

USING STANDARDIZED TEST DATA TO SUPPORT DECISIONS FOR PLACEMENT INTO 8TH GRADE ALGEBRA

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Background

In an effort to raise academic standards and close the achievement gap in mathematics, the 1998 California Mathematics Framework established algebra as mathematics content standards for 8th grade students. This caused many school districts in California to reevaluate its achievement expectations for all 8th grade students and to institute more aggressive local policies about placement of 8th graders into algebra. While data from the California Standards Test (CST) suggest that more students are successfully completing algebra (or higher¹) in 8th grade, it is also widely recognized that far too many students are still unsuccessful in algebra as 8th graders (see Table 1). As a result, one of the new features of the 2006 California Mathematics Framework is an explicit acknowledgement that all students may not be ready for algebra as 8th graders, along with a curriculum outline for an algebra readiness program for low achieving students.

Table 1:

Achievement of 8th Grade Students Who Took the Algebra (or higher) CST			
Year	% of the 8 th Grade Class	% who are score proficient or advanced on CST	% who score below basic or far below basic on CST
2003	34%	41%	42%
2004	41%	38%	34%
2005	48%	37%	35%
2006	50%	43%	34%

Most 8th grade students are placed into an algebra class or into a general mathematics class. This decision is typically made at the school level and guided by district policy. Therefore, analysis of CST achievement data across districts can give us insight into one indicator of academic success in algebra. This study aims to shed some light on the following questions:

- **What level of mathematics achievement is needed in 7th grade for success in algebra in the 8th grade?**
- **How can a school use CST data as an indicator of mathematical growth for 8th graders who take algebra or general mathematics?**

California has collected achievement data in mathematics using the CST for the past several years, and results are available for every school at <http://star.cde.ca.gov/>.

¹ About 2-3% of all 8th grade students take geometry. For the purposes of this analysis, achievement of these students will be aggregated with the students who take algebra.

School reports include the number of students who take various standards-based mathematics tests and the percentage of students who meet one of five different proficiency levels. These levels are advanced, proficient, basic, below basic, and far below basic. All 7th graders take a CST focused on California's 7th grade mathematics standards. 8th grade students who are on track to complete algebra take an algebra CST. 8th graders who have not completed a year of algebra take a general mathematics CST, which consists primarily of 7th grade mathematics standards.

For this study, the CST achievement scores of 7th grade students in 2005 were compared to the cohort's 8th grade achievement scores in 2006. Scores for 50 middle schools in the greater Los Angeles area were analyzed using a visual display that compared stacked bar graphs. Analysis of student cohorts made it possible to determine the class was making progress in mathematics from one year to the next. Comparisons across schools allowed for plausible generalizations about the effects of varied algebra placement policies.

An assumption and an unknown are worth noting at this point. First, although we recognize that schools do not place students into algebra based on 7th grade CST scores (in fact, these scores are not even available for this purpose), we will assume that the more proficient students in 7th grade took the algebra CST while the less proficient students took the general math CST. Second, we acknowledge that CST data provides no information about the curriculum provided to the students (an important study for another time), which is quite varied from school to school. To complicate matters further, a recent legal ruling now requires that 8th grade students be assigned a grade level (algebra) textbook. How much teachers use those algebra books in classes where students take the general mathematics CST is generally unknown.

Using Stacked Bar Graphs to Compare Data: A Look at California's 8th Graders

The stacked bar graphs in *Figure 1* compare achievement of 7th graders in 2005 to achievement of 8th graders in 2006 for all of California. We will use these graphs to explain some of the information that can be extracted from them and to get a sense of California's typical algebra placement pattern.

Figure 1: Achievement of the 8th Grade Class of 2006 State of California

Figure 1 includes four bars. The top bar gives achievement data for the 7th grade, showing the percentage of students who met various proficiency levels in 2005. Here we see that about 37% of all 7th graders scored proficient or advanced on the 2005 CST. In 8th grade, students may take the algebra CST² (represented by the third bar), or they may take a general mathematics CST (represented by the 4th bar). The assumption that more proficient 7th graders took the algebra CST, while the less proficient 7th graders took the general mathematics test is evident in the layout of bars 3

² Once again, note that geometry CST scores (2-3% of all 8th graders) are combined with algebra scores for purpose of this analysis.

and 4: a portion of each bar is blank, and the sum of the two bars is 100%. The bar just below the 7th grade bar (bar 2) represents the aggregated achievement scores for all 8th grades. For example, about 13% of the 8th students were proficient in algebra (bar 3) and about 10% of students were proficient in general mathematics (bar 4). Therefore bar 2 shows that 23% of all 8th grade students were proficient in the math class they took.

From *Figure 1*, we see that about 50% of all students took algebra. This group includes about half of the students who scored basic, along with the students who scored proficient, or advanced in 7th grade. Note that although California policies established strong incentives for schools to make algebra its curriculum, still about half of all students in 8th grade took the general mathematics test. Furthermore, a comparison of bar 1 and bar 2 reveals that the overall percentage of students scoring below basic (or far below basic) increased while the percentage of students scoring proficient or advanced decreased. In other words, if the course taken by 8th graders is not considered a factor, the overall proficiency levels of students in California decreased from 7th grade to 8th grade in 2006.

A Closer Look at Some Schools

For this study, profiles for more than 50 schools in Los Angeles County representing 10 different school districts were created and reviewed. Schools were not selected randomly; rather, they were selected because it was known that they represented a variety of policies for placement in algebra and range of achievement levels on the academic performance index (API). Once stacked bar graph profiles were created, the schools were sorted into three categories based on the minimum level of achievement of 7th graders who took the algebra CST:

- (1) Aggressive algebra placement (minimum 7th grade CST score is far below basic or below basic)
- (2) Typical algebra placement (minimum 7th grade CST score is basic)
- (3) Conservative algebra placement (minimum 7th grade CST score is proficient)

Examples are used here to illustrate some observations and generalizations.

(1) Aggressive Algebra Placement (when compared to State Data)

Figure 2: Achievement of the 8th Grade Class of 2006

School A: API = 5

Figure 3: Achievement of the 8th Grade Class of 2006

School B: API = 2

Schools that aggressively place students into algebra enroll all (or almost all) 8th graders in algebra, regardless of their achievement in 7th grade. The profiles for School A and School B illustrate aggressive placement in algebra. Both schools happen to serve low

income students and large populations of second language learners. School #1 taught all 8th graders Algebra 1 in 2006. School #2 placed all its students in an algebra course in 2006, although some of them did not finish the course.

The profiles for Schools A and B illustrate that aggressive algebra placement policies were problematic because fewer students scored in the proficient range in 8th grade than in 7th grade. The profile for school B does suggest some success in general mathematics where the percentage of students who scored far below basic decreased by more than 50%.

(2) Typical Algebra Placement (when compared to State Data)

Figure 4: Achievement of the 8th Grade Class of 2006

School C: API = 4

Figure 5: Achievement of the 8th Grade Class of 2006

School D: API = 6

Figure 6: Achievement of the 8th Grade Class of 2006

School E: API = 8

Aggregated California data showed that the typical minimum proficiency level of 7th graders taking algebra was basic. The profiles for School C (API = 4), School D (API = 6), and School E (API = 8) are similar to the state profile in this regard.

The profiles for Schools B, C, and D illustrate varied success among students who take algebra with a basic competency in 7th grade math. By comparing bar 1 and bar 2, we see that both School C and E increased the total percentage of students who scored proficient or advanced, which means that some of the students who scored basic in 7th grade improved their overall level of achievement. However, in School C, not all of the proficient 7th graders remained proficient in algebra. Furthermore, it appears that most of the students who entered algebra with basic competency in 7th grade either scored at the basic level or dropped to below basic or far below basic on the algebra test.

All three of these schools offered a general mathematics course to students who were not ready for algebra. Turning to the general mathematics bars, we see that, except for the far below basic students in school C, the lower achieving students are showing improvement in general mathematics.

These findings not only suggest that proficiency in 7th grade mathematics is an important indicator for success in algebra, but they also suggest most students who are scoring at the basic level or below will benefit from a course in general mathematics in the 8th grade.

(3) Conservative Algebra Placement (when compared to State Data)

Figure 7: Achievement of the 8th Grade Class of 2006
School F: API = 5

Figure 8: Achievement of the 8th Grade Class of 2006
School G: API = 9

School F (API = 5) and School G limited enrollment into 8th grade algebra to students who scored proficient or higher. Here we see that most (but not all!) of the students continued to score proficient higher in mathematics.

The scores in general mathematics reveal that the proficiency in general mathematics is improving. However, very few students who were proficient in 7th grade math showed growth, and the program at School F does not seem to be benefiting the students who are far below basic.

These findings are consistent with the profiles in (2) above. Furthermore, these findings suggest that students who are proficient in 7th grade math may have little to gain from an 8th grade general mathematics course.

A Closer Look At Some High Achieving Schools: What Can We Learn?

Figure 9: Achievement of the 8th Grade Class of 2006
School H: API = 10

Figure 10: Achievement of the 8th Grade Class of 2006
School K: API = 10

Although high achieving schools have more students who scored proficient or advanced in 7th grade, they generally took a conservative approach to algebra placement. Both School H and K limited the students who took algebra to those who were proficient in 7th grade mathematics.

It is of interest to note that in spite of the incentives established by the State for schools to make algebra its 8th grade course, high achieving schools continue to offer general mathematics to large numbers of students. Profiles of high achieving schools seems to indicate that the districts are more interested in having individual students score proficient or advanced in the courses they take than the percentage of students who take algebra. For example, School K is one of the highest achieving school districts in the state, yet it continues to place 25% of its 8th graders in a general mathematics class.

While the number of students scoring proficient for these schools is very high, achievement patterns are consistent with findings (2) and (3) above. That is:

- Students who scored proficient or higher in algebra were proficient in 7th grade mathematics
- It was not very likely that students who scored proficient in 7th grade showed growth in an 8th grade general mathematics course.
- Students who scored at the basic level or below in 7th grade mathematics can benefit from a course in general mathematics in the 8th grade.
- Reducing the number of students who score basic or below by 50% in one year seems to be a very good and achievable result.

Summary

What level of mathematics achievement is needed in 7th grade for success in algebra in the 8th grade? Analysis of school profiles strongly suggests that proficiency in 7th grade mathematics is an important indicator of success in 8th grade algebra. Furthermore, profiles showed that while some successful algebra students scored at a basic level in 7th grade math, it is more likely that students who score in the basic range or below will benefit from a general mathematics course in 8th grade.

How can a school use CST data as an indicator of mathematical growth for 8th graders who take algebra or general mathematics? Schools where students are growing mathematically reduce the number of students from year-to-year who score basic, below basic, and far below basic, while increasing the number of students who are scoring at the proficient or advanced levels. Creating stacked bar graph displays using CST data, such as the ones included in this study, give school decision makers a visual tool for assessing the effectiveness of math programs and enrollment policies.

Note from the author: The template used to analyze CST data for this study was created using an EXCEL spreadsheet. Schools who wish to analyze their own CST data may download the template at www.introtoalg.org.