



## BACKGROUND

From 2007 to 2010, mathematics educators from the Center for Mathematics and Teaching (CMAT) worked within the UCLA Department of Mathematics to provide training for teachers and curriculum for students. In response to the number of students under-prepared for Algebra at the 8<sup>th</sup> grade level, *Introduction to Algebra* was developed with significant contributions from university mathematicians, educators with expertise in the teaching of special education learners and English learners, an independent evaluator and feedback from extensive field-testing. *Introduction to Algebra* targeted students who were not ready for Algebra. These students typically scored Far Below Basic, Below Basic or in the low Basic range on the 7<sup>th</sup> Grade California Standards Test.

## ABOUT THE INTRODUCTION TO ALGEBRA COURSE

*Introduction to Algebra* was designed as a full-year course aimed at preparing California's lowest achieving 8<sup>th</sup> grade students for Algebra. The program was adopted by the State of California in the 2007 California Mathematics Adoption as an Algebra Readiness program. This course was designed by experienced middle school teachers who understood how to address the mathematical and pedagogical needs of struggling students. The course addressed all the topics identified for an Algebra Readiness Program so that students could be better prepared for the General Mathematics California Standards Test (General Math CST), the California High School Exit Exam (CAHSEE) and Algebra coursework.

The state textbook adoption was intended to fill the gap at the middle school level for students not ready for Algebra. However, at the end of 2007 after the adoption process, the Governor reversed the education policy of offering both Algebra and Algebra Readiness to a position of Algebra for all at 8<sup>th</sup> grade. This limited the number of districts willing to implement the program. Despite this policy, districts that were focused on the needs of students rather than placing all students—ready or not—into Algebra purchased Algebra Readiness products, including *Introduction to Algebra*.

## Mathematics Reform

### POLICY BRIEF

Evaluation of the effectiveness of the *Introduction to Algebra* curriculum

### Snapshot of Student Outcomes

*This policy brief was developed by Public Works and the Center for Mathematics and Teaching*

## PREPARING FOR THE COMMON CORE STATE STANDARDS IN MATHEMATICS

Districts began to purchase and implement *Introduction to Algebra* in 2007-08 and have continued to do so through the 2013-14 school year. The CMAT team is developing four new programs for students in grades 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> grades and for Algebra aligned to the Common Core State Standards in Mathematics (CCSS-M), which were developed nationally through a state-led effort coordinated by the National Governors Association (NGA) and the Council of State School Officers (CSSO). California has adopted these standards and has authorized a Mathematics Instructional Materials Adoption for grades kindergarten to eight with a timeline for materials aligned to the CCSS-M by March 2014 and a curriculum framework in November 2013. CMAT has already developed the *MathLinks* Grade 6 and *MathLinks* Grade 7 Common Core Supplements to combine with *Introduction to Algebra* in the 7<sup>th</sup> grade as preparation for the 8<sup>th</sup> grade Common Core aligned mathematics course. CMAT has also developed a full Grade 8 CCSS-M program, which is on track to be adopted by California in January 2015.

## AN EXAMINATION OF STUDENT OUTCOMES FOR INTRODUCTION TO ALGEBRA

CMAT estimates that over 150 districts and 1,000 teachers have implemented the program. As designed, the program includes extensive professional development, providing required instructional minutes and targeting the appropriate audience (low achieving 8<sup>th</sup> grade students). However, the districts that have purchased the program have varied in terms of how they have chosen to implement the program including the students who are targeted, the extent of teacher training and scheduling students for the recommended instructional minutes.

CMAT approached Public Works (PW), a third-party evaluation firm, to examine outcomes in key implementation years 2009-10 and 2010-11 as well as offer suggestions in how to better track outcomes. CMAT staff identified twelve school districts with a

total of 47 middle schools that implemented *Introduction to Algebra* including participation in the professional development related to teaching the materials. In other words, CMAT staff selected the districts and schools that they believed had the strongest implementation in 2009-10 and 2010-11 that may have resulted in student outcomes.

Ideally, a student outcome study would have included rosters of the teachers that implemented the program, number of hours each teacher participated in professional development, lists of students affected by these teachers/curriculum, and individual student CST scores prior to entering the 8<sup>th</sup> grade, at the end of 8<sup>th</sup> grade (after *Introduction to Algebra*), and at the end of 9<sup>th</sup> grade (after *Algebra*). Further, in order to design a study to capture the outcomes of the program, a matched control group based on 7<sup>th</sup> grade achievement in similar schools not implementing the program would provide a basis for comparison. However, when it is a curriculum product for sale and where the publisher has limited control over how the product is actually implemented, these ideal conditions for evaluation are rare.

Instead, to evaluate *Introduction to Algebra*, PW examined patterns in the identified districts related to overall district and school performance on general mathematics CSTs at the 8<sup>th</sup> grade level with a special emphasis on movement of students from Far Below and Below Basic toward Basic as intended by the *Introduction to Algebra* curriculum. In order to examine patterns of performance on the 8<sup>th</sup> grade general math CST in schools and districts identified by CMAT as implementing the program, data from 12 districts with a total of 47 middle schools were examined for two separate time periods during which program implementation began and, potentially, increased across the school for all 8<sup>th</sup> graders enrolled in general math. The first relevant time period examined for this analysis related to change in CST performance from 2009 (2008-09 school year) to 2011 (2010-11 school year). The more narrow time period of 2010 to 2011 was also analyzed.

### **CRITERIA FOR EXAMINING STUDENT OUTCOMES**

Because the program is designed to affect the lowest performing students in 8<sup>th</sup> grade math, the analysis was seeking patterns related to:

- First, reductions in the percent of students performing at the Far Below Basic level on the 8<sup>th</sup> grade general math California Standards Test (CST).
- Second, patterns related to reductions in Below Basic, with the assumption that reductions in these two categories of performance might indicate an associated increase related to the Basic level of performance, a key goal of the program.
- Third, patterns related to school wide improvement on the Academic Performance Index (API), California's system of accountability for schools that emphasizes growth (in contrast to the absolute targets for performance in the federal Adequate Yearly Progress measure (AYP)) were also examined.

### **THE RESULTS**

The analysis included twelve school districts with a total of 47 middle schools that implemented *Introduction to Algebra* and contracted with CMAT to provide professional development. Table 1 is a summary of these results.

Of the 47 middle schools included in the analysis, 24 showed improvements in at least one of the criteria described above. At least one school from each of the twelve districts implementing *Introduction to Algebra* showed some level of improvement based on the study criteria (reductions in Far Below and Below Basic categories, increase in Basic and/or school wide improvement on the API) during at least one of the two time periods examined.

Table 1 provides a list of the schools showing improvement and is sorted by the first criteria—the schools that had the greatest reductions in the percentage of students scoring Far Below Basic from 2009 to 2011. Seven middle schools had the greatest reductions in this category of student performance ranging from 6 to 24%. Another seven middle schools reduced the percentage of students scoring Far Below Basic from 2010 to 2011 by 8 to 19%.

The next two sets of columns relates to student performance in the Below Basic and Basic categories. The greatest reductions in the Below Basic category of student performance ranged from 8 to 27%



between 2009 and 2011. Increases in the percent of 8<sup>th</sup> graders scoring Basic ranged from 9 to 26% from 2009 to 2011 in the seven schools showing the greatest improvement for this criteria.

A school's improvement on the API was also examined. However, there were only a few schools for which this criteria reflected a notable improvement and they were not necessarily the same schools ranking at the top of the list related to Far Below and Below Basic performance.

School District	School Name	Reduce FBB		Reduce BB		Increase Basic		API Improvement		
		09-11	10-11	09-11	10-11	09-11	10-11	08-11	09-11	10-11
Napa Valley	Harvest	<b>-24%</b>	2%	<b>-27%</b>	3%	<b>26%</b>	-4%			
Dry Creek	Creekview Ranch	<b>-17%</b>	-7%	-6%	-4%	<b>23%</b>	<b>16%</b>			
Pajaro Valley	Aptos	<b>-10%</b>	-1%	<b>-12%</b>	<b>-10%</b>	-1%	1%			
SV	Adele Harrison	<b>-8%</b>	<b>-8%</b>	8%	-1%	<b>11%</b>	<b>6%</b>			
SV	Altimira	<b>-7%</b>	-4%	<b>-8%</b>	<b>-6%</b>	<b>9%</b>	<b>1%</b>			
Lincoln	Don Riggio	<b>-7%</b>	<b>-8%</b>	1%	-4%	6%	6%			
Lincoln	Tully C. Knowles	<b>-6%</b>	3%	<b>-14%</b>	8%	12%	-9%			
San Lorenzo	Edendale	4%	<b>-19%</b>	<b>-10%</b>	<b>-12%</b>	7%	28%			
Lincoln	Colonial Heights	-4%	<b>-15%</b>	0%	3%	<b>14%</b>	<b>14%</b>			
Colton Joint	*Terrace Hills	3%	<b>-11%</b>	4%	9%	2%	-2%	<b>77</b>	<b>26</b>	<b>12</b>
Oxnard	Robert J. Frank	5%	<b>-10%</b>	-7%	-6%	4%	9%			
Pajaro Valley	Pajaro	-4%	<b>-9%</b>	24%	3%	3%	10%	<b>54</b>	<b>15</b>	<b>9</b>
Davis	Ralph Waldo Emerson	0%	<b>-9%</b>	-5%	-1%	6%	-2%			
Napa Valley	American Canyon	0%	<b>-8%</b>	-15%	8%		11%			
Colton Joint	Washington	37%		<b>-23%</b>	<b>-6%</b>	-13%	-14%			
Natomas	Heron	-2%		<b>-19%</b>	<b>-14%</b>	4%	16%	<b>84</b>	<b>56</b>	<b>38</b>
Colton Joint	Colton	-3%		<b>-11%</b>	<b>8%</b>	<b>14%</b>	0%	<b>58</b>	<b>24</b>	<b>22</b>
Lincoln	Brookside	10%		<b>-9%</b>	<b>-10%</b>		14%			
Davis	Oliver Wendell Holmes	4%		<b>-8%</b>	<b>-6%</b>	-7%	-9%			
Dry Creek	Antelope Crossing	-5%		-1%	14%	<b>10%</b>	<b>10%</b>			
Lincoln	*Sierra	3%		2%	3%	-1%	-8%	<b>69</b>	<b>74</b>	<b>19</b>
Calexico	Enrique Camarena	4%		2%		-5%		<b>54</b>	<b>16</b>	
Vallejo	Franklin	2%		-3%	-6%	-2%	4%	<b>52</b>	<b>2</b>	<b>-3</b>
Napa Valley	*Redwood	6%		8%	5%	-8%	1%	<b>50</b>	<b>8</b>	<b>0</b>

\*AMOS went up 2008-11 in these schools: Terrace Hills (27%), Redwood (24%) and Sierra (24%)

Note: Bold indicates that these schools were top % change when lists sorted by that criteria

### MOVING FORWARD WITH THE INTRODUCTION TO ALGEBRA PROGRAM

In California, the "Algebra for All" policy for 8<sup>th</sup> grade has now been reversed and, instead, has moved the expectation to 9<sup>th</sup> grade in alignment with the new federal Common Core State Standards in mathematics (CCSS-M) adopted by California in 2010. The implementation of this policy change provides an opportunity for CMAT to address these new standards through the lessons it has learned in implementation of *Introduction to Algebra*. Moving forward, it is essential for districts to understand that *Introduction to Algebra* is more than curriculum materials. Implemented most effectively, districts and schools must consider the following in order to truly have fidelity to the program as it was originally envisioned.



- **Professional Development:** *Introduction to Algebra* is a different pedagogical approach to teaching mathematics with the focus on students who struggle with mathematics. To be effective, the curriculum requires teachers delivering the curriculum to complete the CMAT professional development, which includes at minimum two days of training up front and up to five days of additional training throughout the school year. Without professional development, the program would be difficult for even the most experienced teacher to implement appropriately.
- **Targeting 8<sup>th</sup> Grade Students in Need:** *Introduction to Algebra* was designed for 8<sup>th</sup> grade students not ready for Algebra who scored Far Below Basic, Below Basic, or in the low Basic range on the 7<sup>th</sup> grade California Standards Test. Districts and schools must examine 7<sup>th</sup> grade data in order to appropriately place students prior to the start of school.
- **Adequate Instructional Minutes:** *Introduction to Algebra* was designed as a core mathematics program that is taught one class period everyday or in a block schedule which also equals approximately five hours per week. It is not designed as a supplemental program, as an extension class or to be integrated with another text. *Introduction to Algebra* is a stand-alone core program.
- **Highly Qualified Teachers:** Given that *Introduction to Algebra* targets students struggling with mathematics, these students deserve the best teachers to help them catch up to other students. *Introduction to Algebra* works most effectively with committed, dedicated and qualified teachers.

### About the Center for Mathematics and Teaching

The Center for Mathematics and Teaching (CMAT) is dedicated to advancing struggling students nationwide to mathematical literacy at all levels from the primary grades through beginning Algebra. Formed in 2007 as a 501(c)3 nonprofit organization to support the implementation of *Introduction to Algebra*, a state-adopted mathematics Algebra Readiness program, CMAT aims to accomplish its goal by increasing the confidence and competence in the learning and teaching of mathematics with cognitively demanding student curricula and content-driven teacher training designed by mathematics educators. More information can be found at: [www.mathandteaching.org](http://www.mathandteaching.org)

### About Public Works

Public Works is a non-profit corporation dedicated to working with schools, government agencies and the non-profit sector by providing services and resources to organizations that educate and inform children, youth and families. Our mission is to put data into action, transforming statistics into information that informs decisions, improves accountability and communicates the impact of public policy.

Public Works has served as the statewide evaluator for the CaMSP program and for DO Math. More information can be found at: [www.publicworksinc.org](http://www.publicworksinc.org).



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