after the implementation (potentially in 2014–15) of new assessments aligned with the Common Core.

Finally, under the current testing regime, student CST scores often are not available until after schools have set up their fall schedules. This issue could be considered as new assessments aligned with the Common Core are adopted. Can new state assessments for grade 7 directly inform placements in grade 8? What other forms of guidance do schools and districts need? State policy leaders should look at ways to get state test results to districts and schools in time for these data to inform decisions about placement and support.

Decisions at the middle grades level reverberate throughout the K–12 system

What math content is taught, to which students, and in what grade represents a very complex systems challenge for California. Although state education leaders may focus on mathematics standards and assessments in grade 8 as the most obvious issues to resolve as they implement the Common Core standards, they cannot afford to ignore the repercussions of their decisions for the K–12 system as a whole.

Although state education leaders may focus on mathematics standards and assessments in grade 8 as the most obvious issues to resolve as they implement the Common Core standards, they cannot afford to ignore the repercussions of their decisions for the K–12 system as a whole.

A strong foundation in mathematics developed in the elementary grades is the best preparation for learning algebra content successfully in the middle grades and the first step toward subsequent success in the subject in high school. Districts should evaluate and develop the capacity of their elementary and early-middle grades teachers to provide students a strong foundation in math consistent with the Common Core standards, such as by benchmarking and targeting key skills and concepts. From a state policy perspective, the California Commission on Teacher Credentialing should continue considering ways to strengthen mathematics instruction in the elementary and middle grades, including among teachers holding multiple-subject credentials.

In addition, more 8th graders getting further in math—whether by way of the grade 8 Common Core or a full Algebra I course—has implications for the courses offered by high schools. Districts

and their high schools will need to re-examine their course sequences—and their teaching capacity—to ensure a coherent path for entering students and to meet increased demand for advanced courses in mathematics and in the sciences. This will require collaboration between districts in places where students transition from an elementary school district to a high school district, as do a substantial portion of California students. Adding to the complexity, high school course sequences have not yet been developed in the context of the Common Core standards. How these sequences will meet the course requirements for admissions eligibility for the University of California and California State University systems is also unclear.

Finally, public universities in the state that prepare future teachers will need to evaluate how their programs align with the new Common Core standards.

Preparing for the Common Core

The California Legislature will need to:

- Revisit the legal prohibition that currently prevents the State Board from taking action to develop new curriculum frameworks and instructional materials until July 2013.
- Ensure adequate support for professional development and student data systems related to implementation of the Common Core.

California's public universities will need to:

- Clarify how course sequences developed in light of the Common Core relate to the math course-taking requirement for admissions eligibility.
- Ensure the alignment of teacher preparation with the Common Core.

The California State Board of Education will need to:

- Decide what grade 8 math standard will be reflected in state assessment and accountability policies.
- Quickly explain to local educators the extent to which the Common Core lays out two acceptable approaches in 8th grade math.
- Consider how new assessments aligned with the Common Core can provide more timely data for local decisions about student placement and support—including the availability of grade 7 test scores to inform grade 8 placements.

The California Commission on Teacher Credentialing will need to:

- Continue considering ways to strengthen math instruction in the elementary and middle grades, including among teachers holding multiple-subject credentials.

School districts will need to:

- Develop the capacity of elementary teachers to provide students a strong foundation in math aligned with the Common Core.
- Evaluate course sequences and teacher capacity at the high school level in light of the Common Core standards and to meet demand for advanced courses.

California needs to move forward

California's gains in Algebra I course taking and success during the past half-decade and more have raised expectations for what is possible in the state. The gains for many low-income and minority students have been particularly notable. California's middle grades educators should continue to widen access to challenging mathematics coursework—building on a strong foundation from earlier grades, based on careful understanding of students' preparedness, and leveraging all the interventions and support that districts and schools have the resources to provide.

As California looks ahead to the Common Core, it is not necessary to re-enact the same battles over mathematics that divided the state in the past and sometimes resulted in ambiguous policies. Instead, state leaders should start with the facts about student preparation and clarify their goals for student success in math. They should also acknowledge that all students deserve math courses that challenge them, but that all students need not follow an identical path and timeline toward college- and work-readiness. Policymakers should then do everything in their power to provide local school districts and schools with clear direction and adequate support so they can get on with the crucial work of preparing all middle grades students for success in a demanding high school curriculum that meets the needs of the 21st century.

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Acknowledgments

The following individuals contributed to an October 2010 advisory meeting that helped clarify our understanding of our research findings and their implications. We thank these advisers for contributing their time and expertise. They bear no responsibility for the content of this brief, nor for the larger report from which this brief draws.

- Manny Barbara (Silicon Valley Education Foundation)
- Heather Calahan (Philip C. Curtis Jr. Center for Mathematics and Teaching, University of California, Los Angeles)
- Phil Daro (America's Choice)
- Geno Flores (California Department of Education)
- Scott Farrand (Department of Mathematics and Statistics, California State University, Sacramento)
- Susie W. Hakansson (California Mathematics Project)
- Nicolas Schweizer (California State Board of Education)
- Sheri Willebrand (California Mathematics Council)

We also thank Jennifer O'Day (American Institutes for Research) and Michael E. Hanson (Fresno Unified School District) from the California Collaborative on District Reform, and John Mockler, for taking time to review and offer insight on this brief.

Finally, special thanks to the principals and teachers of the 303 middle grades schools that participated in the original *Gaining Ground in the Middle Grades* survey, and the 157 participating district superintendents and charter management organization (CMO) leaders.

To Learn More

The full follow-up analysis from which this policy and practice brief draws and its appendices are available to download for free at www.edsource.org. All materials from the original *Gaining Ground in the Middle Grades* study are also available to download for free from this location.

Also coming soon from EdSource: A superintendent and principal leadership guide, aligned with the findings of the *Gaining Ground in the Middle Grades* project.



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