Acceleration, Access, and Equity: Pathways for Success in the Common Core

Curtiss Center Mathematics and Teaching Conference
March 1, 2014
Panel Members

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• Neal Finkelstein WestEd
• Gary Clark Director of Undergrad Admission
• Sunny Chin-Look Alhambra USD
• Thao Dinh Los Angeles USD
Middle School Acceleration

- To prepare students for high school mathematics in eight grade, districts are encouraged to have a well-crafted sequence of **compacted courses**.

- Compacting means to compress content, which requires a faster pace to complete, as opposed to skipping content.

- Compact 3 years of content into 2 years
Guidelines for the Development of Compacted Courses

- Compacted courses should include the same Common Core State Standards as the non-compacted courses.
- Decisions to accelerate students into the Common Core State Standards for high school mathematics before ninth grade should not be rushed.
Guidelines for the Development of Compacted Courses

- Decisions to accelerate students into high school mathematics before ninth grade should be based on solid evidence of student learning.

- A menu of challenging options should be available for students after their third year of mathematics—and all students should be strongly encouraged to take mathematics in all years of high school.
Other Ways to Accelerate Students

- Allowing students to take two mathematics courses simultaneously (such as Geometry and Algebra II, or Precalculus and Statistics).
- Allowing students in schools with block scheduling to take a mathematics course in both semesters of the same academic year.
Other Ways to Accelerate Students

- Offering summer courses that are designed to provide the equivalent experience of a full course in all regards, including attention to the Mathematical Practices.

- Creating different compaction ratios, including four years of high school content into three years beginning in 9th grade.

- Creating a hybrid Algebra II-Precalculus course that allows students to go straight to Calculus.
Accelerated 7th Grade

- Unit 1 Rational Numbers and Exponents
- Unit 2 Proportionality and Linear Relationships
- Unit 3 Introduction to Sampling Inference
- Unit 4 Creating, Comparing, and Analyzing Geometric Figures
Unit 1 Relationships Between Quantities and Reasoning with Equations

Unit 2 Linear and Exponential Relationships

Unit 3 Descriptive Statistics

Unit 4 Expressions and Equations

Unit 5 Quadratic Functions and Modeling
Acceleration

History

Data

International Benchmark
Decision Point

5th  6th  7th  8th
Acceleration

“When students have mastered the content described in the CCSSM with California Additions for kindergarten through grade eight, they will be ready to complete Common Core Algebra I or Common Core Mathematics I.”

-CDE Math Framework
Accelerated Math Course Sequence in HS

9th
Algebra II (H)

10th
Trig/Pre-Calc. (H)

11th
AP Calc. AB

12th
AP Calc. BC
Multiple ADPs

HS Regular Math Track

M I  →  M II  →  M III

- Precalc
- Stat
- AP Stat

Acceleration Math Track

8th Grade Math

A I  (MI + some MII)  →  A II  (rest of MII + some MIII)  →  A III  (rest of MIII + Pre Calc)

- AP Calc (BC)
Rethinking Math Course Sequences under the Common Core State Standards

Neal Finkelstein

2014 Philip C. Curtis Jr. Center for Mathematics and Teaching Conference

March 1, 2014
• 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: misplacement in math is common, with significant consequences for students throughout middle and high school, and beyond.
“A-G” Course Requirements

9th Grade
- Other A-G
- Math (Algebra 1)
- English

10th Grade
- Other A-G
- Math (Geometry)
- Math (Algebra 1)
- English

11th Grade
- Other A-G
- Lab Science
- Math (Algebra 1)
- English

12th Grade & Graduates
- Other A-G (elective)
- Visual & Performing Art
- History/Social Science
- Language -- Non-English
- Lab Science
- Math (Algebra 2)
- Math (Geometry)
- English

TES Benchmarks
www.transcriptevaluationservice.com
Cumulative Units Completed in Math, by Grade Level

Grade 9
- % of Students (%)
- % of Students (%)

Grade 10
- % of Students (%)
- % of Students (%)

Grade 11
- % of Students (%)
- % of Students (%)

Grade 12
- % of Students (%)
- % of Students (%)

Cumulative C-units

NOTE: Vertical red line represents the UC and CSU required number of units to meet A-G benchmarks at each grade level.
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.
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.
Math Trajectory

13457-
# Math Course Rankings

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Independent Study</td>
</tr>
<tr>
<td>1</td>
<td>Basic Math (Math 7, Foundations, CAHSEE Prep, etc)</td>
</tr>
<tr>
<td>2</td>
<td>Pre-Algebra</td>
</tr>
<tr>
<td>3</td>
<td>Algebra</td>
</tr>
<tr>
<td>4</td>
<td>Geometry</td>
</tr>
<tr>
<td>5</td>
<td>Intermediate Algebra/Algebra II</td>
</tr>
<tr>
<td>6</td>
<td>Statistics/Finite/Discrete</td>
</tr>
<tr>
<td>7</td>
<td>Pre-calculus/Math Analysis/Trigonometry</td>
</tr>
<tr>
<td>8</td>
<td>Calculus</td>
</tr>
<tr>
<td>9</td>
<td>Linear Algebra</td>
</tr>
</tbody>
</table>
Math course-taking patterns

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Percentage of Students</th>
<th>Cumulative Percentage of Students</th>
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</thead>
<tbody>
<tr>
<td>1. 134578</td>
<td>3.30</td>
<td>3.30</td>
</tr>
<tr>
<td>2. 134576</td>
<td>2.52</td>
<td>5.82</td>
</tr>
<tr>
<td>3. 234578</td>
<td>2.47</td>
<td>8.30</td>
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<tr>
<td>4. 23345-</td>
<td>2.08</td>
<td>10.38</td>
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<tr>
<td>5. 234577</td>
<td>1.68</td>
<td>12.06</td>
</tr>
<tr>
<td>6. 13457-</td>
<td>1.65</td>
<td>13.72</td>
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<tr>
<td>7. 234576</td>
<td>1.64</td>
<td>15.35</td>
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<tr>
<td>8. 13345-</td>
<td>1.48</td>
<td>16.84</td>
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<td>9. 133457</td>
<td>1.38</td>
<td>18.30</td>
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<td>10. 233457</td>
<td>1.44</td>
<td>19.73</td>
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<tr>
<td>11. 345786</td>
<td>1.43</td>
<td>21.17</td>
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<tr>
<td>12. 12345-</td>
<td>1.35</td>
<td>22.52</td>
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<tr>
<td>13. 334578</td>
<td>1.34</td>
<td>23.86</td>
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<td>14. 345788</td>
<td>1.28</td>
<td>25.14</td>
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<td>15. 23457-</td>
<td>1.27</td>
<td>26.41</td>
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<td>16. 233455</td>
<td>1.18</td>
<td>27.59</td>
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<tr>
<td>17. 133455</td>
<td>1.08</td>
<td>28.67</td>
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<tr>
<td>18. 334576</td>
<td>0.92</td>
<td>29.59</td>
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<tr>
<td>19. 22345-</td>
<td>0.87</td>
<td>30.46</td>
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<tr>
<td>20. 12344-</td>
<td>0.78</td>
<td>31.24</td>
</tr>
</tbody>
</table>
Repeating and passing rates among students within the sample

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebra 1 pass rate in grade 8 among students who first took algebra 1 in grade 8</td>
<td>62.69</td>
</tr>
<tr>
<td>Algebra 1 pass rate in grade 9 among students who first took algebra 1 in grade 9</td>
<td>37.60</td>
</tr>
<tr>
<td>Proportion of the sample who took algebra 1 in grades 8 and 9</td>
<td>22.72</td>
</tr>
<tr>
<td>Proportion of the sample who took algebra 1 in grades 9 and 10</td>
<td>13.49</td>
</tr>
<tr>
<td>Proportion of the sample who took algebra 1 in grades 8, 9, and 10</td>
<td>4.43</td>
</tr>
<tr>
<td>Proportion of the sample who ever repeated algebra 1</td>
<td>33.57</td>
</tr>
<tr>
<td>Proportion of the sample who ever repeated geometry</td>
<td>15.96</td>
</tr>
<tr>
<td>Proportion of the sample who ever repeated algebra 2</td>
<td>10.17</td>
</tr>
<tr>
<td>Proportion of the sample who ever repeated algebra 1, geometry, or algebra 2</td>
<td>49.70</td>
</tr>
<tr>
<td>Proportion of the sample who ever passed algebra 2</td>
<td>44.24</td>
</tr>
<tr>
<td>Proportion of the sample who did not take a math course in grade 12</td>
<td>30.18</td>
</tr>
</tbody>
</table>
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.
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.
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.
Considerations for CCSSM Implementation

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.
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.
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.
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.
Five ways to Calculus

1) Compacting in Middle School

- Grade 6
- Grade 7 + Part of Grade 8
- Part of Grade 8 + Algebra I or Integrated I
- Geometry or Integrated II
- Algebra II or Integrated III
- Precalc
- Calculus

Acceleration Decision Point
Five ways to Calculus

2) Doubling Up in High School

- Grade 6
- Grade 7
- Grade 8
- Algebra I
- Algebra II
- Precalc
- Calculus

Acceleration Decision Point

Geometry
Five ways to Calculus

3) Accelerated Integrated Pathway

- Grade 6
- Grade 7
- Grade 8
- Part of Integrated I and Integrated II
- Part of Integrated II and Integrated III
- Precalc
- Calculus

Acceleration Decision Point

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Five ways to Calculus

4) Enhanced Pathway

- Grade 6
- Grade 7
- Grade 8
- Enhanced Algebra I/Integrated I
- Enhanced Geometry/Integrated II
- Enhanced Algebra II/Integrated III
- Calculus

Acceleration Decision Point
Five ways to Calculus

5) Summer Bridge Pathway

Grade 6 → Grade 7 → Grade 8 → Algebra I/Integrated I → Geometry/Integrated II → Algebra II/Integrated III or Summer Bridge → Calculus

Acceleration Decision Point
Considerations for CCSSM Implementation

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.
Available On-line

College Bound in Middle School & High School: How Course Sequences Matter

Rethinking Math Course Sequences under the Common Core State Standards

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