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

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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.

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 have been well-positioned for success in the course, many others clearly struggled in the course after struggling with math as 7th graders.

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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
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.

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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

<table>
<thead>
<tr>
<th>SCI Band</th>
<th>Far Below Basic</th>
<th>Below Basic</th>
<th>Low-Basic</th>
<th>High-Basic</th>
<th>Low-Proficient</th>
<th>High-Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>20th–35th SCI</td>
<td>2,797</td>
<td>8,819</td>
<td>6,113</td>
<td>5,715</td>
<td>4,925</td>
<td>4,449</td>
<td>2,886</td>
</tr>
<tr>
<td>70th–85th SCI</td>
<td>1,094</td>
<td>4,758</td>
<td>4,326</td>
<td>5,196</td>
<td>5,370</td>
<td>6,815</td>
<td>6,480</td>
</tr>
</tbody>
</table>

Data: California Department of Education, restricted-use longitudinal research file

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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.