Does Diagnostic Math Testing Improve Student Learning?

Julian Betts

This project was supported with funding from the Donald Bren Foundation. The California Academic Partnership Program also provided support to the authors for related research.
Outline

- Math Diagnostic Testing Project
- Examining San Diego Unified
- Results from San Diego Unified
- Summary and Conclusions
Math Diagnostic Testing Project

- Tests, diagnoses student math skills, problems
  - Provides fast, detailed feedback to teachers
- A joint CSU, UC project (1977)
  - Available to all California schools
  - Ten regional centers process tests, provide resources
- Differs from California Standards Test
  - Student/class intervention tool vs. school accountability measure
  - CST test results available only months later
MDTP Testing in State is Growing
Students Receive Detailed Reports of Discrete Math Tasks

Here are the diagnostic results from the "Mathematics Course Readiness Test", TR45K08, that you have recently taken. Your Score, the Critical Level, and the Total Possible score for each topic are reported below. The Critical Level for each topic is what MDTP considers to be the minimum number of correct responses for you to show adequate preparation in that topic.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Your Score</th>
<th>Critical Level</th>
<th>Total Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literals &amp; Equations</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Data Analysis, Probability, &amp; Statistics</td>
<td>5</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Congratulations! Your results indicate that you have done well in each of the following topics:

However, your results indicate you need review in the following topics:

Integers                                    5          6          8
Fractions and their Applications             4          5          7
Decimals, their Operations & Applications; Percent  5        6        9
Exponents and Square Roots; Scientific Notation  2        3        4

Your results indicate you need substantial review in the following topics:

Geometric Measurement and Coordinate Geometry  2        5        7

Your total score is 26 out of 45, which is 58%. We hope you find this information helpful. Please contact your teacher for specific activities and assignments that will aid in any necessary review.
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Dual Use of MDTP in San Diego

- SDUSD testing mandated for middle, high school
- Goals
  - Ensure students placed in appropriate class
  - Identify students needing summer school
- Individual teachers testing independently, voluntarily
  - Before, during, and after mandate period
  - Most common use throughout state
Different Research Approaches Required for Two Testing Methods

- We compare growth of student math CST score
  - In years and grades with a mandated MDTP test, to years without testing
  - A natural experiment
- No similar natural experiment available for voluntary testing
  - Observed impact may stem from unusual factors of teachers and/or of classes tested
Data Sources

- Results from 2001-02 to 2006-07 school years, 165,863 tests
- Mandated tests
  - Annual student-level records
  - Other relevant information: previous scores, classroom setting, et al.
- Voluntary tests
  - San Diego MDTP office provided students, schools data
  - Matched to a database of complete student records
  - Identified about 80 percent of tested students
## Participation Rates in Mandated MDTP Testing in San Diego

<table>
<thead>
<tr>
<th></th>
<th>Grade 6</th>
<th>Grade 7</th>
<th>Grade 8</th>
<th>Grade 9</th>
<th>Grade 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001-02</td>
<td>0</td>
<td>.3</td>
<td>81</td>
<td>51</td>
<td>.4</td>
</tr>
<tr>
<td>2002-03</td>
<td>0</td>
<td>.3</td>
<td>60</td>
<td>43</td>
<td>.3</td>
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<tr>
<td>2003-04</td>
<td>0</td>
<td>88</td>
<td>.2</td>
<td>0</td>
<td>0</td>
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<tr>
<td>2004-05</td>
<td>23*</td>
<td>91</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005-06</td>
<td>95</td>
<td>88</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2006-07</td>
<td>63</td>
<td>63</td>
<td>.1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Selected schools only
Bold indicates mandated testing
CST and MDTP on Separate Schedules

Voluntary MDTP

CST

MDTP, Voluntary MDTP

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Mandated MDTP Clearly Boosted Math Skills for All Participants

![Graph showing achievement percentile over years for One MDTP Test and Two MDTP Tests. The graph indicates a clear boost in skills after the first test year.]
Smallest Positive Effects for Those With Lowest Initial Achievement

Math achievement gain on CST

Based on most recent CST math score
Based on first available CST math score

Past mathematics achievement level

Low | Medium | High
Voluntary Testing Had Little Effect

- Voluntary testing from September to March associated with lower March CST score
  - Correlational, not causal
  - No relationship when class average of prior math achievement scores factored in
  - Teachers appear to be selectively testing classes with weaker achievement

- Voluntary testing late in prior year not linked to current year CST score
How Did Mandated MDTP Have Such a Large Effect?

- Students more accurately tracked into appropriate classes
  - Explains 5–11 percent of positive effect
- Better identification of students needing summer school
  - Explains 1 percent of effect
- Could be that mandated testing worked better than voluntary testing because it engaged entire math departments in working together to spot and improve areas of student weakness
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Summary: Mandated Testing

- District-mandated MDTP testing associated with positive gains in subsequent year
- Gains increase if students tested two years in a row
- Just under a third of effect dissipates within a year if students tested only once
Voluntary MDTP testing fails to deliver similar benefits.

In some cases, negative effects seen due to testing on already low-achieving classes:
- Reflects only decision by some teachers to test a struggling class.

Unclear whether these effects apply more generally in other school districts.
Lessons for California’s Accountability System

- CST not designed to fill diagnostic test role, but...
- Could be made more useful if results, feedback made more timely, detailed
- Conversion to computerized state test could help
- Room for both diagnostic and accountability testing exists in current education landscape
The Future of State Testing

- California one of 18 governing states in the SMARTER Balanced Assessment Consortium
  - Developing tests for the national Common Core standards in math and English
- SMARTER planning computer adaptive testing
  - Could improve ability of teachers to more timely use test results
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Note on the use of these slides

These slides were created to accompany a presentation. They do not include full documentation of sources, data samples, methods, and interpretations. To avoid misinterpretations, please contact:

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Thank you for your interest in this work.
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