Rethinking Math Course Sequences under the Common Core State Standards

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Background

- With increasing information available on what constitutes college and career readiness, accountability systems might be able to include relevant information on students' course progression patterns.
- Not coincidentally, the implementation of the Common Core State Standards in Math (CCSSM) requires rethinking not only course content, but also course sequencing.
- Research base on course-taking patterns is substantial and the data is available to support analysis.

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2012 Study of Math Course Sequences

- Links students over time
- Students were 7th graders in 2004/05, and expected to be 12th graders in 2009/10
- In this analysis we only include students who were enrolled in the same district in each of the years from 2004/05 to 2009/10 (stable students)
- Dataset contains over 24,000 students in 24 districts
- Wide variety of districts based on geographic location, size, urbanicity, student demographics, academic achievement, etc.

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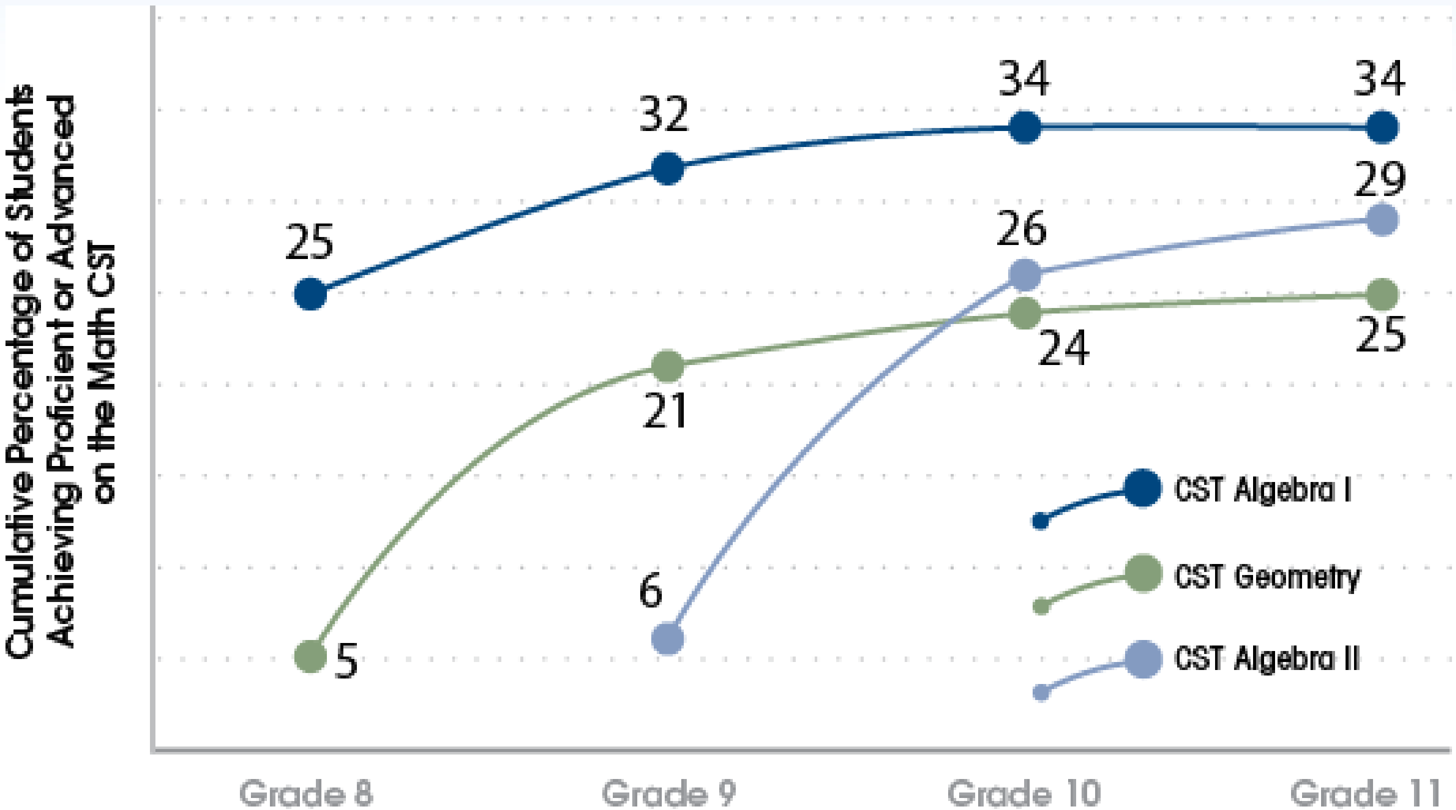
Cumulative percentage of students achieving Proficient or Advanced on the math CST



This chart shows the patterns by which students reach the proficient or advanced level in Algebra 1, Geometry, and Algebra II as measured by the California Standards Test (CST), by their grade in school. For those students who do not reach these levels the first time they take the CST, only a small proportion reach these levels by taking the CST multiple times.

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Math Trajectory

1 3 4 5 7 -
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Math Course Rankings

Rank	Description
0	Independent Study
1	Basic Math (Math 7, Foundations, CAHSEE Prep, etc)
2	Pre-Algebra
3	Algebra
4	Geometry
5	Intermediate Algebra/Algebra II
6	Statistics/Finite/Discrete
7	Pre-calculus/Math Analysis/Trigonometry
8	Calculus
9	Linear Algebra

Math course-taking patterns

	Sequence	Percentage of Students	Cumulative Percentage of Students
1.	134578	3.30	3.30
2.	134576	2.52	5.82
3.	234578	2.47	8.30
4.	23345-	2.08	10.38
5.	234577	1.68	12.06
6.	13457-	1.65	13.72
7.	234576	1.64	15.35
8.	13345-	1.48	16.84
9.	133457	1.46	18.30
10.	233457	1.44	19.73
11.	345786	1.43	21.17
12.	12345-	1.35	22.52
13.	334578	1.34	23.86
14.	345788	1.28	25.14
15.	23457-	1.27	26.41
16.	233455	1.18	27.59
17.	133455	1.08	28.67
18.	334576	0.92	29.59
19.	22345-	0.87	30.46
20.	12344-	0.78	31.24

Repeating and passing rates among students within the sample

	Percentage
Algebra 1 pass rate in grade 8 among students who first took algebra 1 in grade 8	62.69
Algebra 1 pass rate in grade 9 among students who first took algebra 1 in grade 9	37.60
Proportion of the sample who took algebra 1 in grades 8 and 9	22.72
Proportion of the sample who took algebra 1 in grades 9 and 10	13.49
Proportion of the sample who took algebra 1 in grades 8, 9, and 10	4.43
Proportion of the sample who ever repeated algebra 1	33.57
Proportion of the sample who ever repeated geometry	15.96
Proportion of the sample who ever repeated algebra 2	10.17
Proportion of the sample who ever repeated algebra 1, geometry, or algebra 2	49.70
Proportion of the sample who ever passed algebra 2	44.24
Proportion of the sample who did not take a math course in grade 12	30.18

Findings

Finding 1: Math performance in grade 7 is predictive of high-school math course-taking.

Students who perform well in grade-7 math are likely to take more-advanced courses in high school compared to those who struggle with middle-school math.

Findings

Finding 2: The majority of students who achieved at least Proficient on their math CSTs are those who took algebra 1 in grade 8, geometry in grade 9, and algebra 2 in grade 10.

In general, however, this accelerated pathway does not support students who are not proficient in math in grade 7.

Findings

Finding 3: Many students repeat algebra, but few repeaters achieve proficiency on their second attempt.

Roughly one third of students in the study sample repeated algebra 1 at some point between grades 7 and 12 — repetition that yielded discouraging results.

Are Course Sequences Stable?

- Question for discussion: is information we glean from course sequence information stable across time, stable across districts and stable across students?
- Consider the challenges of course sequencing decisions under the implementation of the Common Core State Standards in math (CCSSM).
- We need to think through the variation in not only course sequences but also course placement decisions.
- Are course sequences measuring an input or an outcome?

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Considerations

Math matters in elementary school

The large variation in students' grade-7 math performance suggests that more work must be done at the elementary level to prepare students for success in middle-grade math. The implementation of CCSSM in early grades can enable substantial revisions in instructional approaches.

Therefore, what is the mechanism for examining student growth from elementary to middle grades, for example.

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Considerations

The CCSSM Algebra 1 and Mathematics 1 courses build on the CCSSM for Grade 8, and are correspondingly more advanced than the previous expectations for Algebra 1.

Some recalibration of course sequencing will be needed given the additional content. What should we do while the recalibration is under way? Is the variance in course content stable or still evolving?

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Considerations

Decisions to accelerate students while in middle school should be carefully considered.

Solid evidence of mastery of prerequisite standards should be required; diagnostic testing can help identify strengths and challenges in particular areas of math content.

But acceleration is a complicated areas of policy discussion at the district level. Should the decision to accelerate students (an input) be included, somehow, in how we think about student or school-level outcomes?

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Considerations

When acceleration does occur, through compacted courses, content should be the same as full-length courses.

Clear learning progressions through the major mathematical domains need to be retained, consistent with the design of the standards. Omitting concepts should be avoided.

Considerations

Examples of compacted sequences are increasingly available, and experimentation coupled with evaluation will be required moving forward.

A middle school sequence could, for example, compact grade 7, grade 8 and Algebra 1/Integrated I.

When experimentation is under way, what should happen to the way in which we think about accountability systems?

Considerations

Irrespective of students' math performance, taking four years of high-school math strengthens their postsecondary and employment opportunities in STEM-related fields.

Successful transitions beyond high school, without the need for remediation, are in part dependent on students' consistent math enrollment throughout high school. How can a course sequence be included for accountability purposes? What are the required warrants?

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