Nevada Math Outcomes Analysis 2016/17

Grade Levels: 3, 4, 5
ST Math Program: Gen-4
Analysis Type: Z-score of scale score
Treatment-Years: 2016/17
Baseline-Year: 2013/14
Subgroup: All Students

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Abstract

This analysis evaluates grades using ST Math in Nevada in 2016/17. It identifies those grades with nominal or better implementation of the ST Math program, and matches them to randomly selected, similar math-performance comparison grades. The nominal ST Math users are an aggregation of 11 grades, consisting of grades 3, 4, and 5 at 8 schools, with an average baseline of 57% in Meets or Exceeded Standard proficiency levels (refer to Figures 2 and 3 to see how your schools compare to those analyzed in this report).They were matched to 11 similar, randomly selected control grades at 10 schools that never used ST Math. Grade-wise growth in math proficiency was evaluated (i.e. growth in same grade, same school, from 2013/14 to 2016/17) on the percentage proficient, scale scores, and Z-scores of the scale scores (see Section 3.1). Grades 3, 4, and 5 aggregated showed an ST Math effect of 13.98 points at the Meets or Exceeded Standard levels, 7.33 points at the Meets Standard Level, 6.65 points at the Exceeds Standard Level, and Z-score of 0.65.

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1 Introduction

1.1 Background

This is a quasi-experimental analysis at the grade-mean level. Entire grades represent the units of analysis, and outcome measures are the 2-year changes in grade-mean CRT Meets or Exceeded Standard percentages. The treatment grades used the ST Math program for 2 years, beginning in the 2016/17 school year. The study hypothesis is treatment grades using ST Math will outperform similar matched control grades, using their "business as usual" conditions of instructional content and professional development. The control grades were selected to have similar demographic, math, and economically disadvantaged attributes to the treatment grades during the baseline year (2013/14), and did not use ST Math in 2016/17, and 2016/17. The treatment grades' selection pool was all schools using ST Math in grades 3, 4, and 5 in Nevada. The control grades' pool was all schools not using ST Math in grades 3, 4, and 5 in Nevada. This study method measures effectiveness of the ST Math program when nominally implemented.

1.2 Program Description

The ST Math program is a supplemental math program covering grade-level Nevada math standards. The ST Math content consists of visual representations of math standards, concepts, and procedures, presented to students as "Puzzles" of virtual manipulatives, with which they interact to pose solutions. Each time the student poses a solution, the computer visually animates the Puzzle, diagram, or symbols to show why the posed solution correctly solves, or why it does not solve, the math problem (puzzle). The Puzzles are arranged into sequential groups, called "Levels". To proceed to the next Level in sequence, the student needs to master his/her current Level. Mastering a Level requires solving 100% of the math problems, or Puzzles correctly. In this way, the program is self-paced. Students must correctly solve approximately 4-12 Puzzles, with only 1 failure and retry allowed, to proceed. Levels are sequenced together into Games and, again, the student must master each Game to get to the next Game in sequence. Games are sequenced into "Learning Objectives" (e.g. 'Fractions Concepts'). The ST Math curriculum of approximately 20-25 Learning Objectives can be rearranged in a year-long, grade-level syllabus to match district math pacing through the school year.

The Puzzles typically start with concrete representations of the math, without abstract symbols, math vocabulary, or even English words. Gradually, through subsequent Levels or Games, abstractions are introduced. For example, a Puzzle might start with "n" green blocks on the screen, and then at a subsequent Level may represent the quantity with the numeral for "n" (no green blocks anymore). In this way, three things are accomplished: i) language proficiency prerequisites to engage with the program are minimal, ii) non-mathematical distractions (e.g. back-stories for word problems) are minimized or eliminated – thereby reducing load on working memory, and iii) the actual math in the problem can be represented clearly, simply, and unambiguously.

Besides the self-paced progress made by students in their one-to-one environment, the program is designed to be referenced by teachers during their regular math instruction. It is supplemental to core or basal math instruction and instructional materials. As the great majority of grade-level math standards are covered in the ST Math digital curriculum, completion of 100% of the entire ST Math curriculum (i.e. completing every Game) is required to cover all grade-level math standards.

Teachers receive initial training, either face to face or through self-guided online instruction. The training covers account startup, as well as math learning and growth mindset goals, the pedagogical

approach to learning in a visual experiential game, monitoring and intervention of the student 1:1 game play, and connecting of ST Math content to classroom content and pacing.

To achieve nominal progress through the program, there is a time-on-task requirement. While student progress rates through the program vary, MIND Research Institute has found that consistent application of 90 minutes per week throughout the school year is sufficient to get most students through at least half of the ST Math Learning Objectives. Students are recommended to use the program in school for at least two 45-minute sessions per week, or 90 minutes per week, over about 35 weeks. Analyses of ST Math usage have shown that consistently following this schedule throughout the school year is usually sufficient to achieve 50% or more Progress through ST Math content. Progress is a percentage of ST Math content coverage, and is defined as Levels completed by the student, divided by the total number of Levels in the curriculum. In addition, MIND's historical analyses have shown that it is necessary to complete at least 50% of the program in order to expect significantly higher performance compared to non-users.

2 Data Collection

Since this analysis uses grades as the unit of analysis, and states publish grade-mean state standardized test scores, the data for student math outcomes is collected from each state education agency's research files (retrieved from state websites). The treatment students use ST Math student accounts served by MIND. Student ST Math usage data is aggregated to grade-level means by MIND.

2.1 Proficiency Levels Definition

The following (Table 1) is Nevada's proficiency level descriptions:

Proficiency Level	State Proficiency Level Name
L1	Emergent/Developing
L2	Approaches Standard
L3	Meets Standard
L4	Exceeds Standard

Table 1: Proficiency Level Naming

2.2 Treatment Grades Pool and Selection

The Treatment grades pool originated with all schools and grades using ST Math in Nevada. From these schools, every grade that had used the ST Math program was identified. They comprise the Treatment grades pool for this evaluation of 2-year usage.

Because the analysis uses grade-mean data, such as grade-mean scale scores or grade-mean proficiency level percentages, it is necessary that the program also be a grade-wide treatment, with the great majority of students in each grade receiving treatment. Otherwise, the grade-means reported by the state of 100% of *tested* students would not be valid measures of a smaller fraction of *treatment* students. MIND's site implementation requirement is that an entire grade, including all teachers and all classes within that grade, use the ST Math program. We validate how closely

this is the case for each individual treatment grade by comparing the number of ST Math student accounts at a grade level to the Nevada's reported enrollment at that grade level. We discard from the Treatment pool any grade with a ratio of ST Math student accounts to reported grade enrollment lower than 85%.

Furthermore, the outcomes measure is a summative year-end test, i.e. Nevada's standardized math assessment (CRT). The math assessment thus covers all the math standards for that entire grade level. Meanwhile, the ST Math program curriculum (arranged into Learning Objectives) is also aligned to Nevada math standards. To infer that the ST Math content is having a valid effect on student outcomes on the summative assessment, we discard any grade with grade-mean of ST Math Progress for its students lower than 50% by year-end.

Progress is a percentage, and is defined as Levels completed by the student, divided by the total number of Levels in the grade-level curriculum. Note that student achievement of at least 50% progress in ST Math is accomplished primarily by teacher assignment of computer session time to students. With sufficient time on task, students make progress. The program helps them self-pace through providing real-time informative feedback for each puzzle.

2.3   Control Grades Pool and Selection

The control grades are randomly selected from a control pool of schools in Nevada. Though they are randomly selected, they are also matched to be similar to the Treatment grades' math attributes and demographics during the baseline 2013/14 year. The matched attributes include:

- scale score

- student percentages at each math proficiency level

- percentage of students receiving free or reduced lunch (using the demographic data from MDR).

To mitigate the risk of randomly picking a set of Control grades that generates an outlier for effect, a Monte Carlo approach is used to perform many random picks. The control pool's size is large enough that there are many possible "picks" of closely matched control grades.

One hundred randomly matched picks are made and sets of matched control grades are generated. For each set, the quality of the match as well as the math growth of the potential control set is evaluated. Some picked sets have high average math growth, some have low average math growth. From the set of all picks, a median pick is chosen. This avoids either an unlikely overestimate, or underestimate, of the Control grades' growth. When multiple median picks exist, the control set with the minimal math score differences in the baseline year is chosen.

3 Data Analysis

The set of all schools and grades using ST Math in Nevada is evaluated for Enrollment percentage and Progress percentage parameters. A filtered Treatment set (TRT) of all ST Math grades with $\geq 85\%$ Enrollment and $\geq 50\%$ Progress is identified. State math assessment data is tabulated. A matching set of Control grades based on baseline year state math assessment is selected.

Changes in math performance, i.e. the difference in math performance of a grade from a baseline year to the final year, are evaluated and tabulated. Statistical tests of the significance of the difference in math performance changes between Treatment grades and Control grades are performed. Finally, a grade-by-grade disaggregation is performed.

3.1 Z-scores

When states change their state assessment throughout the years, they also change the range of possible scale scores achieved on the exam. This makes it difficult to compare changes in grade mean scale scores across years with a different exam. To deal with this issue, a new Z-score is calculated. For each year being analyzed, by grade, a Z-score takes the difference of the grade mean scale score and the mean of all scale scores statewide for that year, and then divides it by the standard deviation of all scale scores statewide for that year. Here is a fictional example to illustrate the calculation of a Z-score for the 2015/16 exam:

School A, Grade 3, Mean scale score: 300
Average across all schools statewide, Grade 3: 350
Standard deviation across all schools statewide, Grade 3: 30
Z-score=((School A, Grade 3, Mean scale score)-(Average across all schools, Grade 3))/(Standard deviation across all schools, Grade 3)

$$\text{Z-score=}\frac{300-350}{30} = -1.67$$

The Z-score is calculated for every grade across all years being analyzed, using the full state data set of Nevada schools for the averages and standard deviations. The use of Z-scores is a valid statistical method to normalize any dataset and to enable analysis across otherwise uncomparable exams. In this report, we will include both mean scale scores and their accompanying Z-scores.

3.2 Percentile Ranking

These newly calculated z-scores can then be converted into a percentile ranking. Each percentile ranking shows the grade's performance relative to the others in that year and grade. For example, for a specific grade 3, a percentile ranking of 50 shows that this grade 3 performed at the average of all third grades in the state for that testing year.

3.3   Final Treatment and Control

3.3.1   ST Math Grade-Aggregated Implementation ($\geq 85\%$ Enrollment Grades Only)

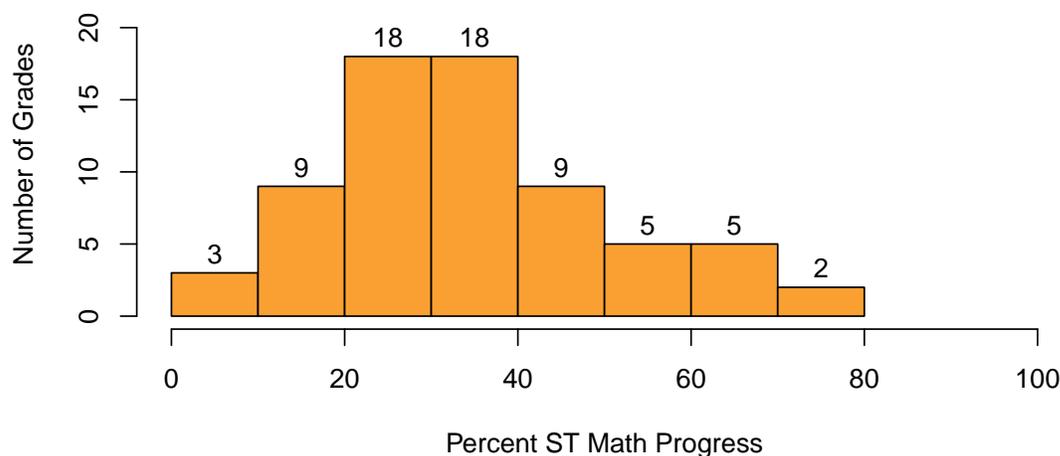**ST Math Percent Grade Mean Progress Distribution – 2016/17**

Figure 1: Histogram of ST Math Percent Progress for $\geq 85\%$ Enrollment Grades 2016/17

For all ST Math grades with Enrollment $\geq 85\%$, Figure 1 shows the frequency distribution of grade-average Progress percentage through the program. Note that we will only be using grades with $\geq 50\%$ Progress as the Treatment Group.

Table 2 provides descriptive statistics of the Progress distribution. Table 3 shows the number of remaining treatment grades after applying enrollment and progress filters.

	Min.	Max.	Average	S.D.
ST Math % Progress	2.0	75.9	34.9	16.6

Table 2: Descriptive Statistics of ST Math Percent Progress for $>= 85$ percent Enrollment Grades

Grades with $>= 85\%$ Enrollment:	56
Grades with in addition $>= 50\%$ Progress:	11

Table 3: Number of ST Math Grades with $>= 85$ percent Enrollment and with $>= 50$ percent progress

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3.3.2 Filtering Treatment and Controls

Table 4 shows the total number of grades in the Treatment pool, the number of grades that exceeded the 85% Enrollment figure, and also the 50% Progress filter. Other rows in the table indicate counts of numbers of students (2016/17 from state testing count) and counts of number of schools represented. The number of matched Control (CTRL) grades, students, and schools is also shown.

	Grade 3	Grade 4	Grade 5	Total
ST Math Using Grades	24	22	23	69
ST Math Using Schools	24	22	23	28
ST Math Students	2656	2429	2441	7526
ST Math Grades (Enroll >= 85%)	20	17	19	56
TRT Grades (Enroll >= 85% & Prog >= 50%)	2	5	4	11
TRT Schools (Enroll >= 85% & Prog >= 50%)	2	5	4	8
TRT Students (Enroll >= 85% & Prog >= 50%)	280	703	452	1435
CTRL Grades	2	5	4	11
CTRL Schools	2	5	4	10
CTRL Students	139	447	423	1009

Table 4: Treatment Pool Filtering and Controls: Counts of Grades, Schools, and Students

3.3.3 Match of Controls to Treatment

Figure 2 shows the density plot of the baseline CRT Math scale scores (left plot) and baseline percent students at CRT Meets or Exceeded Standard (right plot) for treatment grades overlayed on control grades, showing the closeness of the match obtained between Treatment and Control sets of grades in the baseline year, 2013/14. It is important to keep in mind that we only have a small number of treatment and control grades (11) and that the Control set was arrived at through a Monte Carlo process (see Section 2.3) rather than a closest math performance match.
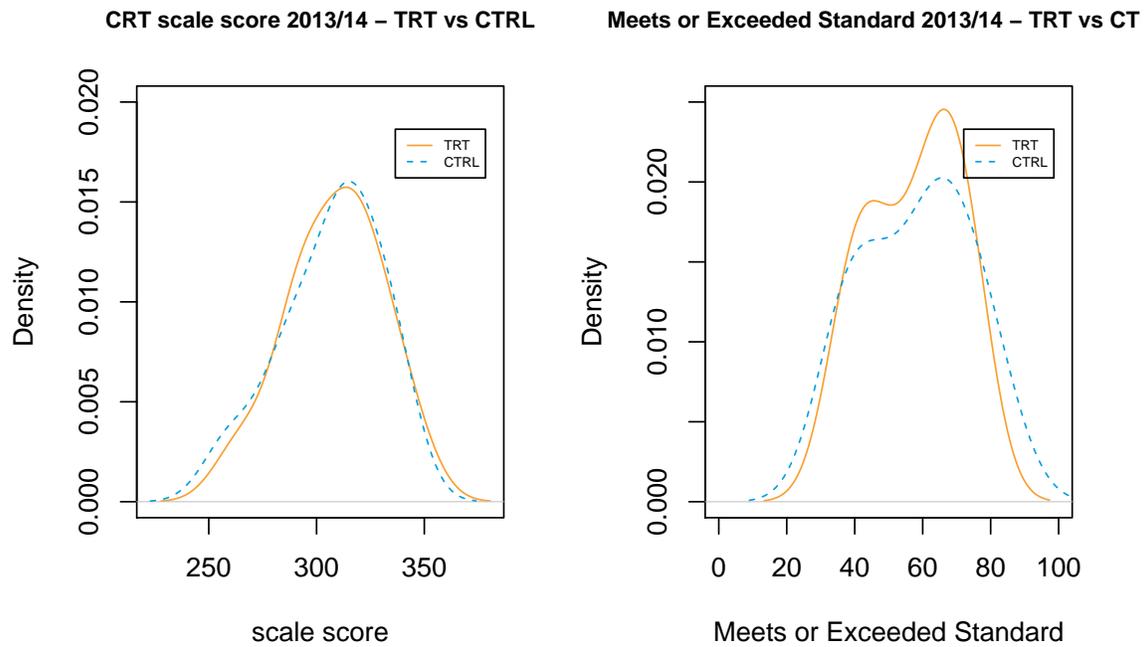

Figure 2: Baseline Year Density Plots Showing Math Scores Match between TRT and CTRL - 2013/14

Similarly, figure 3 shows the density plot of the percentage of students needing free or reduced lunch for treatment grades overlayed on control grades, showing the closeness of the match obtained between Treatment and Control sets of grades.
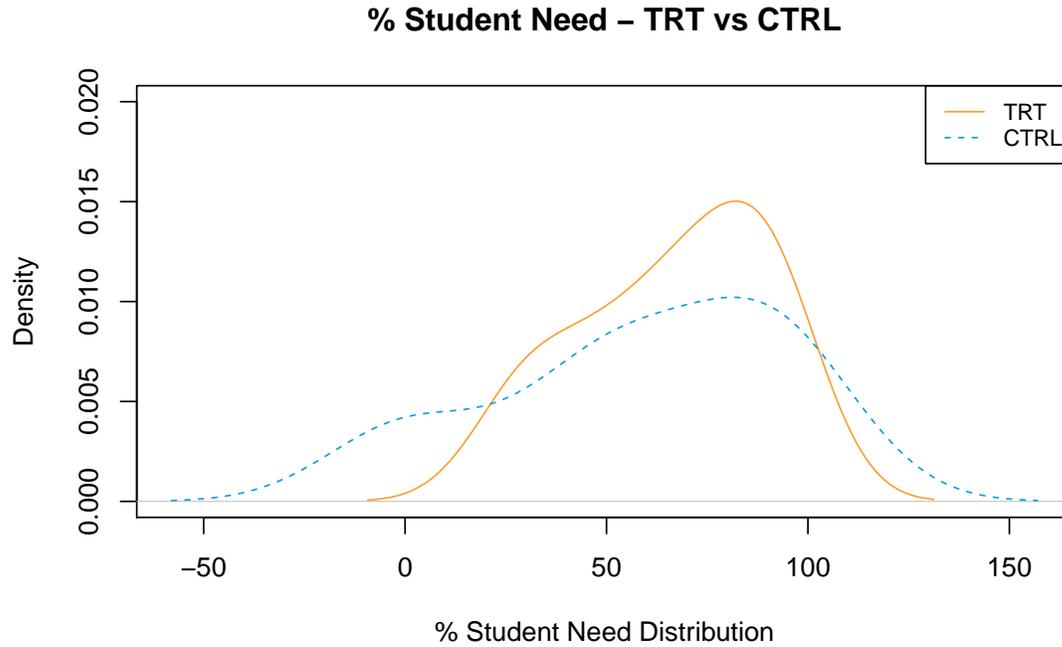

Figure 3: Baseline Year Density Plot Showing Student Need Match between TRT and CTRL

Table 5 shows the difference of the means of Treatment versus Control in the baseline year, with accompanying p-values, for percent Meets or Exceeded Standard, for mean scale score, and for percent of students receiving free or reduced lunch. The large p-values show the differences between the Treatment and Control grades are not statistically significant.

	Mean(TRT)	SD(TRT)	Mean(CTRL)	SD(CTRL)	Estimate	P-Value
Meets or Exceeded Standard - 2013/14	57.25	13.65	58.22	16.08	-0.97	0.88
Scale score - 2013/14	308.42	22.30	306.72	23.67	1.70	0.86
Percent Free or Reduced Lunch	66.82	23.49	58.91	35.61	7.91	0.55

Table 5: Matching TRT and CTRL

3.4 Grade-Aggregated Analysis

Table 6 shows for both Treatment (TRT) and Control (CTRL) aggregation across grades of scale scores, Z-scores, and proficiency level distributions. The far right column also shows the average ST Math Progress for the TRT set.

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per Comp.
TRT.13.14	11	8	1250	308.4	-0.62	31.55	16.75	25.99	46.99	10.28	57.25	–
TRT.15.16	11	8	1138	2453.8	-0.23	40.36	34.28	30.96	23.34	11.43	34.77	–
TRT.16.17	11	8	1173	2466.3	0.07	47.00	30.45	29.79	23.25	16.53	39.76	62.54
TRT.Delta	–	–	–	2157.9	0.68	15.45	13.70	3.80	-23.75	6.25	-17.48	–
CTRL.13.14	11	10	1059	306.7	-0.63	32.18	17.53	24.29	49.69	8.53	58.22	–
CTRL.15.16	11	10	888	2443.4	-0.56	33.45	40.11	34.28	16.99	8.58	25.60	–
CTRL.16.17	11	10	1009	2444.2	-0.60	31.91	38.40	34.85	18.62	8.13	26.75	–
CTRL.Delta	–	–	–	2137.5	0.03	-0.27	20.87	10.56	-31.07	-0.40	-31.46	–

Table 6: Yearly Math Proficiency and Counts for TRT and CTRL Grade-Aggregated Datasets

The following chart (Figure 4) shows the changes in percentage of students at each math proficiency level for the grade-aggregated Treatment and Control sets (TRT.delta and CTRL.delta).
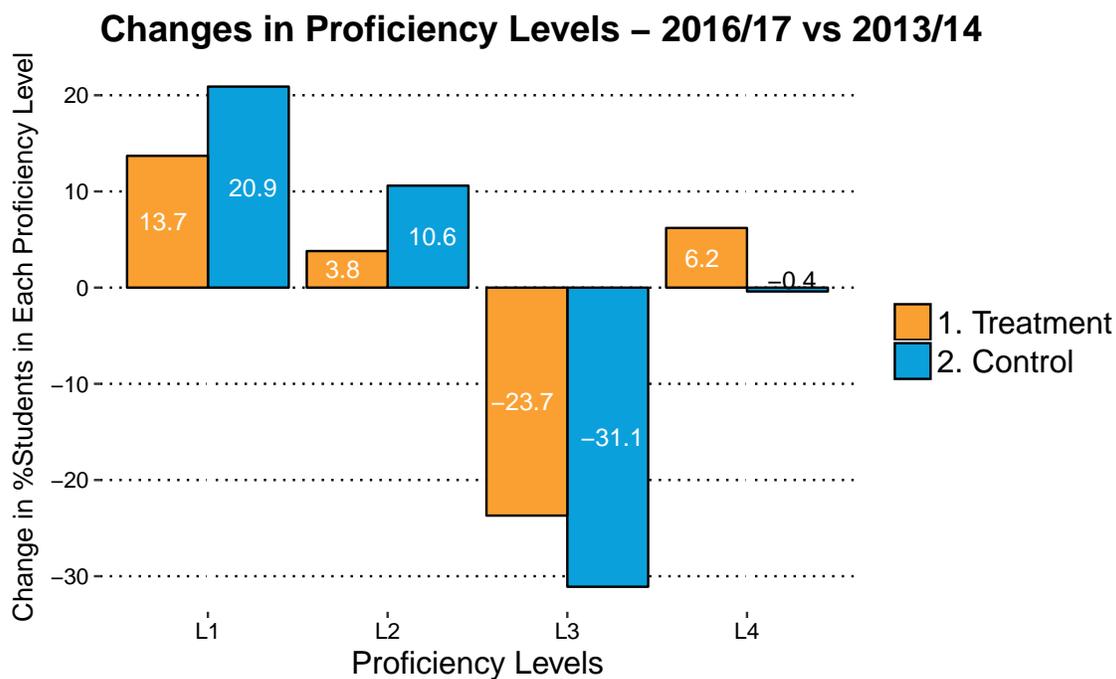

Figure 4: Change at each Proficiency Level for Grade-Aggregated TRT and CTRL Datasets between 2013/14 and 2016/17

Similarly, Figure 5 shows the changes in CRT Math scale scores and changes in Z-scores for the grade-aggregated Treatment and Control sets.
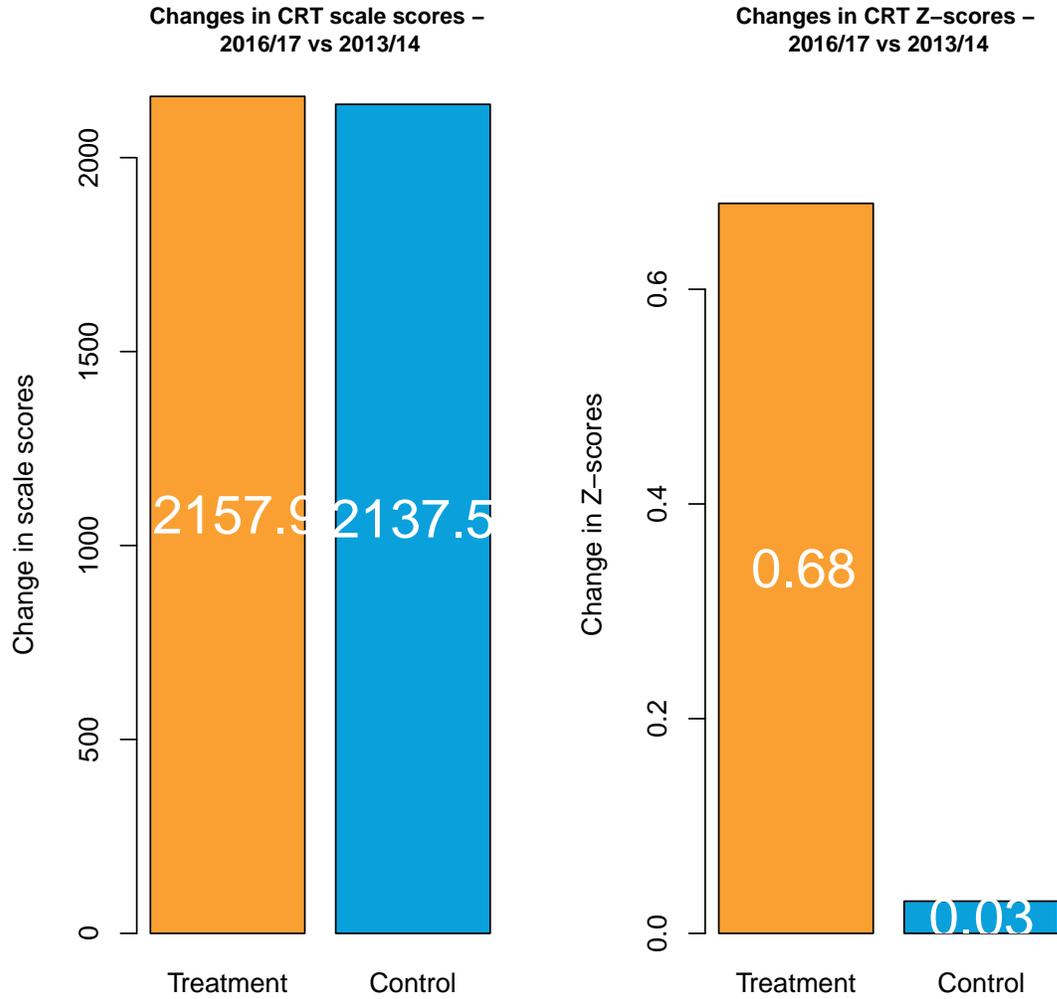

Figure 5: Changes in CRT Math scale scores and Z-scores (See Section 3.1) for Grade-Aggregated TRT and CTRL datasets between 2013/14 and 2016/17

Further, Figure 6 shows the changes in percent of students at CRT Meets or Exceeded Standard for the grade-aggregated Treatment and Control sets.

Changes in Meets or Exceeded Standard 2016/17 vs 2013/14
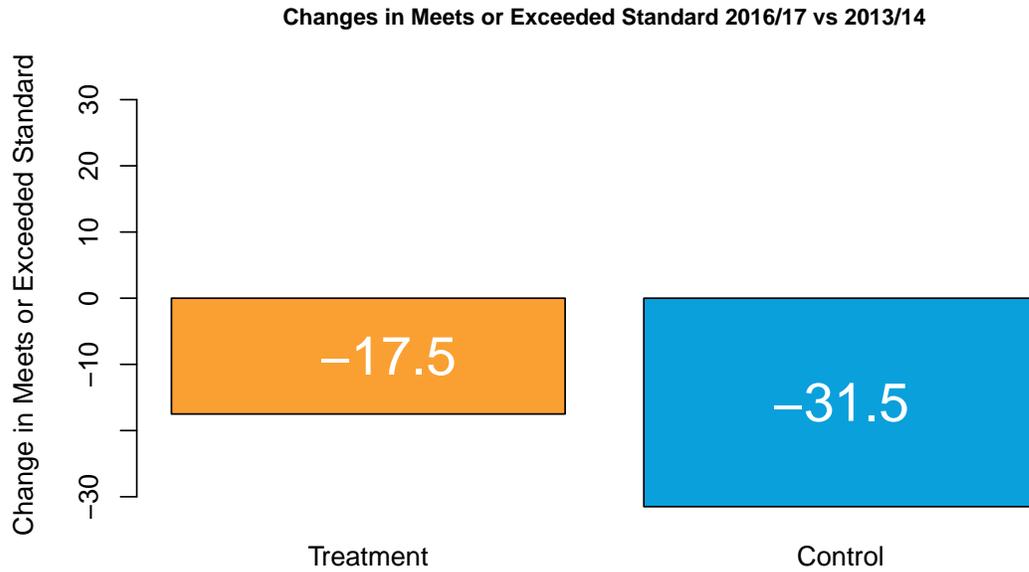
Figure 6: Changes in Meets or Exceeded Standard for Grade-Aggregated TRT and CTRL datasets between 2013/14 and 2016/17

Finally, Table 7 shows the statistics for the *differences* in changes between TRT and CTRL (Treatment - Control) for these same CRT math proficiency and scale score changes as in the above figures. [1]

	Estimate	P-Value	Int.Low	Int.High
Meets or Exceeded Standard	13.98	0.08	-2.05	30.01
scale score	20.46	0.10	-4.57	45.49
Z-score	0.65	0.10	-0.14	1.43
L1	-7.17	0.26	-20.24	5.89
L2	-6.76	0.10	-14.90	1.38
L3	7.33	0.35	-8.62	23.27
L4	6.65	0.09	-1.26	14.55

Table 7: Statistics for the Differential Changes in Math Scores Growth (TRT - CTRL)

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[1]* statistically significant $p < 0.05$

Finally, Figure 7 shows the changes in mean percentile ranking between TRT and CTRL.
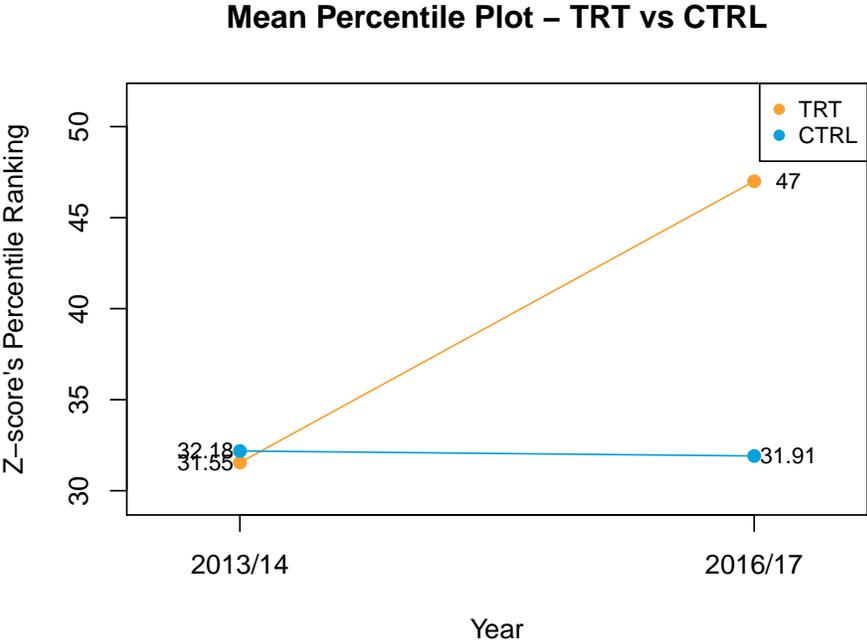
Mean Percentile Plot – TRT vs CTRL

Figure 7: Changes in Percentile Ranking for TRT and CTRL Datasets between 2013/14 and 2016/17

3.5 Grade-Level Analysis

3.5.1 Grade Level Result Tables

The following tables (Table 8, 9, and 10) present a disaggregation of results by grade level. The far right column in each table also shows the average ST Math Progress for the TRT set.

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per I
TRT.13.14	2	2	227	325.6	0.08	52.50	12.70	23.30	23.30	40.75	64.00	–
TRT.15.16	2	2	220	2444.7	0.66	59.50	21.20	21.55	32.95	24.30	57.25	–
TRT.16.17	2	2	239	2474.8	1.51	86.00	13.05	17.65	28.60	40.80	69.40	63.02
TRT.Delta	–	–	–	2149.2	1.44	33.50	0.35	-5.65	5.30	0.05	5.40	–
CTRL.13.14	2	2	152	302.2	-0.87	20.00	17.15	33.55	27.65	21.75	49.35	–
CTRL.15.16	2	2	131	2419.7	-0.15	44.50	30.50	31.20	23.70	14.55	38.30	–
CTRL.16.17	2	2	139	2418.6	-0.27	42.00	28.45	31.90	26.65	13.00	39.70	–
CTRL.Delta	–	–	–	2116.3	0.60	22.00	11.30	-1.65	-1.00	-8.75	-9.65	–

Table 8: Grade 3 - Yearly Math Performance and Counts for TRT and CTRL Datasets

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per
TRT.13.14	5	5	591	305.9	-0.82	24.80	11.76	30.76	53.42	4.08	57.50	–
TRT.15.16	5	5	516	2452.8	-0.19	42.20	27.42	37.36	25.84	9.42	35.26	48.71
TRT.16.17	5	5	543	2456.5	-0.18	39.40	27.00	35.70	25.00	12.30	37.28	60.42
TRT.Delta	–	–	–	2150.6	0.64	14.60	15.24	4.94	-28.42	8.22	-20.22	–
CTRL.13.14	5	5	489	314.2	-0.41	40.60	8.80	26.00	57.18	8.04	65.22	–
CTRL.15.16	5	5	398	2444.9	-0.43	39.80	34.16	37.42	19.02	9.38	28.40	–
CTRL.16.17	5	5	447	2452.5	-0.30	39.20	26.42	44.80	20.82	7.98	28.78	–
CTRL.Delta	–	–	–	2138.3	0.10	-1.40	17.62	18.80	-36.36	-0.06	-36.44	–

Table 9: Grade 4 - Yearly Math Performance and Counts for TRT and CTRL Datasets

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per I
TRT.13.14	4	4	432	303.0	-0.70	29.50	25.02	21.38	50.80	2.80	53.55	–
TRT.15.16	4	4	402	2459.6	-0.73	28.50	49.40	27.68	15.40	7.50	22.93	–
TRT.16.17	4	4	391	2474.5	-0.35	37.00	43.48	28.47	18.38	9.67	28.05	64.95
TRT.Delta	–	–	–	2171.5	0.35	7.50	18.45	7.10	-32.42	6.87	-25.50	–
CTRL.13.14	4	4	418	299.6	-0.80	27.75	28.62	17.52	51.35	2.52	53.90	–
CTRL.15.16	4	4	359	2453.3	-0.92	20.00	52.35	31.90	11.10	4.60	15.75	–
CTRL.16.17	4	4	423	2446.6	-1.14	17.75	58.35	23.90	11.85	5.88	17.75	–
CTRL.Delta	–	–	–	2147.0	-0.34	-10.00	29.73	6.38	-39.50	3.35	-36.15	–

Table 10: Grade 5 - Yearly Math Performance and Counts for TRT and CTRL Datasets

3.5.2 Grade-Level Analysis of Changes in Math Meets or Exceeded Standard

Figure 8 shows the difference in the growth of percentages of students at math Meets or Exceeded Standard, for the TRT and CTRL datasets, disaggregated by grade:

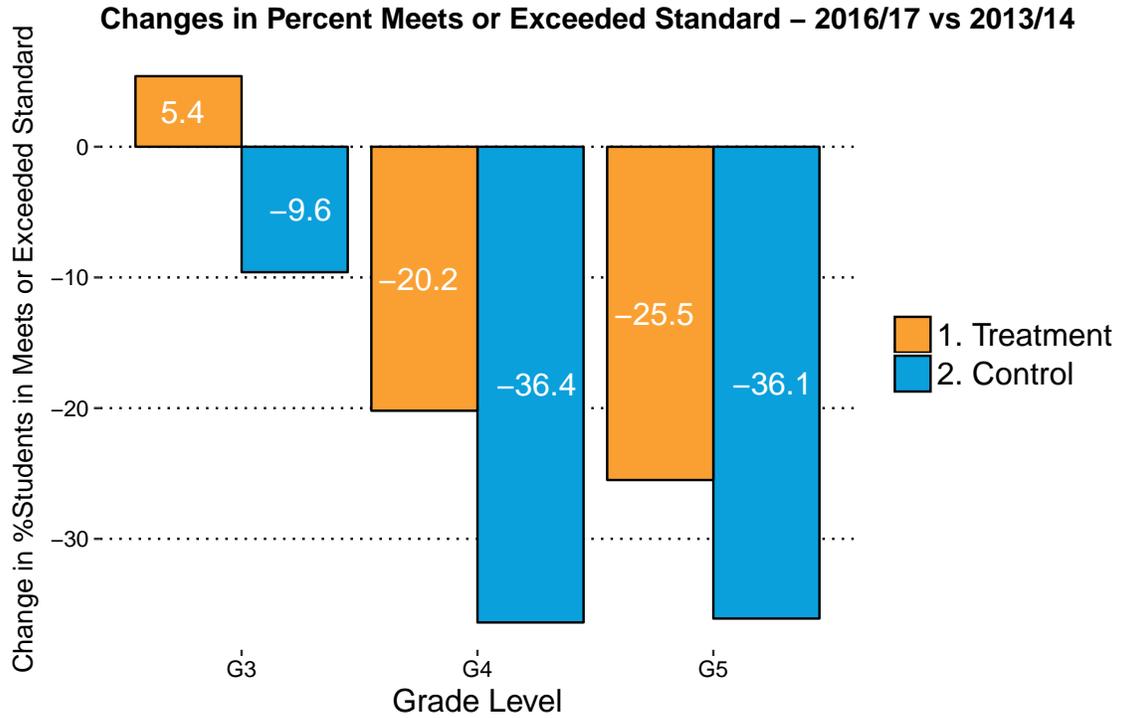**Changes in Percent Meets or Exceeded Standard – 2016/17 vs 2013/14**

Figure 8: Changes in Percent of Students at Meets or Exceeded Standard for TRT and CTRL Datasets between 2013/14 and 2016/17

Table 11 shows the statistics for the *differences* in changes between TRT and CTRL (Treatment - Control) for these same Meets or Exceeded Standard math proficiency changes as shown in Figure 8.

	Estimate	P-Value	Int.Low	Int.High
Grade 4	16.22	0.17	-8.68	41.12

Table 11: Statistics for the Differential Changes in Meets or Exceeded Standard, (TRT - CTRL)

3.5.3 Grade-Level Analysis of Changes in CRT Math scale scores

Figure 9 shows the changes in the grade-mean math scale scores of students for the TRT and CTRL datasets, disaggregated by grade:
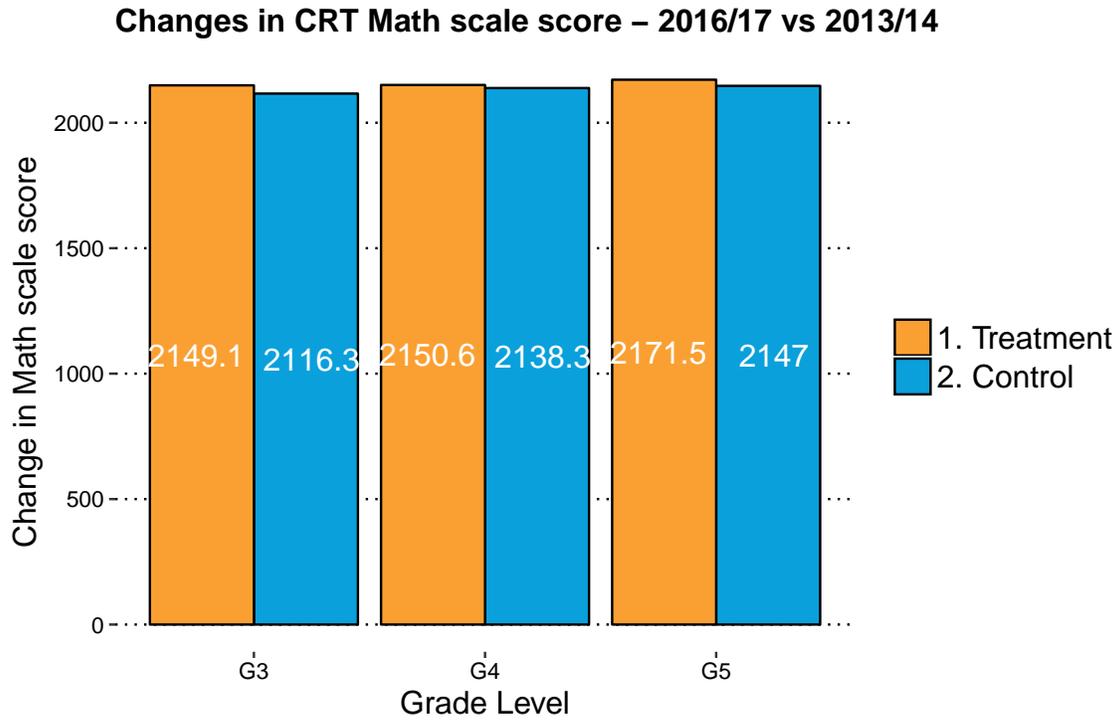

Figure 9: Changes in Grade-Mean CRT Math scale score for TRT and CTRL Datasets between 2013/14 and 2016/17

Table 12 shows the statistics for the differences between TRT and CTRL (Treatment - Control) for these same CRT math scale score changes as shown in Figure 9.

	Estimate	P-Value	Int.Low	Int.High
Grade 4	12.30	0.49	-28.10	52.70

Table 12: Statistics for the Differential Changes in CRT Math scale scores Growth, (TRT - CTRL)

3.5.4 Grade-Level Analysis of Changes in CRT Z-scores of scale scores

Figure 10 shows the changes in the grade-mean Z-scores of students for the TRT and CTRL datasets, disaggregated by grade:
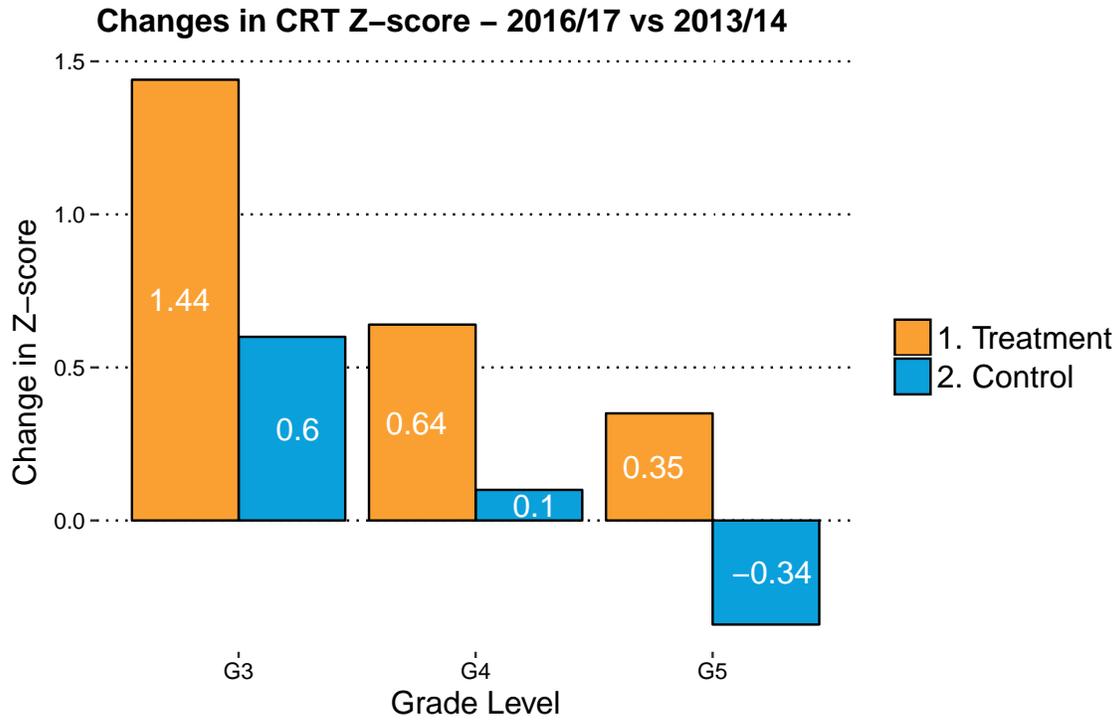

Figure 10: Changes in Grade-Mean CRT Z-score (See Section 3.1) for TRT and CTRL Datasets between 2013/14 and 2016/17

Table 13 shows the statistics for the differences between TRT and CTRL (Treatment - Control) for these same CRT Z-score changes as shown in Figure 10.

	Estimate	P-Value	Int.Low	Int.High
Grade 4	0.54	0.38	-0.80	1.87

Table 13: Statistics for the Differential Changes in CRT Z-scores (See Section 3.1) Growth, (TRT - CTRL)

4 Effect Size

The following table shows the effect sizes for Meets or Exceeded Standard, CRT scale score, and accompanying Z-score.

	Scale score Effect Size	Z-score Effect Size	Meets or Exceeded Standard Effect Size
Grade 3	3.65	2.28	1.79
Grade 4	0.57	0.50	0.90
Grade 5	0.76	0.76	0.68
All Grades	0.86	0.73	0.87

Table 14: Cohen's d Effect Size

5 Findings Summary

Nevada grades 3, 4, and 5 using ST Math for the year 2016/17 averaged 34.9% ST Math Progress. 12/69 grades (17%) averaged covering more than 50% of ST Math content. No statistically significant findings were discovered during this analysis due to the small number of treatment grades for this state.

6 Confounders

Despite best efforts in minimizing confounders to the results of this analysis, there still remain a few input variables that could be significant in affecting differences of state test score outcomes between the Treatment and Control sets. One issue is the lack of randomization of grades chosen to receive the ST Math treatment. Instead of randomized selection, Treatment grades are self-selected. Self-selection can be an indication of districts or schools with a focus on math, an appetite for change, and with a spotlight on math training. Furthermore, not all grades using the ST Math program are chosen for analysis. Each grade must pass two specific filters to be considered for the Treatment set: the first being an enrollment filter of at least 85% of students in each grade using the program, and the second being a progress filter of at least 50% of the program completed on average by students in that grade. These filters might indicate relatively high-functioning schools with a team of relatively effective teachers in that grade, thus resulting in better instruction overall. A mitigation of this possible confounder is our selection of treatment groups on the grade level, rather than the teacher level, so there is no cherry picking of teachers: the full range of teachers in each grade is included. Moreover, the specific teachers may often be the same in the baseline year as in the current year, so the Treatment growth is not due to teacher differences. Finally, a possible confounder lies in the "business as usual" conditions at the matched control grades chosen for each analysis. It's unknown whether these control grades used other programs that could affect the comparison of the two sets of grades. The Monte Carlo Method is used to mitigate the possibility of control picks being favorable or unfavorable (see Section 2.3).

7 Reference Tables Grouped By School Year

The following tables show grade-level details, grouped by school year and for treatment (Table 15) and controls (Table 16) separately.

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per Comp.
Grade 3 (13.14)	2	2	227	325.6	0.08	52.5	12.70	23.30	23.30	40.75	64.00	–
Grade 4 (13.14)	5	5	591	305.9	-0.82	24.8	11.76	30.76	53.42	4.08	57.50	–
Grade 5 (13.14)	4	4	432	303.0	-0.70	29.50	25.02	21.38	50.80	2.80	53.55	–
All Grades (13.14)	11	8	1250	308.4	-0.62	31.55	16.75	25.99	46.99	10.28	57.25	–
Grade 3 (15.16)	2	2	220	2444.7	0.66	59.5	21.20	21.55	32.95	24.30	57.25	–
Grade 4 (15.16)	5	5	516	2452.8	-0.19	42.2	27.42	37.36	25.84	9.42	35.26	48.71
Grade 5 (15.16)	4	4	402	2459.6	-0.73	28.50	49.40	27.68	15.40	7.50	22.93	–
All Grades (15.16)	11	8	1138	2453.8	-0.23	40.36	34.28	30.96	23.34	11.43	34.77	–
Grade 3 (16.17)	2	2	239	2474.8	1.51	86.0	13.05	17.65	28.60	40.80	69.40	63.02
Grade 4 (16.17)	5	5	543	2456.5	-0.18	39.4	27.00	35.70	25.00	12.30	37.28	60.42
Grade 5 (16.17)	4	4	391	2474.5	-0.35	37.00	43.48	28.47	18.38	9.67	28.05	64.95
All Grades (16.17)	11	8	1173	2466.3	0.07	47.00	30.45	29.79	23.25	16.53	39.76	62.54

Table 15: TRT Grades Detail Sorted by Year

	# Grades	# Schools	# Students	Scale score	Z-score	Percentile	L1	L2	L3	L4	Meets or Exceeded Standard	ST Math Per Comp.
Grade 3 (13.14)	2	2	152	302.2	-0.87	20.0	17.15	33.55	27.65	21.75	49.35	–
Grade 4 (13.14)	5	5	489	314.2	-0.41	40.6	8.80	26.00	57.18	8.04	65.22	–
Grade 5 (13.14)	4	4	418	299.6	-0.80	27.75	28.62	17.52	51.35	2.52	53.90	–
All Grades (13.14)	11	10	1059	306.7	-0.63	32.18	17.53	24.29	49.69	8.53	58.22	–
Grade 3 (15.16)	2	2	131	2419.7	-0.15	44.5	30.50	31.20	23.70	14.55	38.30	–
Grade 4 (15.16)	5	5	398	2444.9	-0.43	39.8	34.16	37.42	19.02	9.38	28.40	–
Grade 5 (15.16)	4	4	359	2453.3	-0.92	20.00	52.35	31.90	11.10	4.60	15.75	–
All Grades (15.16)	11	10	888	2443.4	-0.56	33.45	40.11	34.28	16.99	8.58	25.60	–
Grade 3 (16.17)	2	2	139	2418.6	-0.27	42.0	28.45	31.90	26.65	13.00	39.70	–
Grade 4 (16.17)	5	5	447	2452.5	-0.30	39.2	26.42	44.80	20.82	7.98	28.78	–
Grade 5 (16.17)	4	4	423	2446.6	-1.14	17.75	58.35	23.90	11.85	5.88	17.75	–
All Grades (16.17)	11	10	1009	2444.2	-0.60	31.91	38.40	34.85	18.62	8.13	26.75	–

Table 16: CTRL Grades Detail Sorted by Year

8 Lists of Schools

8.1 Treatment Schools

The following table lists the treatment schools and grades (after 85% enrollment and 50% progress filtering) used in the analysis.

PID	IID	District	School Name	GRADE
5270224	CHA6VM	Clark	Frias ES	3, 4
5099501	ROG6VK	Clark	Gehring ES	5
3328904	CHA6VK	Clark	Hill ES	3
712045	ROB6VO	Clark	Lake ES	4
5270157	RIC6VB	Clark	Priest ES	4, 5
3401661	RIC6VJ	Clark	Rundle ES	4, 5
711986	ROB6V9	Clark	Taylor (Robert) ES	5
2179413	RET6VI	Clark	Tobler ES	4

Table 17: Treatment Schools (TRT Dataset)

8.2 Control Schools

The following table lists the control schools and grades (matched control grades to treatment grades) used in the analysis.

PID	District	School Name	GRADE
10030102	Clark	100 Academy ES	4, 3
712033	Clark	Bell ES	5
3010729	Clark	Cox (Clyde) ES	4
3011979	Clark	McDoniel ES	4
4465062	Clark	Roberts ES	4
5348156	Clark	Tanaka ES	5
2180254	Elko	West Wendover Elementary	5
713764	WCSD	Corbett ES	4
2126832	WCSD	Dunn ES	3
713752	WCSD	Mitchell ES	5

Table 18: Matched Control Schools (CTRL Dataset)