



Analysis of Student Achievement Data
Twin Rivers Unified School District
Algebra Project

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Introduction

Success in education initiatives is often defined by positive change in several different domains, including student and parent engagement, persistence, attendance, and achievement. This evaluation of the Twin Rivers Unified School District (TRUSD) Algebra Project deals solely with changes in participants' achievement on standardized tests. As the program is still in its pilot phase and has been implemented with a non-random sample of very few students, quantitative analysis of assessment data must be viewed with the understanding that any findings are likely not generalizable to student populations outside of the classroom where they originated. Nevertheless, this analysis is presented in order to gauge whether, generally speaking, the program as implemented has significantly impacted participating students' test scores.

The Algebra Project is a curriculum that stresses practical application and family involvement to support student learning of algebraic contents. Algebra Project participants comprise an ethnically diverse class of grade 6 students at Allison Elementary. To determine the impact of the program on participants' achievement, two sets of analyses were run:

- (1) Algebra Project participants' class averages on 2010/11 math CST were compared to those of all other TRUSD students, all students at similar schools, and similar (matched) students at those same similar schools.
- (2) Prior year (2009/10) scores on the California Standards Test (CST) in math were stratified by performance level. *Within each stratum (prior year performance level)*, Algebra Project participants' scores were compared those of all other TRUSD students, all other students at similar schools, and similar students at those same similar schools.

Selection of Comparison Groups

In order to construct a comparison group of similar schools and similar students, TRUSD schools were compared in terms of 2010 Base API (based largely on 2009/10 STAR scores) and demographic composition – mainly the percentage of African American, Hispanic, Asian, White, and free/reduced meal-eligible students. The 2010 Base APIs of the similar schools selected are as follows: FC Joyce 779, Kohler 741, and Village Elementary 753, Allison 769. After the similar schools were selected, project participants were matched to individual students within the similar schools on the basis of free/reduced price meal status, ethnicity, and prior year CST math achievement (in that order). The resulting subset of students from similar schools was termed “matched students.” Table 1 details the similarities between Algebra Project participants and the groups selected for comparative analysis. The data in Table 1 solely reflects those students with data from both the 2010 and 2011 administration of the CST.

Table 1. Demographic Characteristics of Participants and Comparison Groups

Subgroup		Algebra Project	Matched Students	Individual Similar Schools			Similar Schools (All)	TRUSD
				FC Joyce Elem.	Kohler Elem.	Village Elem.		
Asian	N	2	3	1	1	2	4	149
	%	7%	10%	2%	2%	4%	3%	9%
Black/African American	N	12	13	9	11	10	30	258
	%	43%	45%	19%	26%	20%	21%	15%

		Individual Similar Schools						
Subgroup		Algebra Project	Matched Students	FC Joyce Elem.	Kohler Elem.	Village Elem.	Similar Schools (All)	TRUSD
Filipino	N	1	0	0	0	0	0	17
	%	4%	0%	0%	0%	0%	0%	1%
Hispanic/Latino	N	5	6	19	15	23	57	712
	%	18%	21%	40%	36%	45%	40%	42%
Pacific Islander	N	2	1	1	0	2	3	27
	%	7%	3%	2%	0%	4%	2%	2%
White	N	6	6	16	14	14	44	505
	%	21%	21%	33%	33%	27%	31%	30%
Free/Reduced Meal Eligible	N	23	24	45	37	47	152	1412
	%	82%	83%	94%	88%	92%	90%	83%

Allison Elementary, which hosts the Algebra Project, is somewhat unique in its demographic composition within TRUSD, as it has a higher percentage of African American students than Hispanic and White combined. Most of the TRUSD schools are either predominately White or Hispanic; hence the difficulty in finding schools with a similar proportion of African American students. Nevertheless, as shown in Table 2, performance on the math CST was similar among the Algebra Project and all comparison groups.

Table 2. Prior Year Math CST Data for Participants and Comparison Groups

Criteria	Algebra Project	Matched Students	Similar Schools	TRUSD
N with 2 years CST math (2010 & 2011)	28	29	141	1694
2010 Grade 5 Math CST				
Cluster 1 (mean n correct)	7.0	7.0	7.6	7.9
Cluster 2 (mean n correct)	10.4	9.3	10.2	10.6
Cluster 3 (mean n correct)	10.8	10.0	11.2	11.6
Cluster 4 (mean n correct)	8.2	8.0	8.9	9.3
Cluster 5 (mean n correct)	3.1	3.0	3.2	3.3
Mean Scale Score (200 – 600)	354	340	360	370
Mean Performance Level (1 – 5)	3.1	2.9	3.4	3.6

Among students with both 2010 and 2011 math CST scores, no statistically significant differences were found ($p < 0.05$) between the Algebra Project participants and any comparison group on the 2010 math CST. Entering the 2010/11 school year, all of the comparison groups had performed similarly to the

Algebra Project students on each cluster of the math CST and on the overall test, indicating that the appropriateness of the selected groups for pre/post comparison.

Analysis of 2011 Assessment Data

In order to gauge the comparative growth of Algebra Project students in curricular areas measured by state and district tests, analyses were conducted comparing program participants to matched students, all students at similar schools, and all district (TRUSD) students. See Table 3 for a comparison of 2011 cluster and scale scores on the 2011 math CST.

Table 3. 2011 Math CST Performance for Algebra Project and Comparison Groups

Criteria	Algebra Project	Matched Students	Similar Schools	TRUSD
N with 2 years CST math (2010 & 2011)	28	29	141	1694
2010 Grade 5 Math CST (mean scale score)	354	340	360	370
2011 Grade 6 Math CST				
Cluster 1: Number Sense - Ratios, Proportions, Percentages, Negative Fractions (mean n correct)	7.3	9.0*	9.5*	9.5*
Cluster 2: Number Sense - Operations and Problem Solving with Fractions (mean n correct)	6.8	6.8	6.5	6.8
Cluster 3: Algebra and Functions (mean n correct)	11.4	11.1	11.8	12.5
Cluster 4: Measurement and Geometry (mean n correct)	5.2	5.3	5.7	5.9
Cluster 5: Statistics, Data Analysis and Probability (mean n correct)	6.3	6.2	6.8	7.2
Mean Scale Score (200 – 600)	331	337	347	356
Mean Performance Level (1 – 5)	3.1	3.1	3.3	3.4
2011 Grade 6 District Cumulative Tests				
Cumulative Test 1 (mean n correct)	22.3	19.1*	19.9*	19.2*
Cumulative Test 2 (mean n correct)	25.5	23.2	25.3	25.4
Cumulative Test 3 (mean n correct)	13.9	19.0*	20.5*	20.3*

*statistically significant difference from Algebra Project ($p < .05$)

When compared to other TRUSD students (matched students, all students in similar schools, and all district students), Algebra Project students performed similarly to their peers, earning similar overall and cluster scores on the 2010/11 Math CST. The sole exception was cluster 1 – Number Sense (Ratios, Proportions, Percentages, and Negative Fractions), where Algebra Project students answered approximately 2 fewer questions correctly than did their peers in a cluster comprised of 18 total questions.

On district cumulative tests, Algebra Project students performed significantly better than their peers on cumulative test 1 – on average scoring 3 points higher than similar students. Mean scores on cumulative test 2 were nearly identical for students in the Algebra Project and all three comparison groups. On

cumulative test 3, Algebra Project students scored on average 5 points lower than similar students, and significantly lower than the other comparison groups as well.

Analysis by 2010 Performance Level

In order to gain insight into whether participation in the Algebra Project was particularly advantageous for students entering at a particular math level, participants were stratified by their prior year (2010) math CST performance level. Within each performance level stratum, Algebra Project participants were compared to students at similar schools with similar demographics (matched students), all students at comparable schools (similar 2010 API and demographics), and all TRUSD students.

In order to verify the validity of this grouping scheme, independent sample t-tests were run within each performance level comparing mean 2010 scale scores for Algebra Project and those of other TRUSD students. See Table 4 below.

Table 4. Mean Prior Year (2010) Scale Score within Performance Level

2010 Math CST Performance Level	2010 Math CST Mean Scale Score			
	Algebra Project	Matched Students	Similar Schools	All TRUSD
Advanced	478	488	486	490
Proficient	418	405	384*	385*
Basic	331	325	326	325
Below Basic	282	278	273	277
Far Below Basic	n/a	242	238	233

*statistically significant difference from Algebra Project ($p < .05$)

No significant differences were found within most performance levels (Advanced, Basic, and Below Basic); however, Algebra Project students who scored at the Proficient level in 2010 earned a scale score significantly higher than did Proficient students at similar schools and those throughout the whole of TRUSD.

As indicated in Table 5, when students are stratified by prior year performance level, the performance of Algebra Project students is generally similar to that of their peers. The only exceptions are in Cluster 1: Number Sense (Ratios, Proportions, Percentages, Negative Fractions), where Proficient and Below Basic Algebra Project participants score lower than their peers, and Cluster 4: Measurement and Geometry, where Advanced students score on average approximately 2 fewer points than their peers. Due to the small size of the Algebra Project and Matched Students groups when stratified by performance level, statistical significance of differences is highly challenging to demonstrate. In other words, it is difficult to be certain that the differences found are due to anything other than random chance.

Table 5. 2011 Mean Math CST Scores for Stratified Participant and Comparison Groups

2010 Math CST Performance Level	Group	N	2011 Math CST Performance					Scale Score
			Cluster 1: Number Sense (Ratios, Proportions, Percentages, Negative Fractions)	Cluster 2: Number Sense (Operations and Problem Solving with Fractions)	Cluster 3: Algebra and Functions	Cluster 4: Measurement and Geometry	Cluster 5: Statistics, Data Analysis and Probability	
Advanced	Algebra Project	6	10.8	8.3	16.0	6.0	9.0	400
	Matched Students	5	12.8	8.6	16.4	8.0	9.0	425
	Similar Schools	28	12.6	8.2	16.6	7.9*	9.1	425
	TRUSD	374	12.3	8.3	16.5	7.9*	9.2	431
Proficient	Algebra Project	4	8.0	6.8	14.3	7.0	8.5	364
	Matched Students	5	12.0*	8.0	15.0	7.0	8.4	398
	Similar Schools	45	10.7*	6.7	13.4	6.4	7.9	366
	TRUSD	559	10.1*	6.9	13.8	6.2	7.8	367
Basic	Algebra Project	6	7.8	6.0	12.5	4.7	5.0	324
	Matched Students	5	8.6	5.6	11.0	5.4	5.8	326
	Similar Schools	31	8.8	6.1	10.6	5.1	5.9	327
	TRUSD	427	8.2	6.2	10.7	4.9	6.1	325
Below Basic	Algebra Project	12	4.9	6.3	7.6	4.4	4.8	290
	Matched Students	11	6.5	5.1	8.4	3.5	4.7	285
	Similar Schools	27	6.0	4.9	7.3	3.4	4.2	280
	TRUSD	253	6.8*	5.5	8.2	4.1	4.9	291
Far Below Basic	Algebra Project	0	n/a	n/a	n/a	n/a	n/a	n/a
	Matched Students	3	7.3	9.7	5.7	2.5	2.5	303
	Similar Schools	10	6.6	6.6	7.0	3.5	3.5	286
	TRUSD	62	7.3	6.8	6.2	3.8	4.3	282

*statistically significant difference from Algebra Project (p<.05)

Analysis of Continuing Algebra Project Students

In the 2010/11 school year, many of the students in the Algebra Project had also been exposed to the program in 2009/10. To determine the impact of two years of exposure on Math CST scores, continuing students were compared to all other TRUSD students who had been in the district since 2008/09 and had not been exposed to the Algebra Project. Due to the small number of students in each performance level with two years of data, the entire population of continuing Algebra Project students was analyzed in comparison to the whole group of matched students, students at similar schools, and all TRUSD students with no exposure to the Algebra Project. Results of the analysis are displayed in Table 6 below.

Table 6. Mean Math CST Scores for Returning Algebra Project Students vs. Comparison Groups

Criteria	Algebra Project	Matched Students	Similar Schools	TRUSD
N with 2 years CST math (2010 & 2011)	18	24	122	1432
2009 Grade 4 Math CST (mean scale score)	366	368	370	371
Cluster 1: Number Sense - Ratios, Proportions, Percentages, Negative Fractions (mean n correct)	7.2	9.13	9.62*	9.57*
Cluster 2: Number Sense - Operations and Problem Solving with Fractions (mean n correct)	7.1	6.4	6.6	6.8
Cluster 3: Algebra and Functions (mean n correct)	11.6	11.7	12.1	12.8
Cluster 4: Measurement and Geometry (mean n correct)	5.4	5.3	5.8	6.0
Cluster 5: Statistics, Data Analysis and Probability (mean n correct)	6.3	6.2	6.9	7.2
Mean Scale Score (200 – 600)	334	343	351	360

*statistically significant difference from Algebra Project ($p < .05$)

The 2009 (grade 4) Math CST scores of Algebra Project students were not significantly different from those of students in any comparison group. Continuing (2 years of exposure) Algebra Project students also had similar 2011 (grade 6) CST scores to students in each of the comparison groups. The sole exception is in Cluster 1: Number Sense - Ratios, Proportions, Percentages, Negative Fractions, where Algebra Project students earned an average raw score significantly lower than that of all students at similar schools and all students throughout the district.

Discussion

Regardless of their starting math level or how long they had been exposed to the program, students who participated in the Algebra Project on average performed about as well as similar students, students at similar schools, and all students in the district on the 2011 Math CST. That is to say, for the single class of students consistently exposed to the program, students did about as well as their peers exposed to other curricula and/or approaches.

As this evaluation addresses a small population of TRUSD students in a single classroom, caution should be used in generalizing the findings of this study or drawing conclusions about the merit or effectiveness of the program. In order to draw stronger conclusions, a more robust design is recommended, such as random selection of teachers and school sites within the district.

While analysis of student achievement data is an important component of most education program evaluations, it is rarely the most appropriate *single* criteria for assessing whether a program has met its goals. Student engagement, teacher engagement, and parent engagement are not always measured by test scores, though they may well influence student persistence, perceived accessibility of mathematics, and overall achievement in the long term.