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FOLLOW-UP ANALYSIS

Improving Middle Grades Math Performance

A closer look at district and school policies and practices, course placements, and student outcomes in California

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

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February 2011

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A closer look at district and school policies and practices, course placements, and student outcomes in California

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

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This report, its appendices, and a companion Policy and Practice Brief are available to download for free at **http://www.edsource.org/**.

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Executive Summary

This report is a follow-up to *Gaining Ground in the Middle Grades* (Williams, Kirst, Haertel, *et al.*, 2010). That study specified a comprehensive set of actionable practices that differentiated higher academic achievement among 303 middle grades schools in California. In doing so, the study provided a compelling and coherent account of middle grades schools that are achieving better student outcomes than their peer schools serving similar students.

This follow-up analysis provides a different, more in-depth look at middle grades mathematics practices and policies.

The *Gaining Ground in the Middle Grades* study

Educators widely accept that much of the difference in student outcomes among schools is directly related to student background. But it is less widely recognized that there is great variation in student performance among schools serving similar student populations. This variation is striking and, in many ways, hopeful. It suggests that school and district policies and practices make a difference.

Beginning in the spring of 2009, EdSource and its partners from Stanford University and American Institutes for Research set out to identify school and district practices and policies that help explain this variation among middle grades schools serving similar students.

The research team surveyed 157 district and charter management organization superintendents, 303 middle grades principals, and 3,752 6th–8th grade English language arts and mathematics teachers. The surveys were extensive, including almost 900 items in total. They focused on concrete, actionable school and district practices and policies in the context of California and federal education policy and decades of middle grades research and recommendations. The practices and policies reported by schools were then analyzed against California Standards Test (CST) scores in English language arts and mathematics for the 204,000 middle grades students in the study, both in a single year and controlling for several years of prior student achievement.

Gaining Ground in the Middle Grades, released in February 2010, specified a comprehensive set of actionable practices that differentiated higher academic achievement among the 303 middle grades schools in the sample:

- An intense, schoolwide focus on improving academic outcomes, with a strong future orientation toward enabling students to succeed in high school, distinguished higher-performing middle grades schools.
- District and principal leadership and the individual and collective work of teachers—their resources and their time—are focused on these shared missions.
- Within the context of a clean, safe, and disciplined school environment, curricula and instruction are closely aligned with state academic standards, and educators use assessment and other student data more extensively to improve student learning and instructional practice, and to quickly identify students' academic needs and intervene proactively.

This report builds on the foundation of *Gaining Ground in the Middle Grades*

This follow-up report provides a different, more in-depth look at middle grades mathematics practices and policies specifically. It offers new insight into mathematics practices and policies in California and their relationship with student outcomes.

A total of **303 middle grades schools** in California, each serving at least grades 7 and 8—the same sample that was the basis for *Gaining Ground in the Middle Grades*—comprises the sample. As in the initial study, this sample is bimodal, including:

- **144 schools located in the 20th–35th percentile SCI band, which serve predominantly students from lower-income families**. These schools were more likely than the California average to serve middle grades students who were socioeconomically disadvantaged, Hispanic, English learners, and/or whose parents had achieved no more than a high school diploma.
- **159 schools located in the 70th–85th percentile SCI band, which serve predominantly students from middle-income families.** These schools were more likely than the California average to serve middle grades students who were white and/or whose parents had completed some college or more. At the same time, however, nearly three in ten middle grades students in these schools were socioeconomically disadvantaged on average.

The sample includes both lower- and higher-performing schools in each SCI band in 2008–09, all major middle grades configurations (K–8, 6–8, 7–8), and both charter and traditional public schools.

The follow-up analysis draws from the survey responses of:

- **The principals from all 303 schools.**
- **1,857 teachers who reported *teaching mathematics* in grades 6, 7, and/or 8.**
- **152 district superintendents and five charter management organization (CMO) leaders** who, together, represent 81% of the schools in the sample.

California's standards-based reforms have a clear influence on local mathematics practices and policies

The survey responses of superintendents, principals, and mathematics teachers indicate that California's standards-based reforms have had a decisive impact on the policies and practices of middle grades schools in the sample. In the average school in the sample, 97% of mathematics teachers agreed or strongly agreed that their school closely aligns instruction with the state content standards in mathematics, and 81% agreed or strongly agreed that their school emphasizes selected key standards that teachers prioritize at each grade level.

In addition, many schools are setting measurable goals for student achievement on benchmark assessments and annual standards-based tests. For example, 81% of principals agreed or strongly agreed that their schools set measurable goals for CST scores by grade and subject area. Moreover, 90% of principals agreed or strongly agreed that their districts provide a computer-based system to enable school staff to access and review student data.

However, only 62% of principals agreed or strongly agreed that their districts provide adequate training to ensure effective use of data management software by school staff. Similarly, only 62% of principals reported that they ensure, to a considerable or great extent, common planning time for teachers to meet with others in the same grade and subject and/or discuss common benchmarks and assessments.

Based on principals' survey responses, schools differ widely in which state-adopted curriculum programs they say they use, in part reflecting that 2008–09 was a transition year.

- In each of grades 6–8, basic mathematics curriculum programs from the state's previous (2001/2005) adoption cycle were in somewhat wider use than were programs from the more recent (2007) cycle.
- Altogether, 42% of schools in the sample used an algebra readiness program adopted by the state in 2007, whereas no more than 20% of schools used a recently-adopted mathematics intervention program at any particular grade level.
- In addition, some schools reported using below-grade-level instructional materials in grade 8, perhaps with 8th graders who were not enrolled in Algebra I or needed additional support. For example, 12% of principals reported that their schools use in grade 8 a pre-algebra program aligned with the state's 7th grade standards.

State education policy priorities have strongly influenced mathematics course-taking in California's middle grades

Since 1997, California's mathematics content standards and testing and accountability policies have encouraged more widespread participation in Algebra I in grade 8. One of the most striking changes during the state's standards-based education reform era is the tremendous expansion in the number of middle grades students taking Algebra I—a course that includes content that seems to typically be emphasized in high school standards elsewhere in the nation. (See figure on the next page.) In 2009, 54% of 8th graders and 6% of 7th graders in the state took the end-of-course Algebra I CST.

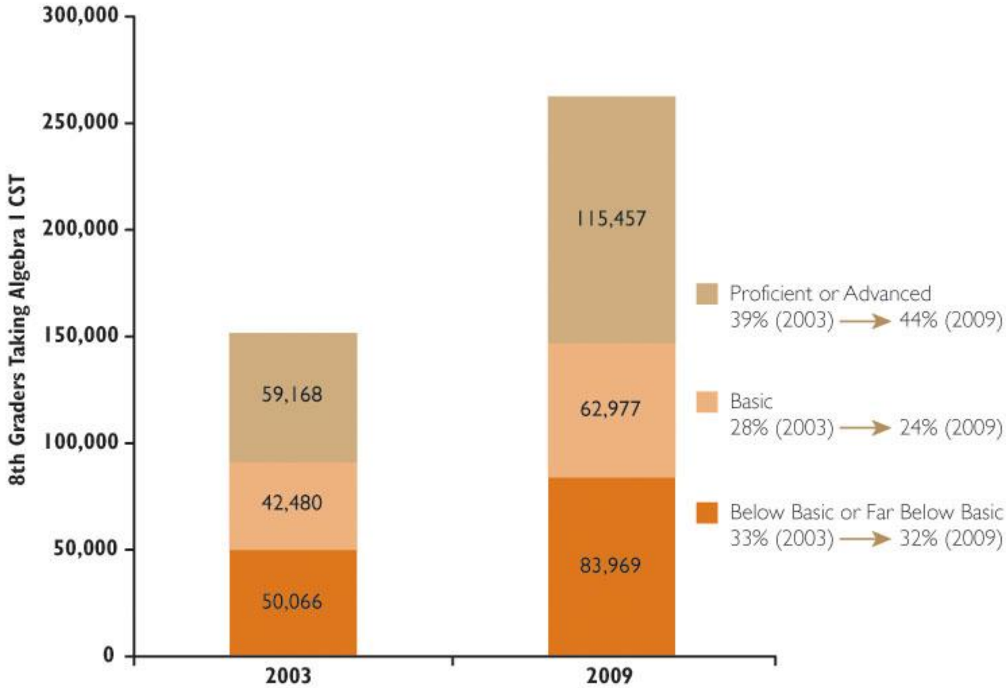
On the one hand, statewide testing data show that 8th grade achievement in Algebra I has improved overall. The percentage of students taking the Algebra I CST who scored *Proficient* or *Advanced* increased from 39% to 44% between 2003 and 2009. And with increased participation, many 8th graders who might not have taken the course previously are doing well. Nearly twice as many scored *Proficient* or *Advanced* on the Algebra I CST in 2009 as in 2003, including 3.8 times as many economically disadvantaged 8th graders.

On the other hand, more than half of 8th graders who take the Algebra I CST score below *Proficient* on the test. More economically disadvantaged 8th graders scored *Below Basic* or *Far Below Basic* in 2009 than took the Algebra I CST *at all* in 2003. There is also evidence from various sources that many students—including students who did well—are required to repeat the course in 9th grade.

Districts and schools across California vary in their reported placement policies and practices

Based on principals' survey responses, 96% of middle grades schools in the sample offer a traditional one-year Algebra I course. Some schools offer other advanced math courses as well, such as the first year of a two-year Algebra I course (14%) and mathematics courses above Algebra I such as Geometry (39%). The decisions local educators make about

Participation in the Algebra I CST among California 8th graders has expanded dramatically



Data: California Department of Education (CDE), Standardized Testing and Reporting (STAR), Accessed 5/10
EdSource 2/11

Note: The counts of 8th graders shown in each figure are based on the number of students *tested* on the Algebra I CST, rather than the number of students with valid scores. The latter data are not published for 2003 as they are for 2009. These counts are *estimates* derived from state reports of performance and may not precisely match the number of students tested due to rounding.

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which students are ready for Algebra I raise complex issues of student grouping, structures for student support, and the role of the district in facilitating efficient paths for students and coherent policies that support student placements.

Survey responses provide insight into placement practices in the sample schools and their districts. Districts in the sample appear to give schools a fair amount of discretion regarding algebra placement. School policies such as explicit, written placement criteria and review of placements to ensure academic appropriateness and access to a rigorous curriculum vary.

Students' prior academic achievement, student CST scores, and teacher recommendations appear to be the most common sources of information that middle grades mathematics educators use when making student placements into general mathematics and Algebra I courses in grades 7 and 8. That said, no single criterion was consistently reported in the vast majority of schools. For example, math teachers consistently reported extensive consideration of student CST scores for Algebra I placement in only 58% of schools.

Student achievement in 8th grade math relates to prior achievement in 7th grade

This follow-up report uses longitudinal student testing data to provide an empirical look at the extent to which schools in the sample place 8th graders into Algebra I in grade 8, how these placements relate with students' prior achievement, and how students' test scores in grade 7 relate with their scores in grade 8. *Our analysis of these data provides important new insight—not previously available—into local placement practices throughout California and their consequences for students.*

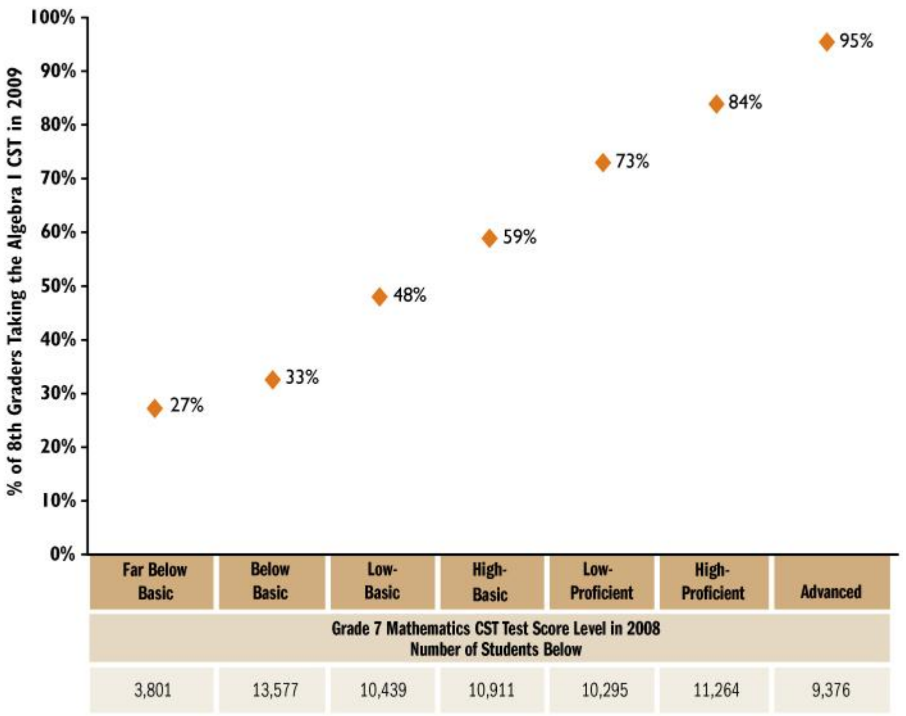
Altogether, about 59% of 8th graders in the sample took the Algebra I CST (rather than the less advanced General Mathematics CST), with the vast majority taking the Algebra I test for the first time. Students who scored higher on the Grade 7 Mathematics CST were more likely to take the Algebra I CST in grade 8—but many students with low scores in grade 7 also did so. (See figure below.) For example, 95% of 8th graders who scored *Advanced* on the Grade 7 Mathematics CST in 2008 went on to take the Algebra I CST in 2009—as did 27% of students who scored *Far Below Basic* on the grade 7 test.

Prior achievement matters for a student's likelihood of scoring highly on either the General Mathematics CST or the Algebra I CST, with the Algebra I CST setting a high standard. Among students who took the Grade 7 Mathematics CST in 2008 followed by the Algebra I CST as 8th graders in 2009, even those who scored at the *high* end of California's *Proficient* performance level as 7th graders had only a 63% chance of scoring *Proficient* or higher in Algebra I. Students who scored at the lowest levels in grade 7 had very low chances of scoring highly in grade 8.

Thus, although many 8th graders who took Algebra I appear to be have been well-positioned for success in the course, many others clearly struggled in the course after struggling with math as 7th graders.

8th graders with higher incoming achievement scores were more likely to take the Algebra I CST, but large proportions of students with low scores also did so

Proportion of 8th graders taking the Algebra I CST, across incoming Grade 7 Mathematics CST score levels, full sample



Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

California schools vary considerably in their observed 8th grade math placements

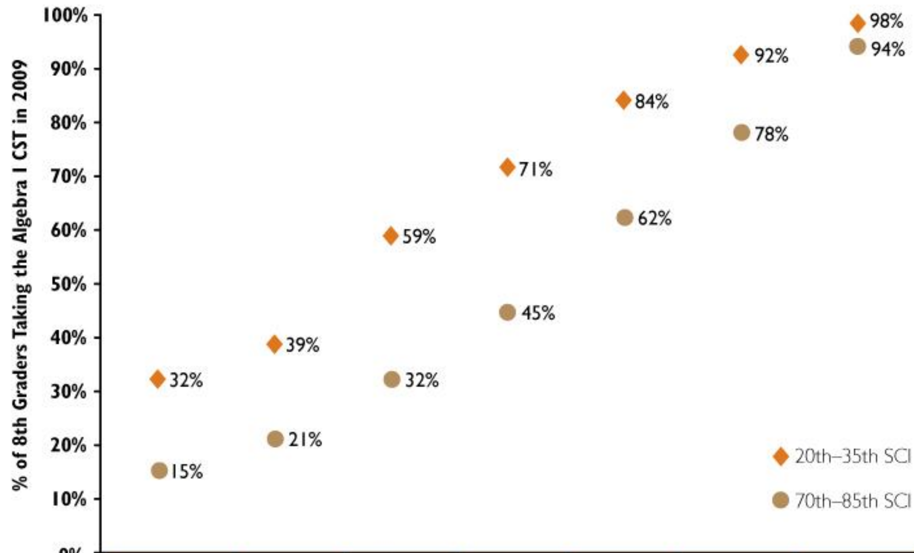
Comparing these data for the two socioeconomic "bands" of schools in the sample:

- The schools that educate predominantly students from lower-income families—located in the 20th–35th percentile SCI band—tended to serve students with somewhat *lower* levels of incoming preparation but provided *wider access* to Algebra I in grade 8; whereas
- The schools that educate predominantly students from middle-income families—located in the 70th–85th percentile SCI band—tended to serve students with somewhat *higher* levels of incoming preparation but were *more selective* in placing 8th graders into Algebra I.

Given similarly prepared students, the schools serving more low-income students placed a *greater* proportion of 8th graders into Algebra I than did the schools serving more middle-income students. (See figure below.) For example, 59% of students in the 20th–35th percentile SCI band who scored *Low-Basic* on the Grade 7 Mathematics CST in 2008 took the Algebra I CST in 2009, compared with 32% of similarly prepared students in the 70th–85th percentile SCI band.

Given similarly prepared students, schools serving predominantly low-income students placed a greater proportion of 8th graders into Algebra I than did schools serving predominantly middle-income students

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



	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
	Grade 7 Mathematics CST Test Score Level in 2008 Number of Students Below						
20th–35th SCI	2,707	8,819	6,113	5,715	4,925	4,449	2,896
70th–85th SCI	1,094	4,758	4,326	5,196	5,370	6,815	6,480

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

These and other data analyzed for this follow-up report show that middle grades schools face challenges and trade-offs as they work to ensure wide access to a rigorous mathematics curriculum. Based exclusively on prior achievement, a school might decide to place students with lower levels of incoming achievement into an algebra readiness course. However, depending on the school, such a decision may involve trade-offs regarding access to Algebra I among different student groups, particularly to the extent that African American, Hispanic, and/or students from less-educated families are more likely to enter grade 8 with lower incoming mathematics achievement. A school might decide instead to emphasize broader student access to Algebra I. But this also involves trade-offs: for example, additional academic support for Algebra I will have implications for the allocation of limited instructional time and resources.

> A companion Policy and Practice Brief provides further discussion of student placements and their implications
>
> The findings from our analysis of student placements using longitudinal state testing data have important **implications for policy and practice** related to middle grades mathematics in California. These findings are explored in more detail, and their implications for policymakers and local educators are discussed, in a **companion Policy and Practice Brief**. This companion document is available from the EdSource website, www.edsource.org.

Schools with higher grade 8 mathematics achievement have an intense focus on student outcomes and high school readiness, grounded in standards-based instruction

New regression analyses were performed for this follow-up report in order to identify policies and practices that correlate with higher school achievement in grade 8 mathematics *in particular*, as measured by the General Mathematics CST and/or the Algebra I CST, and after controlling for key school variables and students' prior test scores. The findings of these analyses reinforce, and are informed by, the broader concept of effective middle grades schools presented in *Gaining Ground in the Middle Grades*. The practices and policies highlighted in this follow-up report, which do not and cannot take place in a vacuum, should be interpreted in the context of the prior study.

The practices and policies that set apart higher- from lower-performing schools serving similar students in grade 8 mathematics fell into five themes:

- *Educators are knowledgeable and sophisticated in teaching the math content standards.* Educators 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.
- *School leaders and teachers report setting and monitoring measurable student achievement goals.* Schools emphasize and set measurable goals for student achievement, such as by grade level, by subject area, and across all performance levels, Schools also set measurable goals to increase the number of students prepared to succeed in Algebra I and the proportion that score proficient or higher on the Algebra I CST—two practices that schools can undertake regardless of their placement policies.

- *The school's instruction and curriculum program is "future oriented" and designed to ensure all students are "high school ready"—that is, prepared to succeed in coursework that will make them "college ready."* Curriculum and instruction are designed to prepare students for a rigorous high school curriculum, such as to leave the middle grades ready to begin taking courses required for University of California (UC)/California State University (CSU) eligibility and on track to pass the California High School Exit Exam (CAHSEE).
- *School leaders' and teachers' instructional decisions are driven by extensive review and use of student assessment data.* Principals meet frequently with teachers—individually, by grade level, by department—and with the entire school staff to review CST results, including results for student subgroups. Teachers collaborate to identify effective instructional practices using data. And students' placements in general mathematics courses in grade 7 and/or 8 take into account students' prior CST scores.
- *The district provides strong leadership and focus on students needing additional academic support.* The school district prioritizes early identification of students needing academic support and addresses the needs of students who are two or more years behind grade level. But middle grades school staff have the ability to develop their own standards-aligned diagnostic assessments, determine the need for them, and/or do their own analysis of the results.

This in-depth analysis did *not* identify a correlation between higher schoolwide achievement in 8th grade mathematics and whether teachers hold single- or multiple-subject credentials, or other formal credential types. In regard to this, it is important to note that this analysis only considered student outcomes at the school level and could not link student data to particular teachers. In addition, although the survey participation rates of teachers among schools in the sample were impressive, we received completed surveys from less than 100% of eligible teachers in 161 of 303 schools in the study.

To learn more

To learn more, see the following documents, available from the EdSource website at www.edsource.org:

- The **follow-up research report**—*Improving Middle Grades Math Performance: A closer look at policies, practices, and course placements*—which includes a technical appendix and two appendices with additional descriptive data.
- A **companion Policy and Practice Brief** on student placement in grade 8 mathematics.

Prologue

About this report and the prior study, *Gaining Ground in the Middle Grades*

On Feb. 24, 2010, EdSource released a large-scale study of middle grades (6–8) practices and policies in 303 California schools and their relationship with student outcomes on the California Standards Tests (CSTs) in English language arts and mathematics. *Gaining Ground in the Middle Grades: Why Some Schools Do Better* is the largest empirical study of its kind conducted to date. It can be found at www.edsource.org.

This report is a follow-up to that study. It focuses specifically on *mathematics policies and practices*.

This is a timely moment for this follow-up analysis

This follow-up analysis was conducted at an important moment of transition for middle grades mathematics in the United States. In June 2010, Common Core State Standards in mathematics, developed under the leadership of the National Governors Association and the Council of Chief State School Officers, were released. The majority of states have since adopted the standards.

These states include California, which had not revised its academic content standards in mathematics since their adoption in 1997. The California State Board of Education unanimously adopted the Common Core standards, with adjustments, following discussion by a state commission about how to address California's long-standing aspiration that more students take Algebra I in grade 8.

This report provides important context for policymakers and education stakeholders in California and other states as they consider how to adapt their policies in such areas as curriculum, assessment, and accountability to help the Common Core standards take hold. The report sheds light on how middle grades schools in California are using state-adopted standards and curriculum programs, as well as standards-based assessments, as a basis for their efforts to improve student achievement. It also identifies practices and policies that appear to differentiate higher school achievement in grade 8 mathematics within this standards-based context.

And in light of California's longstanding policy focus on Algebra I in grade 8 and the challenges this raises for local decision-making regarding student placement, this report provides an empirical exploration of grade 8 Algebra I placement, based on longitudinal data linking the mathematics CSTs that students in the sample took in grade 7 (in 2008) and grade 8 (in 2009).

The *Gaining Ground in the Middle Grades* study

The goals and methodology of this follow-up analysis build on the basic approach, survey instruments, and data of the *Gaining Ground in the Middle Grades* study.

The research question

Educators widely accept that much of the difference in student outcomes among schools is directly related to student background. But it is less widely recognized that there is great variation in student performance among schools serving similar student populations. This variation is striking and, in many ways, hopeful. It suggests that school and district policies and practices make a difference.

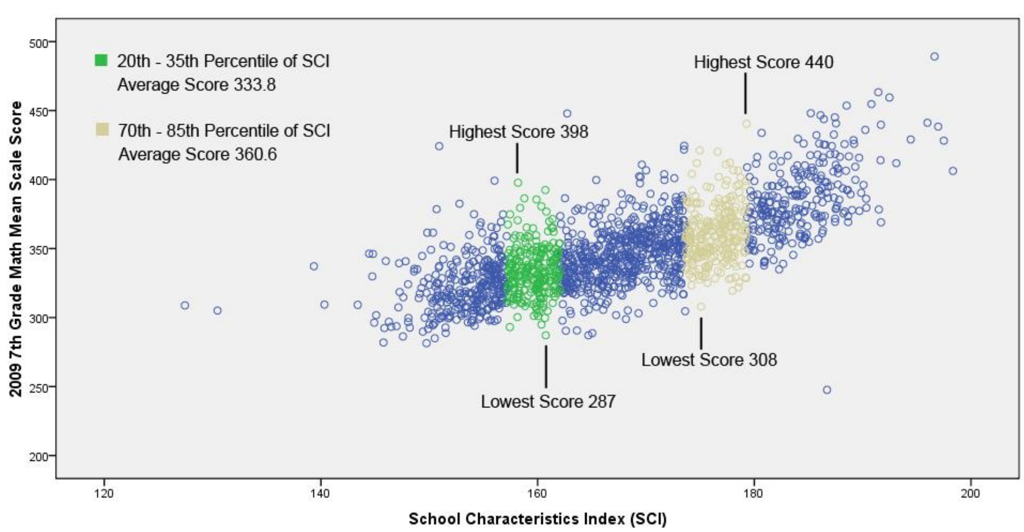
Figure A shows the mean scale scores of California middle grades schools on the Grade 7 Mathematics California Standards Test (CST) in 2009, plotted against each school's School Characteristics Index (SCI). The SCI summarizes multiple factors associated with student performance on state tests and can be understood as a proxy for the average socioeconomic status of a school's students (California Department of Education, 2009b).

As expected, test scores clearly tend to rise as family education and socioeconomic status increase. But average student outcomes on the CSTs vary widely *even among middle grades schools serving student populations with similar backgrounds and demographic profiles*. As Figure A shows:

- Among middle grades schools located in the 20th–35th percentile "band" of the SCI, which serve predominantly students from lower-income families, schools' mean scale scores on the test varied by 111 points, ranging from 287 to 398 (on a scale from 150 to 600).
- Among middle grades schools located in the 70th–85th percentile SCI band, which serve predominantly students from middle-income families, these scores varied by 132 points, ranging from 308 to 440.

Figure A: Middle grades schools serving similar students vary widely in their students' mathematics achievement

Average Grade 7 Mathematics CST scale scores in 2009, among California schools serving at least grade 7 and 8



Data: California Department of Education (CDE), Standardized Testing and Reporting (STAR) Program, Academic Performance Index (API). EdSource 2/11

Note: In the case of schools designated as "elementary" schools for state accountability (API) purposes, the SCI was recalculated to match the SCI metric for "middle" schools.

In comparison with these wide variations among schools serving similar students, the overall average scores for each of the two SCI bands differed by only about 27 points (333.8 vs. 360.6 points in 2009). In other words, there is a wider range of school-level student achievement on the Grade 7 Mathematics CST *within* each of the two SCI bands than, on average, exists between them. This pattern recurs with respect to other middle grades CSTs in English language arts and mathematics, including the Algebra I test taken by many California 8th graders.

Gaining Ground in the Middle Grades was designed to identify school and district practices and policies that help explain this variation among middle grades schools serving similar students.

How we did it

During the 2008–09 school year, the research team conducted a large-scale study of 303 middle grades schools in California. The team surveyed 303 principals, 3,752 English language arts and mathematics teachers in grades 6–8, and 157 superintendents of the districts and charter management organizations that oversee these schools. The response rate among teachers was very high: the average school-level teacher participation rate was 88%, and 142 schools returned 100% of their teacher surveys.

The sample of schools—discussed in subsequent pages—included schools serving grades K–8, 6–8, and 7–8. Half of the schools served predominantly students from lower-income families, and half served predominantly students from middle-income families. Twenty-eight of the schools were charters.

Three separate surveys were developed:

- *The principal survey* had the most items (447). It addressed school practices and policies, as well as district expectations. It also included a "curriculum supplement" that asked which state-adopted curriculum programs were in use in 2008–09.
- *The teacher survey* was administered only to English language arts and mathematics teachers of record in grades 6–8. Its 313 items included some that were specific to teachers in each of the two subject areas. The teacher survey focused primarily on schoolwide and classroom practices and policies, and asked a limited number of questions about district practices.
- *The superintendent survey* had 186 items and inquired into district practices and priorities for their middle grades schools.

The survey questions focused on concrete, actionable practices and policies, based on extensive review of the available middle grades research and policy literature and related literature on such topics as district and school leadership and the use of technology to support data-informed decision-making.[1] The surveys were also informed by external feedback by national and state experts on middle grades education.[2] Some survey

[1] A literature review, discussion of the external feedback and survey development process, and bibliography are provided in *Gaining Ground in the Middle Grades* (Williams, Kirst, Haertel, *et al.*, 2010).

[2] These included three national experts who served as consultants to the *Gaining Ground* study: Robert Balfanz (principal research scientist, Everyone Graduates Center, Johns Hopkins

questions charted timely new ground related to such topics as student placement and the use of student data to detect early warning signals of potential student failure, while other survey questions were inspired by or adapted from pre-existing survey instruments.[3]

The surveys explored 10 broad domains of effective middle grades practice identified through this review:

- A positive, safe, engaging school environment.
- An intense, schoolwide focus on improving academic outcomes.
- School organization of time and instruction.
- Coherent and aligned standards-based instruction and curricula.
- Extensive use of data to improve instruction and student learning.
- Early and proactive academic interventions.
- Attention to student transitions.
- Teacher competencies, evaluation, and support.
- Principal leadership and competencies.
- Superintendent leadership and district support.

The study analyzed the reported district and school practices against school-level scores on California's standards-based tests in English language arts and mathematics in grades 6–8 in 2009. Multiple regression analyses controlled for demographic differences among the close to 204,000 students in the sample schools, as well as other school variables. Another set of analyses relied on a longitudinal student data file to control for three years of prior student achievement to determine which reported practices by middle grades educators were most strongly associated with schools that showed gains in student scores beyond what would have been predicted.

What we learned

The major contribution of *Gaining Ground in the Middle Grades* was the set of specific, actionable practices that differentiated higher academic achievement among the 303 middle grades schools. In summary, stronger reports of the following by educators were associated with higher achievement in the middle grades.

- ***An intense, schoolwide focus on improving academic outcomes*.** Educators set measurable goals for improved student outcomes on standards-based tests and share a mission to prepare students academically for the future. Adults are held accountable and take responsibility for improving student outcomes, and students and parents are expected to share responsibility for student learning.

University); Hayes Mizell (distinguished senior fellow, Learning Forward); and Uri Treisman (professor of mathematics and director of the Charles A. Dana Center, University of Texas at Austin). In addition, Robert T. Linquanti, project director for English Learner Evaluation and Accountability Support (ELEAS) at WestEd, worked on contract with EdSource as a consultant in support of the development and interpretation of survey items pertaining to English learner (EL) students.

[3] These included surveys by the Center for Social Organization of Schools at the Johns Hopkins University (2006; Center for Research on Elementary and Middle Schools, 1988), the Consortium on Chicago School Research at the University of Chicago (2007a, 2007b, 2007c), the RAND Corporation (2006a, 2006b, 2006c), and the research team (Williams, Kirst, Haertel, *et al.*, 2005).

- ***Curricula and instruction are closely aligned with state academic standards.*** Practices such as emphasis on key standards from one grade to the next in each subject area, frequent use of standards-based curricula, teacher collaboration around pacing and benchmarks, and well-defined plans for instructional improvement help ensure coherent implementation of standards-based curricula and instruction.
- ***Assessment and other student data are used extensively to improve student learning and teacher practice.*** Districts play a strong leadership role in the provision and use of student assessment data. The findings confirm a changing role for principals with respect to facility with and frequent use of assessment data, and signal a culture shift with respect to extensive use of these data by teachers.
- ***Emphasis on early identification and proactive intervention to meet students' academic needs.*** Records of entering students are reviewed thoroughly for warning signs of academic vulnerability and need for support. A comprehensive range of required and voluntary strategies are used to intervene on behalf of students who are two or more years below grade level or at risk of failing. Teachers and parents meet to develop and monitor student intervention plans. And schools pay attention to the assessment and careful placement of English learners.
- The importance of ***superintendent leadership and district support*** was clear across many dimensions of policy and practice. ***The changing role of the principal*** in driving student outcome gains, orchestrating school improvement, and serving as the linchpin between the district and teachers was also well documented. So too was ***the individual and collective work of teachers*** with strong competencies, who benefit from substantive practice evaluations and adequate support, time, and resources to improve instruction.
- School environment and organization of time and instruction were not strongly associated overall with improved student outcomes on standards-based tests, but *some practices related to these topics were*. For example, the principal ensures a clean, safe, and disciplined school environment, a higher proportion of students participate in electives and extra-curricular activities, and more time is allocated per month for common planning in grades 7 and 8 for English language arts and mathematics teachers.
- Neither school grade configuration nor the organization of classrooms (e.g., self-contained vs. departmentalized) was clearly associated with higher overall school performance on standards-based tests.

This follow-up analysis

This report builds on the foundation of *Gaining Ground in the Middle Grades*. In doing so, it draws from the same sample of schools and the same survey of school principals, teachers, and superintendents.

The participating schools

A total of **303 middle grades schools** in California, each serving at least grades 7 and 8, comprise the sample. (See Figures B and C on page 7.)

One key feature of the sample of schools is that it is ***bimodal***, including:

- **144 schools located in the 20th–35th percentile SCI band**, which serve predominantly students from lower-income families.
  - During the 2008–09 school year, these schools were more likely than the California average to serve middle grades students who were socioeconomically disadvantaged, Hispanic, English learners, and/or whose parents had not gone to college. Fifty-five (38%) of these schools were designated as being in Year 5 of Program Improvement (PI) under the federal No Child Left Behind law in that year.
- **159 schools located in the 70th–85th percentile SCI band**, which serve predominantly students from middle-income families.
  - During the 2008–09 school year, 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. Only one of these schools was designated as being in Year 5 of PI in 2008–09.

In addition, the sample:

- Includes ***both lower- and higher-performing schools*** in each SCI band in 2008–09.
- Includes ***all major middle grades configurations***. About half of the schools had a 6–8 grade configuration, and the remainder was evenly split between K–8 and 7–8 configurations.[4]
- Includes ***both charter and traditional public schools***. The charter schools in the sample were about evenly split between K–8 and 6–8 grade configurations, and most were in the 70th–85th percentile SCI band.

Superintendents, principals, and mathematics teachers surveyed

At the school level, this follow-up analysis draws from the survey responses of:

- **The principals from all 303 schools.**
- **1,857 teachers who reported *teaching mathematics* in grades 6, 7, and/or 8.**[5]

At the district level, the analysis also draws from surveys completed by:

- **152 district superintendents and five charter management organization (CMO) leaders.** Altogether, these leaders represent 244 (81%) of the 303 schools in the sample. Of the responding superintendents, 49 lead elementary districts, 96 lead unified districts, and seven lead high school districts.

What this report offers

This report offers new insight into mathematics practices and policies in California and their relationship with student outcomes.

- **Chapter One** provides a basic overview of some key standards-based reform contexts in which California's middle grades schools do their work and of the state's interest in increasing student participation and success in Algebra I in grade 8.

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[4] The few schools in the sample with atypical grade configurations (e.g., 5–8) are considered 6–8 schools for the purposes of discussion and descriptive statistics.

[5] One charter school had missing mathematics teacher data.

Figure B: Schools in the sample, by grade configuration and SCI band

	K–8 schools		6–8 schools		7–8 schools	
	20th–35th percentile SCI	70th–85th percentile SCI	20th–35th percentile SCI	70th–85th percentile SCI	20th–35th percentile SCI	70th–85th percentile SCI
Number of schools	25	48	78	72	41	39
Number of schools that were *charters*	4	10	5	8	0	1
Mean cohort size*	62.54	55.02	312.28	299.08	408.05	445.26

Data: EdSource Principal Survey, California Department of Education (Academic Performance Index) EdSource 2/11

* A school's middle grades "cohort size" is its average student enrollment in grades 7 and 8: (Percent of enrollments in grades 7 and 8 multiplied by school enrollment) divided by 2.

Figure C: Average school-level* student demographics among the sample, by SCI band

Student Characteristics, 2008–09	**144 participating schools, 20th–35th percentile SCI** (102,572 students, grades 6–8)	**159 participating schools, 70th–85th percentile SCI** (101,318 students, grades 6–8)
	Mean school-level percentage of students	*Mean school-level percentage of students*
African American	10.0%	4.9%
Asian	3.9%	7.9%
Filipino	3.0%	3.2%
Hispanic	67.7%	25.0%
Pacific Islander	0.8%	0.7%
White	13.2%	55.9%
Socioeconomically Disadvantaged	75.6%	29.1%
English Learners	26.6%	6.5%
Reclassified Fluent English Proficient	22.3%	8.5%
Parental Education – Less than High School	27.5%	5.0%
Parental Education – High School Graduate	26.0%	14.6%
Parental Education – Some College	19.0%	26.4%
Parental Education – College Graduate	8.4%	25.8%
Parental Education – Graduate School	3.0%	14.3%

Data: California Department of Education, 2009 California Standardized Testing and Reporting (STAR) Program.
EdSource 2/11

* All calculations are based on the sum of students tested in English Language Arts in 6th, 7th, and 8th grades. For each school, the number of students tested in a subgroup is divided by the total number of students tested overall. The resulting school-level proportions are then averaged. Note also, for ethnic and parent education groups, that not all students disclose data and not all categories are shown.

Note: Discussion of the representativeness of the school sample compared with nonparticipating schools in the same SCI bands is available in *Gaining Ground in the Middle Grades* (Williams, Kirst, Haertel, *et al.*, 2010).

- **Chapter Two** provides descriptive statistics (drawing on survey data) regarding the extent to which certain key practices and policies related to content standards, curriculum, and assessment have been implemented in the sample schools. The chapter shows the impact of California's standards-based reforms on the policies and practices of middle grades schools.
- **Chapter Three** discusses recent research and policy documents on the complexity of student placement policies in mathematics and their effects. The chapter also provides descriptive statistics (drawing on survey data) regarding policies for oversight and review of student placements at the district and school levels, and the sources of information that math educators most commonly consider when placing students into math courses in grades 7 and 8, including Algebra I.
- **Chapter Four** uses longitudinal student testing data to provide an empirical look at how schools approach the placement of students into Algebra I in grade 8, how this relates to students' prior achievement, and the extent to which prior achievement matters for students' test scores in grade 8. *Our analysis of these data provides important new insight—not previously available—into local placement practices throughout California and their consequences for students.*
- **Chapter Five** provides new regression analyses of policies and practices that correlate most strongly with higher school achievement in grade 8 mathematics, controlling for key school variables and students' prior test scores. These findings reinforce, and are informed by, the broader conception of effective middle grades schools presented in *Gaining Ground in the Middle Grades*.
- The **conclusion** summarizes the findings.
- **Appendix A** provides additional data on Algebra I placement not included in Chapter Four. **Appendix B** provides data on the credentials of mathematics teachers in the sample.
- The **Technical Appendix** provides more detailed information on the analytic methods used in Chapters Four and Five.

How this analysis differs from *Gaining Ground in the Middle Grades*

Although this follow-up analysis builds on the foundation of *Gaining Ground in the Middle Grades*, it differs in important ways.

- The analysis uses survey responses to describe standards-based practices and policies in mathematics among the schools in the sample. Such descriptive data were not presented in the prior study.
- Whereas the prior study considered survey responses from both mathematics and English language arts teachers, this analysis considers only those for ***mathematics teachers*** in each school. This is true for all descriptive statistics based on teacher survey data and for all regression analyses of teacher-reported practices against student achievement outcomes in grade 8 mathematics.
- This analysis draws on longitudinal student data to examine how students' 7th grade mathematics performance relates to their 8th grade placements and achievement.
- Whereas the regression analyses conducted for the prior study inquired into the

correlation of reported practices and policies with schools' student achievement outcomes defined both cross-sectionally (test scores in a single school year) and longitudinally (controlling for prior student achievement), this analysis considers only the correlation of these with ***longitudinal student outcomes in grade 8 mathematics***—that is, with 8th grade achievement on the General Mathematics CST and/or the Algebra I CST after controlling for students' prior test scores.

- Whereas in the prior study separate regression analyses were conducted for each of the 10 research domains to identify which clusters (or subdomains) of policies and practices within each correlated with student outcomes, this analysis sets aside the prior domain structure. Instead, the new regressions described in Chapter Five provide a more fine-grained analysis of mathematics practices and policies—including analyses of responses to individual survey items—to identify which correlate with higher grade 8 mathematics achievement in particular.

Chapter One

State education policy priorities have strongly influenced mathematics course-taking and achievement in California's middle grades

A review of California policy and statewide student achievement trends

This chapter *provides a basic overview of:*

- *Key standards-based reform contexts in which California's middle grades schools do their work, and*
- *California's longstanding policy interest in increasing student participation and success in Algebra I in grade 8.*

Increasing student achievement in mathematics is currently a prominent education policy issue, owing in part to continuing anxiety about U.S. international standing and competitiveness in a changing global economy. The middle grades are crucial to this discussion. They serve as the beginning of the secondary-to-postsecondary pipeline and prepare students to enter a college preparatory curriculum in high school. In addition to providing a foundation for subsequent achievement in mathematics, the middle grades also help students learn how to value the subject itself—ideally, to "see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and [students'] own efficacy" (National Research Council, 2001, pg. 116).

The United States is in the midst of an important transition with respect to the standards by which it aspires to prepare K–12 students in mathematics. The Common Core State Standards Initiative (2010) has focused states' attentions anew on the issue of how mathematics instruction and curricula should be organized. The initiative is one response to the now-common criticism that U.S. mathematics standards and curricula have too often lacked the focus and coherence that is more common in the highest-achieving nations (e.g., Schmidt, Houang, and Cogan, 2002)—a concern reiterated in the 2008 report of the National Mathematics Advisory Panel. The majority of states have adopted the Common Core State Standards in mathematics, including California.

As a foundation for the rest of this follow-up report to *Gaining Ground in the Middle Grades*, this chapter provides basic information regarding California's standards-based education policies in mathematics and the changes in math achievement and Algebra I course-taking that have occurred since content standards were first adopted.

State policies exert significant influence over middle grades mathematics in California

The California State Board of Education (SBE) adopted the state's academic content standards in mathematics in December 1997 (California Department of Education/CDE, 1997/reposted 2009). These mathematics standards differed from those that would be established in many other states:

- For *grades K–7*, content standards were established for each *grade level*.
- For *grades 8–12*, content standards were organized by *course*, beginning with Algebra I.

The question of what mathematics content students should learn and when sparks intense debate in the state, with Algebra I in grade 8 the brightest flashpoint.[6] When adopting standards in 1997, California did not—and does not—require 8th graders to take Algebra I. But the standards did make clear the state's aspiration for growing numbers of students to learn Algebra I in grade 8.

The Algebra I standards also 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, including in the Common Core State Standards released by the National Governors Association and the Council of Chief State School Officers.[7] In contrast, the Common Core focuses on content such as linear equations and aspects of geometry in grade 8.

One unintended consequence of California's approach, historically, has been lack of clarity in state policy about what curriculum to provide the substantial proportion of 8th grade students—including 39% in 2009—who are not yet enrolled in Algebra I or higher. Policymakers attempted to fill this gap during the state's most recent mathematics curriculum program adoption (described later).

The version of the Common Core standards in mathematics adopted by California in August 2010 provides the state, for the first time, with a clear set of *grade 8* standards that provide an alternative to Algebra I as California has defined it to date. However, California's adopted version *also* includes a separate set of standards for Algebra I beginning in grade 8, again including such content as quadratic equations. (See California State Academic Content Standards Commission, 2010.)

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[6] For example, Algebra I was the focus of a lawsuit in 2008 that blocked action on a motion by the State Board of Education to make the Algebra I CST California's sole test of record for federal accountability purposes in grade 8 mathematics. This motion responded to a finding by the U.S. Department of Education that California's General Mathematics CST does not comply with federal requirements because it tests some 8th graders on content defined by California's 1997 standards as intended for grades 6 and 7. (See discussion in EdSource, 2009.)

[7] Minnesota also emphasizes Algebra I in the middle grades through state policy. In 2006, Minnesota lawmakers decided that students beginning with the class of 2015 must complete an Algebra I credit by the end of grade 8.

However, Minnesota and California make different assumptions about grade 8 mathematics content. For example, the Algebra I standards that California adopted in 1997—which are the minimum formal standard for grade 8—include quadratic equations. In contrast, Minnesota's 2007 mathematics standards (Minnesota Department of Education, 2008), like the Common Core State Standards in mathematics, do not call for mastery of quadratic equations until high school.

The California commission responsible for recommending the standards for adoption also duplicated some standards at lower grade levels than originally proposed in the Common Core State Standards, on the grounds that establishing these expectations earlier would better prepare students for Algebra I in grade 8. For example, certain Common Core standards for grade 8 were duplicated in grade 7, and certain standards for grade 7 were duplicated in grade 6. The consequences of these changes for the coherence of middle grades mathematics instruction in California remain to be seen.

Mandatory testing and accountability policies provide incentives for student participation in Algebra I in grade 8

Formally, the math standards California adopted in 1997 are intended as a guide for local educators. But key policy levers have ensured the importance of the standards for local practice. These policy levers will also be central to efforts to implement Common Core State Standards in mathematics.

One of these policy levers is assessment and its relation to state and federal school accountability policies. California public schools are required to administer the annual California Standards Tests (CSTs) in grades 2–11. The CSTs provide a strong incentive for local educators to align instruction with the content standards because the tests are used to report publicly on the academic progress of schools and districts, and to identify those needing improvement.

The state's current assessments are standards-based and, in mathematics, comprised entirely of multiple-choice items. Students' scale scores on the CSTs fall into one of five performance levels: *Far Below Basic*, *Below Basic*, *Basic*, *Proficient*, or *Advanced*.

With respect to middle grades mathematics, these tests include:

- The **Grade 6 Mathematics CST**, which is taken by all 6th graders and is aligned with California's mathematics content standards for grade 6.
- The **Grade 7 Mathematics CST**, which is taken by the vast majority of 7th graders and is aligned with California's mathematics content standards for grade 7.[8]
- The **General Mathematics CST**, which assesses student achievement on grades 6 and 7 standards and is taken by 8th (and 9th) graders who are enrolled in a mathematics course *below a full Algebra I course*. This could be a pre-algebra course, an algebra readiness course, or the first year of a two-year Algebra I course, for example.
- **End-of-course CSTs** in mathematics.[9]
  - In the middle grades, the most common end-of-course test is the **Algebra I CST**, which is taken by students in grades 7 and 8 who are positioned to complete a *full Algebra I course*. (This includes students who are enrolled in the second year of a two-year Algebra I course.) The test is aligned with California's mathematics content standards for Algebra I.
  - Students in grade 8 and above who are enrolled in a higher-level math course such as Geometry take the appropriate end-of-course CST.

[8] According to data from the California Department of Education (CDE), about 6% of 7th graders were enrolled in a full Algebra I course and took the corresponding CST in 2009.

[9] Although Integrated Mathematics CSTs are offered for students taking courses that integrate college-preparatory algebra and geometry content over several years, they are currently uncommon.

Federal school accountability policy encourages student participation in such testing. The No Child Left Behind Act of 2001 required 95% of students in a school to participate in relevant state tests in order for the school to make "adequate yearly progress" (AYP). Any school or district receiving Title I funds that fails to meet this federal requirement for any subgroup of students (based on ethnicity, disability, or English learner status) for two years in a row is placed in Program Improvement. In part, the law emphasized participation to discourage schools from excluding struggling students.

California's school accountability policies have in turn encouraged Algebra I in grade 8. For example, schools are penalized on the Academic Performance Index (API) when 8th and 9th grade students take the General Mathematics CST. For purposes of calculating a school's API (CDE, 2010, pp. 38–40):

- The scores of 8th graders who take the General Math CST are lowered by one performance level. For example, if an 8th grader scores *Proficient* on this CST, a school only gets credit for a score of *Basic*.
- The scores of 9th graders who take the General Math CST are lowered by two performance levels. For example, if a 9th grader scores *Proficient* on this CST, a school only gets credit for a score of *Below Basic*. (The state does not penalize high schools for 9th graders who take the Algebra I CST.)

This penalty is not included in schools' AYP calculations of student proficiency for federal accountability purposes, however. And schools' API scores are a nominal consideration in AYP calculations. Schools need only "demonstrate a growth of at least one point or a minimum API score of at least 650" (CDE, 2009a, pg. 2), which is well below the score received by most California public schools.

State-adopted instructional materials for grades K–8 are another policy lever

Instructional materials are another lever through which education policymakers in California influence local mathematics instruction. State funds for these materials at the K–8 level can only be used to purchase from a list of state-adopted curriculum programs.

The SBE adopted new mathematics curriculum programs in November 2007, including:

- *Basic mathematics curriculum programs*. These materials are intended as the "foundation for instruction," are aligned with the state's mathematics content standards, and support the learning of advanced students, students at or near grade level, and students somewhat below grade level (CDE, 2006/reposted 2007, Ch. 10/pg. 3). Algebra I is effectively California's standard for the adoption of basic mathematics instructional materials at the grade 8 level.
- New *algebra readiness materials*, intended for 8th graders who are not yet ready for Algebra I. Prior to the adoption of these new materials in 2007, California policy was unclear about the instructional materials to be used with this substantial proportion of 8th graders. Algebra readiness programs provided a new tool. The programs build on key content standards from grades 2–6 in order to teach students 16 "target" standards from grade 7 and Algebra I that will prepare them for a full algebra course in high school. The materials are "designed to serve students for a full year of instruction" but can be used in other settings as well (Chapter 10/pg. 4; see also Appendix E).
- New *intervention materials*, for use in grades 4–7. These materials support students

who “have significant gaps in their knowledge of mathematics,” including those who are two or more years below grade level (Chapter 10/pg. 4). The materials focus on a subset of standards from kindergarten through grade seven, with the goal of helping students “learn efficiently from basic grade-level instructional materials.” The CDE emphasizes that these materials are not intended “as a fixed-term course” or for “tracking students” (pg. 342).

The 2008–09 school year—the focus of the *Gaining Ground in the Middle Grades* study—was a transition period for California schools with respect to mathematics curricula. Materials from both the 2001/2005[10] and 2007 state adoption cycles were in use in the state’s middle grades schools. (See discussion in Chapter Two.) This was also a period of uncertainty. A State Board decision in July 2008 raised the prospect of all 8th graders being tested using the state’s Algebra I CST. Although this was blocked through legal action, it raised concern among local educators about whether they should invest in new algebra readiness materials.

California’s recent budget problems have thrown this transition into greater turmoil. The state’s February 2009 budget package made state funds earmarked for instructional materials “flexible” for 2008–09 and 2009–10, and exempted districts from the requirement to purchase materials within two years of a state adoption. The July 2009 budget extended that exemption through 2012–13. Although districts must still provide their students with standards-aligned instructional materials, these materials may be from a prior state adoption.[11] State funds for teacher professional development aligned with state-adopted instructional materials were also put into the flexible category.

Course-taking and achievement in middle grades mathematics in California have responded to these policy levers

Middle grades mathematics education has changed in important ways since the adoption of content standards in 1997, most strikingly with respect to student course-taking and participation in Algebra I. This has led to wider student successes in the course among students who might not previously have taken it in grade 8, but also wider student difficulties with the course in the middle grades.

These changes provide a window into the opportunities and challenges faced by the 303 middle grades schools in the sample. (Note that data from 2009, rather than 2010, is used when summarizing statewide trends in this chapter because the 2008–09 school year was the focus of the *Gaining Ground in the Middle Grades* study.)

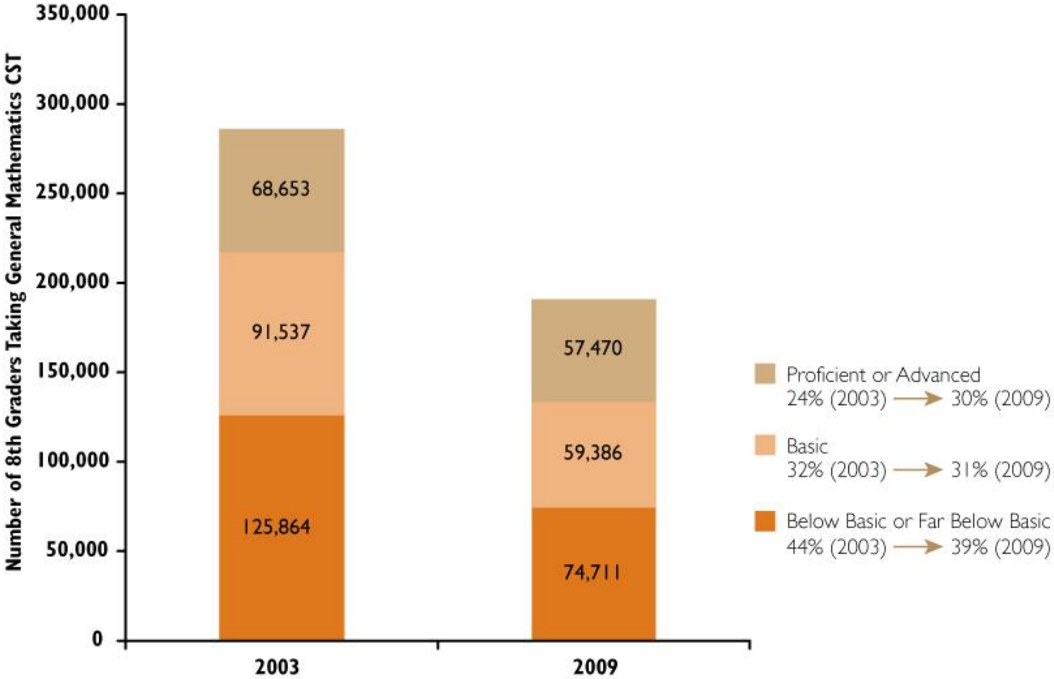
Student scores on the grades 6 and 7 CSTs, and on the General Mathematics CST in grade 8, have improved over time

Student achievement in grades 6 and 7 has improved, at least as measured by the mathematics CSTs for those grades. These changes are most notable in grade 7.

[10] California’s 2005 “follow-up” mathematics adoption added instructional materials to the list adopted during the state’s “primary” mathematics adoption in 2001, as part of the same adoption cycle and based on the same evaluation criteria.

[11] The July 2009 state budget package also effectively put California’s entire curriculum adoption process on hold for several years. The package prohibited the State Board of Education until 2013–14 from adopting new instructional materials or updating the curriculum frameworks that guide publishers’ development of these materials.

Figure 1.1: Although fewer 8th graders take the General Mathematics CST, achievement on the test has improved over time



Data: California Department of Education (CDE), Standardized Testing and Reporting (STAR), Accessed 8/10 EdSource 2/11

Note: The counts of 8th graders shown here are based on the numbers *tested* on the General Mathematics CST, rather than the preferable number of students with valid scores. This is because the latter data are not published for 2003 as they are for 2009. These counts are *estimates* derived from state reports of performance and may not precisely match the number of students tested due to rounding.

- In 2003, 30% of 7th graders scored *Proficient* or *Advanced* on the Grade 7 Mathematics CST, and 38% scored *Below* or *Far Below Basic*.
- In 2009, 43% of students who took the Grade 7 Mathematics CST scored *Proficient* or *Advanced*, and 26% scored *Below* or *Far Below Basic*. This improvement occurred despite the fact that, beginning in 2007, schools began administering the Algebra I CST to 7th graders enrolled in the course. By 2009, 6% of California 7th graders took the more-advanced Algebra I CST in 2009 and thus were excluded from the pool of students who took the Grade 7 Mathematics CST.

Similarly, 8th graders' performance on the General Mathematics CST has improved over time. This occurred despite ambiguity in California state policy regarding the most effective curricula for 8th graders who are not yet enrolled in Algebra I, and despite the fact that fewer 8th graders now take the test (given wider participation in Algebra I).

Between 2003 and 2009, the percentage of California 8th graders taking the General Mathematics CST declined from 60% to slightly more than 39% as more students enrolled instead in Algebra I. During this time (see Figure 1.1):

- The percentage of students taking the General Mathematics CST who scored *Proficient* or *Advanced* improved from 24% in 2003 to 30% in 2009.
- The percentage scoring *Below Basic* or *Far Below Basic* declined from 44% in 2003 to

39% in 2009, representing a declining but still sizeable number of California 8th graders who are struggling to master mathematics content adopted for grades 6 and 7.

Middle grades participation in Algebra I has grown tremendously in California

Student participation in Algebra I in 8th grade has increased dramatically in California during the past decade.

- In 1999, the first year California administered course-specific mathematics tests in grade 8, only 16% of 8th graders took the test for Algebra I (EdSource, 2004).
- In 2003, 32% of 8th graders took the Algebra I CST.
- In 2009, 54% of 8th graders and 6% of 7th graders took the Algebra I CST.

Importantly, participation in the Algebra I CST statewide has increased among 8th graders of all racial and ethnic backgrounds. For example:

- The estimated percentage of African American 8th graders taking the test more than doubled between 2003 and 2009, from 24% to 50%.
- The same was true for Hispanic/Latino 8th graders: an estimated 53% took the Algebra I CST in 2009, compared with only 26% in 2003.[12]

Wider participation leads to many more 8th graders scoring *Proficient* or higher on the Algebra I CST—and many more who score at low levels

Overall between 2003 and 2009, the percentage of California 8th graders taking the Algebra I CST who scored *Proficient* or *Advanced* on the test increased from 39% to 44%. In addition, the percentage scoring *Below Basic* or *Far Below Basic* decreased slightly. This is notable, given the increase in Algebra I participation during this time.

That said, the sheer scale of change supports multiple interpretations of how students are faring in Algebra I in grade 8. (See Figures 1.2 and 1.3 on the next page.)

- From one perspective, many more students are succeeding, including students who might not have had access to the course in prior years. Nearly twice as many 8th graders scored *Proficient* or *Advanced* on the Algebra I CST in 2009 as in 2003, including 3.8 times as many economically disadvantaged 8th graders.
- From another perspective, many more students are struggling in the course. In all, 1.7 times as many 8th graders scored *Below Basic* or *Far Below Basic* on the Algebra I CST in 2009 as in 2003. Among economically disadvantaged 8th graders, more scored at these lowest levels in 2009 than took the Algebra I CST *at all* in 2003.

The apparent frequency with which students repeat Algebra I in high school is an additional cause for concern. Data published by the CDE in August 2008 showed that 38% of 9th graders who took the Algebra I CST in 2008 had already taken the test in a prior year (CDE, 2008a; EdSource, 2009). Based on the CST data presented in Figures 1.2 and 1.3, some of this repetition is likely a consequence of students not succeeding in Algebra I as 8th graders.

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[12] These estimates are calculated by dividing the number of Algebra I CST-takers for each group in a given year (provided by the Standardized Testing and Reporting program) by that group’s total grade 8 enrollment in the same year (provided by the California Basic Educational Data System).

Figure 1.2: Participation in the Algebra I CST among California 8th graders has expanded dramatically, with students scoring at all achievement levels

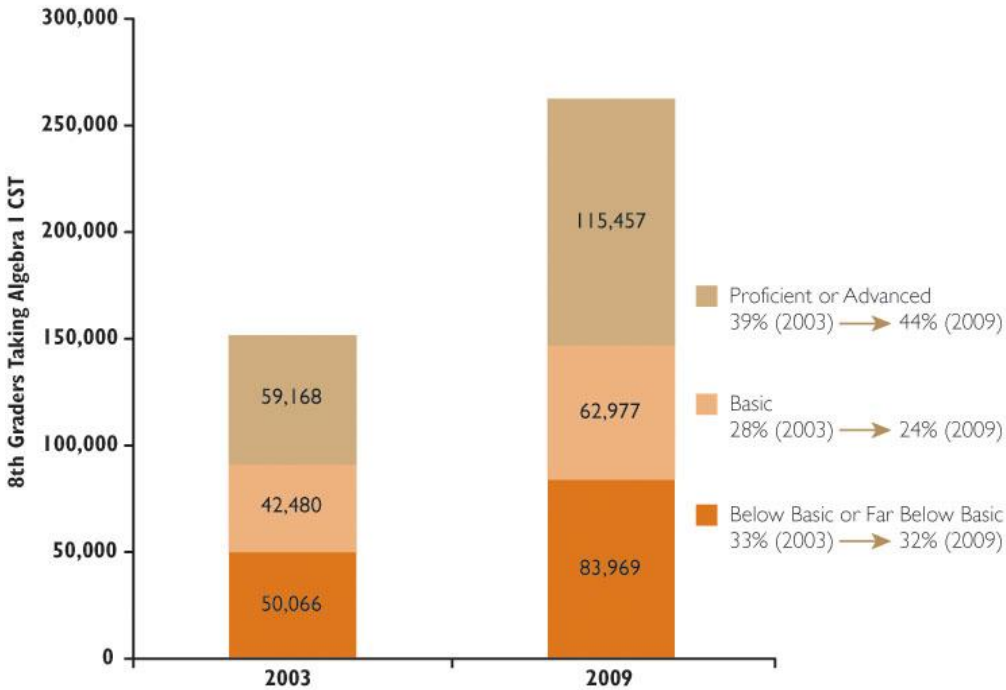
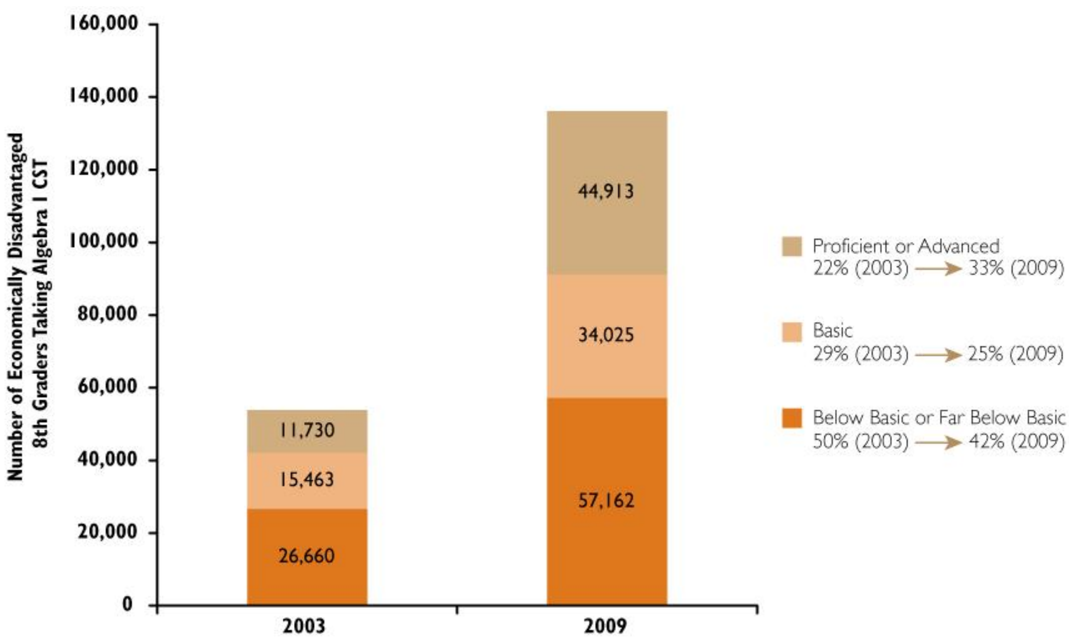


Figure 1.3: Among **economically disadvantaged 8th graders**, dramatically wider participation in the Algebra I CST suggests both wider successes and wider difficulties with the course



Data for both figures: California Department of Education (CDE), Standardized Testing and Reporting (STAR), Accessed 5/10 EdSource 2/11

Note for both figures: The counts of 8th graders shown in each figure are based on the number of students *tested* on the Algebra I CST, rather than the number of students with valid scores. The latter data are not published for 2003 as they are for 2009. These counts are *estimates* derived from state reports of performance and may not precisely match the number of students tested due to rounding.

However, institutional barriers also appear to play a role. A recent report by Waterman (2010) that focused on some California Bay Area students' course-taking paths from grade 8 to grade 9 revealed that about 35% of students who achieved *at least a B-* in Algebra in grade 8 took the course again (and in a few cases took a less advanced course) in grade 9. The report found the same was true for 44% of students who scored *Proficient* or *Advanced* on the Algebra I CST in grade 8.

It is also clear that gaps persist between different student groups in their completion of college-preparatory mathematics courses in high school. Based on testing data for 2009, only an estimated 34% of African American 11th graders and 35% of Latino 11th graders had reached at least Algebra II, compared with 52% of white 11th graders—and 78% of Asian 11th graders. Although these percentages have increased since 2003, they make clear that wider access to Algebra I in grade 8 has not yet translated into equally widespread enrollment in higher mathematics courses for all students.[13]

Thus, the statewide data on Algebra I participation and achievement discussed above raise difficult issues about student placement. These include the adequacy of the foundation students receive in the elementary and early middle grades, the level of prior achievement needed for students to have a high chance of success in Algebra I on the first attempt, and what level of achievement on the Algebra I CST—*Basic* versus *Proficient*, for example—represents an acceptable baseline for success. But these data also raise questions about local planning and capacity, and the extent to which placement policies produce both intended and unintended consequences.

[13] These figures represent the *estimated* percentage of 11th graders in each ethnic group—see footnote 12—taking either the Algebra II CST or the Summative High School Mathematics CST, which is taken by students who have *already completed* Algebra II in a prior year or are enrolled in more advanced math courses (see California Department of Education, 2009c, pg. 18).

Chapter Two

Local mathematics practices and policies across California vary considerably, but the state's standards-based reforms have clear influence

A summary of responses from the ***Gaining Ground*** *surveys of superintendents, principals, and teachers*

This chapter *shows that:*

- *California's standards-based reforms have had a decisive impact on the policies and practices of middle grades schools in the sample.*
- *Schools differ widely in which state-adopted curriculum programs they use, in part reflecting that 2008–09 was a transition year.*

The theory behind standards-based reform is that state policies related to content standards affect what happens at the district, school, and classroom levels. The validity of this theory is particularly salient as the majority of states, including California, move from adoption to implementation of the Common Core State Standards in mathematics and English language arts.

Survey responses from district superintendents, school principals, and mathematics teachers in the sample show that middle grades schools in California all appear to have taken substantive steps in response to the state's standards-based education policies. They differ, however, in the extent to which they report professional practices—such as common planning—that support educators' capacity to continuously improve instruction aligned with the state's content standards.

California's standards-based reforms have had a decisive impact on the policies and practices of middle grades schools in the sample

The data that follow show the strong connection of district and school practices in 2008–09 with the mathematics standards California adopted in 1997. During the ensuing 13 years of state policy regarding assessment, curricula, accountability, and professional development, these standards have clearly made an impact on local policy and action.

Alignment of curriculum and instruction with the California academic content standards

Judging from the survey responses, school districts are providing guidance to help school leaders and teachers focus their attention on state standards. For example, roughly four in five responding district superintendents agreed or strongly agreed that their districts have identified key or power standards for each grade and in each subject.

About the *Gaining Ground* survey data

Responses to ***survey items*** from superintendents, principals, and mathematics teachers form the basis for many of the descriptive statistics presented in this report.

- The majority of survey items asked about the extent to which *detailed, concrete, actionable practices and policies* were in place at each school. Schools may have differed in the practices they reported using, or in the intensity (typically on a five-point scale) to which they agreed these practices were in place or implemented.
- The surveys were *written as neutrally as possible*. They provided a variety of acceptable response options for every area of inquiry—there were no "wrong" answers.
- Some *common items were answered by two or all three respondent groups*. Other items asked superintendents, principals, and/or teachers to report on *their roles relative to one another*. Such items allowed us to explore the alignment of respondents' answers.
- The surveys were written to *accommodate differences* among the 303-school sample in terms of grade configuration, students' socioeconomic status, and charter or noncharter status.

The ***descriptive survey data*** presented in this and the following chapter show the *frequency* with which:

- *Superintendents* (or charter management organization leaders) reported that particular practices or policies are in place in their districts, with each leader representing a single district or CMO.
- *School principals* reported that particular practices or policies are in place in their schools.
- Middle grades *mathematics teachers* reported that particular practices or policies are in place in their schools. These statistics are based on calculation of *the proportion of mathematics teachers in each school who responded to a given survey item in a particular way*.
    - Typically, the *average* school-level proportion of teachers responding in a particular way—whether across the full sample of schools or across a sub-sample—is reported. For the sake of simplicity, these statistics are described in the text as representing "the average school" in the sample or a sub-sample.
    - In some cases—see Chapter Three on placement practices—variation among schools with respect to school-level teacher responses is explored in more detail.
    - When helpful, the proportion of schools in which mathematics teachers were *unanimous* in responding to a survey item in a particular way is discussed (e.g., where 100% of mathematics teachers reported implementing a practice to a "considerable" or "great extent," or where 0% did so).

The reader should note that all district- and school-level percentages are calculated based on the total number of *respondents*—responding superintendents, responding principals, or schools with responding math teachers—to a given survey item, as indicated in each table. For some survey items, this does not represent the full sample of districts or schools because of missing responses. (In addition, one charter school had missing mathematics teacher data.)

Figure 2.1: Principals agreed that their schools align instruction with state academic standards, including emphasis on key standards

Survey Item To what extent do you agree with the following about your school's overall ELA and math instruction?	**Responses of Principals:** *Percentage reporting "Agree" or "Strongly Agree"*						
	Full sample	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=47)	20th–35th %ile SCI	70th–85th %ile SCI	20th–35th %ile SCI (N=41)	70th–85th %ile SCI
Classroom instruction is closely guided by state academic standards.	98% (N=300)	100%	98%	97% (N=77)	100% (N=71)	98%	97% (N=39)
Our school emphasizes select key standards at each grade and in each core subject.	84% (N=297)	88%	72%	84% (N=76)	86% (N=70)	93%	82% (N=38)

Data: EdSource Principal Survey, P_37a, c EdSource 2/11
N-size indicates total number of responding principals.

Figure 2.2: Mathematics teachers also agreed that their schools align instruction with the state content standards

Survey Item *To what extent do you agree with the following?*	**Responses of Mathematics Teachers:** *Average school-level percentage reporting "Agree" or "Strongly Agree"*						
	Full sample (N=302)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=71)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Our school's teachers closely align instruction with the California academic content standards in mathematics.	97%	97%	92%	98%	99%	99%	~100%
Our school's teachers closely align instruction with the CSTs in mathematics.	90%	88%	81%	94%	89%	95%	91%
Our school emphasizes selected key standards that teachers prioritize at each grade level.	81%	80%	68%	86%	84%	83%	77%

Data: EdSource Teacher Survey, Items T_31a–c EdSource 2/11
N-size indicates total number of schools with responding teachers.

In turn, standards guide practice at the school level:

- Virtually all responding principals in the sample (98%) agreed or strongly agreed that classroom instruction in English language arts and mathematics in their schools is closely guided by state academic standards. (See Figure 2.1.) A somewhat smaller proportion of principals (84%) agreed or strongly agreed that their schools emphasize select key standards at each grade and in each subject area.
- Mathematics teachers' responses to similar questions tell the same story. (See Figure 2.2.) In the average school in the sample, 97% of mathematics teachers agreed or strongly agreed that their school closely aligns instruction with the state's mathematics content standards, with agreement being unanimous in nine out of every 10 schools. Again, agreement about emphasizing selected key standards at each grade level was somewhat less common, with 81% of mathematics teachers in the average school agreeing or strongly agreeing.
- Collaboration among teachers to "break down" the state standards, such as to identify

prerequisite student skills, appears to be less common. Only 26% of mathematics teachers in the average school reported that teachers do this to a "considerable" or "great extent."

The role of the California Standards Tests (CSTs) and district benchmark tests

Assessment plays an important role in enabling middle grades educators to evaluate student progress toward meeting the state content standards. The surveys underscore the emphasis schools place on assessments, particularly with respect to the California Standards Tests (CSTs) and district benchmark tests.

California Standards Tests (CSTs). The CSTs—on which federal and state school accountability metrics are largely based—are a key policy lever through which officials have encouraged schools' focus on state content standards. The surveys asked educators in the sample to report on the extent to which their schools set particular kinds of measurable goals and priorities for student achievement based on these tests.

As Figure 2.3 shows:

- Overall, 69% of principals in the sample strongly agreed, and another 26% agreed, that their schools emphasize improving student achievement across all the CST performance levels—that is, moving students from *Far Below Basic* to higher levels, from *Proficient* to higher levels, and so forth. Principal agreement was pervasive across grade configurations and both SCI bands.
- In addition, 44% of principals strongly agreed, and another 37% agreed, that their schools set measurable goals for CST scores by grade level and subject area. Agreement was more widespread among principals in the 20th–35th percentile SCI band than among principals in the 70th–85th percentile SCI band. This difference was most striking among K–8 principals: 92% of principals in K–8 schools serving predominantly students from lower-income families agreed or strongly agreed that their schools do so, compared with only 54% of principals in K–8 schools serving predominantly students from middle-income families.

Figure 2.3: Principals described their schools' goals and priorities for student achievement on the California Standards Tests (CSTs)

Survey Item *To what extent do you agree with each of the following statements?*	**Responses of Principals:** *Percentage reporting "Agree" or "Strongly Agree"*						
	Full sample	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced")	95% (N=303)	100%	94%	92%	96% (N=72)	100%	92%
Our school sets measurable goals for CST scores by grade level and subject area	81% (N=301)	92%	54%	88%	79% (N=70)	90%	85%

Data: EdSource Principal Survey, Item P_11d, f — EdSource 2/11
N-size indicates total number of responding principals.

District benchmark tests. Whereas CSTs are administered once a year, benchmark tests provide periodic feedback regarding students' academic progress in meeting particular academic standards. Judging from survey responses, school districts are providing tools for school leaders and teachers to benchmark student progress. Roughly four in five responding district superintendents agreed or strongly agreed that their districts have developed benchmark assessments aligned with key state standards for each grade and subject in the middle grades.

At the school level, principals were surveyed about the importance of benchmark tests:

- Overall, 75% of principals agreed or strongly agreed that their schools set measurable goals for improving district benchmark scores. The percentage was higher among principals in the 20th–35th percentile SCI band than among principals in the 70th–85th percentile SCI band, except for 6–8 schools. (See Figure 2.4.)
- Fewer principals overall (62%) reported that they ensure to a considerable or great extent that common planning time is available for teachers to meet with others in the same grade and subject area to develop and/or discuss common benchmarks and assessments. Again, principals in the 20th–35th percentile SCI band were more likely to report making extensive efforts to ensure time for such common planning than were principals in the 70th–85th percentile SCI band. (See Figure 2.5.)

In addition, mathematics teachers were surveyed about how frequently they administer benchmark assessments to inform their teaching:

Figure 2.4: Principals reported on setting measurable goals for district benchmark tests

Survey Item *To what extent do you agree with each of the following statements?*	**Responses of Principals:** *Percentage reporting "Agree" or "Strongly Agree"*						
	Full sample (N=279)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=23)	70th–85th %ile SCI (N=44)	20th–35th %ile SCI (N=74)	70th–85th %ile SCI (N=62)	20th–35th %ile SCI (N=39)	70th–85th %ile SCI (N=37)
Our school sets measurable goals for improving district benchmark test scores	75%	78%	64%	77%	77%	90%	59%

Data: EdSource Principal Survey, Item P_11k EdSource 2/11
N-size indicates total number of responding principals.

Figure 2.5: Principals reported on ensuring common planning time for mathematics teachers to develop and/or discuss common benchmarks and assessments

Survey Item *To what extent do you ensure that common planning time is available for English language arts and mathematics teachers to do the following?*	**Responses of Principals:** *Percentage reporting "To a considerable extent" or "To a great extent"*						
	Full sample (N=289)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=24)	70th–85th %ile SCI (N=39)	20th–35th %ile SCI (N=77)	70th–85th %ile SCI (N=70)	20th–35th %ile SCI (N=40)	70th–85th %ile SCI (N=39)
Meet with others in the same grade and subject area to develop and/or discuss common benchmarks and assessments	62%	50%	41%	73%	59%	73%	64%

Data: EdSource Principal Survey, Item P_50d EdSource 2/11
N-size indicates total number of responding principals.

- In the average school in the sample, 72% of mathematics teachers reported that they administer benchmark assessments at least four times per year. (See Figure 2.6.) However, in 120 (40%) of 301 schools for which these data were available, *all* mathematics teachers reported this. Again, this practice was more common among schools in the 20th–35th percentile SCI band than among schools in the 70th–85th percentile SCI band, though the difference was only one percentage point among K–8 schools.

District support of schools to use these data

Using student assessment data for instructional and school improvement requires technical infrastructure and capacity. Overall, 91% of principals agreed or strongly agreed that their school districts provide timely CST student achievement data. (See Figure 2.7.) In addition, 90% of principals agreed or strongly agreed that their districts provide a computer-based system to enable school staff to access and review student data, though such agreement was less pervasive among principals in the 70th–85th percentile SCI band.

Based on principals' survey responses, however, school districts can still improve the capacity of their local schools to use these resources. Only 62% of principals agreed or strongly agreed that their districts provide adequate training to school staff to enable effective use of data management software. (See Figure 2.7.) K–8 schools stand out in this regard because of the wide difference in principals' responses based on SCI band: 83% of

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Figure 2.6: Teachers reported on how frequently they administer benchmark assessments

Survey Item *How frequently do you administer the following kinds of assessments to inform your teaching?*	**Responses of Mathematics Teachers:** *Average school-level percentage reporting "4 Times a Year," "Every Few Weeks," or "Weekly"*						
	Full sample (N=301)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=24)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=71)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Benchmark assessments, which assess whether students are meeting particular academic standards.	72%	70%	69%	83%	61%	83%	66%

Data: EdSource Teacher Survey, Items T_13a EdSource 2/11
N-size indicates total number of schools with responding teachers.

Figure 2.7: Principals reported on district support for accessing and using student data

Survey Item *To what extent do you agree with the following statements?* *Your school district…*	**Responses of Principals:** *Percentage reporting "Agree" or "Strongly Agree"*						
	Full sample	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI	70th–85th %ile SCI	20th–35th %ile SCI	70th–85th %ile SCI	20th–35th %ile SCI	70th–85th %ile SCI
Provides schools with timely CST student achievement data.	91% (N=293)	100% (N=24)	95% (N=44)	84% (N=77)	91% (N=68)	93% (N=41)	90% (N=39)
Provides a computer-based system to enable school staff to access and review student data.	90% (N=290)	96% (N=23)	80% (N=41)	96% (N=76)	90% (N=70)	95% (N=41)	82% (N=39)
Provides adequate training to our staff to enable effective use of the data management software.	62% (N=286)	83% (N=23)	46% (N=41)	62% (N=76)	65% (N=69)	63% (N=41)	58% (N=36)

Data: EdSource Principal Survey, P_54a, c, d EdSource 2/11
N-size indicates total number of responding principals.

K–8 principals in schools serving predominantly students from lower-income families agreed or strongly agreed that their districts provide such training, compared with only 46% of K–8 principals in schools serving predominantly middle-income students.

Curriculum adoption and frequency of use

Another key component of California's standards-based reforms in middle grades mathematics has been state adoption of standards-aligned instructional materials. Under normal circumstances in California, the state earmarks funds for instructional materials that, for the elementary and middle grades, are to be chosen from a list of state-adopted curriculum programs.

Most school principals reported that their district plays a lead role in choosing curriculum programs for the school in mathematics. About a quarter of principals reported a district-wide adoption, and half reported that the district decides with school input. (See Figure 2.8.) In addition, 82% of principals reported expecting their school's mathematics teachers to use the school's adopted mathematics curriculum program "3–4 times per week" or "daily." (See Figure 2.9 on the next page.)

There were interesting differences by grade configuration, however. For example:

- K–8 school principals reported a fair degree of autonomy in adopting mathematics curricula. In particular, more than half of K–8 principals in the 70th–85th percentile SCI band said their schools took the lead in adopting middle grades mathematics curriculum programs. That said, compared with principals in schools with other grade configurations, K–8 principals reported most often that they expect their schools' mathematics teachers to use the school's adopted curriculum program "3–4 times per week" or "daily."
- The reverse was true among 7–8 principals. Principals of 7–8 schools reported most frequently that the district takes a lead role in mathematics curriculum adoption, compared with K–8 and 6–8 principals. But principals of 7–8 schools also reported less

Figure 2.8: Principals reported on who adopts the mathematics curriculum in use at their schools

Survey Item *Who makes decisions about your school's 6th-8th grade [mathematics] curriculum program adoptions? (Check one.)**	**Responses of Principals:** *Percentage selecting each option*						
	Full sample (N=303)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=72)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
District-wide (or CMO**) adoption.	26%	24%	23%	31%	24%	24%	28%
District (or CMO**) with school input.	48%	40%	25%	49%	50%	63%	62%
School staff with district (or CMO**) approval.	26%	32%	44%	23%	28%	12%	18%
Individual teachers make their own decisions.	3%	0%	10%	3%	3%	0%	0%

Data: EdSource Principal Survey, P_29A_2–D_2. "Other" option excluded above. EdSource 2/11
* 18 principals selected more than one option; percentages may not sum to 100%.
** Charter Management Organization.
N-size indicates total number of responding principals.

Figure 2.9: Principals reported the frequency with which they expect mathematics teachers to use their school's adopted math curriculum program

Survey Item	Responses of Principals						
As a principal, how often do you expect your school's math teachers to use the school's adopted *mathematics* curriculum program?	**Full sample** (N=299)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=24)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=77)	70th–85th %ile SCI (N=70)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Percentage reporting "3–4 times per week" or "Daily"	82%	92%	90%	86%	77%	76%	74%

Data: EdSource Principal Survey, P_31. EdSource 2/11
N-size indicates total number of responding principals.

often that they expect mathematics teachers to use the adopted curriculum program at least 3–4 times per week, compared with their peers in other grade configurations.

Mathematics teachers were also surveyed about how frequently they use their schools' adopted math curriculum programs and, in many schools, mathematics teachers are clearly meeting their principals' expectations. In the average school in the sample, 85% of mathematics teachers reported that they use the curriculum program adopted by the school or district on a daily basis. In 169 (56%) of 301 schools for which data were available, *all* responding mathematics teachers reported using the adopted curriculum program daily.

Mathematics teachers were also asked for further detail on the extent to which they adjust lesson plans or take other measures to tailor instruction to their students:

- In the average school in the sample, roughly half of mathematics teachers (48%) reported they modify a lesson plan provided in the adopted curriculum program on a daily basis to better fit the needs of their students. It was far less common for math teachers to report using the adopted curriculum with few or no adjustments; in the average school in the sample, only 21% reported doing this daily.
- Some teachers reported they augment the school's curriculum program with additional materials. For example, 36% of mathematics teachers in the average school reported they do this daily with materials they have chosen.

Summary of standards-based practices

The survey responses indicate that, over time, California's standards-based reforms have had a decisive impact on the connection of state policy with the work of districts, middle grades principals, and mathematics classrooms. Focus on aligning instruction with the standards is pervasive among schools in the sample, and smaller but substantial proportions of educators report focusing on key standards at each grade and in each core subject. Many schools are setting measurable goals for student achievement on benchmark assessments and annual standards-based tests, and most schools in the sample report that their districts provide technology for managing and using data from these assessments.

Particular areas for potential growth and capacity-building—but which also require investment of limited resources—appear to include adequate training for school staff to use data management software most effectively and common planning time and teacher collaboration around standards and benchmarks.

How did charter schools in the sample compare with respect to standards and curriculum?

Alignment with state academic content standards. Like noncharter schools in the sample, charter schools are focused on aligning mathematics instruction with California's academic content standards.

Among principals:

- 100% of responding charter school principals agreed or strongly agreed that their schools' overall English language arts and mathematics classroom instruction is closely guided by state academic standards, compared with 98% of noncharter principals.
- 81% agreed or strongly agreed that their schools emphasize select key standards at each grade and in each core subject, compared with 84% of noncharter principals.

Among middle grades mathematics teachers:

- 91% in the average charter school agreed or strongly agreed that their school's teachers closely align instruction with the California academic content standards in mathematics (compared with 98% in the average noncharter school), and 79% reported that their school emphasizes selected key standards that all teachers prioritize at each grade level (compared with 81%).
- As with noncharters, mathematics teachers in the average charter school reported less often that teachers work together to a "considerable" or "great extent" to "break down" the state content standards, such as to identify prerequisite student skills. Only 24% reported this in the average charter school, compared with 26% in the average noncharter school.

In addition, four of five charter management organization (CMO) leaders—whose organizations represented eight of the charter schools in the sample—reported that their organizations have identified key or power standards for each grade in each subject.

California Standards Tests (CSTs). Charter school principals in the sample were less likely than noncharter principals to report that their schools emphasize CSTs, though large proportions of charter school principals did so.

- 82% of responding charter school principals agreed or strongly agreed that their schools emphasize student achievement across all the CST performance levels, compared with 96% of noncharter principals.
- 75% of charter school principals agreed or strongly agreed that their schools set measurable goals for CST scores by grade level and subject area, compared with 81% of noncharter principals.

Benchmark tests. Charter school principals were more likely than noncharter principals to report school emphasis on benchmark tests, however.

- 81% of responding charter school principals agreed or strongly agreed that their schools set measurable goals for improving district benchmark test scores, compared with 74% of noncharter principals.
- 80% of charter school principals reported that they ensure to a considerable or great extent that common planning time is available for teachers to meet with others in the

[continued]

same grade and subject area to develop and/or discuss common benchmarks and assessments, compared with 60% of noncharter principals.

Three of five charter management organization (CMO) leaders reported that their organizations have developed benchmark assessments aligned with key state standards for each grade and subject in the middle grades.

District (or CMO) support for data use. Charter principals affirmed that their districts or CMOs provide adequate training to school staff to enable effective use of data management software more often than did noncharter principals. In all, 74% of charter principals—including six of seven principals of CMO-affiliated charter schools—agreed or strongly agreed that their districts or CMOs provide such training, compared with 61% of noncharter principals. (Overall, 90% of charter school principals agreed or strongly agreed that their districts or CMOs provide a computer-based system to enable school staff to access and review student data.)

Curriculum adoption and frequency of use. The principal survey responses suggest that charter schools have greater autonomy than noncharter schools with respect to curriculum adoptions in mathematics and more frequently grant curricular discretion to individual mathematics teachers. For example:

- 21% of charter school principals reported that individual teachers make their own decisions about adopting mathematics curricula in grades 6–8, compared with only 1% of noncharter principals.
- 46% of charter school principals reported that school staff make adoption decisions in mathematics with the approval of their district or CMO, compared with 24% of noncharter principals.
- 67% of charter school principals reported that they expect their schools' mathematics teachers to use the adopted curriculum program in their subject "3–4 times per week" or "daily," compared with 84% of noncharter principals.

Schools differ widely in the state-adopted curriculum programs they use, in part reflecting that 2008–09 was a transition year

The 2008–09 school year was a time of transition for California's middle grades schools with respect to mathematics curricula. The state adopted a new list of mathematics curriculum programs in November 2007, including new intervention and algebra readiness materials. These materials had only begun to enter California's middle grades classrooms in 2008–09, and some but not all districts had purchased them. As a result, instructional materials from both the 2001/2005 state adoption cycle and the 2007 cycle were in use in the state. The data below provide a window into this transition—a transition that is greatly complicated by California's state budget problems.[14]

[14] As described in Chapter One, California school districts can currently defer purchasing new instructional materials through 2012–13. In all, two-thirds of responding superintendents in the sample reported that their districts had already purchased texts for grades 7 and 8 related to the

The rest of this chapter shows that basic mathematics curriculum programs from the 2001/2005 state adoption cycle were still somewhat more frequently used during this transition year than were newly-adopted basic programs from the 2007 cycle. Among the other new materials, algebra readiness programs were in wider use among schools in the sample than were mathematics intervention materials. And some schools reported using below-grade-level instructional materials in grade 8, possibly with 8th graders not enrolled in Algebra I or needing additional support.

Basic mathematics curriculum programs

School principals were given a list of state-adopted curriculum programs and asked to indicate which basic mathematics curriculum programs their schools used in 2008–09, and in which grades.

- At all three grade levels, basic curriculum programs from the 2001/2005 state adoption cycle were in somewhat wider use than were programs from the 2007 cycle.
- No single program was selected by more than 33% of principals for a given grade level, and most reported programs were selected by fewer than 10%.

Some principals reported that their schools use a curriculum program designed for earlier grades with at least some 8th graders, perhaps in an effort to serve 8th graders who are not yet ready for Algebra I. Although this analysis cannot provide comprehensive insight into this practice,[15] the data do show that:

- 12% of principals reported using in grade 8 a pre-algebra program aligned with 7th grade standards.
- 4% of principals reported using in grade 8 a program aligned with no higher than 6th grade standards.

These data speak to what, historically, has been a lack of clarity in California about the curricula to be used with 8th graders who are not yet ready for Algebra I—an issue not addressed by the SBE until the adoption of algebra readiness materials in 2007.

Mathematics intervention programs

Principals also indicated which recently-adopted mathematics intervention programs (see Chapter One) their schools used in 2008–09, if any, and in which grades. As shown in Figure 2.10 (on the next page):

- These new intervention programs were not yet in widespread use among the middle grades schools in the sample. Overall, no more than about one in five principals reported that their schools use a state-adopted intervention program at any particular grade level.
- Principals of 6–8 schools in the 20th–35th percentile SCI band reported using a state-adopted mathematics intervention program in far greater proportion than did other principals.

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most recent mathematics curriculum adoption. (This figure excludes the five charter management organization leaders in the sample, none of whom reported having yet purchased new math texts for the middle grades.)

[15] In cases where the principal reported that his or her school used, at the grade 8 level, curriculum programs adopted by the state for grades 6–8 or 7–8, there is no way to tell whether below-grade-level *components* of these programs were used with 8th graders.

- Although the state formally adopted mathematics intervention programs for use in grades 4–7, 12% of principals in the sample reported their schools use these materials in grade 8.

Algebra readiness programs

Finally, principals indicated which recently adopted algebra readiness programs—intended for use with 8th graders who are not ready for Algebra I (see Chapter One)—their schools used in 2008–09, if any. (See Figure 2.11.)

- These new algebra readiness programs were in wider use among the middle grades schools in the sample than were new intervention materials. Altogether, 42% of principals in the sample reported that their schools use a state-adopted algebra readiness program.
- Principals of 6–8 and 7–8 schools in the 20th–35th percentile SCI band reported using an algebra readiness program in greatest proportion compared with other principals. Principals of 6–8 and 7–8 schools in the 70th–85th percentile SCI band did so in smallest proportion.

Figure 2.10: Principals reported the schools' use of *any* state-adopted mathematics intervention program in grades 6–8

Survey Item *Which of the following mathematics intervention materials are in use at your school this year?*	**Responses of Principals:** *Percentage reporting that they use **any** state-adopted mathematics intervention program, at each grade level*						
	Full sample (N=303)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=72)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Any selected for *grade 6*	20% (N=223*)	8%	19%	31%	14%	N/A	N/A
Any selected for *grade 7*	17% (N=303)	12%	10%	32%	14%	15%	5%
Any selected for *grade 8*	12% (N=303)	8%	8%	22%	13%	7%	5%

Data: EdSource Principal Survey, Curriculum Supplement. EdSource 2/11
N-size indicates total number of responding principals.
* Excludes 7–8 schools.

Figure 2.11: Principals reported their schools' use of *any* state-adopted algebra readiness program

Survey Item *Which of the following Algebra Readiness programs are in use at your school this year?*	**Responses of Principals:** *Percentage reporting that they use **any** state-adopted algebra readiness program*						
	Full sample (N=303)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=72)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Any algebra readiness program selected	42%	40%	42%	51%	33%	49%	31%

Data: EdSource Principal Survey, Curriculum Supplement. EdSource 2/11
N-size indicates total number of responding principals.

Chapter Three

Student placement in middle grades mathematics raises challenging questions for local educators; districts and schools across California vary in their reported policies

Policy discussion, and summary of responses from the **Gaining Ground** *surveys of superintendents, principals, and teachers*

This chapter:

- *Shows that the vast majority of middle grades schools in the sample offer a traditional one-year Algebra I course, and some schools offer other kinds of advanced math courses as well.*
- *Discusses recent research and policy documents that reveal the complexity of student placement policies and their effects, including considerations of student grouping, structures for student support, and the role of the district in facilitating efficient paths for students and coherent policies in support of student placements.*
- *Shows that districts in the sample appear to give schools a fair amount of discretion regarding algebra placement, with school policies varying.*

Chapter One described the tremendous changes in student course-taking—in particular, middle grades students' growing participation in Algebra I—that have taken place in California for more than a decade. In light of this, the present chapter turns to the complex issue of student placement.

Algebra I (and higher) courses offered by middle grades schools in the sample

Before considering student placement directly, it is important to understand that Algebra I courses are offered in the vast majority of middle grades schools in the sample.

Survey responses by principals show the extent to which schools in the sample offer courses at the level of Algebra I or higher to students in grades 7 and/or 8.[16] The vast majority offer Algebra I as a traditional one-year course. (See Figure 3.1 on the next page.) Only 12 (4%) of 303 principals did not report such a course.

[16] Unfortunately, this chapter cannot clarify the mathematics courses schools offered to 7th and 8th graders who are *not* ready for Algebra I. Although the principal survey asked respondents to report on such courses using a provided list, these data proved confounding. In part, and as highlighted recently by Waterman (2010), California educators appear to think about and refer to middle grades mathematics courses in many different ways, by many different names.

Some schools provide additional options for advanced mathematics course-taking (see Figure 3.1):

- 14% of principals reported that their schools offer Algebra A, which is typically the first half of a two-year Algebra I course. This type of course was cited most frequently by principals of 6–8 and 7–8 schools in the 70th–85th percentile SCI band, with about one-quarter in each of these groups doing so.
- 20% of principals reported that their schools offer Algebra I honors courses, with principals of 6–8 and 7–8 schools in the 20th–35th percentile SCI band doing so most frequently. Principals of K–8 schools rarely reported such courses.
- 39% of principals reported offering mathematics above Algebra I, such as Geometry. This was most common in 6–8 and 7–8 schools, including more than two-thirds of 7–8 schools in the 70th–85th percentile SCI band.

Figure 3.1: Principals reported the Algebra I (and higher) courses their schools offer

Survey Item *What math courses does your school offers to 7th and 8th grade students? (Check all that apply.)*	**Responses of Principals:** *Percentage selecting each option*						
	Full sample (N=303)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=25)	70th–85th %ile SCI (N=48)	20th–35th %ile SCI (N=78)	70th–85th %ile SCI (N=72)	20th–35th %ile SCI (N=41)	70th–85th %ile SCI (N=39)
Algebra I as a one-year course	96%	88%	90%	97%	100%	98%	97%
Algebra A (one semester of content taught over one academic year)	14%	16%	2%	6%	26%	12%	23%
Algebra I Honors	20%	4%	8%	27%	19%	32%	15%
Math above Algebra I (e.g., Geometry)	39%	16%	19%	35%	49%	41%	69%

Data: EdSource Principal Survey, P_34d–g. Items pertaining to *courses below Algebra I* are excluded above. EdSource 2/11
Note: A handful of principals provided an "Other" write-in response in which they specified additional course configurations. N-size indicates total number of responding principals.

Educators grapple with placement in the context of wanting more students prepared for a college-preparatory curriculum in high school

When and how K–12 students access higher mathematics instruction is currently an important topic of discussion nationally. These issues were at the heart of the development of the Common Core State Standards in mathematics, for example. They were also a concern of the 2008 report by the National Mathematics Advisory Panel (NMAP), which warned that "too many students in middle or high school algebra classes are woefully unprepared for learning even the basics of algebra" (pg. 32), having not mastered critical foundations for success in the subject.

The goal of increasing the number of middle grades students in California successfully taking Algebra I has informed the state's academic content standards and assessment and accountability policies. And whether students successfully complete Algebra I in a timely fashion—whether in grade 8 or grade 9—has implications beyond the course itself. For example, research conducted in California by Finkelstein and Fong (2008) found that 42% of students in the study sample had not completed "two semesters of at least [A]lgebra I with a grade of 'C' or better" by the end of grade 9 (pg. 7), putting these students at a disadvantage for becoming eligible for admission to a public four-year state university.[17]

The NMAP Task Group on Conceptual Knowledge and Skills (2008) notes some research drawing on national datasets that suggests ways students might benefit from Algebra I in the middle grades, given historical course-taking patterns. These potential benefits include socialization into advanced mathematics course-taking in high school and higher mathematics achievement in grade 12 (Smith, 1996), and higher rates of mathematics achievement growth—including for lower-achieving students—through high school (Ma, 2005). However, this research does not directly clarify the practical and policy implications of making Algebra I in the middle grades a more universal expectation.

The emphasis on Algebra I in California education policy and the prevalence of the course among the state's middle grades schools make student placement a vital issue. As elsewhere, middle grades educators in California are challenged to address variations in students' mathematics preparation and still provide wide access to a rigorous curriculum that prepares students for a college preparatory program of study. This makes it increasingly important to understand the practical considerations of student placement policies and evaluate their implications.

Policies for student placement and grouping can have both intended and unintended effects

Different approaches to placing, grouping, and supporting students in college preparatory mathematics courses can have both intended and unintended consequences. These issues are important, in part, because of concern that lower-income and minority students have historically been tracked into mathematics classes with lower educational expectations, thereby reducing their future prospects (e.g., Oakes and others, 1990). National studies continue to find differences among student groups with respect to completing the most advanced course sequences in high school (Dalton, Ingels, *et al.*, 2007; Shettle, Roey, *et al.*, 2007; Bozick and Ingels, 2008). One recent brief (Walston and McCarroll, 2010) found that, even among students who were relatively well prepared in grade 5, both African American and male students were less likely to take algebra in grade 8.

One recent report explores the 8th grade mathematics course placements of the lowest-achieving 10% of 8th graders on the National Assessment of Educational Progress (Loveless, 2008). The report found that the proportion of these lower-achieving 8th graders who were enrolled in Algebra I or higher increased from 8% in 2000 to almost 29% in 2005. However, these students were frequently unable to correctly answer test items that assessed such basic concepts as rounding a decimal to the nearest whole number. Based on other NAEP data on the characteristics of students' schools and teachers, the report concludes that policies aimed at more equitable access to rigorous math curricula had the unintended consequence of putting less-prepared teachers in algebra classrooms with students of widely differing levels of preparation.

However, others argue that accelerated mathematics course-taking in heterogeneous classrooms can be effective in promoting subsequent study of advanced mathematics among students with different levels of incoming achievement, including among socioeconomically disadvantaged students. For example, Burris, Heubert, and Levin

[17] Finkelstein and Fong's findings may understate the challenges some students faced: the sample included only students who, as 12th graders in 2003–04 or 2004–05, had remained in the same high school through grades 9–12, thus excluding students who dropped out, for example.

(2006) document a policy in Nassau County, Long Island, in which workshops for students needing additional help and assignment of teachers to work in both regular classrooms and support workshops provided additional support structures.

Two recent studies explore a 1997 Chicago Public Schools policy to require algebra instruction for all students by grade 9. This research makes clear that such policies may have mixed results as they evolve over time (Allensworth, Nomi, *et al.*, 2009, summarized in Mazzeo, 2010; Nomi and Allensworth, 2009, summarized in Durwood, Krone, and Mazzeo, 2010). As with the focus on Algebra I in grade 8 in California, the Chicago policy was intended to broaden access to college-preparatory coursework.

Prior to the policy, Chicago high schools varied considerably with respect to the courses students took (Allensworth, Nomi, *et al.*, 2009). The policy to eliminate remedial courses had both intended and unintended effects:

- On the one hand, more Chicago students earned Algebra I credit by the end of grade 9 and students' graduation rates were not adversely affected.
- On the other hand, math course failure increased among students who started with low and average levels of math achievement, and math course absences increased among students who began at average levels.

How Chicago students were grouped in 9th grade math courses changed over time. Following the policy to eliminate remedial courses, 9th graders with the lowest incoming levels of math achievement enrolled in more heterogeneous classrooms and 9th grade mathematics teachers reported more instructional time devoted to algebra (Allensworth, Nomi, *et al.*, 2009, pg 387). However, a 2003 policy targeting "below norm students" for a "double dose" of regular algebra instruction with an additional support period[18] led to more homogeneous, ability-grouped classrooms (Nomi and Allensworth, 2009). According to the researchers:

- From one perspective, the 2003 policy resulted in greater mathematics learning among *both* targeted and nontargeted students, as measured by standardized tests.
- From another perspective, the policy did not reduce ninth-grade course failure in mathematics for the targeted students as intended, suggesting to Chicago researchers that curricular interventions must be paired with efforts to improve students' academic behaviors and attendance (Durwood, Krone, and Mazzeo, 2010).[19] The policy also "unintentionally increased failure rates in ninth-grade algebra for students who were not targeted" (Nomi and Allensworth, 2009, pg. 142), possibly as a result of these students being held to a higher standard in less heterogeneous, more demanding classrooms. And students with the lowest incoming skills, including many with learning disabilities, struggled in double-dose settings not designed to meet their needs.

[18] The "double dose" practice is not unique to Chicago. For example, the practice is one component of the Talent Development comprehensive high school reform model, where it is intended to help accelerate student achievement (see Balfanz, Legters, and Jordan, 2004). The Chicago case features the policy "on its own without the other instructional supports" that make up a comprehensive school reform model (Durwood, Krone, and Mazzeo, 2010, pg. 3).

[19] For example, research conducted in high-poverty middle schools in Philadelphia affirmed the importance of students' academic effort, attendance, and behavior for closing achievement gaps in mathematics by the end of the middle grades (Balfanz and Byrnes, 2006).

District data capacity and planning are also crucial concerns

The issue of student placement also raises questions about how to provide local educators with the most current and helpful data for making decisions, and about district planning to serve students most effectively.

An example from California's Long Beach Unified School District makes clear the importance of district capacity to provide timely and helpful student data (Anderson and Newell, 2008). District researchers found that, in 2005–06, students who entered the middle grades having scored *Proficient* (but not *Advanced*) in grade 5 were mostly placed into regular grade 6 math courses; only about 38% were placed into an accelerated grade 6 course. Two years later, only 35% of these students who were placed initially in a regular course were positioned to complete at least a full Algebra I course in grade 8, compared with roughly 70% of these students who had an accelerated initial placement.

These findings led the Long Beach Unified researchers to suggest ways the district could refine its process for making grade 6 placement recommendations to schools (Anderson and Newell, pp. 12–13, 15). The researchers also note, however, that acceleration of more students would require the district to provide professional development to teachers to ensure that more teachers are ready to teach accelerated courses.

A recent report by the California Collaborative on District Reform (Bitter and O'Day, 2010)—a collaboration between researchers, unified school district leaders, and other stakeholders—highlights considerations for districts when planning for student placements. The authors argue that "[d]eveloping a system for effective and equitable placement of students into algebra and advanced mathematics courses can involve extensive data analysis" (pg. 6), including analysis of anticipated enrollments in Algebra I and higher mathematics courses so a district can plan for future instructional capacity (e.g., needed credentials, looming teacher retirements).

Removing institutional barriers to students' efficient progress in high school mathematics *after* taking Algebra I in grade 8 also appears to be an important area for district leadership, at least judging from the Waterman (2010) report discussed in Chapter One. Recall that 44% of students in that report who had scored *Proficient* or *Advanced* on the Algebra I CST in grade 8 took the course again (and in a few cases took a less advanced course) in grade 9. The seeming arbitrariness of these placements suggests that poor transitions into high school "needlessly [hold] many capable students back from progressing through advanced mathematics in high school" (Waterman, 2010, pg. 1). This is particularly concerning to the extent that students become discouraged in the subject despite early success. District planning to smooth out institutional barriers in mathematics may be a particular challenge where students move from an elementary school district to a high school district, as is the case in many places in California.

What did superintendents, principals, and teachers say about their middle grades mathematics placement policies?

The *Gaining Ground* surveys asked superintendents, principals, and mathematics teachers in the sample about their placement policies and practices.

Leadership and oversight

In general, school districts in the sample appear to give schools a fair amount of discretion, sometimes within certain parameters, regarding algebra placement—at least in

Figure 3.2: Superintendents report on district policies for Algebra I placement

Survey Item *Please indicate which of the following apply to your district's or CMO's Algebra I placement policies. (Check all that apply.)*	**Responses of District Superintendents:** *Percentage selecting each option*			
	Full sample (Non-CMO) (N=152)	Unified (K–12) Districts (N=97)	High School Districts (N=6)	Elementary Districts (N=49)
The district has explicit written placement criteria.	34%	33%	33%	35%
The district annually evaluates the effectiveness and appropriateness of its Algebra placement policies.	39%	40%	33%	37%
The district requires student placements to be reviewed by school department chairs for academic appropriateness.	38%	46%	50%	20%
The district requires student placements to be reviewed by school administrative teams to ensure wide student access to a rigorous curriculum.	47%	53%	50%	35%

Data: EdSource Superintendent Survey, Items S_18a–d EdSource 2/11
N-size indicates total number of responding superintendents.

Figure 3.3: Principals report on school policies for mathematics placement

Survey Item *Please tell us about your school's placement policies [in mathematics].*	**Responses of Principals:** *Percentage responding "Yes"*						
	Full sample	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI	70th–85th %ile SCI	20th–35th %ile SCI	70th–85th %ile SCI	20th–35th %ile SCI	70th–85th %ile SCI
Does your school have explicit written placement criteria?	58% (N=294)	24% (N=25)	20% (N=46)	63% (N=75)	65% (N=71)	83% (N=40)	76% (N=37)
Are student placements reviewed by the administrative team to ensure wide access to a rigorous curriculum?	82% (N=290)	50% (N=24)	60% (N=47)	92% (N=72)	87% (N=70)	95% (N=41)	89% (N=36)
Are student placements reviewed by department chairs for academic appropriateness?	65% (N=243*)	50% (N=8*)	71% (N=28*)	57% (N=68)	67% (N=63)	70% (N=40)	72% (N=36)

Data: EdSource Principal Survey, P_32A_2–C_2. EdSource 2/11
N-size indicates total number of responding principals.
* A total of 37 K–8 principals did not answer this item.

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the dimensions considered by the survey.

As Figure 3.2 shows:

- Only 34% of responding superintendents reported that their districts have explicit written placement criteria for Algebra I. A somewhat greater proportion (39%) reported that their district evaluates the effectiveness and appropriateness of its algebra placement policies annually. (Among those superintendents who reported explicit written placement criteria, nearly two-thirds also reported annual review of district placement policies.)
- In high school and unified school districts, about half of superintendents said they require student placements to be reviewed by department chairs for academic appropriateness and by school administrative teams to ensure wide access to a rigorous curriculum. Elementary district superintendents were much less likely to report that their districts do this.

At the school level, principals reported whether similar policies were in place related to middle grades mathematics placements more generally, not limited to Algebra I.

As Figure 3.3 (on the previous page) shows:

- In general, review of student placements by the administrative team to ensure wide access to a rigorous curriculum was the most widely affirmed policy among principals (82%) in the sample, followed by review of placements by department chairs for academic appropriateness (65%) and explicit written placement criteria (58%).
- There were some notable variations based on school grade configuration.
  - Fewer than a quarter of K–8 principals reported that their schools have explicit written placement criteria in mathematics, compared with two-thirds of 6–8 principals and about four in five principals of 7–8 schools.
  - Slightly more than half of K–8 principals reported that students' math placements are reviewed by the administrative team to ensure wide access to a rigorous curriculum, compared with about nine in 10 principals of 6–8 and 7–8 schools.

Placement considerations

The teacher survey asked mathematics teachers to report on the extent to which they consider various sources of information when making decisions about student placements, both into grade 7/8 general mathematics courses and into Algebra I. Teachers could affirm strong consideration of multiple measures or criteria for placement if appropriate.

For each kind of mathematics course, Figure 3.4 (on the next page) shows the number of schools in the sample where:

- Mathematics teachers *consistently* reported that a particular source of information is considered to a "considerable" or "great" extent (i.e., 75% or more mathematics teachers in the school reported this).
- Mathematics teachers *inconsistently* reported, and appear to have differences of opinion regarding, whether a particular source of information is considered to a "considerable" or "great" extent (i.e., more than 25% but fewer than 75% of mathematics teachers in the school reported this).
- Mathematics teachers *rarely or never* reported that a particular source of information is considered to a "considerable" or "great" extent (i.e., 25% or fewer mathematics teachers in the school reported this).

The recent report by the California Collaborative on District Reform notes that educators typically rely on teacher recommendations and mathematics grades when deciding student placements (Bitter and O'Day, 2010, pg. 6). The teacher survey data confirm this but also make clear the importance of students' CST scores.[20] As Figure 3.4 shows:

- Students' prior academic performance and CST scores were the most common considerations for both general mathematics and Algebra I placements. For example,

[20] Again, because prior-year CST scores do not become available until late August, it is unclear the extent to which schools in the sample consider students' *most recent* CST scores for this purpose. Students' CST scores from earlier years would be available, however, and Anderson and Newell (2008) describe use of students' most recent CST scores to adjust course placements.

mathematics teachers consistently cited student CST scores as strong considerations for student placement into Algebra I in 58% of schools.

- Teacher recommendations were also a relatively common consideration for Algebra I placements, with mathematics teachers consistently citing these as a strong consideration in 42% of schools. Teacher recommendations were reported less consistently in relation to general mathematics placements.

By contrast, the perspectives and requests of parents and students were rarely reported as strongly influencing student placements.

Figure 3.4 also shows that placement or basic skills exams—whether developed inside or outside the district—were reported inconsistently in schools as strong considerations for student placement. For example, taking the two survey items pertaining to placement exams together, math teachers in only 33% of responding schools consistently reported *some kind* of placement exam as a strong consideration for Algebra I placements.

The reader should note that a school that typically places 8th graders into Algebra I could still consider a range of criteria when placing students into particular course sections or other instructional contexts. For example, information on prior academic performance could be used by educators to decide which students might benefit most from an additional

Figure 3.4: Mathematics teachers report on criteria for student placement in grades 7 and 8

Survey Items	**Responses of Mathematics Teachers, full sample:**					
To what extent is each of the following considered for determining student placement, regarding… (**NOTE:** Teachers could report extensive consideration of multiple criteria.)	**…Grade 7 and 8 Mathematics Courses (General Math)?** (N=300)			**…Algebra I?** (N=297)		
	Number (%) of schools in which no more than 25% checked "Considerable" or "Great Extent"	**Number (%) of schools** in which more than 25% but fewer than 75% checked "Considerable" or "Great Extent"	**Number (%) of schools** in which at least 75% checked "Considerable" or "Great Extent"	**Number (%) of schools** in which no more than 25% checked "Considerable" or "Great Extent"	**Number (%) of schools** in which more than 25% but fewer than 75% checked "Considerable" or "Great Extent"	**Number (%) of schools** in which at least 75% checked "Considerable" or "Great Extent"
A placement or basic skills test developed outside the school district, such as by a textbook publisher or university*	127 (42%)	***135 (45%)***	37 (12%)	***139 (47%)***	101 (34%)	57 (19%)
A placement or basic skills test developed by the department, school, or district	93 (31%)	***154 (51%)***	53 (18%)	92 (31%)	***148 (50%)***	57 (19%)
Teacher recommendation	64 (21%)	***141 (47%)***	95 (32%)	59 (20%)	113 (38%)	***125 (42%)***
Student prior academic performance	26 (9%)	133 (44%)	***141 (47%)***	31 (10%)	105 (35%)	***161 (54%)***
Student CST scores	30 (10%)	95 (32%)	***175 (58%)***	37 (12%)	88 (30%)	***172 (58%)***
Parent request and/or perspective	***186 (62%)***	102 (34%)	12 (4%)	***207 (70%)***	82 (28%)	8 (3%)
Student request and/or perspective	***254 (85%)***	39 (13%)	7 (2%)	***250 (84%)***	39 (13%)	8 (3%)

Data: EdSource Teacher Survey, Items T_29a–g, T_30a–g EdSource 2/11
Numbers in red text indicate the largest value.
N-size indicates total number of schools with responding teachers.
* N-size for General Math is 299 for this item.

support course and for how long.

Schools varied in the extent to which mathematics teachers reported that 8th graders are "typically" placed in Algebra I (not shown in Figure 3.4). At one end of the spectrum, *all* responding mathematics teachers reported this being true to a "considerable" or "great" extent in 63 of 299 schools (21%); at the other end of the spectrum, *no* responding mathematics teachers did so in 67 schools (22%).

That teachers in some schools described Algebra I placements as "typical" in grade 8 does not necessarily mean these placements were *universal*, however. Testing data reviewed by the research team show that as few as 8% of schools in the sample administered the Algebra I CST (or higher) to all or nearly all 8th graders in 2008–09.[21]

How did charter schools in the sample compare with respect to math placement policy?

Algebra I (and higher) courses offered. All charter school principals in the sample reported that their schools offer Algebra I as a one-year course. None offer Algebra I as an honors course or a two-year course. Only 21% of charter school principals reported that their schools offer mathematics above Algebra I, such as Geometry, compared with 41% of noncharter principals.

Leadership and oversight. As with school districts, the charter management organizations (CMOs) in the sample appear to grant their affiliated schools a fair amount of discretion regarding Algebra I placements, at least in the dimensions considered by the survey. The five CMO leaders reported few requirements for evaluation or review of placements.

At the school level:

- Responding charter school principals were less likely than noncharter principals to report explicit written criteria for student placement in mathematics (20% vs. 61%) or that student placements in mathematics are reviewed by the administrative team to ensure wide access to a rigorous curriculum (64% vs. 84%).
- More comparably, 63% of responding charter school principals reported that student placements in mathematics are reviewed by department chairs for academic appropriateness, compared with 66% of noncharter principals.

Placement considerations. There were some differences between charter and noncharter schools regarding which criteria mathematics teachers reported considering when placing students into general mathematics or Algebra I courses. For example, in 35% of charter schools, few math teachers reported using student CST scores to a considerable or great extent to determine Algebra I placements. The same was true in only 11% of noncharter schools.

Looking ahead to Chapter Four

This chapter provided an introduction to the complexities of student placement practice and policy in mathematics. It also showed that, in general, school districts in the sample

[21] This 8% of schools includes *only* schools where *either*: (a.) 100% of 8th graders took the Algebra I CST or higher in 2009, *or* (b.) no more than 10 8th graders took the General Mathematics CST and these exceptions constituted no more than 5% of all 8th graders in the school.

appear to give schools a fair amount of discretion in this matter, with school-level policies varying. Students' prior academic achievement, students' CST scores, and teacher recommendations are the predominant considerations that mathematics educators reported taking into account when placing students into courses in grades 7 and 8, including Algebra I.

These survey data help illuminate what districts and schools *consider* with respect to student placements into mathematics courses. However, these survey data do not provide direct insight into *actual mathematics course-taking* in the sample schools. Chapter Four uses longitudinal student testing data to provide an empirical look at the placement of 8th graders into Algebra I, how this relates to students' prior achievement, and the extent to which prior achievement matters for students' test scores in grade 8.

Chapter Four

Student achievement in 8th grade math relates to prior achievement in 7th grade, and California schools vary considerably in their 8th grade math placements

An empirical analysis from the ***Gaining Ground*** *longitudinal data file of student placements in grade 8 mathematics*

This chapter explores:

- *The extent to which 8th graders in the 303 schools took the Algebra I CST, how their likelihood of doing so varied depending on prior-year achievement, and how 8th graders with different levels of prior preparation fared on either the General Mathematics CST or the Algebra I CST.*
- *How schools varied in their observed placement of 8th graders into Algebra I depending on SCI band, and the implications of this for students of different backgrounds.*

For policymakers and middle grades educators in California, student placement into Algebra I has been a focus of intense debate in recent years. The state has used its accountability system to encourage algebra in 8th grade, and state board actions increased the pressure the summer prior to the *Gaining Ground* study (see EdSource, 2009).

The availability of longitudinal testing data for California students affords new opportunities to better understand students' course-taking paths in middle grades mathematics. This chapter analyzes the placement of 8th graders into mathematics courses, based on longitudinal data linking students' California Standards Test (CST) scores in grades 7 and 8. *It provides important new insight, not previously available, into local placement practices throughout California and their consequences for students.*

The majority of 8th graders took the Algebra I CST in 2009—including many students with low chances of scoring highly, given their prior mathematics achievement

The majority of 8th graders in the 303-school sample took the Algebra I CST or higher, based on longitudinal data linking students' mathematics California Standards Test (CST) scores in grade 7 (2008) and grade 8 (2009).

Of the 74,434 8th graders[22] represented in Figure 4.1 (on page 45):

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[22] This total excludes 8th graders in 2009 for whom: (1) there was no matching record providing a valid 2008 Grade 7 Mathematics CST or Algebra I CST score; (2) there was no valid 2009 CST

Terms used in this chapter

The data explored in this chapter are based on an analysis of students' ***test-taking paths*** from grade 7 to grade 8. For example, some students took the Grade 7 Mathematics CST in 2008, followed by either the General Mathematics CST or the Algebra I CST as 8th graders in 2009. Others took the Algebra I CST as 7th graders in 2008, followed by either the Algebra I CST or the Geometry CST as 8th graders in 2009.

However, for the sake of easier communication, this chapter typically refers to student ***placements*** into math *courses* rather than to student test-taking paths, recognizing that these terms are not strictly synonymous. This easier language is justified because:

- The Algebra I CST and the Geometry CST are end-of-*course* tests; and
- All 8th graders who are not yet positioned to complete *at least a full Algebra I course*—whether because they are not yet enrolled in Algebra I or because they are enrolled in the first year of a two-year Algebra I course—are expected by the state to take the General Mathematics CST.

Finally, an 8th grader's ***level of prior achievement*** is defined in this chapter exclusively in terms of the level (see Figure 4.2) of his or her prior-year CST scale score in mathematics in grade 7. Thus, ***similarly prepared*** 8th graders are those who scored at the same level on the grade 7 CST. This is an admittedly limited measure that, by itself, provides no diagnostic information about a student's readiness for Algebra I. But as this chapter makes clear, considering students' prior math preparation in this way provides a powerful window into why local placement decisions matter.

- About 59% took the Algebra I CST in 2009. More specifically:
  - **57%—42,679 8th graders in all—took the Algebra I CST after having taken the Grade 7 Mathematics CST in 2008**. These 8th graders include those who enrolled in a one-year Algebra I course for the first time, and those who enrolled in the second year of a two-year Algebra I course.
  - **In addition, fewer than 2%—1,158 8th graders in all—repeated the Algebra I CST, having already taken it as 7th graders in 2008**. Assuming schools administered state tests as intended, these students had enrolled in a full Algebra I course as 7th graders and repeated the course as 8th graders.
- **36%—26,984 8th graders in all—took the General Mathematics CST in 2009**, after having taken the Grade 7 Mathematics CST in 2008. These 8th graders enrolled in a mathematics course *below a full Algebra I course*—for example, a pre-algebra course, an algebra readiness course, or the first year of a two-year Algebra I course.
- **Nearly 5%—3,613 8th graders in all—took the Geometry CST in 2009**, having already taken the Algebra I CST as 7th graders in 2008. These students completed Algebra I in grade 7.

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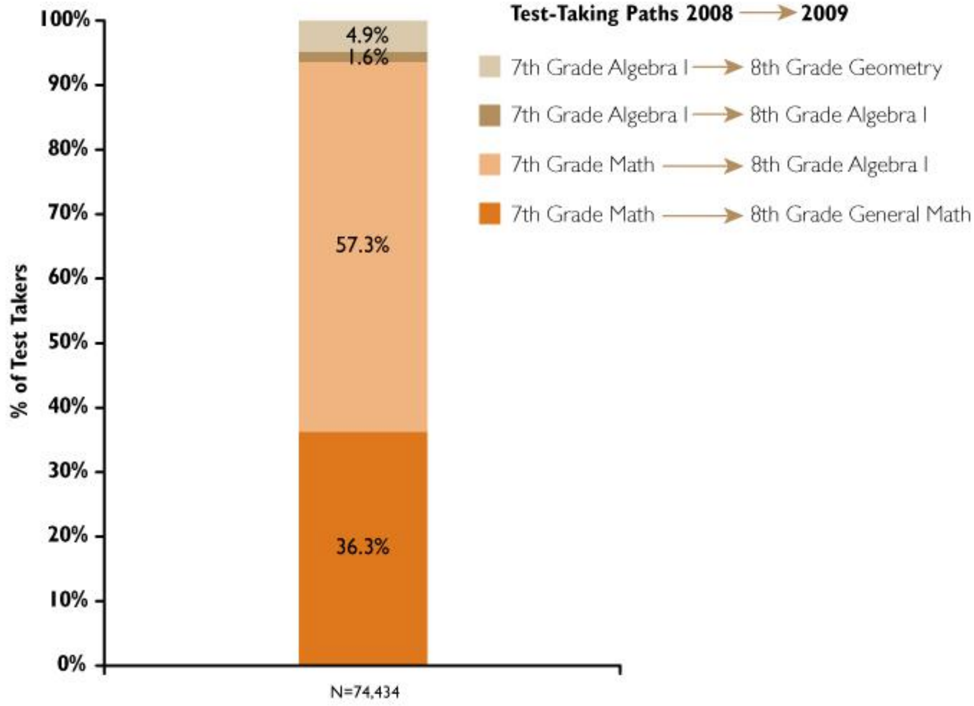
score in General Mathematics, Algebra I, or Geometry; or (3) the 2008-to-2009 CST-taking sequence was not one of the four sequences (or "paths") described above. In this chapter, all general references to 8th graders in the sample are understood to exclude these students.

Figure 4.1: The majority of 8th graders in the sample took the Algebra I CST in 2009

Students' test-taking paths from 7th- to 8th-grade mathematics, full sample



Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

Students who scored higher in grade 7 were more likely to take the Algebra I CST in grade 8, but many low-scoring students also did so

The data explored so far show that the majority of 8th graders in the sample took a full Algebra I course in 2009. But they do not provide perspective on these students' prior preparation. What was the likelihood that an 8th grader would take the Algebra I CST in 2009, given his or her CST score in grade 7 in 2008?

To answer this question, we focus on the 69,663 8th graders (from Figure 4.1) who took the Grade 7 Mathematics CST in 2008. Further, the research team defined *seven levels* of student achievement on the Grade 7 Mathematics CST in that year, based on California's five established performance levels. (See Figure 4.2 on the next page.) For each grade 7 achievement level, the research team examined the proportion of 8th graders who took the Algebra I CST (rather than the General Mathematics CST) in 2009.[23]

Then data (see Figure 4.3 on the next page), make clear that students who scored higher in grade 7 were more likely to take the Algebra I CST in grade 8, but that many low-scoring students also did so.

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[23] This analysis does ***not*** show if or how schools *used* students' grade 7 CST scores to make placement decisions. Although mathematics teachers' survey responses show that many schools in the sample do consider students' prior CST scores when making decisions about placements into Algebra I (see Chapter Three), it is unclear the extent to which schools in the sample use grade 7 CST scores *in particular* for this purpose, given differences in when schools begin classes and set up class rosters. As mentioned earlier, Anderson and Newell (2008) describe use of students' most recent CST scores when they become available to adjust course placements.

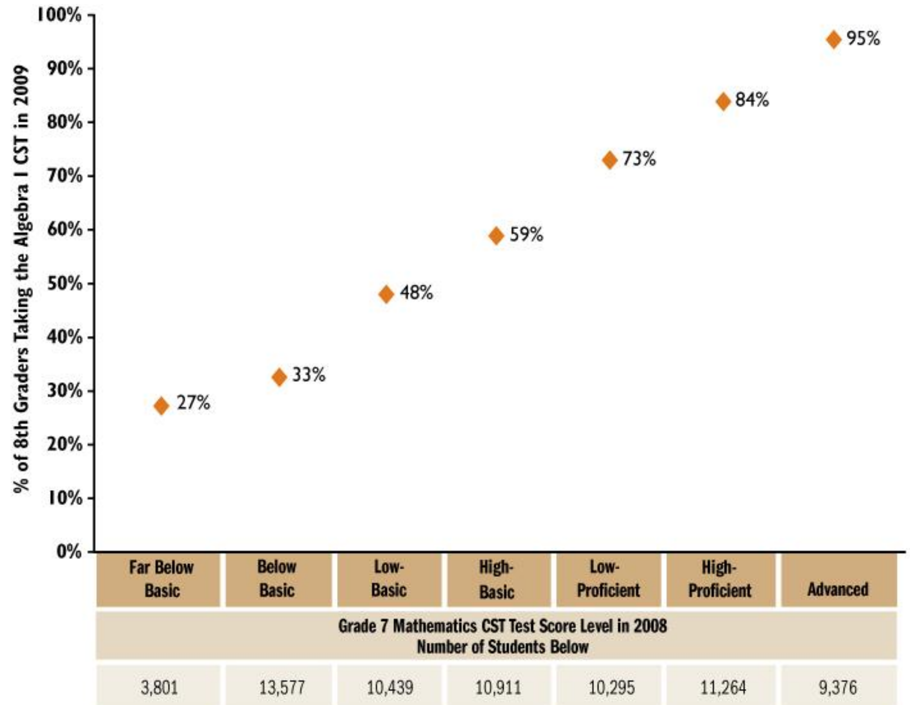
Figure 4.2: CST achievement levels considered in this chapter

Five State-Defined CST Performance Levels	Seven Performance Levels Considered In This Chapter	Scale Score Ranges		
		Grade 7 Mathematics CST (2008)	General Mathematics CST (2009)	Algebra I CST (2009)
Far Below Basic	**Far Below Basic**	150–256	150–256	150–252
Below Basic	**Below Basic**	257–299	257–299	253–299
Basic	**Low-Basic**	300–324	300–324	300–324
	High-Basic	325–349	325–349	325–349
Proficient	**Low-Proficient**	350–374	350–374	350–374
	High-Proficient	375–413	375–413	375–427
Advanced	**Advanced**	414–600	414–600	428–600

EdSource 2/11

Figure 4.3: Although 8th graders with higher incoming achievement scores were more likely to take the Algebra I CST, large proportions of students with low scores also did so

Proportion of 8th graders taking the Algebra I CST, across incoming Grade 7 Mathematics CST score levels, full sample



Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

For example:

- Nearly all 8th graders who scored *Advanced* on the Grade 7 Mathematics CST in 2008 went on to take the Algebra I CST in 2009 (about 95%), rather than the General Mathematics CST.
- However, substantial (though smaller) proportions of students who scored at the lowest levels on the Grade 7 Mathematics CST also took the Algebra I CST in grade 8. This included:

- 27% of 8th graders who scored *Far Below Basic* in grade 7;
- 33% of those who scored *Below Basic* in grade 7; and
- 48% of those who scored *Low-Basic* in grade 7.

However, having students who scored at the lowest levels on the Grade 7 Mathematics CST take the Algebra I CST as 8th graders is only problematic if these students do not succeed in the course. So how did students' Grade 7 Mathematics CST scores in 2008 relate with their subsequent scores as 8th graders in 2009, on either the General Mathematics CST or the Algebra I CST?[24]

Prior achievement matters for 8th graders' prospects of scoring highly on the General Mathematics CST or the Algebra I CST, with the Algebra I CST setting a high standard

To address this question, we add one more layer of information about these 69,663 8th graders: their respective levels of achievement on the test each took in grade 8, whether the General Mathematics CST or the Algebra I CST. (See previous Figure 4.2.) Figure 4.4 shows the proportions of 8th graders who scored at least *Low-Basic* and at least *Low-Proficient* on these two tests in 2009, given their grade 7 achievement levels in 2008.

Figure 4.4 makes clear that:

- Prior-year achievement, as measured by the Grade 7 Mathematics CST in 2008, was strongly related to students' scores on either the General Mathematics CST or the Algebra I CST in 2009. Separate analyses conducted by the research team showed that Grade 7 Mathematics CST performance accounts for about 50% of the variance in 8th grade scores on either the General Mathematics CST or the Algebra I CST.
- In addition, the Algebra I CST appears to set a fairly high standard for the level of incoming achievement required for a student to be reasonably likely to score highly.

Figure 4.4: Prior achievement matters for 8th graders' prospects of scoring highly on the General Mathematics CST or the Algebra I CST

Given different levels of incoming student achievement on the **Grade 7 Mathematics CST (2008)**…	*…And among students who went on to take the **General Mathematics CST** in grade 8 (2009)…*			*…And among students who went on to take the **Algebra I CST** in grade 8 (2009)…*		
	How many entered with each level of incoming achievement?	What % scored **Low-Basic or higher** on the General Mathematics CST?	What % scored **Low-Proficient or higher** on the General Mathematics CST?	How many entered with each level of incoming achievement?	What % scored **Low-Basic or higher** on the Algebra I CST?	What % scored **Low-Proficient or higher** on the Algebra I CST?
Far Below Basic	2,764	18%	2%	1,037	7%	1%
Below Basic	9,159	48%	8%	4,418	21%	3%
Low-Basic	5,452	***80%***	27%	4,987	44%	11%
High-Basic	4,512	***93%***	***56%***	6,399	***62%***	20%
Low-Proficient	2,809	***98%***	***82%***	7,486	***79%***	39%
High-Proficient	1,837	***99%***	***93%***	9,427	***92%***	***63%***
Advanced	451	***100%***	***97%***	8,925	***99%***	***90%***

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

Percentages in red text indicate that the proportion of students meeting a particular achievement was ***at least 50%***.

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[24] Other data on 8th graders' success (e.g., math course grades) were not available for analysis.

For example, students in the sample must have scored at least *High-Proficient* on the Grade 7 Mathematics CST to have had a favorable chance of scoring at least *Low-Proficient* on the Algebra I CST.

Summarizing Figure 4.4 in greater detail:

- Students who scored ***Far Below Basic* or *Below Basic* in grade 7** had unfavorable chances of scoring highly on either test, although those who scored *Below Basic* in grade 7 and went on to take the General Mathematics CST had nearly a coin-toss's chance (48%) of scoring at the *Low-Basic* level or higher.
- Students who scored ***Low-Basic* in grade 7** and went on to take the General Mathematics CST had a strong chance (80%) of scoring *Low-Basic* or higher.
- Students who scored ***High-Basic* or *Low-Proficient* in grade 7** and went on to take the General Mathematics CST had a better-than-half (56% or higher) chance of scoring *Low-Proficient* or higher, while those who took the Algebra I CST had a better-than-half (62% or higher) chance of scoring *Low-Basic* or higher.
- Among students who took the Algebra I CST in 2009, only those who scored **at least *High-Proficient* in grade 7** had a favorable chance of scoring *Low-Proficient* or higher on the test. Students who scored ***Advanced* in grade 7** had an extremely strong chance of both taking and scoring *Low-Proficient* or higher on the Algebra I CST.

These comparisons should be interpreted with caution because 8th graders are not randomly sorted into Algebra I CST-takers and General Mathematics CST-takers. However, it is also not the case that only better-prepared students take the Algebra I CST. Rather, students may be sorted into these two groups based on a complicated mix of school policy, student preparation (e.g., as defined by placement tests, prior test results, grades, and teacher recommendations), and no doubt other factors besides.

But these data do make clear that, although many 8th graders who were placed into Algebra I appear to be have been well-positioned for success in the course, many others clearly struggled in the course after having struggled with mathematics as 7th graders. For example:

- Of those 8th graders who scored *Advanced* on the Grade 7 Mathematics CST in 2008, the vast majority went on to take the Algebra I CST in 2009 (about 95%)—with virtually all of these students scoring at least *Low-Basic* on the test, and the vast majority scoring at least *Low-Proficient*.
- By contrast, few of those 8th graders who took the Algebra I CST after having scored at the lowest levels in grade 7 scored at least *Low-Basic* on the test in 2009. Unfortunately, this analysis cannot clarify which forms of additional support (if any) were provided to these students, nor whether particular forms of support enabled higher student achievement for some.

Implications in the context of school accountability

The data just explored also suggest that middle grades educators have some flexibility to exercise their best judgment in placing students—depending on the level of grade 8 achievement educators think is preferable as a foundation for high school—with less worry about incurring a penalty on California's Academic Performance Index. Recall that, as explained in Chapter One, a score of *Proficient* on the General Mathematics CST in grade 8 provides a school with the same "credit" toward its Academic Performance Index for school accountability purposes as does a score of *Basic* on the Algebra I CST in the same grade.

Thus, it is interesting that, among students who scored either *High-Basic* or *Low-Proficient* on the Grade 7 Mathematics CST, those 8th graders who took the General Mathematics CST had a similar chance of scoring at least *Proficient* as those 8th graders who took the Algebra I CST had of scoring at least *Basic*. Given this, schools that view *Basic* as a worthwhile threshold for student achievement in algebra might decide to place students with these levels of incoming achievement into a full Algebra I course, whereas schools that view *Proficient* as their goal might decide to place these students into an algebra readiness course, for example.

The remainder of this chapter makes clear that other trade-offs may also be involved in such decisions, however.

Algebra I placements differed by school SCI band and student background

Further exploration of these longitudinal testing data reveals that Algebra I placement practices differ among different kinds of schools. The remainder of this chapter explores:

- The extent to which middle grades schools from the two SCI bands in the study sample varied in their placement of similarly prepared 8th graders into Algebra I.[25]
- The implications of these decisions for 8th graders of different backgrounds.

Schools serving predominantly lower-income students placed greater proportions of students into Algebra I than did schools serving predominantly middle-income students

There is a notable difference between the two SCI bands with respect to the placement of 8th graders into Algebra I:[26]

- Schools in the 20th–35th percentile SCI band—which educate students from predominantly lower-income families—tended to serve students with somewhat *lower* levels of incoming preparation, but they *placed more 8th graders* into Algebra I; whereas
- Schools in the 70th–85th percentile SCI band—which educate students from predominantly middle-income families—tended to serve students with somewhat *higher* levels of incoming preparation, but they were *more selective when placing 8th graders* into Algebra I or higher.

Figures 4.5a and 4.5b show these differences in placement practice. Comparing the two groups of schools:

- 8th graders in the 20th–35th percentile SCI band schools tended to have somewhat *lower* grade 7 CST scores, whereas 8th graders in the 70th–85th percentile SCI band schools tended to have somewhat *higher* incoming scores. (See bottom of Figure 4.5b.)
- However, the schools in the 20th–35th percentile SCI band placed a greater proportion of 8th graders into Algebra I than did the schools in the 70th–85th percentile SCI band.[27] (See Figure 4.5a.)
- This was true *regardless of students' respective levels of prior achievement*, with the difference being most notable at the lower end of the incoming achievement range. (See Figure 4.5b.) For example:
    - 32% of students in the 20th–35th percentile SCI band who scored *Far Below Basic* on the Grade 7 Mathematics CST in 2008 took the Algebra I CST in 2009, compared with 15% of similarly-prepared students in the 70th–85th percentile SCI band.

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[25] To reiterate, this analysis does ***not*** show if or how schools *used* students' grade 7 CST scores to make placement decisions. Rather, the following provides a helpful *proxy* measure of how the two groups of schools tend to differ in their math placements.

[26] Unfortunately, other important areas of instructional variation between schools—such as what forms of additional support students receive in their placements (if any) and how students are grouped within Algebra I courses—are beyond the scope of these data.

[27] Although the schools in the 70th–85th percentile SCI band placed a sizeable proportion of students into Geometry, these schools were nevertheless more selective as a group with respect to placing students into *a full Algebra I course or higher* than were the schools in the 20th–35th percentile SCI band, based on the different rates by which the two groups of schools administered the General Mathematics CST. (See Figure 4.5a.)

Figure 4.5a: Algebra I in grade 8 was a more common expectation among schools in the 20th–35th percentile SCI band, whereas schools in the 70th–85th percentile SCI band were more selective

Students' test-taking paths from 7th- to 8th-grade mathematics, by SCI band

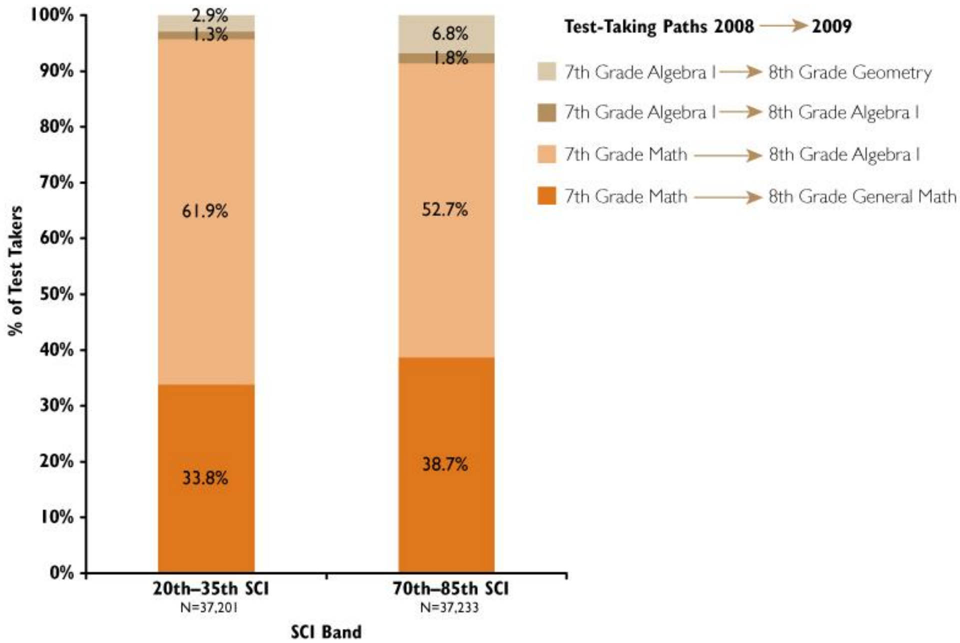
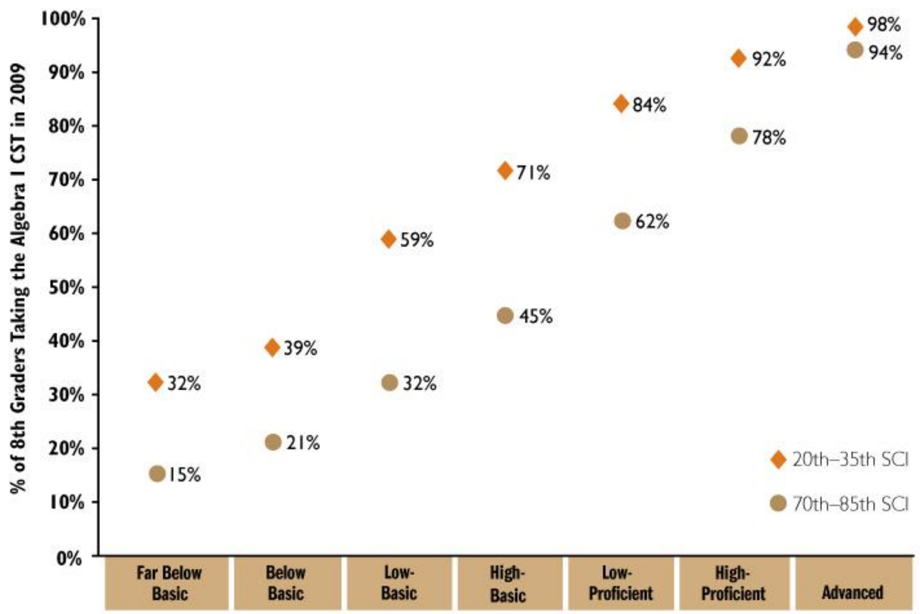


Figure 4.5b: Given similarly prepared students, schools in the 20th–35th percentile SCI band placed greater proportions of 8th graders into Algebra I than did schools in the 70th–85th percentile SCI band

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



	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
	Grade 7 Mathematics CST Test Score Level in 2008 Number of Students Below						
20th–35th SCI	2,707	8,819	6,113	5,715	4,925	4,449	2,896
70th–85th SCI	1,094	4,758	4,326	5,196	5,370	6,815	6,480

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

- Similarly, 59% of students in the 20th–35th percentile SCI band who scored *Low-Basic* on the Grade 7 Mathematics CST in 2008 took the Algebra I CST in 2009, compared with 32% of similarly prepared students in the 70th–85th percentile SCI band.

Algebra I placement varied by student background—but requires careful interpretation

The differences between the two SCI bands just described help explain, in part, different patterns of 8th grade placement among students of different backgrounds. First, consider **parental education level**, which is a measure of socioeconomic status widely understood to have a strong impact on student achievement.

- From one perspective (see Figure 4.6a), *8th graders with college-educated parents* were more likely to take the Algebra I CST than were students whose parents had less education. This was true in both SCI bands. Students with college-educated parents were also more likely to take the Geometry CST.
- However, when students are compared based on their prior achievement levels (see Figure 4.6b), *8th graders whose parents had not graduated from high school* were more likely to take the Algebra I CST than were *similarly prepared* 8th graders whose parents had more education. This was true across virtually all incoming achievement levels.

This seeming contradiction is a product of the fact that students of different backgrounds are not distributed equally across different kinds of schools and do not enter grade 8 with the same patterns of incoming achievement. For example:

- Students of different backgrounds often attend schools with different kinds of placement profiles. 8th graders whose parents were not high school graduates had a higher chance of taking the Algebra I CST when compared with other similarly prepared students in part because most attended schools in the 20th–35th percentile SCI band. In contrast, 8th graders with college-educated parents generally attended schools in the 70th–85th percentile SCI band.
- At the same time—*although students from all backgrounds scored at all levels on the Grade 7 Mathematics CST*—students whose parents were not high school graduates were more likely to enter grade 8 with lower incoming scores, especially compared with students whose parents were college-educated. (See bottom of Figure 4.6b.) The result is that, in both SCI bands, 8th graders with the least-educated parents took the Algebra I CST in the smallest *overall* proportion.

The differences between the two SCI bands also help explain, in part, different patterns of 8th grade placement among students depending on their **racial or ethnic backgrounds**. This section focuses on the four largest student groups: African American, Asian, Hispanic/Latino, and white.

- From one perspective (see Figure 4.7a on page 55), white 8th graders were more likely to take the Geometry CST than were African Americans or Hispanics in both SCI bands. And among schools in the 70th–85th percentile SCI band, white 8th graders were also more likely to take the Algebra I CST (altogether, about 57% did so) than

Figure 4.6a: Overall, 8th graders with college-educated parents took the Algebra I CST or higher in great proportion than did 8th graders with less educated parents

Students' test-taking paths from 7th- to 8th-grade mathematics, by parent education and SCI band

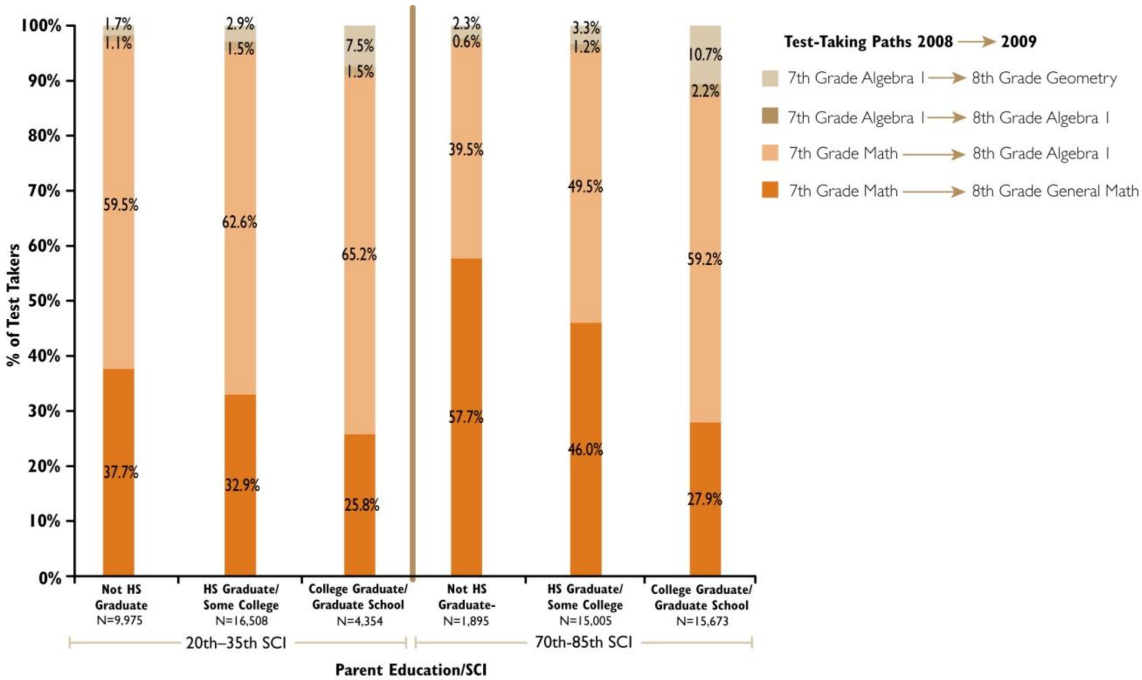
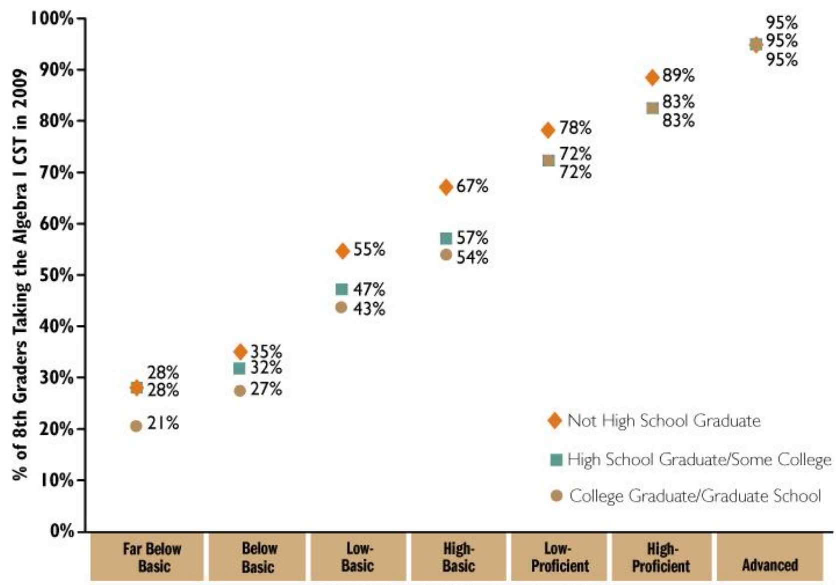


Figure 4.6b: But 8th graders whose parents were not high school graduates often had the highest chances of taking the Algebra I CST when compared with similarly prepared students

Proportion of 8th graders taking the Algebra I CST, across incoming Grade 7 Mathematics CST score levels, by parent education



	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
	Grade 7 Mathematics CST Test Score Level in 2008 Number of Students Below						
Not High School Graduate	1,043	3,190	2,013	1,858	1,423	1,270	736
High School Graduate/ Some College	1,583	6,115	4,967	4,995	4,510	4,636	3,299
College Graduate/ Graduate School	399	1,899	1,831	2,425	2,834	3,904	4,334

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

were African Americans (49%) or Hispanics (46%).[28] Asian 8th graders were the most likely to take the Algebra I CST and, notably, the Geometry CST.

- However, when students are compared based on their prior achievement levels (see Figure 4.7b), white students were less likely to take the Algebra I CST than were *similarly prepared* students from the other three groups. This was true across virtually all incoming achievement levels.

Again, this seeming contradiction is a product of the distribution of students among schools and these students' patterns of incoming achievement. For example:

- African American and Hispanic 8th graders had a higher chance of taking the Algebra I CST than similarly prepared white students in part because they were more likely to attend schools in the 20th–35th percentile SCI band.
- But at the same time—*although students from all backgrounds scored at all levels on the Grade 7 Mathematics CST*—African American and Hispanic students were more likely to enter grade 8 with lower incoming scores, compared with white students. (See the bottom of Figure 4.7b.)

Middle grades schools serving different student populations face substantive trade-offs with respect to the placement of 8th graders into Algebra I

One upshot of the complexities just described is that middle grades schools face substantive trade-offs as they work to ensure student access to a rigorous mathematics curriculum, which in California is often defined in terms of Algebra I in grade 8.

For example, based exclusively on prior achievement, a school might decide to place 8th graders with lower levels of incoming achievement into an algebra readiness course as further preparation for a college-preparatory curriculum in high school, given that relatively few students with lower levels of incoming achievement score highly on either the General Mathematics CST or the Algebra I CST.

But depending on the school, such a decision may involve trade-offs regarding student access, particularly to the extent that African American, Hispanic, and/or students from less-educated families are more likely to enter grade 8 with lower incoming mathematics achievement. Given this, a school might decide to place greater emphasis on student access to Algebra I in grade 8, especially if earlier assess to the course is seen as necessary to give students a chance to compete for admission to California's most selective public universities.

However, this also involves potential trade-offs. To the extent that broader access also requires additional academic support structures—perhaps involving additional instructional time or staff—schools must also decide how to balance support with other school activities and distribute instructional resources most effectively.

(NOTE: See Appendix A for additional explorations of these placement data as they pertain to school grade configuration and charter status.)

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[28] Percentages include students who took the Algebra I CST in both grade 7 (2008) and grade 8 (2009).

Figure 4.7a: Overall, African American and Hispanic 8th graders took the Algebra I CST (or higher) at the lowest rates among the four groups

Students' test-taking paths from 7th- to 8th-grade mathematics, by ethnicity and SCI band

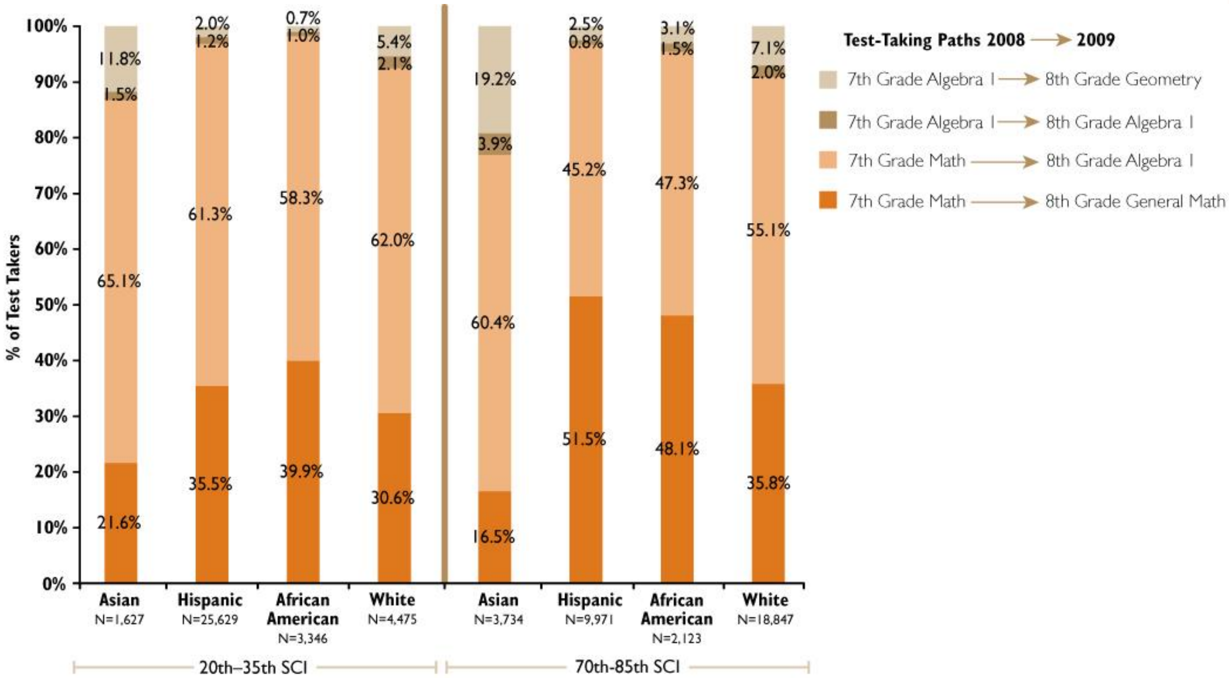
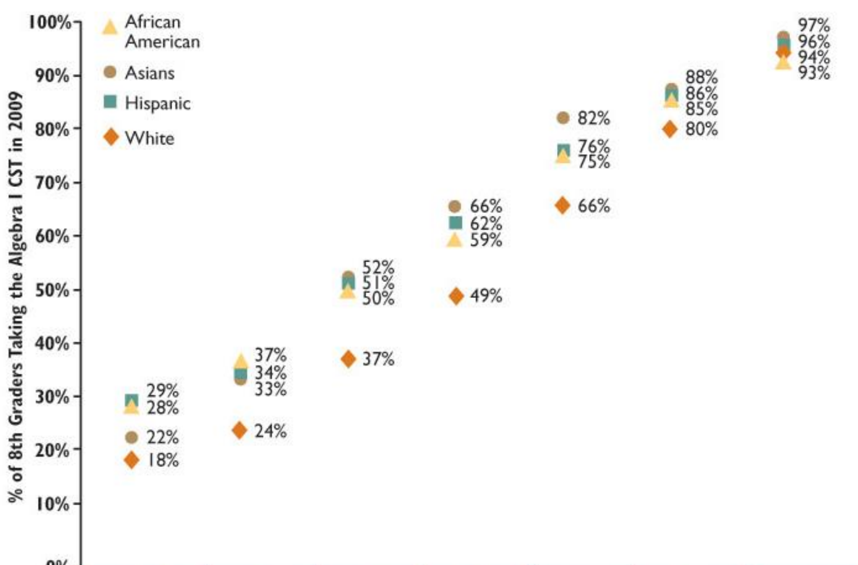


Figure 4.7b: However, white students generally had the lowest chances of taking the Algebra I CST when compared with similarly prepared students of other backgrounds

Proportion of 8th graders taking the Algebra I CST, across Grade 7 Mathematics CST score levels, by ethnicity



	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
	Grade 7 Mathematics CST Test Score Level in 2008 Number of Students Below						
African American	450	1,515	906	836	653	583	370
Asian	80	365	412	550	664	986	1,226
Hispanic	2,527	8,463	5,944	5,620	4,781	4,372	2,753
White	621	2,628	2,601	3,194	3,494	4,472	4,269

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

Chapter Five

Practices and policies that correlate with higher student achievement in 8th grade mathematics

New regression analyses of school achievement on the General Mathematics and Algebra I CSTs against survey items from the ***Gaining Ground*** *study*

This chapter:

- *Describes the new regression analyses including the longitudinal outcome measures, the survey respondents, and the survey items considered as potential predictors of higher school-level achievement in grade 8 mathematics.*
- *Presents the findings.*
- *Discusses how these new findings fit into the broader conception of effective middle grades schools presented in the original* Gaining Ground in the Middle Grades *study.*

The goals and methodology of the follow-up analysis described in this chapter build on the basic approach, survey instruments, and data of the *Gaining Ground in the Middle Grades* study. But it provides a more fine-grained analysis of practices and policies that correlate with higher grade 8 mathematics achievement, considering a more limited set of outcome measures, survey respondents, and items, and employing a refined set of statistical controls for differences among schools and students.

Description of the new analyses

The research team conducted analyses to find out which survey-reported school and district policies and practices correlate most strongly with higher school achievement in grade 8 mathematics, after adjusting for relevant background factors and prior student achievement. The analyses focus on school achievement as measured by the California Standards Tests (CSTs) in General Mathematics and Algebra I, taken by 8th graders.

Longitudinal outcome measures

The outcome measures used in these analyses were *residuals* of 8th graders' school-level CST outcomes on the General Mathematics CST and the Algebra I CST, *after controlling for prior student achievement*. These were based on a student-level data file with CST scores spanning four years.[29]

[29] The research team requested a set of restricted-use, student-level data files from the California Department of Education in order to construct these outcome variables.

In summary:

- Based upon individual prior CST scores in mathematics, regression analysis was used to predict 2009 scores for 8th graders attending each school in the sample.
- Individual student residuals (i.e., *observed* minus *predicted* scores) were then calculated, which represent 8th grade mathematics achievement that is purged of up to three years of prior performance.
- These residuals were then averaged across all students at each school to provide a school-level “longitudinal” measure of achievement.
- This was done separately for 8th graders taking the General Mathematics CST versus the Algebra I CST in 2009 to create the dependent variables for these analyses.

The analyses were designed to identify which school and district practices are most strongly associated with student achievement beyond the predicted levels, as measured by the estimated portion of school-level CST scores for 2009 that could not be explained by prior-year scores, and after controlling for other school variables.

Survey respondents and items considered

The analyses examined survey responses from the following respondents:

- The district superintendent (or charter management organization leader) of each school, when available.
- The principal of each school.
- All responding teachers in each school *who reported having taught mathematics to students in grades 6, 7, and/or 8*.

The particular policies and practices of interest, which the research team tested for possible correlation with higher school-level mathematics achievement in grade 8, were grouped for analysis in two different ways.

- One set of analyses considered school-level responses to *individual survey items* that were drawn from the superintendent, principal, and teacher surveys. These items were selected because either:
    - They were mathematics-related, such as math teachers’ responses regarding alignment of their instruction with California’s academic content standards; or
    - They represented areas of practice and policy the research team hypothesized might contribute to higher student outcomes, such as related to assessment, use of data, and interventions and instructional support for students.

  Survey items for which there was no or virtually no variation in responses and teacher survey items with low reliability were excluded from consideration.[30] In all, 104 individual survey items—or, in a few cases, variables derived from survey responses—were considered.
- Another set of analyses considered all *subdomains*—i.e., collections of survey items

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[30] See the Technical Appendix for discussion of how the reliability of teacher survey items was determined.

measuring a common concept or practice—that were reported in the original *Gaining Ground in the Middle Grades* study as correlating with higher school-level achievement *in general*, using longitudinal outcomes. Subdomains whose content focused on English language arts—e.g., pertaining to the use of English language arts curricula—were excluded. The goal of this analysis was to see which of these many subdomains of practice correlate most strongly with school-level achievement *in grade 8 mathematics in particular*. After careful review, a total of 75 subdomains were included in the analysis.

Regression analysis

The regression analysis specifically focused on the sample of students with the two most prevalent math test paths (Grade 7 Mathematics CST to Grade 8 General Mathematics CST and Grade 7 Mathematics CST to Grade 8 Algebra I CST). The general specification of the final regressions that were run is as follows:

Grade 8 Mathematics Performance = f(Student Background, School Characteristics,
Algebra Placement Sensitivity/Stringency,
Non-Mathematics Policy/Practice,
Policy/Practice To Be Tested)

The student background and school characteristics include virtually all of the controls that were used in the original *Gaining Ground in the Middle Grades* research report (e.g., school percent socioeconomically disadvantaged, English learners, etc.). Additional controls included measures of "sensitivity" and "stringency," which were used to account for the selectivity with which schools place 8th graders into Algebra I (defined by an 8th grader taking the Algebra I CST rather than the General Mathematics CST). (Sensitivity is a measure that describes the marginal responsiveness of school 8th grade algebra placement to prior 7th grade math achievement, whereas stringency describes the overall level of the relationship.)[31]

For each mathematics outcome, final regression models were run that incorporated all of the control variables listed above (i.e., the student background and school characteristics, sensitivity/stringency measures, etc.), as well as a single variable representing a given policy or practice of interest or area of policy or practice (as measured by individual survey items or subdomain variables, as outlined earlier). In all, separate regressions for each of 104 individual survey items and 75 subdomains were run for each of the two mathematics outcomes (for a total of 358 regressions).

Running such a large number of tests of item significance—179 for each outcome—increases the risk of obtaining statistically significant results merely by chance (increasing what is referred to as the Experimentwise Type I Error Rate). Recognizing this, our analysis drew upon a procedure developed in Benjamini and Hochberg (1995) that takes into account the potential danger of drawing false significant findings in the face of multiple inferences (also known as the *multiplicity effect*).[32] After running the full battery of regressions and applying the Benjamini-Hochberg procedure, 10 survey items (six each

[31] An additional control was included to account for a subdomain that the research team considered not directly related to mathematics policy and practice, but which nevertheless had proved to be significantly correlated with one of the grade 8 mathematics outcomes in the analysis performed for the original report. A detailed account of the full list of control variables is provided in the Technical Appendix.

[32] Thissen, Steinberg and Kuang (2002) provide a less technical discussion of the procedure.

for the Grade 8 General Mathematics and Grade 8 Algebra I outcomes, which includes two items common to both) and eight subdomain composite variables (two for Grade 8 General Mathematics and seven for Grade 8 Algebra I, which includes one item common to both) proved to be significant.[33] These results provide the foundation upon which the main findings reported in this chapter are based.

It should be noted that another set of regressions was run where each of these significant policy/practice variables was interacted with the SCI band indicator to test whether a significant differential relationship existed between the 20th–35th percentile and 70th–85th percentile SCI band schools. However, the results of this analysis showed that there was no significant SCI band difference in any of the estimated relationships.

Caveats for interpreting the findings

Every type of analysis has strengths and limitations, and this one is no different. Before presenting the findings of the analyses outlined above, it is important to note a few caveats for interpretation.

- These analyses are neither an evaluation of any particular middle grades program or philosophy nor an exploration of middle grades pedagogy.
- Because the survey instruments covered a broad range of middle grades policies and practices, they could not delve deeply or narrowly into any one particular area of effective-schools practices.
- Surveys are by nature "self reports" by the educators who complete them. The research team did not conduct school or district site visits to observe and verify implementation of the practices reported by responding superintendents, principals, or teachers. However, the size of the 303-school sample and the design of the survey—which included high teacher-participation rates at each school and subsequent consistency checks among teacher responses—add to the validity of the survey responses.
- Because the outcome measures used for analysis are derived from scores on standards-based state tests in mathematics taken by middle grades students, our characterization of school performance reflects the limitations of these tests, which do not capture other important dimensions of school effectiveness.
- The analyses consider only outcomes for schools as a whole, rather than the outcomes of any particular student group reported separately under the federal No Child Left Behind law. In addition, Special Education teachers were not surveyed, and the outcomes studied do not include the results of assessments taken by many students who receive Special Education services (i.e., the California Modified Assessment or the California Alternate Performance Assessment).
- Finally, although the analyses found correlations between some practices and higher school-level achievement outcomes in grade 8 mathematics, no nonexperimental study can claim to identify causal relationships between schooling practices and achievement outcomes.

[33] The Technical Appendix provides a full account of the estimated coefficients and description of the significant items and subdomains.

FINDINGS

What practices and policies differentiated schools with higher 8th grade mathematics achievement?

The multiple regression analyses identified a coherent body of policies and practices as correlating with higher school-level achievement on the General Mathematics CST and/or the Algebra I CST in grade 8. In general, achievement tended to be higher—controlling for prior student achievement and student and school characteristics—when:

- Educators *agreed more strongly* that each of these practices or policies is in place in their school or district; or
- Educators reported a *greater intensity of implementation* of each of these practices or policies.

The policies and practices that differentiated higher- from lower-performing schools fit into five groups or themes:

- **Aligning instruction with academic content standards;**
- **Setting measurable goals for student achievement;**
- **A strong future orientation toward high school;**
- **Reviewing and using student assessment data; and**
- **The district-school relationship in identifying and addressing students' instructional needs.**

The findings under each of these themes pertain to the full sample of schools. As noted earlier, the analyses did not determine any instance in which these correlations differed significantly between schools in the 20th–35th percentile SCI band and schools in the 70th–85th percentile SCI band.

The analyses also did *not* identify a correlation between higher schoolwide achievement in 8th grade mathematics and whether teachers hold single- or multiple-subject credentials, or other formal credential types. In regard to this, it is important to note that this analysis only considered student outcomes at the school level and could not link student data to particular teachers. In addition, although the participation rates of teachers among schools in the sample were impressive, we received completed surveys from less than 100% of eligible teachers in 161 of 303 schools in the study.

The rest of this chapter presents for each of the five themes, in turn:

- A *brief introduction* to the findings;
- A *boxed list of the specific items and subdomains* that differentiated higher- from lower-performing schools in the sample; and
- A brief discussion of *the extent to which these practices were common or uncommon* among the schools in the full sample.

Aligning instruction with academic content standards

One especially clear theme among the practices and policies that differentiated higher from lower school-level mathematics performance in grade 8 was the importance of aligning instruction with California's academic content standards.

In particular, greater agreement about emphasizing select *key standards* as a focus for instruction was associated with higher achievement on both the General Mathematics CST and the Algebra I CST. Close alignment with academic content standards more generally, including teacher reports of more extensive collaboration to "break down" state standards, was also associated with higher outcomes in Algebra I.

FINDINGS—Aligning instruction with academic content standards

Controlling for prior student achievement and other things being equal, ***stronger agreement about the following*** *was associated with higher school-level mathematics performance in grade 8 (General Mathematics CST or Algebra I CST, as noted).*

Item-level analyses:

- *The principal agreed more strongly that the school emphasizes select key standards at each grade and in each core subject.* (General Mathematics CST, Algebra I CST)
- *Mathematics teachers agreed more strongly that the school emphasizes selected key standards that teachers prioritize at each grade level.* (General Mathematics CST)

Subdomain analyses:

- *The principal agreed more strongly that the school's English language arts and mathematics instruction is closely guided by state academic standards and emphasizes key standards in each grade and core subject.* (Algebra I CST) – *Total number of items in subdomain: 4*
- *Mathematics teachers agreed more strongly that they closely align instruction with the California academic content standards and CSTs and emphasize key standards, and reported more extensive collaboration to "break down" the state content standards (such as to identify prerequisite student skills).* (Algebra I CST) – *Total number of items in subdomain: 4*

How common were these practices among the full sample?

The frequency with which middle grades educators in the sample undertook these practices was discussed in Chapter Two. To reprise, in more detail:

- Agreement that instruction is aligned with or guided by the state academic content standards was pervasive. For example, 65% of principals strongly agreed, and another 33% agreed, that English language arts and mathematics instruction in their schools is closely guided by state academic standards. Only five principals did not affirm this practice.
- 45% of principals strongly agreed, and 39% agreed, that their schools emphasize selected key standards at each grade and in each core subject. Altogether, 16% of principals did not affirm this practice.
- Similarly, 81% of mathematics teachers in the average school[34] agreed or strongly agreed that their school emphasizes selected key standards that teachers prioritize at each grade level. In 122 (40%) of 302 schools (for which data were available), all responding mathematics teachers agreed with this statement.
- However, only 26% of mathematics teachers in the average school reported that teachers collaborate by working together to "break down" the state content standards, such as to identify prerequisite student skills, to a considerable or great extent. In 107 (35%) of 302 schools, no mathematics teachers reported this level of implementation; in only 5 schools (fewer than 2%) did all math teachers do so.

[34] For the purpose of *descriptive statistics* based on mathematics teachers' survey responses, the proportion of mathematics teachers meeting a certain response threshold for a given survey item is calculated for each school in the sample, and the *average* school-level proportion of teachers responding in this fashion among the full sample of schools is reported for "the average school." This way of summarizing teacher responses descriptively provides context for thinking about the regression results and the prevalence of certain practices, ***but did not play a role in the regression analyses themselves***.

Setting measurable goals for student achievement

Another theme among the practices and policies that differentiated higher from lower school-level mathematics performance in grade 8 was a school's focus on measurable student achievement goals.

Schools where educators more strongly reported emphasizing and setting measurable goals for student achievement—by grade level and subject area, and across all performance levels—tended to have higher achievement on both the General Mathematics CST and the Algebra I CST.

In addition, schools where mathematics teachers more strongly reported measurable goals to increase the number of students prepared to succeed in Algebra I tended to have higher outcomes on the Algebra I CST. This was also true for schools where the principal more strongly reported measurable goals to increase the proportion that score *Proficient* or higher on the Algebra I CST.

FINDINGS—Setting measurable goals for student achievement

Controlling for prior student achievement and other things being equal, ***stronger agreement about the following*** *was associated with higher school-level mathematics performance in grade 8 (General Mathematics CST or Algebra I CST, as noted).*

Item-level analyses:

- *Mathematics teachers agreed more strongly that the school emphasizes improving student achievement across all the CST performance levels (from Far Below Basic through Advanced).* (General Mathematics CST, Algebra I CST)
- *Mathematics teachers agreed more strongly that the school sets measurable goals to increase the number of students prepared to succeed in Algebra I.* (Algebra I CST)
- *The principal agreed more strongly that the school sets measurable goals to increase the proportion of students that score Proficient or Advanced on the Algebra I CST.* (Algebra I CST)

Subdomain analyses:

- *Mathematics teachers agreed more strongly that the school emphasizes improving achievement across all the CST performance levels (from Far Below Basic through Advanced) and sets measurable goals for CST scores by grade level and subject area.* (General Mathematics CST, Algebra I CST) – *Total number of items in subdomain: 2*
- *The principal agreed more strongly that the school emphasizes improving achievement across all the CST performance levels (from Far Below Basic through Advanced), and sets measurable goals by grade level and subject area.* (Algebra I CST) – *Total number of items in subdomain: 2*

How common were these practices among the full sample?

The frequency with which middle grades educators in the sample undertook some practices related to CST performance was discussed in Chapter Two. To reprise, in more detail:

- 69% of principals strongly agreed, and 26% agreed, that their schools emphasize improving student achievement across all the CST performance levels. Only 5% of principals did not affirm this practice.
- 44% of principals strongly agreed, and 37% agreed, that their schools set measurable goals for CST scores by grade level and subject area. Nearly one in five principals did not affirm this practice.

In addition, related to Algebra I preparation and achievement:

- 38% of principals strongly agreed, and 42% agreed, that their schools set measurable goals to increase the proportion of students that score *Proficient* or *Advanced* on the Algebra I CST. Nearly one in five principals did not affirm this practice.
- In the average school in the sample, 72% of responding mathematics teachers agreed or strongly agreed that their school sets measurable goals to increase the number of students prepared to succeed in Algebra I. In 84 (28%) of 302 schools, all mathematics teachers did so.

A strong future orientation toward high school

Another area of practice and policy that differentiated higher from lower school-level mathematics performance in grade 8, relative to the Algebra I CST, was a strong future orientation toward preparing students for high school.

Schools where mathematics teachers reported that curriculum and instruction are designed, to a greater extent, to prepare students for a rigorous high school curriculum—such as to leave the middle grades ready to begin taking courses required for University of California (UC) or California State University (CSU) eligibility and on track to pass the California High School Exit Exam (CAHSEE)—tended to have higher outcomes in Algebra I.

FINDINGS—A strong future orientation toward high school

Controlling for prior student achievement and other things being equal, ***stronger agreement about the following*** *was associated with higher school-level mathematics performance in grade 8 (Algebra I CST).*

Item-level analyses:

- *Mathematics teachers reported that, to a greater extent, the school's instruction and curriculum are designed to prepare all students to leave the middle grades ready to begin taking courses required for University of California/California State University eligibility ("A-G" courses).* (Algebra I CST)

Subdomain analyses:

- *Mathematics teachers reported that, to a greater extent, the school's instruction and curriculum are designed to prepare students for a rigorous high school curriculum, such as to leave the middle grades ready to begin taking courses required for University of California/California State University eligibility ("A-G" courses) and on track to pass the California High School Exit Exam (CAHSEE).* (Algebra I CST) – *Total number of items in subdomain: 3*

How common were these practices among the full sample?

- In the average school in the sample, 79% of mathematics teachers reported that their school's curriculum and instruction are designed to prepare all students to leave the middle grades on track to pass the CAHSEE to a considerable or great extent. In 116 (39%) of 301 schools, all mathematics teachers reported this.
- Fewer mathematics teachers reported that their schools' curriculum and instruction are designed to prepare all students to leave the middle grades ready to begin taking courses required for UC/CSU eligibility to a considerable or great extent. In the average school in the sample, 62% reported this, and in just 63 (21%) of 300 schools did all mathematics teachers report this.

Reviewing and using student assessment data

Another theme among the practices and policies that differentiated higher from lower school-level mathematics performance in grade 8, relative to the General Mathematics CST, was educators' review and use of student assessment data.

Schools where the principal reported meeting more frequently with teachers—e.g., individually, by grade level, by department—to review CST results (including results for student subgroups), and reported meeting with the entire school staff, tended to have higher achievement on the General Mathematics CST.

In addition, schools where mathematics teachers reported more extensive collaboration among teachers to analyze student data to identify effective instructional practices tended to have higher achievement on the test.

Finally, schools where mathematics teachers reported that students' CST scores are considered to a greater extent when determining student placements into grade 7 and 8 general mathematics classes tended to have higher achievement on the test. Because prior-year CST scores do not become available until late August and schools differ in when they set up class rosters and begin classes, it is unclear the extent to which schools in the sample consider students' *most recent* scores for this purpose. Scores from earlier years would be available, however, and in some cases students' most recent CST scores might be used to make adjustments to course placements.

FINDINGS—Reviewing and using student assessment data

*Controlling for prior student achievement and other things being equal, **stronger agreement about the following** was associated with higher school-level mathematics performance in grade 8 (General Mathematics CST).*

Item-level analyses:

- *The principal reported that she/he meets more frequently with English and/or mathematics teachers by department to review CST results, including subgroups.* (General Mathematics CST)
- *Mathematics teachers reported more extensive teacher collaboration to analyze student assessment data to identify effective instructional practices.* (General Mathematics CST)
- *Mathematics teachers reported that, to a greater extent, the school considers student CST scores for determining student placement in grade 7 and 8 mathematics courses (General Math).* (General Mathematics CST)

Subdomain analyses:

- *The principal reported that she/he meets more frequently with teachers individually, with grade-level teachers, and with English and/or mathematics teachers by department to review CST results (including subgroups), and meets more frequently with the entire school staff to review schoolwide CST scores.* (General Mathematics CST) – *Total number of items in subdomain: 5*

How common were these practices among the full sample?

Related to principal review of CST data with teachers and school staff:

- 27% of principals reported that they meet with individual teachers to review CST results (including subgroups) throughout the year, and 40% reported doing so a few times per year. Another 26% of principals reported meeting with individual teachers for this purpose only at the start of the year, and 8% said they never do so.
- Somewhat greater percentages of principals reported meeting with *groups* of teachers to review CST data—both by grade level and by department—throughout the year.
- 28% of principals reported that they meet with the entire school staff to review schoolwide CST scores throughout the year, and 31% reported doing so a few times per year. Another 40% of principals reported meeting with the entire school staff for this purpose only at the start of the year. Only a few reported never doing so.

Related to teacher collaboration on analyzing student assessment data to identify effective instructional practices:

- In the average school in the sample, only 37% of mathematics teachers reported that teachers in their school collaborate to do this to a considerable or great extent. In 68 (23%) of 302 schools, no mathematics teachers reported this level of implementation.

Related to the use of CST scores as a consideration for placing students into grades 7 and/or 8 general mathematics classes:

- In the average school in the sample, 72% of responding mathematics teachers reported that students' CST scores are considered to a considerable or great extent for placing students into general mathematics courses in grades 7 and 8. In 100 (33%) of 300 schools, all mathematics teachers did so.

The district-school relationship in identifying and addressing students' instructional needs

The final area of practice and policy that differentiated higher from lower school-level mathematics performance in grade 8, relative to the Algebra I CST, related to the district-school relationship in identifying and addressing students' different instructional needs.

District leadership and focus on students needing academic assistance is one component of this theme. Schools where the principal agreed more strongly that 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 tended to have higher school-level Algebra I achievement.

But another component of this theme seems to rest on the district's confidence that school staff have or can develop the expertise and capacity to take an active role in diagnosing student needs. Schools with superintendents who reported that the district allows middle grades schools to develop their own standards-aligned diagnostic assessments, determine the need for diagnostic assessments, and do their own analysis of student results also tended to have higher outcomes in Algebra I.

FINDINGS—The district-school relationship in identifying and addressing students' instructional needs

Controlling for prior student achievement and other things being equal, ***stronger agreement about the following*** *was associated with higher school-level mathematics performance in grade 8 (Algebra I CST).*

Item-level analyses:

- *The principal agreed more strongly that the school district addresses the needs of students who are two or more years below grade level.* (Algebra I CST)

Subdomain analyses:

- *The principal agreed more strongly that the school district addresses the needs of students two or more years behind grade level and emphasizes early identification of students needing academic support.* (Algebra I CST) – *Total number of items in subdomain: 2*
- *The superintendent reported that the district allows middle grades schools to develop their own standards-aligned diagnostic assessments, determine the need for diagnostic assessments, and do their own analysis of student results.* (Algebra I CST) – *Total number of items in subdomain: 3*

How common were these practices among the full sample?

Related to district emphasis on students needing academic support or below grade level:

- 31% of principals strongly agreed, and 52% agreed, that their districts emphasize early identification of students needing academic support. Altogether 17% of principals did not affirm this statement about their respective districts.
- Only 15% of principals strongly agreed, and 52% agreed, that their districts address the needs of students who are two or more years below grade level. Nearly one in three principals did not affirm this statement about their respective districts.

Related to an active school role in the diagnostic assessment of students:

- 55% of district superintendents reported that their districts allow school staff to do their own analysis of the results of diagnostic student assessment data.[35]
- Some district superintendents reported that their districts grant schools additional kinds of discretion, with 37% reporting that their districts allow schools to develop their own diagnostic assessments aligned with the state standards by grade and subject for the middle grades.[36] Altogether, 27% reported that their districts allow educators in the middle grades to determine the need for diagnostic assessments.[37]

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[35] Does not include charter management organization (CMO) leaders. Three of five CMO leaders (60%) reported that their organizations allow school staff to do their own analysis of the results of diagnostic student assessment data.

[36] Does not include charter management organization (CMO) leaders. Two of five CMO leaders (40%) reported that their organizations allow schools to develop their own diagnostic assessments aligned with the state standards by grade and subject for the middle grades.

[37] Does not include charter management organization (CMO) leaders. Two of five CMO leaders (40%) reported that their organizations allow educators in the middle grades to determine the need for diagnostic assessments.

These findings reinforce, and are informed by, the broader concept of effective middle grades schools presented in *Gaining Ground in the Middle Grades*

The findings presented in this chapter provide a nuanced look at practices and policies that correlated with higher school-level achievement in grade 8 mathematics, beyond what would be predicted by prior student achievement.

However, these practices and policies do not and cannot take place in a vacuum. As such, these findings should be interpreted in the context of the broader concept of effective middle grades schools presented in *Gaining Ground in the Middle Grades*.

An intense, schoolwide focus on improving academic outcomes

One of the most important findings of *Gaining Ground in the Middle Grades* was that ***an intense, schoolwide focus on improving academic outcomes*** distinguishes higher-performing middle grades schools serving similar students**.** Educators set measurable goals for improved student outcomes on standards-based tests and share a mission to prepare students academically for the future. Adults are held accountable and take responsibility for improved student outcomes, and students and parents are expected to share responsibility for student learning.

This follow-up analysis:

- Reinforces the importance of measurable and clearly defined goals for mathematics achievement in grade 8—not only with respect to improving student outcomes across the full spectrum of student achievement and by grade and subject area, but also with respect to student success in Algebra I. Moreover, these Algebra I goals—increasing the number of students prepared to succeed in the course, and increasing the proportion of students who score highly on the Algebra I CST—do not depend on any particular school policy for placing students into the course.
- Underscores the importance of a strong future orientation toward high school and beyond, particularly for advanced mathematics coursework such as Algebra I.

Curricula and instruction are coherent and closely aligned with state academic standards

Gaining Ground in the Middle Grades also affirmed the importance of ***curricula and instruction that are coherent and closely aligned with state academic standards*** in differentiating higher middle grades achievement. Emphasis on academic content standards, frequent use of standards-based curricula, teacher collaboration around pacing and benchmarks, and well-defined plans for instructional improvement help ensure coherent implementation of standards-based curricula and instruction.

This follow-up analysis:

- Highlights in particular the practice of prioritizing select key standards at each grade level and in each subject area, as well as collaboration among teachers to “break down” state standards (such as to identify prerequisite student skills)—in other words, using state content standards as a tool for achieving curricular coherence and shared expectations among educators.

Extensive use of assessment and other student data to improve student learning and teacher practice

Gaining Ground in the Middle Grades also found that ***extensive use of assessment and***

other student data to improve student learning and teacher practice distinguished higher-performing schools serving similar students. Districts played a strong leadership role in the provision and use of student assessment data. Moreover, the roles of principals and teachers alike were consistent with a school culture of data-informed decision-making, with student outcomes as the focus.

This follow-up analysis:

- Highlights principal leadership related to review of CST data with teachers, and collaboration among teachers to analyze student assessment data with the goal of identifying effective instructional practices.
- Draws attention to the role of student achievement data in informing how middle grades educators place students into general mathematics courses in grades 7 and 8.

Emphasis on early identification and proactive intervention to meet students' academic needs

Another key finding of *Gaining Ground in the Middle Grades* was that a strong ***emphasis on early identification and proactive intervention to meet students' academic needs*** distinguished higher-performing middle grades schools serving similar students. Educators review the academic, behavior, and attendance records of entering students thoroughly for warning signs of academic vulnerability and need for support. A comprehensive range of required and voluntary strategies are used to intervene when needed, teachers and parents meet to develop and monitor student intervention plans, and schools pay attention to the assessment and careful placement of English learners.

This follow-up analysis:

- Underscores the importance of district leadership in focusing local educators' attention on students needing academic support.
- Highlights the active role of local educators in the diagnostic assessment of students' particular needs.

The roles of districts, principals, and teachers

In *Gaining Ground in the Middle Grades*, ***superintendent leadership and district support*** across many dimensions of policy and practice was essential for differentiating higher-performing middle grades schools serving similar students. Likewise, ***the changing role of the principal*** in driving student outcome gains, orchestrating school improvement, and serving as the linchpin between the district and teachers was well documented; as was ***the individual and collective work of teachers*** with strong competencies who benefit from substantive practice evaluations and adequate support, time, and resources to improve instruction.

These changing roles are also highlighted throughout the findings of this follow-up analysis.

School environment and organization of time and instruction

Although ***school environment and organization of time and instruction*** were not strongly associated with improved student outcomes overall in *Gaining Ground in the Middle Grades*, some practices related to these were. These included, for example, that more time is allocated per month for common planning in grades 7 and 8 for English language arts and mathematics teachers. The findings of this follow-up analysis do not explicitly highlight the importance of such time. However, common planning time is clearly important for enabling collaboration among teachers around standards and effective instructional practices and meetings between principals and teachers to review student data. Strong awareness of a school's measurable goals for student achievement also requires time for educators to form shared goals and expectations.

Conclusion

Summary of findings

The original *Gaining Ground in the Middle Grades* study specified a comprehensive set of actionable practices that differentiated higher academic achievement among 303 middle grades schools in California. In doing so, the study provided a compelling and coherent account of middle grades schools that are achieving better student outcomes than their peer schools serving similar students.

Educators in these schools reported an intense, schoolwide focus on improving academic outcomes, with a strong future orientation toward enabling students to succeed in high school. District and principal leadership and the individual and collective work of teachers—their resources and their time—are focused on these shared missions. Within the context of a clean, safe, and disciplined school environment, curricula and instruction are closely aligned with state academic standards, and educators use assessment and other student data extensively to improve student learning and instructional practice, and to quickly identify students' academic needs and intervene proactively.

This follow-up report provides a different, more in-depth look at middle grades mathematics practices and policies. Below, we make some descriptive observations and summarize the main findings.

Descriptive observations

California's academic content standards and related state policies strongly influence the goals that middle grades schools set, the ways they measure progress, and the instruction they provide

California's mathematics content standards—first adopted in 1997—have, in concert with aligned assessments and curricula, had an impact in the middle grades.

- *Middle grades educators' focus on aligning instruction with the state standards is pervasive.* In higher-performing schools in particular, educators are focusing on key standards and setting measurable goals for student achievement on standards-based tests.
- *Most schools are provided technology for managing and using this information by their districts.* However, it was less common for school staffs to report that their district provides adequate training to ensure effective use of data management software, or that they have extensive common planning time and teacher collaboration around standards and benchmarks.
- Despite California's most recent mathematics instructional materials adoption in 2007, older basic curriculum programs were still in somewhat wider use than were newer programs. Not only was 2008–09 a transition year in the adoption cycle, but state budget cuts affected districts' ability to purchase new materials. Among the other new materials adopted in 2007, algebra readiness programs were in use in 42% of the schools in the sample—more common than the use of state-adopted intervention materials.

In the sample, about 60% of 8th graders took the Algebra I CST in 2008–09, but schools vary widely in their placement policies

Without question, one of the most striking changes since California's standards-based education reform era began is the tremendous expansion in the number of middle grades students taking Algebra I—a course that includes content that seems to typically be emphasized in high school standards elsewhere in the nation. Among the nearly 75,000 8th graders considered in this report, 59% took the state's Algebra I test, 36% took the General Math test (indicating they had not yet completed Algebra I), and 5% took the Geometry test. These percentages are similar to current statewide figures and represent a substantial shift in course taking: indeed, only 32% of 8th graders statewide took the Algebra I CST in 2003.

But the criteria by which middle grades students are placed in Algebra I remains an uncertain area of policy and practice, and recent research and policy documents show that district policies can have both intended and unintended consequences. On the one hand, statewide testing data show that 8th grade achievement in Algebra I has improved overall, and that many students who might not have taken the course previously are doing well. But on the other hand, more than half of the students who take the Algebra I CST in 8th grade score below proficient on the test, and there is evidence that many students—including students who did well—are required to repeat the course in 9th grade.

The descriptive data presented in this follow-up report provide some insight into the considerations that currently guide local decision-making. In the sample:

- Educators at the school level often decide on the criteria used to determine which middle grades students are ready for Algebra I. Superintendents reported that their district policies grant schools a fair amount of discretion regarding algebra placement.
- The implementation of policies such as explicit, written placement criteria and review of placements to ensure academic appropriateness and access to a rigorous curriculum varies among schools.
- Students' prior academic achievement, student CST scores, and teacher recommendations appear to be the most common sources of information that middle grades mathematics educators use when making 7th and 8th grade placements into general mathematics and Algebra I courses. That said, no single criterion was consistently reported in the vast majority of schools. For example, math teachers consistently reported extensive consideration of student CST scores for Algebra I placement in only 58% of schools.

The majority of 8th graders who took the Algebra I CST in 2009 included many whose chances of scoring highly were relatively low

Our analysis of Algebra I placement in California middle grades schools underscores the tension between access and success

Algebra I in grade 8 has been intensely debated by policymakers and middle grades educators in California. Many middle grades schools in the state have made a concerted effort to place more middle grades students into the course. The state has used its accountability system to encourage this, and the pressure on schools further increased the summer prior to this study because of (now-blocked) state board actions.

The availability of longitudinal testing data for California students now affords new opportunities to better understand students' course-taking paths in middle grades mathematics. Our analysis of longitudinal data linking students' CST scores in grades 7 and 8 provides important new insight—not previously available—into local placement practices throughout California and their consequences for students.

Our analysis of these data for the schools in the sample shows that:

- *Students who scored higher in grade 7 were more likely to take the Algebra I CST in grade 8, but many low-scoring students also did so.*
- *Even among similarly prepared 8th graders, schools in the 20th–35th percentile SCI band (serving predominantly students from lower-income families) placed greater proportions of students into Algebra I than did schools in the 70th–85th percentile SCI band (serving predominantly students from middle-income families).* In other words, the schools serving lower-income students are less likely to restrict access to Algebra I based on 8th graders' prior math performance.
- *Prior achievement matters for students' prospects of doing well on either the General Mathematics CST or the Algebra I CST.* The Algebra I CST sets a particularly high standard. For example, in order to have a favorable chance of scoring at least *Low-Proficient* on the Algebra I CST in 2009, students needed to have scored at least *High-Proficient* on the Grade 7 Mathematics CST in 2008.

However, these data also make clear that schools face substantive trade-offs when making placement decisions. For example, educators must decide how to balance early access to advanced mathematics coursework with students' incoming preparation, particularly to the extent that African American, Hispanic, and/or students from less-educated families are more likely to enter grade 8 with lower incoming mathematics achievement.

> A companion Policy and Practice Brief provides further discussion of student placements and their implications
>
> The findings from our analysis of student placements using longitudinal state testing data have important **implications for policy and practice** related to middle grades mathematics in California. These findings are explored in more detail, and their implications for policymakers and local educators are discussed, in a **companion Policy and Practice Brief**. This companion document is available from the EdSource website, www.edsource.org.

Schools with higher grade 8 math achievement have an intense focus on student outcomes and high school readiness, grounded in standards-based instruction

The regression findings reinforce, and are informed by, the broader concept of effective middle grades schools presented in *Gaining Ground in the Middle Grades*

The practices and policies that differentiated higher- from lower-performing schools serving similar students—controlling for students' prior academic achievement in mathematics and key school variables such as algebra placement, and as measured by the General Mathematics CST and/or the Algebra I CST in grade 8—fell into five themes.

- *Educators are knowledgeable and sophisticated in teaching the math content* *standards*. Educators 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.

- *School leaders and teachers report setting and monitoring measurable student achievement goals*. Schools emphasize and set measurable goals for student achievement, such as by grade level, by subject area, and across all performance levels, Schools also set measurable goals to increase the number of students prepared to succeed in Algebra I and the proportion that score proficient or higher on the Algebra I CST—two practices that schools can undertake regardless of their placement policies.
- *The school's instruction and curriculum program is "future oriented" and designed to ensure all students are "high school ready"—that is, prepared to succeed in coursework that will make them "college ready."* Curriculum and instruction are designed to prepare students for a rigorous high school curriculum, such as to leave the middle grades ready to begin taking courses required for University of California (UC)/California State University (CSU) eligibility and on track to pass the California High School Exit Exam (CAHSEE).
- *School leaders' and teachers' instructional decisions are driven by extensive review and use of student assessment data.* Principals meet frequently with teachers—individually, by grade level, by department—and with the entire school staff to review CST results, including results for student subgroups. Teachers collaborate to identify effective instructional practices using data. And students' placements in general mathematics courses in grade 7 and/or 8 take into account students' prior CST scores.
- *The district provides strong leadership and focus on students needing additional academic support.* The school district prioritizes early identification of students needing academic support and addresses the needs of students who are two or more years behind grade level. But middle grades school staff have the ability to develop their own standards-aligned diagnostic assessments, determine the need for them, and/or do their own analysis of the results.

This in-depth analysis did *not* identify a correlation between higher schoolwide achievement in 8th grade mathematics and whether teachers hold single- or multiple-subject credentials, or other formal credential types. In regard to this, it is important to note that this analysis only considered student outcomes at the school level and could not link student data to particular teachers. In addition, although the participation rates of teachers among schools in the sample were impressive, we received completed surveys from less than 100% of eligible teachers in 161 of 303 schools in the study.

Importantly, the practices and policies highlighted above do not and cannot take place in a vacuum. As such, these findings should be interpreted in the context of the broader concept of effective middle grades schools presented in *Gaining Ground in the Middle Grades*.

Acknowledgments

The research team thanks the following individuals for their contributions to an **October 2010 advisory meeting** that helped clarify our understanding of the research findings and their implications. We thank these advisors for contributing their time and expertise. They bear no responsibility for the content of this report, nor for the content of the companion Policy and Practice Brief.

- **Manny Barbara** (Silicon Valley Education Foundation)
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Very special thanks go out 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 leaders**.

Finally, 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.

Appendix A

Further data on Algebra I placement

Chapter Four examined the mathematics placements of 8th graders in the sample, based on longitudinal data linking students' California Standards Test (CST) scores in grades 7 and 8. The chapter explored the extent to which 8th graders in the 303 schools took the Algebra I CST, how the likelihood of doing so varied depending on prior-year achievement, and how 8th graders with different levels of prior preparation fared on either the General Mathematics CST or the Algebra I CST. The chapter also explored how schools varied in their observed placement of 8th graders into Algebra I depending on SCI band, and the implications of this for students of different backgrounds.

The following pages provide additional explorations of these data, pertaining to differences in:

- School grade configuration (K–8 vs. 6–8 vs. 7–8); and
- School charter status.

K–8 schools placed greater proportions of 8th graders into Algebra I than did 6–8 or 7–8 schools

School placement practices differed notably based on school grade configuration.

- K–8 schools placed a greater overall proportion of 8th graders in Algebra I (about 73%) than did schools 6–8 schools (about 59%) or 7–8 schools (about 58%).[38] (See Figure A-1.) This is striking given that nearly two-thirds of K–8 schools in the sample were located in the 70th–85th percentile SCI band, where schools otherwise tended to be more selective in their placements. (See discussion in Chapter Four.)

  In comparison, 6–8 and 7–8 schools were more selective than K–8 schools with respect to placing students into a full Algebra I course or higher. (See Figure A-1.)

- In addition, when students are compared based on their prior achievement levels, K–8 schools were more likely to place *similarly prepared* 8th graders into Algebra I than were 6–8 or 7–8 schools. This was true across nearly all incoming achievement levels. (See Figure A-2.) For example:
  - 45% of students in K–8 schools who scored *Far Below Basic* on the Grade 7 Mathematics CST in 2008 took the Algebra I CST in 2009, compared with slightly more than a quarter in 6–8 and 7–8 schools.
  - 62% of students in K–8 schools who scored *Low-Basic* on the Grade 7 Mathematics CST in 2008 took the Algebra I CST in 2009, compared with 49% in 6–8 schools and 44% in 7–8 schools.

Why K–8 schools stand out in this way is unclear and a topic for further research. One hypothesis is that these schools, which serve far fewer 8th graders, have less capacity to differentiate student placements. But the reality is clearly more complex. Further analysis of student testing data shows that K–8 schools in the sample were *not* more likely than 6–8 and 7–8 schools to have used Algebra I as a default mathematics course for all or nearly all 8th graders.[39] And those K–8 schools that *did* administer the Algebra I CST or higher to all or nearly all 8th graders tended, on average, to serve somewhat *larger* numbers of students in grades 7 and 8 than did K–8 schools with more varied grade 8 test-taking.

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[38] Percentages include students who took the Algebra I CST in both grade 7 (2008) and grade 8 (2009).

[39] Based on schools where *either*: (a.) 100% of 8th graders took the Algebra I CST or higher in 2009, *or* (b.) no more than 10 8th graders took the General Mathematics CST and these exceptions constituted no more than 5% of all 8th graders in the school.

Figure A-1: Algebra I in grade 8 was a more common expectation in K–8 schools than in 6–8 or 7–8 schools

Students' test-taking paths from 7th- to 8th-grade mathematics, by grade configuration

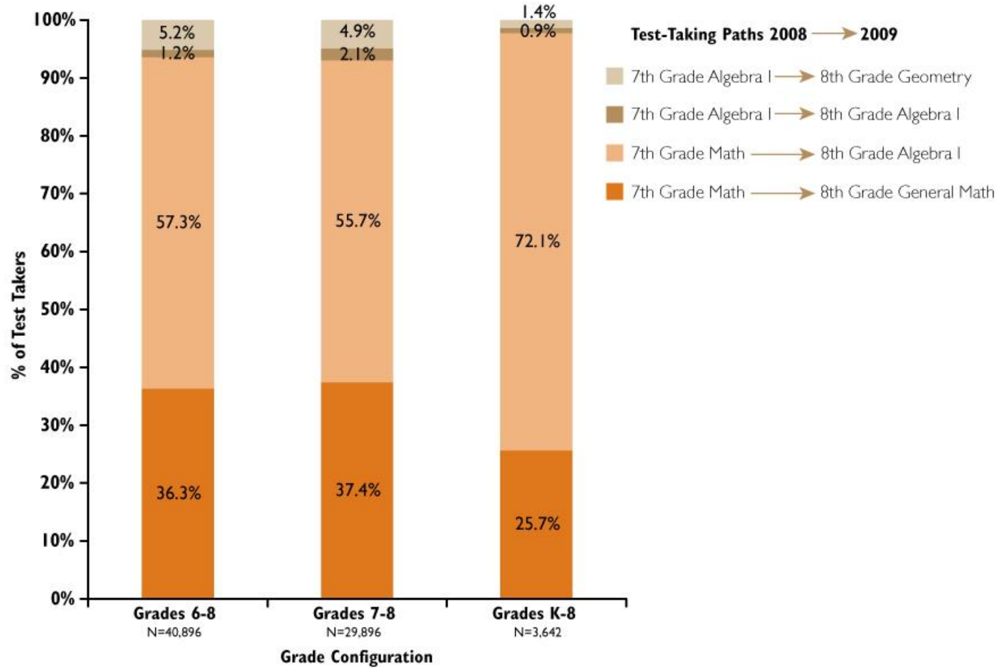
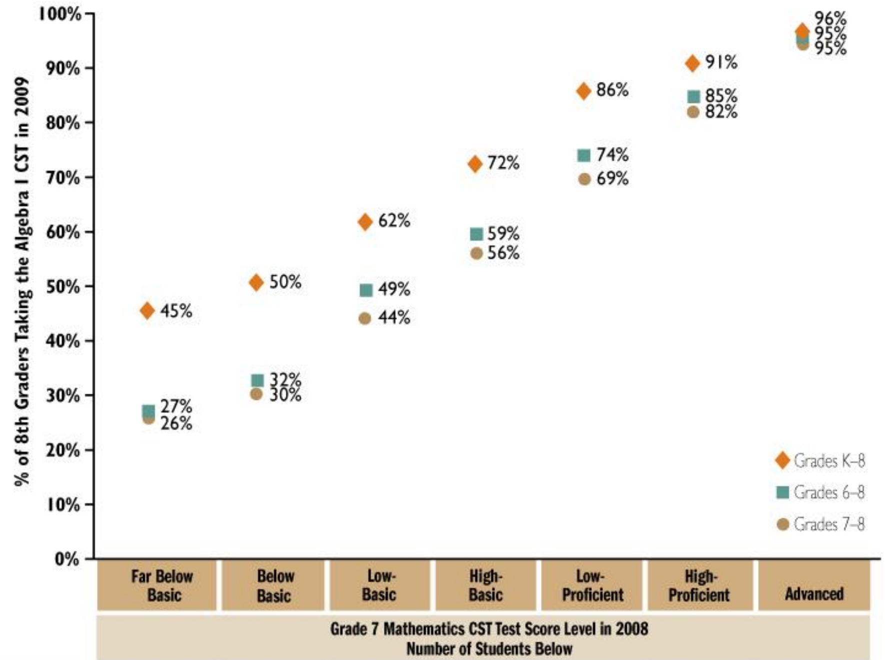


Figure A-2: Given similarly prepared students, K–8 schools placed greater proportions of 8th graders into Algebra I than did 6–8 schools or 7–8 schools

Proportion of 8th graders taking the Algebra I CST,
across incoming Grade 7 Mathematics CST score levels, by grade configuration



Grade 7 Mathematics CST Test Score Level in 2008 — Number of Students Below	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
Grades K–8	146	644	554	610	588	583	436
Grades 6–8	2,219	7,891	5,729	5,874	5,563	5,905	5,094
Grades 7–8	1,436	5,042	4,156	4,427	4,144	4,776	3,846

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

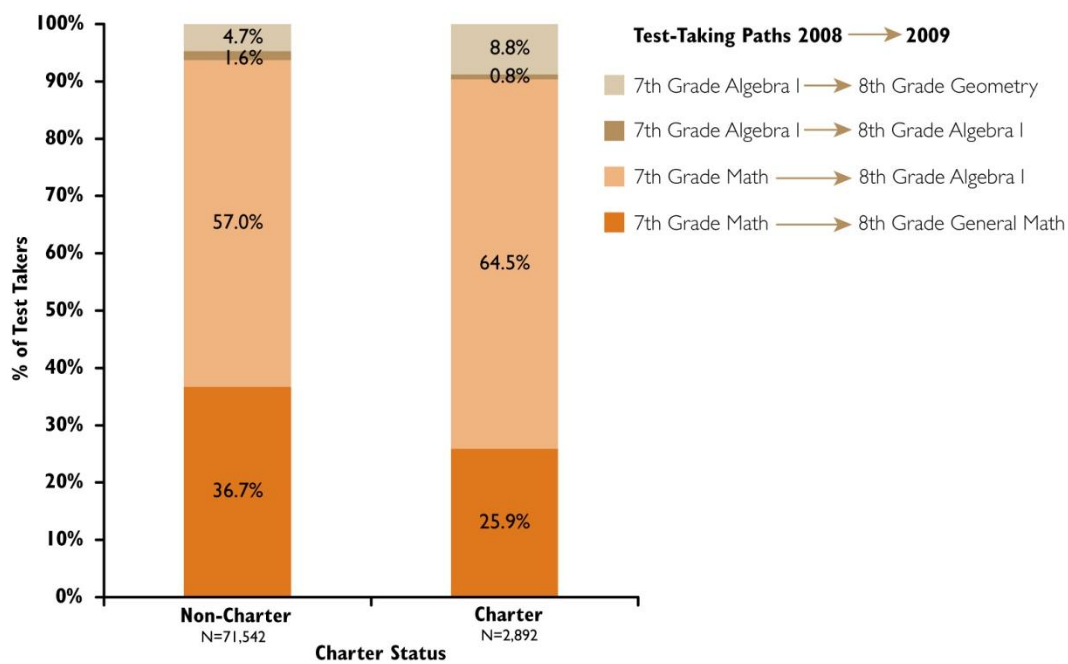
Charter schools placed greater proportions of 8th graders into Algebra I than did noncharter schools

The sample included 28 charter schools. Nine charter schools (32%) were in the 20th–35th percentile SCI band and 19 (68%) were in the 70th–85th percentile SCI band. Only one had a 7–8 grade configuration; the rest were nearly evenly split between K–8 and 6–8 configurations.

- Eighth graders in charter schools took both the Algebra I CST and the Geometry CST in greater proportions in 2009 than did 8th graders in noncharter schools. (See Figure A-3.)
- In addition, across most incoming achievement levels, 8th graders attending charter schools had higher chances of taking the Algebra I CST than did similarly prepared 8th graders attending noncharter schools. (See Figure A-4.)
  - This was most notably the case among students who scored *Low-Basic*, *High-Basic*, and *Low-Proficient* on the Grade 7 Mathematics CST in 2008.
  - Eighth graders who scored *Far Below Basic* and *Advanced*—i.e., the lowest and highest incoming achievement levels—were exceptions. Among these students, 8th graders attending noncharter schools took the Algebra I CST in somewhat higher proportions than did similarly prepared 8th graders attending charter schools.

Figure A-3: 8th graders attending charter schools were more likely to take both the Algebra I CST and the Geometry CST, compared with 8th graders attending noncharter schools

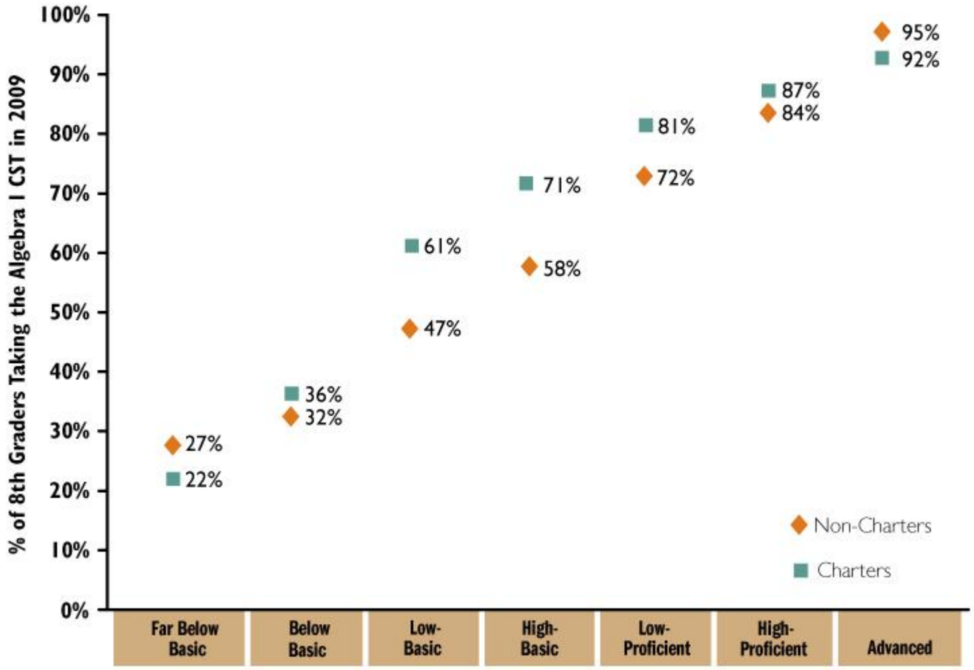
Students' test-taking paths from 7th- to 8th-grade mathematics, by charter status



Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

Figure A-4: For the most part, 8th graders attending charter schools had higher chances of taking the Algebra I CST than did similarly prepared 8th graders attending noncharter schools

Proportion of 8th graders taking the Algebra I CST, across incoming Grade 7 Mathematics CST score levels, by charter status



Grade 7 Mathematics CST Test Score Level in 2008 Number of Students Below	Far Below Basic	Below Basic	Low-Basic	High-Basic	Low-Proficient	High-Proficient	Advanced
Non-charters	3,719	13,174	10,099	10,533	9,876	10,752	8,896
Charters	82	403	340	378	419	512	480

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11

Appendix B

The credentials of middle grades mathematics teachers differ depending on school grade configuration and teachers' grade levels

California does not have a teaching credential specific to the middle grades. Teachers can hold a variety of credentials and be authorized to teach middle grades mathematics in the state, depending on the kinds of classrooms in which they teach (see California Commission on Teacher Credentialing, 2009, pp. 3E-1–3E-3). In general:[40]

- A **single-subject credential in mathematics** authorizes middle grades teachers to teach math in a *departmentalized* classroom. These include the traditional *single-subject credential in mathematics* and the *single-subject credential in foundational mathematics*. The latter authorizes mathematics instruction including algebra, geometry, consumer mathematics, and probability and statistics, but not instruction in more advanced courses such as calculus.[41]
- A **multiple-subject credential** authorizes middle grades teachers to teach math (including Algebra I) in a *self-contained* classroom, or in a *"core"* (or semi-self-contained) classroom in which two or more subjects are taught to the same students.
- In addition, **subject-matter and supplementary authorizations** that permit the teaching of mathematics in a *departmentalized* classroom can be "added" to a multiple-subject credential or single-subject credential in another subject. Depending on how these authorizations are acquired, they generally limit such teaching to content for grades 9 and lower (regardless of the grade level at which this content is taught) or to classrooms in grades 9 and below.

In the teacher survey, middle grades mathematics teachers reported the credentials they held.[42] Overall, about two-thirds of mathematics teachers in the sample reported holding a multiple-subject credential, and almost one-third reported holding a single-subject credential in mathematics. (See Figure B-1 on the next page.) In addition, some reported holding a single-subject credential in English language arts and/or another subject.

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[40] This summary does not include other short-term, provisional intern, local teaching assignment, or limited assignment options. (See California Commission on Teacher Credentialing, 2009, pp. 3E-1–3E-3.) The California Commission on Teacher Credentialing (2010) recently adopted preconditions and program standards for a Mathematics Instructional Certificate and a Mathematics Instructional Leadership Specialist Credential. These are intended to strengthen the mathematics knowledge and pedagogy of teachers who enter the profession with multiple-subject credentials and provide districts greater flexibility in organizing classrooms at the elementary and middle grades levels.

[41] The study surveys did not distinguish between these two single-subject credentials.

[42] This appendix provides information on the percentages of mathematics teachers who reported holding one or more of the following: a *multiple-subject credential*, a *single-subject credential in mathematics*, and/or a *single-subject credential in other disciplines*. However, it does not consider additional subject-matter authorizations that teachers might have held because of limitations of the survey data.

Figure B-1: Mathematics teachers reported the teaching credentials they hold

Survey Item *Which of the following California teaching credentials or permits do you hold?* *(Check all that apply.)*	**Responses of Mathematics Teachers:** *Overall percentage of teachers (in each sample) reporting each type of credential*						
	Full sample (N=1,857)	**K–8 Schools**		**6–8 Schools**		**7–8 Schools**	
		20th–35th %ile SCI (N=88)	70th–85th %ile SCI (N=133)	20th–35th %ile SCI (N=638)	70th–85th %ile SCI (N=514)	20th–35th %ile SCI (N=254)	70th–85th %ile SCI (N=230)
A California multiple-subject credential	67%	86%	82%	69%	70%	52%	53%
A California single-subject credential in Mathematics	31%	8%	19%	27%	29%	42%	47%
A California single-subject credential in English language arts	2%	0%	2%	2%	3%	3%	5%
A California single-subject credential in another subject	12%	7%	8%	10%	13%	12%	20%

Data: EdSource Teacher Survey, Items T_49a_a–d EdSource 2/11
N-size indicates total number of **teachers** responding within a given sample of schools.

The credentials reported differ by school grade configuration. (See Figure B-1.)

- Among K–8 schools, more than 80% of middle grades mathematics teachers reported holding a multiple-subject credential. Single-subject credentials in mathematics were rare, especially among teachers who worked in K–8 schools in the 20th–35th percentile SCI band.
- Among 7–8 schools, by contrast, slightly more than half of mathematics teachers reported holding a multiple-subject credential, and more than 40% reported holding a single-subject credential in mathematics.
- Schools with a 6–8 grade configuration occupied a middle ground between K–8 and 7–8 schools. More than two-thirds of mathematics teachers in these schools reported holding a multiple-subject credential, and more than one-quarter reported holding a single-subject credential in mathematics.

In addition, 6th grade mathematics teachers stand out from 7th and 8th grade mathematics teachers with respect to their credentials.[43] Altogether, 87% of 6th grade mathematics teachers in the sample reported holding a multiple-subject credential, compared with 58% of 7th grade mathematics teachers and 54% of 8th grade mathematics teachers. Eighth grade mathematics teachers who taught a full Algebra I course[44] reported holding a single-subject credential in mathematics in the greatest proportion (50%).

[43] These groups of teachers are not mutually exclusive; some may have taught mathematics at multiple grade levels.

[44] "Algebra I teachers" are defined here as those who (a) reported teaching mathematics in grade 8 and (b) reported teaching Algebra I as a one-year course or as an honors course. Teachers who taught only the first year of a two-year Algebra I course are not included.

How did charter schools in the sample compare with respect to the credentials of middle grades mathematics teachers?

The sample included 28 charter schools. In all, 105 teachers who taught middle grades mathematics in these charter schools reported on the teaching credentials they hold.

Among middle grades mathematics teachers in the sample:

- 71% in charter schools reported holding a multiple-subject credential, compared with 66% in noncharter schools.
- 23% in charter schools reported holding a single-subject credential in mathematics, compared with 31% in noncharter schools.
- A single mathematics teacher at a single charter school reported holding a single-subject credential in English language arts, compared with nearly 3% in noncharter schools. In addition, 11% in charter schools reported holding a single-subject credential in another subject, compared with 12% in noncharter schools.

Technical Appendix

Study analysis

This appendix provides an overview of the data and methodology used to conduct the descriptive and regression analyses included in Chapters Four and Five of the report.

Chapter Four - Math Placement Practices in California Middle Grades

Chapter Four of the report documents the results of several descriptive analyses related to the placement of students in 8th Grade Algebra I. The first of these investigated the different combinations of middle grades mathematics coursework taken moving from 7th to 8th grade. To facilitate this analysis, we made use of a special restricted-use dataset provided upon request from the California Department of Education (CDE) that included four years (from 2005–06 through 2008–09) of student-level California Standards Test (CST) achievement data for pupils in the middle grades (6th, 7th, or 8th grade in 2008–09).[45]

The mathematics CSTs taken by students as 7th graders in 2008 and as 8th graders in 2009 were taken as proxies for the courses they had completed in those respective school years. Using the tests taken in 2008 and in 2009 by students in the school sample who were in the 8th grade in 2009, the dataset was limited to those pupils with the four most prevalent paths:

- Grade 7 Mathematics CST to Grade 8 General Mathematics CST.
- Grade 7 Mathematics CST to Grade 8 Algebra I CST.
- Grade 7 Algebra I CST to Grade 8 Algebra I CST.
- Grade 7 Algebra I CST to Grade 8 Geometry CST.

The four course combinations are highlighted in Figure A on the next page, which shows that approximately 94% of 8th graders in our sample were included in these paths.

A series of tabulations was run calculating the proportion of students in each of the four paths using the full sample, as well as breaking the data up into sub-samples according to student background and school characteristics as follows:

- Student Background Characteristics
  - Gender
  - National School Lunch Program Status
  - English Learner Status
  - Parental Education
    - Not High School Graduate
    - High School Graduate or Some College
    - College Graduate or Higher

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[45] Achievement outcomes included English Language Arts (ELA) and mathematics mean scaled scores on the tests included in California's Standardized Testing and Reporting (STAR) program. A more in-depth description of this data can be found in Appendix A (section "*Constructing Longitudinal Outcome Variables*") of Williams, Kirst, Haertel, *et al.* (2010).

Figure A: Number and Proportion of 8th Grade Students by Math Test Taken in Grades 7 and 8 (2007–08 and 2008–09)					
	8th Grade Math Test Taken in 2008–09				
7th Grade Math Test Taken in 2007–08	**Grade 8 General Mathematics CST**	**Grade 8 Algebra I CST**	**Grade 8 Geometry CST**	**Other**	**Total**
Grade 7 Mathematics CST	26,984 33.96	42,679 53.72	97 0.12	29 0.04	69,789 87.84
Grade 7 Algebra I CST	47 0.06	1,158 1.46	3,613 4.55	27 0.03	4,845 6.10
Other	112 0.14	81 0.10	1 0.00	0 0.00	194 0.24
Missing Value	2,337 2.94	2,242 2.82	44 0.06	1 0.00	4,624 5.82
Total	29,480 37.10	46,160 58.10	3,755 4.73	57 0.07	79,452 100.00

Data: California Department of Education, restricted-use longitudinal research file EdSource 2/11
Each cell contains total number and proportion of students for specific 7th/8th grade math test combination. Highlighted cells indicate sample used for report analyses.

- Ethnicity
    - African American
    - Asian
    - Hispanic
    - White or Other
- School Characteristics
    - Student Characteristics Index (SCI) Band[46]
        - 20th to 35th Percentile SCI Band
        - 70th to 85th Percentile SCI Band
    - Charter Status
    - Grade Configuration
        - Kindergarten through 8th Grade
        - 6th through 8th Grade
        - 7th and 8th Grade
    - Program Improvement Status

The results of these tabulations were used to construct the column charts in Chapter Four (Figures 4.1, 4.5a, 4.6a, 4.7a) and Appendix A (Figures A-1, A-3).

[46] The School Characteristic Index (SCI) is a mechanism designed to measure the challenges faced by schools due to the level of student need, teacher capacity, and school context. The SCI is used by the CDE to identify similar schools (with respect to need) to compare outcomes. (For more on the derivation of the index, see California Department of Education, 2009b.)

A second descriptive analysis investigated the proportion of 8th grade students placed in Algebra (i.e., taking the Algebra I CST) conditional on 7th grade test score performance. To simplify the analysis the sample was further limited to just the two most prevalent paths, namely those that included Grade 7 Mathematics CST (accounting for approximately 88% of 8th graders in our sample):

- Grade 7 Mathematics CST to Grade 8 General Mathematics CST.
- Grade 7 Mathematics CST to Grade 8 Algebra I CST.

Next, each student in the sub-sample was grouped into a test bracket category according to their mean scale score on the Grade 7 Mathematics CST as shown in the third (or middle) column of Figure B.

Figure B: Definitions of CST achievement level brackets

Five State-Defined CST Performance Levels	Seven Performance Levels Considered In Chapter Four	Scale Score Ranges		
		Grade 7 Mathematics CST (2008)	General Mathematics CST (2009)	Algebra I CST (2009)
Far Below Basic	**Far Below Basic**	150–256	150–256	150–252
Below Basic	**Below Basic**	257–299	257–299	253–299
Basic	**Low-Basic**	300–324	300–324	300–324
	High-Basic	325–349	325–349	325–349
Proficient	**Low-Proficient**	350–374	350–374	350–374
	High-Proficient	375–413	375–413	375–427
Advanced	**Advanced**	414–600	414–600	428–600

EdSource 2/11

Using the sub-sample of students in the two paths listed above, the proportion of 8th graders placed in Algebra (i.e., taking the Algebra I CST) within each of the listed Grade 7 test brackets was calculated. Further breakouts were calculated for each of the Grade 7 Mathematics CST sub-samples defined by the student and school characteristics listed above. The results of these conditional proportions were used to construct plotted charts in Chapter Four (Figures 4.3, 4.5b, 4.6b, 4.7b) and Appendix A (Figures A-2, A-4).

A third analysis was performed to track how performance on the Grade 7 Mathematics CST was related to later performance on the Grade 8 General Mathematics CST or Grade 8 Algebra I CST. Similar test brackets were created for the two 8th grade tests as defined in columns four and five of Figure B. For each of the two 8th grade tests, tabulations were run of the total counts and proportions of students by 7th versus 8th grade test bracket, the results of which were used to construct Figure 4.4 in Chapter Four.

Chapter Five – Practices and Policies Correlating with 8th Grade Math Achievement

Chapter Five reports the results of an extensive regression analysis designed to identify those practices and policies that are significantly correlated with 8th grade math achievement. The regression analysis again specifically focused on the sample of students with the two most prevalent math test paths (Grade 7 Mathematics CST to Grade 8 General Mathematics CST and Grade 7 Mathematics CST to Grade 8 Algebra I CST).

Regression Specification – The general specification of the final regressions that were run is as follows:

$$Y_s = \alpha + \mathrm{B}X_s + \Phi S_s + \gamma d_s + \delta p_s + \varepsilon_s$$

where,

Y = School average mean scale score on the mathematics test of interest.

X = Matrix of baseline variables related to student background and school characteristics.

S = Matrix of variables measuring the *sensitivity* and *stringency* of school placement of 8th graders into algebra.

d = Subdomain composite variable measuring school practice not directly related to, but nonetheless found to be significantly correlated with, one of the two mathematics tests of interest.

p = Individual school policy or practice thought to be related to performance on the mathematics test of interest.

ε = Random error term assumed to be independently and identically distributed.

The subscript s denotes an index of schools in our sample. Coefficients α, γ, and δ reflect individual coefficients specific to the model intercept, d and p, respectively, while B and Φ denote vectors of coefficients specific to the baseline variables and placement sensitivity/stringency controls. We next briefly discuss each type of control variable used in the model.

Outcomes – The mathematics tests of interest are the Grade 8 General Mathematics CST and Grade 8 Algebra I CST. Note that the regression analysis made use of "longitudinal" school-level averages of the individual student mean scale mathematics test scores, which were adjusted by controlling for the prior three years of performance.[47] Specifically, the outcome measures used in these analyses were residuals of 8th graders' school-level CST outcomes on the General Mathematics CST and the Algebra I CST, after controlling for up to three years of prior student achievement. Using the restricted-use data file from CDE that contained student-level CST achievement data for middle grades pupils (those in 6th, 7th, or 8th grade in 2008–09), the following steps were performed:

- Predicted scores were calculated for each 8th grader based upon regressions of 2009 mean scale score on up to three years of prior CST scores in mathematics.

[47] The research team requested a set of restricted-use, student-level data files from the California Department of Education in order to construct these outcome variables. For further discussion, see Williams, Kirst, Haertel, *et al.* (2010)—section "*Constructing Longitudinal Outcome Variables*" in Appendix A.

- From the predicted and observed mean scale scores a residual (i.e., *observed* minus *predicted* score) for each student was then calculated. The residualized score represents 8th grade mathematics achievement that is purged of up to three years of prior performance.
- The residualized scores were then averaged across all students at each school to provide a school-level "longitudinal" measure of achievement.
- This was done separately for 8th graders taking the General Mathematics CST versus the Algebra I CST in 2009 to create the dependent variables for these analyses.

Baseline Controls – To control for differences in achievement that could be explained by school-level student and school background characteristics, the following set of baseline control variables were included in all estimated models:[48]

- Student Characteristics
  - Percent of Socioeconomically Disadvantaged
  - Percent English Learners
  - Ethnicity
    - Percent African American
    - Percent Asian
    - Percent Filipino
    - Percent Hispanic
    - Percent White (Omitted Reference Category)
  - Parental Education
    - Percent Parents Not Graduating High School (Omitted Reference Category)
    - Percent Parents Graduating High School or With Some College
    - Percent Parents Graduating College or Higher
- School Characteristics
  - Average Cohort Size of 7th and 8th Graders
  - SCI Band
    - 20th to 35th Percentile SCI Band (Omitted Reference Category)
    - 70th to 85th Percentile SCI Band
  - Grade Configuration
    - Kindergarten through 8th Grade
    - 6th through 8th Grade (Omitted Reference Category)
    - 7th and 8th Grade

Selectivity and Stringency – In an attempt to control for the selectivity with which schools place 8th graders into Algebra I—again, as defined by an 8th grader taking the Algebra I CST rather than the General Mathematics CST—the analysis also explored the inclusion of the absolute probability of placement in 8th grade Algebra I, as well as several different control variables designed to measure the strength of the relationship between prior achievement (on the Grade 7 Mathematics CST) and the probability of being placed into 8th grade Algebra I. The introduced variables strive to measure this relationship through concepts we term *sensitivity* and *stringency*.

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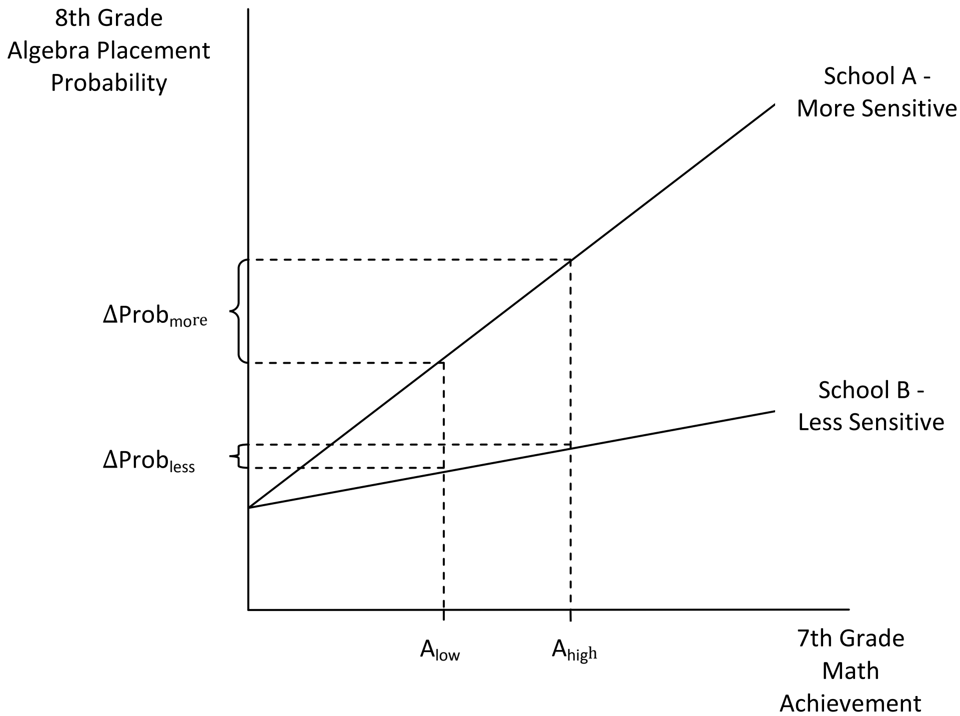
[48] Data sources for the baseline control variables are documented in Williams, Kirst, Haertel, *et al.* (2010)—section "*Constructing Files for Data Analysis*" in Appendix A.

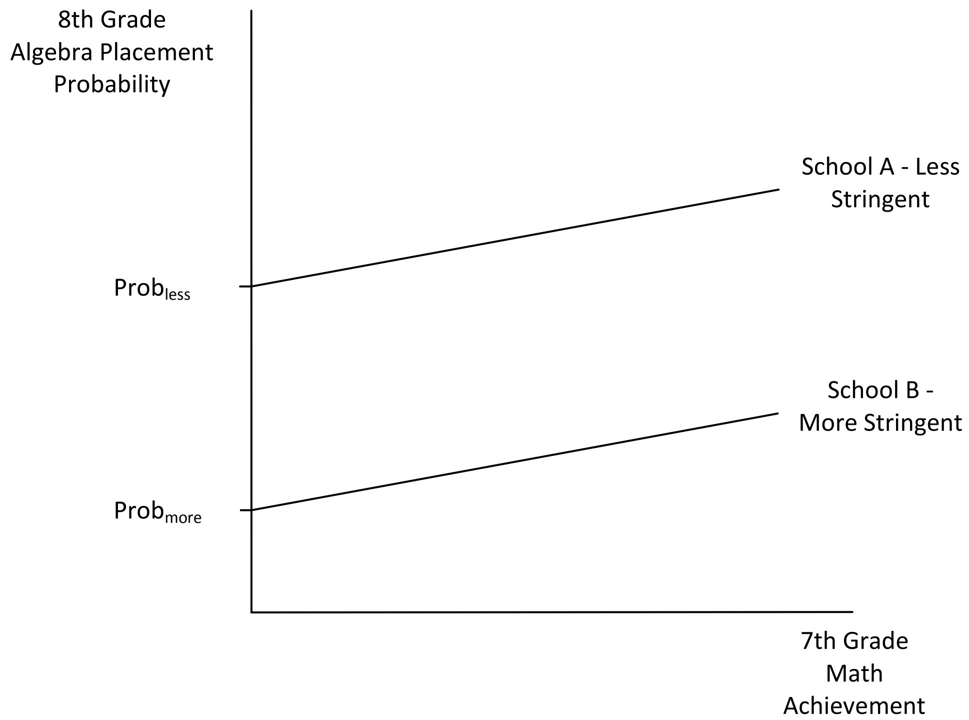
Sensitivity is a measure that describes the marginal responsiveness of school 8th grade algebra placement to prior 7th grade math achievement. Consider the example in Figure C showing the expected relationship between 7th grade mathematics achievement and the probability of being placed in Algebra I in 8th grade for hypothetical schools A and B that are relatively more and less sensitive, respectively. Next, compare the expected probability of being placed in Algebra I given an increase in grade 7 achievement (depicted by the move from A_{low} to A_{high}). The increase in expected probability associated with the more sensitive school (School A) is far greater than that of its less sensitive counterpart. The example shows that algebra placement in School A is far more responsive (i.e., sensitive) to prior math achievement compared with School B.

Figure C: Graphical Representation of Placement Sensitivity



Whereas sensitivity is a measure of the marginal responsiveness of expected Algebra I placement to prior math achievement, stringency describes the overall level of the relationship. Figure D demonstrates this by depicting the relationship for schools that are equally sensitive, but exhibit lower (School A) and higher (School B) stringency measures. Irrespective of the level of sensitivity, the more stringent school has a lower expected Algebra I placement probability, which is reflected in differences in the y-axis intercepts ($Prob_{less}$ and $Prob_{more}$).

Figure D: Graphical Representation of Algebra Placement Stringency



The additional school-level sensitivity and stringency measures that were explored for use as baseline controls included:

- Sensitivity Measures
  - Within-school point biserial correlation between 8th grade Algebra I placement indicator and 7th grade math test score.
  - Within-school biserial correlation between 8th grade Algebra I placement indicator and 7th grade math test score.
  - Conditional proportions of students placed in Algebra I for each 7th grade test bracket.[49]
  - Linear combination of conditional proportions of 8th grade Algebra I placement (conditional on 7th grade math test score).[50]
- Stringency Measure
  - Unconditional overall proportion of 8th grade Algebra I takers.

Clearly, the various sensitivity and stringency measures might overlap with respect to the variation each explains in the two outcome variables of interest (Grade 8 General Mathematics CST and Grade 8 Algebra I CST). In order to determine a final set of sensitivity/stringency variables to be added to the baseline set of controls, we made use of a forward stepwise regression technique. The regression procedure was performed separately for each of the two outcomes using first only the sensitivity variables, followed by just the stringency measure, and finally both types of controls. The final set of sensitivity/stringency measures added to the baseline controls used in all regressions run was as follows:

- Sensitivity – Conditional proportions of 8th graders placed in Algebra I within the following Grade 7 Mathematics CST test performance brackets:
  - Low-Basic – 300 <= Mean Scaled Score <= 324
  - High-Basic – 325 <= Mean Scaled Score <= 349
  - Low-Proficient – 350 <= Mean Scaled Score <= 374
- Stringency – Unconditional overall proportion of 8th grade Algebra I takers.

Subdomain Composite Variable Controls – The original *Gaining Ground in the Middle Grades* research report provided significant results concerning the two 8th grade mathematics outcomes of interest that did not pertain directly to mathematics policy and practice. Therefore, in order to explain additional variation in the outcomes above and beyond what the baseline and sensitivity/stringency controls account for, this analysis tested a limited set of composite variable subdomains[51] not directly related to mathematics policy and practice, but which nevertheless had proved to be significantly correlated with

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[49] The seven test brackets of Grade 7 CST Mathematics are defined in the first column of Figure B, above.

[50] The linear combination was created by summing a calculated series of linear contrasts across conditional placement proportions for each school. The formulas used to calculate the linear contrasts were specific to the pattern of test brackets with non-zero proportions. These are available upon request from the authors.

[51] Composite variable subdomains are collections of combined survey items measuring a common concept or practice. A detailed account of how these were created can be found in Williams, Kirst, Haertel, *et al.* (2010)—section "*Constructing Composite Independent Variables (Subdomains)*" in Appendix A.

a grade 8 mathematics outcome in the analysis performed for the original report. An initial set of five subdomain composite variables from the initial study were chosen and subject to a forward stepwise regression procedure, with the baseline and sensitivity/stringency controls mentioned above locked in (i.e., forced into the equation). In the end, only one of the five candidate subdomain composite variables was retained and added to the collection of controls to be used for the Grade 8 Algebra I CST outcome regressions.

Final Regressions – For each mathematics outcome, final regression models were run that incorporated all of the control variables listed above (i.e., the baseline controls, sensitivity/stringency measures, and one additional subdomain composite variable), as well as a single variable representing a given policy or practice or area of policy or practice as measured by individual principal, teacher or superintendent survey items or subdomain composite variables derived from multiple survey items.[52] The particular policies and practices of interest captured by the individual survey items and subdomain composite variables were chosen as follows:

- **Survey Items –** The survey items included in this analysis were either mathematics-related (e.g., math teachers' responses regarding alignment of their instruction with California's academic content standards) or represented areas of practice and policy the research team hypothesized might contribute to higher student outcomes (e.g., items related to assessment, use of data, and interventions and instructional support for students). Survey items for which there was no or virtually no variation in responses and teacher survey items with low reliability were excluded from consideration. Specifically, we evaluated the intraclass correlation and school-level reliability for each teacher survey item. Those exhibiting low between-school variation relative to within-school variation were omitted from the analysis. This determination was based on the school-level reliability coefficient calculated from the intraclass correlation; items for which the school-level reliability was less than 0.25 were dropped from further consideration. In all, 104 individual survey items—or, in a few cases, individual variables derived from survey responses—were considered.
- **Composite Subdomains –** Composite subdomain variables chosen for this analysis were those reported in the original *Gaining Ground in the Middle Grades* study as correlating with higher school-level achievement *in general*, using longitudinal outcomes. Subdomains whose content focused on English language arts—e.g., pertaining to the use of English language arts curricula—were excluded. The goal of this analysis was to see which of these practice areas correlate most strongly with school-level *grade 8 mathematics achievement in particular*.

In all, separate regressions for each of 104 individual survey items and 75 subdomains were run for each of the two mathematics outcomes (for a total of 358 regressions).

[52] It should be noted that to derive school-level measures of the teacher survey items, teacher responses on each item were averaged to the school-level based only on instructors that taught math. In a similar vein, the subdomain composite variables made up of teacher survey items were also based upon these school-level averages of mathematics teacher survey responses. Further discussion of how the subdomain composite variables were created can be found in Williams, Kirst, Haertel, *et al.* (2010) (see section "*Constructing Composite Independent Variables (Subdomains)*" in Appendix A).

Running such a large number of inferential tests increases the risk of obtaining statistically significant results merely by chance (increasing what is commonly referred to as the Experimentwise Type I Error Rate). To this end, our analysis drew upon a procedure developed in Benjamini and Hochberg (1995) that takes into account the potential danger of drawing false significant findings in the face of multiple inferences (also known as the *multiplicity effect*). Application of the method produces a graduated critical value against which to compare the order statistics of the regression coefficient p-values. This procedure controls the *False Discovery Rate*, which is the expected value of the proportion of Type I errors, as opposed to the more conservative Experimentwise Type I Error Rate, which refers to the probability of making at least one Type I error.[53] For this application, because all hypotheses were directional, p-values corresponding to one-tailed tests were used.

Figure E shows that after applying the procedure, 10 survey items (six each for the Grade 8 General Mathematics and Grade 8 Algebra I outcomes, which includes two items common to both) and eight subdomain composite variables (two for Grade 8 General Mathematics and seven for Grade 8 Algebra I, which includes one item common to both) proved to be significant. Figures F and G provide descriptions of the individual survey items that proved significant, as well as those survey items that made up the significant composite subdomain variables.

Another set of regressions was run where each of these significant policy/practice variables was interacted with the SCI band indicator to test whether a significant differential relationship existed between the 20th–35th percentile and 70th–85th percentile SCI band schools. The results of this analysis showed that there was no significant SCI band difference in any of the estimated relationships.

Finally, in order to inform the narrative description of significant *subdomains* in Chapter Five, additional regressions were run on each constituent item within each significant subdomain to determine which constituent items most clearly differentiated higher from lower school performance on the relevant CST outcome. In effect, these analyses clarified which constituent items appeared to contribute most strongly to the predictive power of each significant subdomain. The narrative descriptions of each subdomain finding in Chapter Five, and in Figures F and G that follow, include only those constituent items found to be statistically significant in these final regressions.

[53] The reader is also referred to Thissen, Steinberg, and Kuang (2002) for a less technical discussion of the procedure.

Figure E: Summary of Significant Survey Items and Subdomain Composite Variables from Regression Analysis

	Grade 8 General Math					Grade 8 Algebra I				
	Survey Item	**Coefficient**	**Std. Error**	**P-Value**	**Benjamini-Hochberg Critical Value**	**Survey Item**	**Coefficient**	**Std. Error**	**P-Value**	**Benjamini-Hochberg Critical Value**
Survey Items	t_29e	3.461	1.148	0.0014	0.0029	t_10h	5.946	2.127	0.0028	0.0029
	p_37c	2.653	0.866	0.0012	0.0024	t_10d	7.607	2.464	0.0011	0.0024
	t_31c	4.122	1.315	0.0010	0.0019	t_12c	7.022	2.258	0.0010	0.0019
	t_39g	3.749	1.159	0.0007	0.0014	p_37c	4.841	1.459	0.0005	0.0014
	p_19g	3.101	0.909	0.0004	0.0010	p_11i	5.435	1.467	0.0001	0.0010
	t_10d	5.338	1.427	0.0001	0.0005	p_53k	4.987	1.342	0.0001	0.0005
	Subdomain	**Coefficient**	**Std. Error**	**P-Value**	**Benjamini-Hochberg Critical Value**	**Subdomain**	**Coefficient**	**Std. Error**	**P-Value**	**Benjamini-Hochberg Critical Value**
Subdomain Composite Variables	Psb6_P1a	2.616	0.799	0.0006	0.0013	Tsb3_T10	3.640	1.391	0.0047	0.0047
	Tsb3_T3	2.987	0.849	0.0003	0.0007	Tsb3_T3	4.217	1.444	0.0019	0.0040
						Psb5_P8	3.881	1.324	0.0018	0.0033
						Tsb5_T8a	4.446	1.516	0.0018	0.0027
						Psb3_P3	4.161	1.343	0.0011	0.0020
						Psb7_P5	4.745	1.341	0.0002	0.0013
						Ssb6_S9	5.298	1.450	0.0002	0.0007

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Figure F: Significant Survey Items and Subdomain Composite Variable from Regression Analysis, Differentiating Higher School-Level Achievement on the General Mathematics CST (Taken by 8th Graders)	
Survey Items	**Content**
t_29e	*Regarding grade 7 and 8 mathematics courses (General Math) to what extent is each of the following considered for determining student placement?* Student CST scores.
p_37c	*To what extent do you agree with the following about your school's overall ELA and math instruction?* Our school emphasizes select key standards at each grade and in each core subject.
t_31c	*To what extent do you agree with the following?* Our school emphasizes selected key standards that teachers prioritize at each grade level.
t_39g	*Overall, to what extent do teachers in your school collaborate to do the following?* Analyze student assessment data to identify effective instructional practices.
p_19g	*With regard to your use of assessment data, to what extent do you do the following?* I meet with English and/or math teachers by department to review CST results, including subgroups.
t_10d	*How much do you agree with the following statements?* Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced").
Subdomains	**Content**
Psb6_P1a	**The principal reported that she/he meets more frequently with teachers individually, with grade-level teachers, and with English and/or mathematics teachers by department to review CST results (including subgroups), and meets more frequently with the entire school staff to review schoolwide CST scores. (5 items)** *With regard to your use of assessment data, to what extent do you do the following?* ○ (p_19a) I meet with individual teachers to review CST results, including subgroups. ○ (p_19d) I meet with grade level teachers to review grade level CST results, including subgroups. ○ (p_19g) I meet with English and/or math teachers by department to review CST results, including subgroups. ○ (p_19j) I meet with other school administrators to review schoolwide CST scores. ○ (p_19m) I meet with the entire school staff to review schoolwide CST scores.
Tsb3_T3	**Mathematics teachers agreed more strongly that the school emphasizes improving achievement across all the CST performance levels (from *Far Below Basic* through *Advanced*) and sets measurable goals for CST scores by grade level and subject area. (2 items)** *How much do you agree with the following statements?* ○ (t_10d) Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced"). ○ (t_10g) Our school sets measurable goals for CST scores by grade level and subject area.

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Figure G: Significant Survey Items and Subdomain Composite Variable from Regression Analysis, Differentiating Higher School-Level Achievement on the Algebra I CST (Taken by 8th Graders)	
Survey Items	**Content**
t_10h	*How much do you agree with the following statements?* Our school sets measurable goals to increase the number of students prepared to succeed in Algebra I.
t_10d	*How much do you agree with the following statements?* Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced").
t_12c	*Related to students leaving your middle grades to enter high school, to what extent are your school's instruction and curriculum designed to:* Prepare all students to leave the middle grades ready to begin taking courses required for UC/CSU eligibility ("A-G" courses).
p_37c	*To what extent do you agree with the following about your school's overall ELA and math instruction?* Our school emphasizes select key standards at each grade and in each core subject.
p_11i	*To what extent do you agree with each of the following statements?* Our school sets measurable goals to increase the proportion of students that score proficient or advanced on the Algebra I CST.
p_53k	*To what extent do you agree with the following statements? Your school district:* Addresses the needs of students who are two or more years below grade level.
Subdomains	**Content**
Tsb3_T10	**Mathematics teachers reported that, to a greater extent, the school's instruction and curriculum are designed to prepare students for a rigorous high school curriculum, such as to leave the middle grades ready to begin taking courses required for University of California/California State University eligibility ("A-G" courses) and on track to pass the California High School Exit Exam (CAHSEE). (3 items)** *Related to students leaving your middle grades to enter high school, to what extent are your school's instruction and curriculum designed to:* ○ (t_12a) Prepare all students to leave the middle grades with strong foundational academic and study skills. ○ (t_12b) Prepare all students to leave the middle grades on track to pass the California High School Exit Exam (CAHSEE). ○ (t_12c) Prepare all students to leave the middle grades ready to begin taking courses required for UC/CSU eligibility ("A-G" courses).
Tsb3_T3	**Mathematics teachers agreed more strongly the school emphasizes improving achievement across all the CST performance levels (from Far Below Basic through Advanced) and sets measurable goals for CST scores by grade level and subject area. (2 items)** *How much do you agree with the following statements?* ○ (t_10d) Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced"). ○ (t_10g) Our school sets measurable goals for CST scores by grade level and subject area.

(Figure continued on next page.)

Figure G (continued): Significant Survey Items and Subdomain Composite Variable from Regression Analysis, Differentiating Higher School-Level Achievement on the Algebra I CST (Taken by 8th Graders)	
Psb5_P8	**The principal agreed more strongly that the school's English language arts and mathematics instruction is closely guided by state academic standards and emphasizes key standards in each grade and core subject. (4 items)** *To what extent do you agree with the following about your school's overall ELA and Math instruction?* ○ (p_37a) Classroom instruction is closely guided by state academic standards. ○ (p_37b) Classroom instruction is closely guided by state adopted textbooks/curriculum programs. ○ (p_37c) Our school emphasizes select key standards at each grade and in each core subject. ○ (p_37d) Instruction for EL students also takes into account state English Language Development (ELD) standards.
Tsb5_T8a	**Mathematics teachers agreed more strongly that they closely align instruction with the California academic content standards and CSTs and emphasize key standards, and reported more extensive collaboration to "break down" the state content standards (such as to identify prerequisite student skills). (4 items)** *To what extent do you agree with the following?* ○ (t_31a) Our school's teachers closely align instruction with the California academic content standards in mathematics. ○ (t_31b) Our school's teachers closely align instruction with the CSTs in mathematics. ○ (t_31c) Our school emphasizes selected key standards that teachers prioritize at each grade level. *Overall, to what extent do teachers in your school collaborate to do the following?* ○ (t_39c) Work together to "break down" the state content standards (e.g., identify prerequisite student skills).
Psb3_P3	**The principal agreed more strongly that the school emphasizes improving achievement across all the CST performance levels (from *Far Below Basic* through *Advanced*), and sets measurable goals by grade level and subject area. (2 items)** *To what extent do you agree with the following statements?* ○ (p_11d) Our school emphasizes improving student achievement across all the CST performance levels (from "Far Below Basic" through "Advanced"). ○ (p_11f) Our school sets measurable goals for CST scores by grade level and subject area.
Psb7_P5	**The principal agreed more strongly that the school district addresses the needs of students two or more years behind grade level and emphasizes early identification of students needing academic support. (2 items)** *Your school district:* ○ (p_53h) Emphasizes early identification of students needing academic support. ○ (p_53k) Addresses the needs of students who are two or more years below grade level.
Ssb6_S9	**The superintendent reported that the district allows middle grades schools to develop their own standards-aligned diagnostic assessments, determine the need for diagnostic assessments, and do their own analysis of student results. (3 items)** *Which of the following are true about your district or CMO role related to diagnostic and/or placement tests? (check all that apply)* ○ (s_09b) Our district allows schools to develop their own diagnostic assessments aligned with the state standards by grade and subject for the middle grades. ○ (s_09d) Our district allows educators in our middle grades to determine the need for diagnostic assessments. ○ (s_09f) Our district allows school staff to do their own analysis of the results of diagnostic student assessment data.

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