USA Math Outcomes Analysis 2022/23

Grade Levels: 3, 4, 5
ST Math Program: Gen-6
Analysis Type: Z-score of Math Proficiency
Treatment-Years: 2021/22 and 2022/23
Baseline-Year: 2020/21
Subgroup: All

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Abstract

This analysis evaluates grades using ST Math in the USA in 2022/23. 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 115 grades, consisting of grades 3, 4, and 5 at 75 schools, with an average baseline z-score of -0.44. Refer to Figures 2 and 3 for the math performance and demographic distributions. They were matched to 115 similar, randomly selected control grades at 107 schools that never used ST Math. Grade-wise growth in math proficiency was evaluated (i.e. growth in same grade, same school, from 2020/21 to 2022/23) on the mean z-scores of percent Proficient or Advanced (see Section 3.1). Grades 3, 4, and 5 aggregated showed an ST Math effect of 0.26 z-score points.

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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 z-score of Proficient or Advanced. The treatment grades used the ST Math program for 2 years, beginning in the 2021/22 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 and math attributes (See Figures 2 and 3) to the treatment grades during the baseline year (2020/21), and did not use ST Math in any subsequent year. The treatment grades' selection pool was all schools using ST Math in grades 3, 4, and 5 in the USA. The control grades' pool was all schools not using ST Math in grades 3, 4, and 5 in the USA. This study method measures effectiveness of the ST Math program when nominally implemented.

1.2 Program Description

Spatial-Temporal Math (ST Math) is game-based, instructional software for K–12 students, created by the MIND Research Institute (MIND). The purpose of the program is to boost math comprehension through visual learning. The ST Math software games begin without language or symbol abstractions by posing math problems as purely visual puzzles. In this way, three objectives 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. Interactive, animated visual manipulatives provide informative feedback on student solutions. A score of 100 percent on a game level comprised of 4-12 puzzles is required for progression through the levels. Failure requires a re-play of the level, via a new quasi-random set of puzzles. In this way, progression is self-paced.

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.

For students to achieve nominal progress through the program, there is a recommended time-on-task requirement of 90 minutes per week over about 30 weeks. Consistent application of 90 minutes per week throughout the school year is normally sufficient to result in a grade's average ST Math content coverage exceeding 50% by year-end. In this study, we include grades that have achieved 40% or more content coverage (Progress) by April 15th.

This is a passive study with no experimental setup or extraordinary communications to any schools. All schools in this study therefore received normal program implementation support through the year from MIND support managers. This support includes bundled startup services of approximately 2-4 hours of training either in-person or online, access to live webinars, regular online and push reports on usage and progress, email/phone helpdesk, and proactive monitoring for gaps or issues by MIND support representatives.

MIND Research Institute initiated, funded, and exercised editorial control over this study.

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 Treatment Grades Pool and Selection

The Treatment grades pool originated with all schools and grades using ST Math in the USA. From these schools, every grade that had used the ST Math program in 2021/22 and 2022/23 was identified. They comprise the Treatment grades pool for this evaluation of 2-year usage.

2.1.1 Enrollment Filter

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 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%.

2.1.2 Content Coverage Filter

Furthermore, the outcomes measure is a summative year-end test, i.e. the standardized math assessment of that state. 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 each state's 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 40% by April.

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 40% 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.

2.2 Control Grades Pool and Selection

The control grades are randomly selected from a control pool of schools in the USA. Though they are randomly selected, they are also matched to be similar to the Treatment grades' math attributes

during the baseline year and the four years prior, in addition to the baseline demographics. The matched attributes include:

- grade-mean z-score of percent Proficient or Advanced
- percentage of students receiving free or reduced lunch at the school-level (using the demographic data from MDR).

The method of matching used is propensity score matching, via the "matchit" program in R, with "mahalanobis" as the distance measure.

3 Data Analysis

The set of all schools and grades using ST Math in USA is evaluated for Enrollment percentage and Progress percentage parameters. A filtered Treatment set (TRT) of all ST Math grades with $\geq$ 85% Enrollment and $\geq$ 40% 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

In order to analyze across all states with different math assessments, a new z-score of that test's math proficiency is calculated. For each year being analyzed, by grade, a z-score takes the difference of the grade mean percent proficient and the mean of all percent proficient statewide for that year, and then divides it by the standard deviation of all percent proficient 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, Percent Proficient: 70
Average across all schools statewide, Grade 3: 50
Standard deviation across all schools statewide, Grade 3: 20
Z-score=((School A, Grade 3, Percent Proficient)-(Average across all schools, Grade 3))/(Standard deviation across all schools, Grade 3)

$$\text{Z-score}=\frac{70-50}{20}=1$$

The z-score is calculated for every grade across all years being analyzed, using the full state data set of 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 only analyze 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)

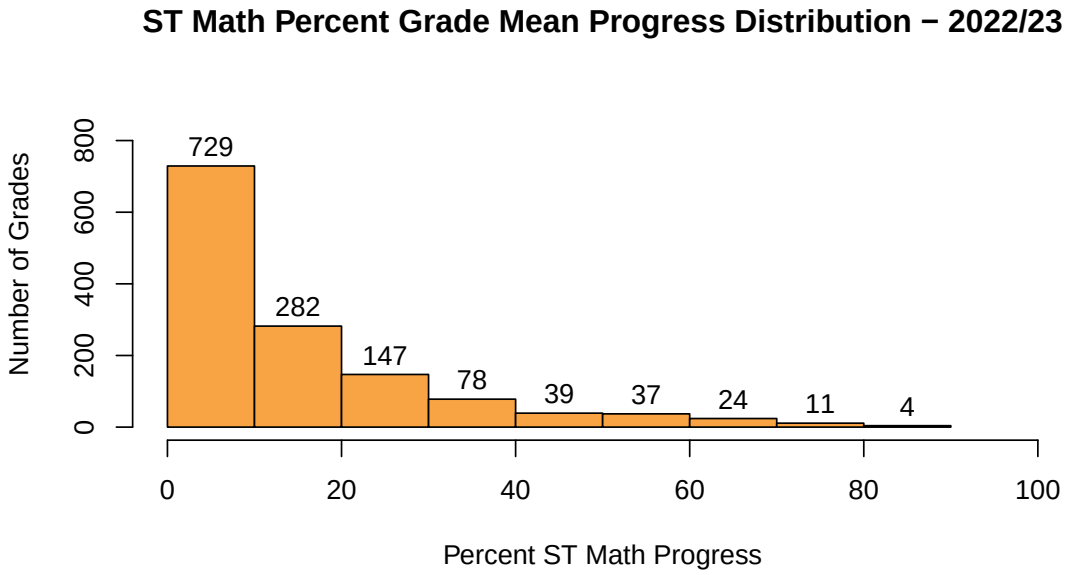

Figure 1: Histogram of ST Math Percent Progress for $\geq$ 85% Enrollment Grades 2022/23

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 $\geq$ 40% Progress as the Treatment Group.

Table 1 provides descriptive statistics of the Progress distribution. Table 2 shows the number of remaining treatment grades after applying enrollment and progress filters.

	Min.	Max.	Average	S.D.
ST Math % Progress	0.0	88.1	15.2	15.7

Table 1: Descriptive Statistics of ST Math Percent Progress for >= 85 percent Enrollment Grades

Grades with >= 85% Enrollment:	1351
Grades with in addition >= 40% Progress:	115

Table 2: Number of ST Math Grades with >= 85 percent Enrollment and with >= 40 percent progress

3.3.2 Filtering Treatment and Controls

Table 3 shows the total number of grades in the Treatment pool, the number of grades that exceeded the 85% Enrollment filter, and also the 40% Progress filter. Other rows in the table indicate counts of numbers of students (2022/23 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	1016	982	907	2905
ST Math Using Schools	1016	982	907	1206
ST Math Students	77656	76142	74240	228038
ST Math Grades (Enroll >= 85%)	617	409	325	1351
TRT Grades (Enroll >= 85% & Prog >= 40%)	33	55	27	115
TRT Schools (Enroll >= 85% & Prog >= 40%)	33	55	27	75
TRT Students (Enroll >= 85% & Prog >= 40%)	2717	4273	1968	8958
CTRL Grades	33	55	27	115
CTRL Schools	33	54	27	107
CTRL Students	2559	4028	1753	8340

Table 3: Treatment Pool Filtering and Controls: Counts of Grades, Schools, and Students

3.3.3 Match of Controls to Treatment

Figure 2 shows the density plots of the baseline z-score of percent students at state assessment Proficient or Advanced (left plot) and the percentage of students needing free or reduced lunch (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, 2020/21.

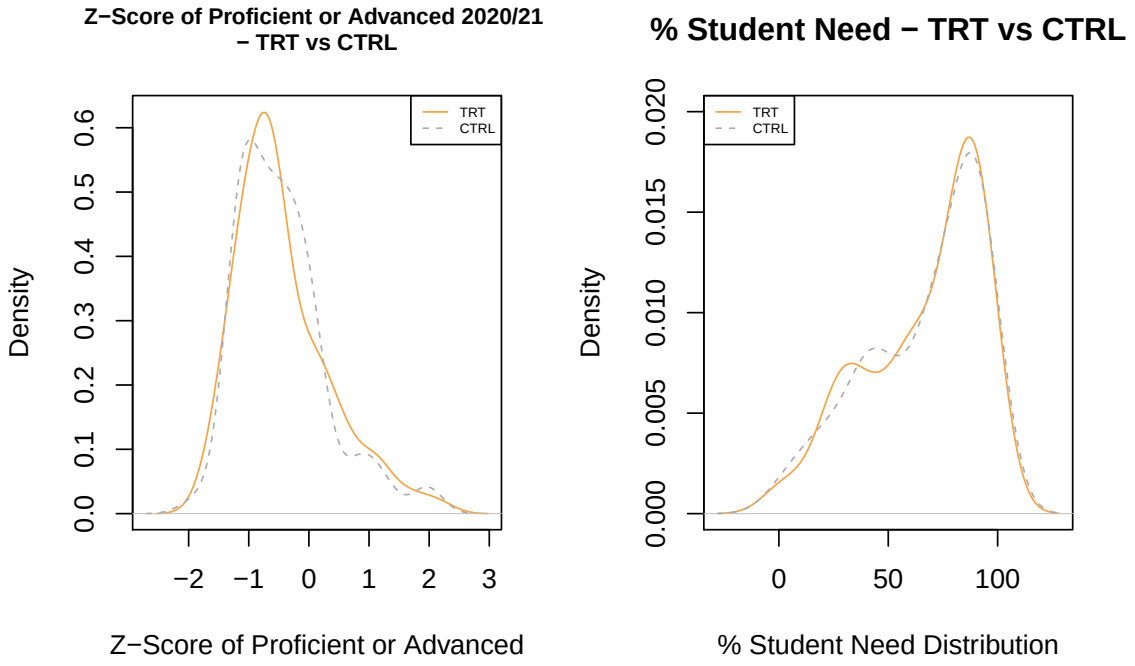

Figure 2: Baseline Year Density Plots Showing Math Scores and Percent Student Need Match between TRT and CTRL - 2020/21

Table 4 shows the difference of the means of Treatment versus Control in the baseline year, with accompanying p-values, for mean z-score of percent Proficient or Advanced 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	Effect Size
Z-Score of Proficient or Advanced - 2020/21	-0.44	0.79	-0.45	0.75	0.01	0.92	0.01
Percent Free or Reduced Lunch	66.35	26.48	66.52	26.86	-0.17	0.96	-0.01

Table 4: Matching TRT and CTRL

3.4 Grade-Aggregated Analysis

Table 5 shows for both Treatment (TRT) and Control (CTRL) aggregation across grades of proficiency level distributions. The far right column also shows the average ST Math Progress for the TRT set.

	# Grades	# Schools	# Students	Z-Score	Percentile	ST Math Per Comp.
TRT.21.22	115	75	8075	-0.44	34.74	–
TRT.22.23	115	75	8520	-0.13	44.37	56.46
TRT.Delta	–	–	–	0.31	9.63	–
CTRL.21.22	115	107	7482	-0.45	34.24	–
CTRL.22.23	115	107	8340	-0.40	37.51	–
CTRL.Delta	–	–	–	0.05	3.27	–

Table 5: All Grades Together Growth

Figure 3 shows the changes in mean z-scores of percent Proficient or Advanced for the grade-aggregated Treatment and Control sets.

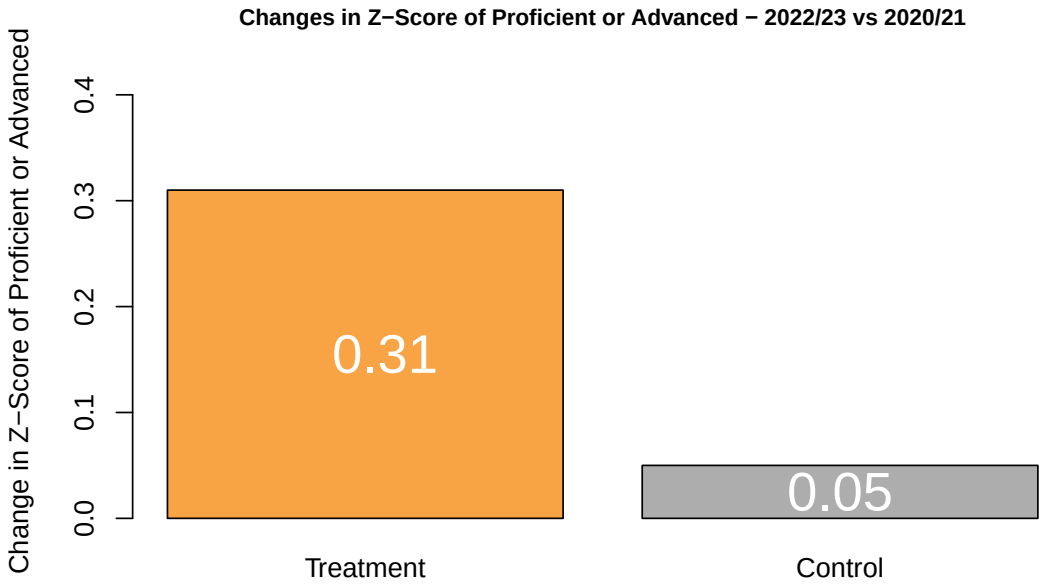

Figure 3: Changes in Z-Score of Proficient or Advanced (See Section 3.1) for Grade-Aggregated TRT and CTRL datasets between 2020/21 and 2022/23

Further, Table 6 shows the statistics for the *differences* in changes between TRT and CTRL (Treatment - Control) for these same z-score changes as in the above figure. [1]

	Estimate	P-Value	Int.Low	Int.High
Z-Score	0.26	0.00*	0.08	0.43

Table 6: Statistics for the Differential Changes in Math Scores Growth (TRT - CTRL)

Finally, Figure 4 shows the changes in mean percentile ranking between TRT and CTRL.

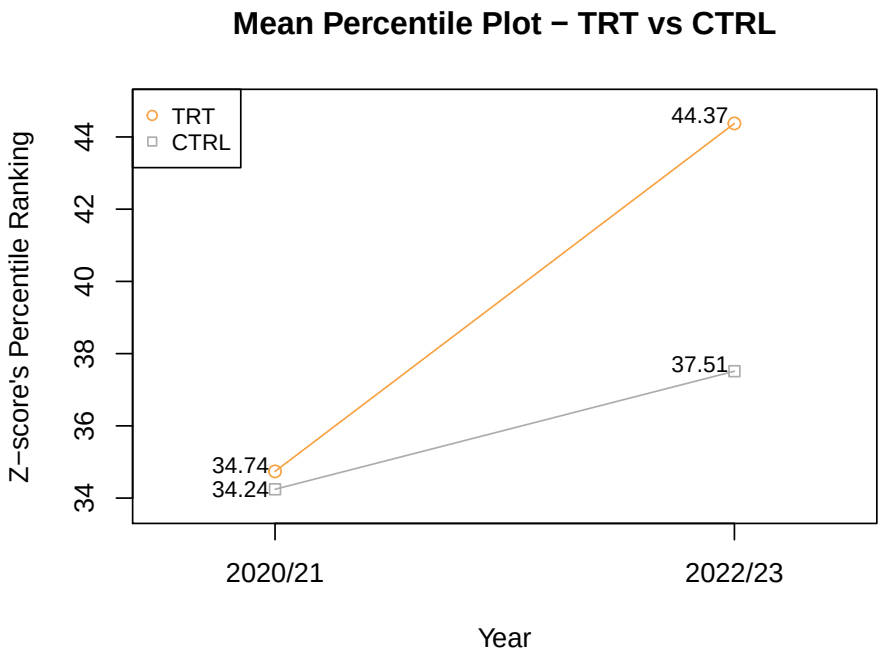

Figure 4: Changes in Percentile Ranking for TRT and CTRL Datasets between 2020/21 and 2022/23

[1] * statistically significant p<0.05

3.5 Grade-Level Analysis

3.5.1 Grade Level Result Tables

The following tables (Table 7, 8, and 9) 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	Z-Score	Percentile	ST Math Per Prog.
TRT.21.22	33	33	2415	-0.66	28.06	–
TRT.22.23	33	33	2593	-0.18	43.30	52.74
TRT.Delta	–	–	–	0.48	15.24	–
CTRL.21.22	33	33	2150	-0.65	28.36	–
CTRL.22.23	33	33	2559	-0.56	32.64	–
CTRL.Delta	–	–	–	0.08	4.27	–

Table 7: Grade 3 - Yearly Math Performance and Counts for TRT and CTRL Datasets

	# Grades	# Schools	# Students	Z-Score	Percentile	ST Math Per Prog.
TRT.21.22	55	55	3917	-0.25	40.56	–
TRT.22.23	55	55	4052	-0.04	46.91	58.88
TRT.Delta	–	–	–	0.21	6.35	–
CTRL.21.22	55	54	3554	-0.28	39.47	–
CTRL.22.23	55	54	4028	-0.26	41.65	–
CTRL.Delta	–	–	–	0.01	2.18	–

Table 8: Grade 4 - Yearly Math Performance and Counts for TRT and CTRL Datasets

	# Grades	# Schools	# Students	Z-Score	Percentile	ST Math Per Prog.
TRT.21.22	27	27	1743	-0.57	31.04	–
TRT.22.23	27	27	1875	-0.26	40.52	56.09
TRT.Delta	–	–	–	0.30	9.48	–
CTRL.21.22	27	27	1778	-0.58	30.78	–
CTRL.22.23	27	27	1753	-0.48	35.04	–
CTRL.Delta	–	–	–	0.10	4.26	–

Table 9: Grade 5 - Yearly Math Performance and Counts for TRT and CTRL Datasets

3.5.2 Grade-Level Analysis of Changes in Z-Score of Proficient or Advanced

Figure 5 shows the changes in the grade-mean z-scores of students for the TRT and CTRL datasets, disaggregated by grade:

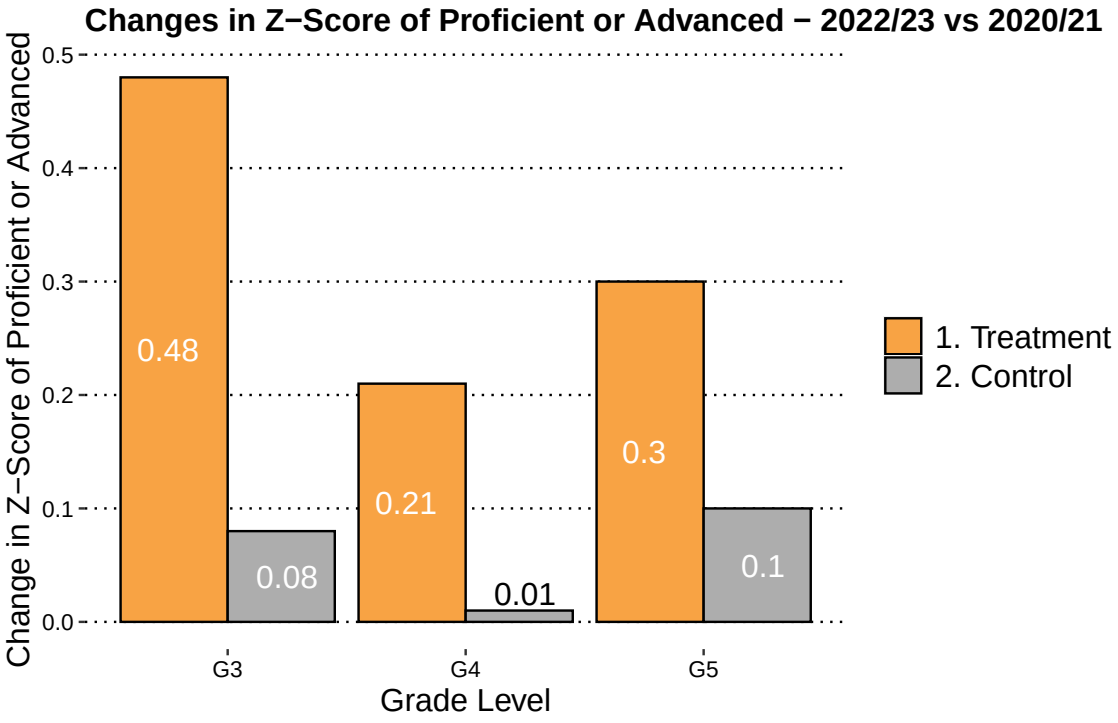

Figure 5: Changes in Grade-Mean Z-Score of Proficient or Advanced (See Section 3.1) for TRT and CTRL Datasets between 2020/21 and 2022/23

Table 10 shows the statistics for the differences between TRT and CTRL (Treatment - Control) for these same z-score changes as shown in Figure 5.

	Estimate	P-Value	Int.Low	Int.High
Grade 3	0.40	0.01*	0.12	0.68
Grade 4	0.20	0.16	-0.08	0.47
Grade 5	0.21	0.25	-0.15	0.57

Table 10: Statistics for the Differential Changes in Z-scores (See Section 3.1) Growth, (TRT - CTRL)

4 Effect Size

The following table shows the effect sizes for z-score of Proficient or Advanced.

	Z-Score of Proficient or Advanced Effect Size
Grade 3	0.67
Grade 4	0.25
Grade 5	0.27
All Grades	0.34

Table 11: Cohen's d Effect Size

5 Findings Summary

USA grades 3, 4, and 5 using ST Math for the year 2022/23 averaged 9.1% ST Math Progress. 125/2905 grades (4%) averaged covering more than 40% of ST Math content. Statistically significant differences were found in this analysis for both grade-aggregated and individual grade-level results. Looking at Table 6, a statistically significant difference was found for grade-aggregated z-score, with an estimate of 0.26 points favorable for the ST Math treatment set. Further, referring to table 10, grade 3 ST Math treatment sets outpeformed their matched controls for z-score of Proficient or Advanced with statistically a significant difference of 0.4.

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 40% 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.

7 Reference Tables Grouped By School Year

The following tables show grade-level details, grouped by school year and for treatment (Table 12) and controls (Table 13) separately.

	# Grades	# Schools	# Students	Z-Score	Percentile	ST Math Per Comp.
Grade 3 (21.22)	33	33	2415	-0.66	28.06	–
Grade 4 (21.22)	55	55	3917	-0.25	40.56	–
Grade 5 (21.22)	27	27	1743	-0.57	31.04	–
All Grades (21.22)	115	75	8075	-0.44	34.74	–
Grade 3 (22.23)	33	33	2593	-0.18	43.30	52.74
Grade 4 (22.23)	55	55	4052	-0.04	46.91	58.88
Grade 5 (22.23)	27	27	1875	-0.26	40.52	56.09
All Grades (22.23)	115	75	8520	-0.13	44.37	56.46

Table 12: TRT Grades Detail Sorted by Year

	# Grades	# Schools	# Students	Z-Score	Percentile	ST Math Per Comp.
Grade 3 (21.22)	33	33	2150	-0.65	28.36	–
Grade 4 (21.22)	55	54	3554	-0.28	39.47	–
Grade 5 (21.22)	27	27	1778	-0.58	30.78	–
All Grades (21.22)	115	107	7482	-0.45	34.24	–
Grade 3 (22.23)	33	33	2559	-0.56	32.64	–
Grade 4 (22.23)	55	54	4028	-0.26	41.65	–
Grade 5 (22.23)	27	27	1753	-0.48	35.04	–
All Grades (22.23)	115	107	8340	-0.40	37.51	–

Table 13: CTRL Grades Detail Sorted by Year

8 Lists of Schools

8.1 Treatment Schools

The following tables list the treatment schools and grades (after 85% enrollment and 40% progress filtering) used in the analysis.

PID	State	District	School Name	GRADE
2176021	AR	SPRINGDALE SCHOOL DISTRICT	PARSON HILLS ELEMENTARY SCHOOL	4
4935756	AZ	Tucson Country Day School, Inc.	Tucson Country Day School	3, 4, 5
66810	CA	Beverly Hills Unified	Hawthorne Elementary	4, 5
78631	CA	Los Nietos	Aeolian Elementary	4
78655	CA	Los Nietos	Rancho Santa Gertrudes Elementary	5
220092	GA	FIRST DISTRICT	LIBERTY ELEMENTARY SCHOOL	4, 5
2180216	GA	FIRST DISTRICT	LYMAN HALL ELEMENTARY SCHOOL	4
4030576	GA	FIRST DISTRICT	TAYLORS CREEK ELEMENTARY SCHOOL	4, 5
4356588	GA	FIRST DISTRICT	FRANK LONG ELEMENTARY SCHOOL	3
4918411	GA	FIRST DISTRICT	WALDO PAFFORD ELEMENTARY SCHOOL	3, 4, 5
239043	IA	Guthrie Center Comm School District	Guthrie Center Elementary School	3, 4
274536	IL	Burbank SD 111	Maddock Elementary School	4, 5
274548	IL	Burbank SD 111	F B Mccord Elem School	4, 5
1532563	IL	City of Chicago SD 299	De Diego Elem Community Academy	4
441090	MA	Boston	Kennedy Patrick J Elementary School	3
441545	MA	Boston	Russell Elementary School	5
2126818	MA	Clinton	Clinton Elementary	3
3333258	MA	Franklin	Parmenter	3, 4, 5
425307	MA	Holyoke	E N White Elementary	3
430821	MA	Lowell	Pawtucketville Memorial	4
419138	MA	New Bedford	Charles S Ashley	4
446715	MA	Oxford	Clara Barton	3
1168291	MA	Pittsfield	Allendale	4, 5
1168526	MA	Pittsfield	Silvio O Conte Community	5
1168538	MA	Pittsfield	Williams	3, 4, 5
510677	MI	Birch Run Area Schools	North Elementary School	3, 4
10904278	NV	Clark	Sister Robert Joseph Bailey Elementary School	3, 4, 5
830283	OH	Paint Valley Local	Paint Valley Elementary	3
1022752	TX	ALDINE ISD	ODOM EL	3, 4
1022790	TX	ALDINE ISD	THOMPSON EL	4
1022817	TX	ALDINE ISD	RAYMOND EL	4
1022831	TX	ALDINE ISD	GOODMAN EL	3, 4
1022843	TX	ALDINE ISD	CARROLL EL	3, 4
1022867	TX	ALDINE ISD	JOHNSON EL	4
1022893	TX	ALDINE ISD	STEPHENS EL	3, 4
1022910	TX	ALDINE ISD	WORSHAM EL	3, 4
1022934	TX	ALDINE ISD	ORANGE GROVE EL	3
1022946	TX	ALDINE ISD	SAMMONS EL	3, 4
1857258	TX	ALDINE ISD	CARMICHAEL EL	3, 4
2201389	TX	ALDINE ISD	CONLEY EL	4
2894376	TX	ALDINE ISD	DUNN EL	4
3246760	TX	ALDINE ISD	GRAY EL	3
3399812	TX	ALDINE ISD	CALVERT EL	3, 4
4032598	TX	ALDINE ISD	ESCAMILLA EL	5
4285276	TX	ALDINE ISD	REED ACADEMY	5
4805046	TX	ALDINE ISD	CARTER ACADEMY	3, 4
5097228	TX	ALDINE ISD	HILL EL	5
11074682	TX	ALDINE ISD	JONES EL	3, 4
12104395	TX	ALDINE ISD	CYPRESSWOOD EL	4
1001526	TX	ANGLETON ISD	SOUTHSIDE EL	4, 5
2845947	TX	ANGLETON ISD	RANCHO ISABELLA	3
1002154	TX	BRYAN ISD	SUL ROSS EL	4
5011066	TX	CEDARS INTERNAT	CEDARS INTERNAT	4
1016002	TX	EL PASO ISD	CHARLES Q MURPH	5
2043216	TX	EL PASO ISD	BOBBY JOE HILL	4

Table 14: Treatment Schools (TRT Dataset)

PID	State	District	School Name	GRADE
1032874	TX	IRION COUNTY IS	IRION EL	4
11014632	TX	LA ACADEMIA DE	LA ACADEMIA DE	5
1060649	TX	LASARA ISD	LASARA EL	3, 4, 5
1020144	TX	PAMPA ISD	AUSTIN EL	4
11932060	TX	PRIORITY CHARTE	COVE CHARTER AC	4
4017794	TX	ROUND ROCK ISD	FERN BLUFF EL	4
4945892	TX	ROUND ROCK ISD	CACTUS RANCH EL	4
1057745	TX	SABINAL ISD	SABINAL EL	3, 4, 5
999580	TX	SOUTHWEST ISD	BOB HOPE EL	4
1049853	TX	TAFT ISD	WOODROE PETTY E	3, 4, 5
4149177	TX	TERRELL ISD	DR BRUCE WOOD E	4
1173222	TX	WICHITA FALLS I	BOOKER T WASHIN	4
1065522	UT	Canyons District	Ridgecrest School	3
11832276	UT	Promontory School of Expeditionary Learning	Promontory School of Expeditionary Learning	3, 5
4455251	UT	Washington District	Three Falls School	4, 5
1068641	UT	Weber District	West Weber School	4
1134824	WI	West Allis-West Milwaukee	Hoover Elementary	4
1134848	WI	West Allis-West Milwaukee	Irving Elementary	5
1134850	WI	West Allis-West Milwaukee	Jefferson Elementary	3, 4, 5
1134965	WI	West Allis-West Milwaukee	Horace Mann Elementary	3, 4

Table 15: Treatment Schools (TRT Dataset)

8.2 Control Schools

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

PID	State	District	School Name	GRADE
25373	AR	PARAGOULD SCHOOL DISTRICT	OAK GROVE ELEMENTARY SCHOOL	4
5356218	AZ	Liberty Elementary District	Westar Elementary School	4
3399288	AZ	Peoria Unified School District	Apache Elementary School	3
41896	AZ	Washington Elementary School District	Lookout Mountain School	5
4934477	CA	Newport-Mesa Unified	Newport Coast Elementary	4
128482	CA	San Jose Unified	Simonds Elementary	5
11705415	CA	Today's Fresh Start-Compton	Today's Fresh Start-Compton	4
139041	CA	Visalia Unified	Washington Elementary	5
208290	GA	FIRST DISTRICT	GOULD ELEMENTARY SCHOOL	3, 5
4876148	GA	FIRST DISTRICT	SOUTHWEST ELEMENTARY SCHOOL	4
221864	GA	GRIFFIN	FAIRVIEW ELEMENTARY	4
223422	GA	METRO	HOUSE ELEMENTARY SCHOOL	3
2128866	GA	METRO	ANNISTOWN ELEMENTARY SCHOOL	4
4755257	GA	METRO	PARTEE ELEMENTARY SCHOOL	4
218570	GA	NORTHWEST GEORGIA	BUCHANAN ELEMENTARY SCHOOL	5
11452917	GA	NORTHWEST GEORGIA	SARA M. RAGSDALE ELEMENTARY	5
2112219	IA	Galva-Holstein Comm School District	Galva-Holstein Upper Elementary	3
253922	IA	Southeast Webster Grand Comm School District	Dayton Center	4
288886	IL	Addison SD 4	Fullerton Elem School	4
269567	IL	Evergreen Park ESD 124	Southeast Elem School	5
311536	IL	Jacksonville SD 117	Washington Elem School	4
294689	IL	La Harpe CSD 347	La Harpe Elementary School	4
287777	IL	Oblong CUSD 4	Oblong Elem School	5
416241	MA	Barnstable	West Villages Elementary School	3
416899	MA	Central Berkshire	Craneville	3
11435517	MA	Fitchburg	McKay Elementary School	3
429767	MA	Framingham	Miriam F McCarthy School	5
422111	MA	Ipswich	Winthrop	4
445993	MA	Leominster	Fall Brook	5
446076	MA	Leominster	Johnny Appleseed	3, 4
431019	MA	Malden	Forestdale	3
417776	MA	Mount Greylock	Williamstown Elementary	4, 5
419231	MA	New Bedford	John Avery Parker	5
1168368	MA	Pittsfield	Robert T. Capeless Elementary School	4
432427	MA	Somerville	Arthur D Healey	4
446959	MA	Southbridge	West Street	3
426569	MA	West Springfield	Philip G Coburn	5
505581	MI	Huron Valley Schools	Highland Elementary School	3
502876	MI	Mona Shores Public School District	Ross Park Elementary School	4
711390	NV	Clark	C. C. Ronnow Elementary School	3, 4
713506	NV	Washoe	GLENN DUNCAN S.T.E.M. ACADEMY	5
800769	OH	Columbus City Schools District	Oakland Park Alternative Elementary	3
1023031	TX	ALIEF ISD	SMITH EL	4
1023043	TX	ALIEF ISD	MAHANAY EL	4
2177972	TX	ALIEF ISD	HEFLIN EL	3, 4
1051765	TX	ARLINGTON ISD	JOHNS EL	4
1548471	TX	ARLINGTON ISD	ATHERTON EL	4
4035760	TX	ARLINGTON ISD	BRYANT EL	3
996112	TX	BEEVILLE ISD	R A HALL EL	4
3318399	TX	CANTON ISD	CANTON INT	4
1052343	TX	CASTLEBERRY ISD	JOY JAMES ACADE	3
1008316	TX	CEDAR HILL ISD	PLUMMER EL	4
4028286	TX	CENTRAL ISD	CENTRAL EL	3
1042477	TX	CONROE ISD	ANDERSON EL	4
11920445	TX	CONROE ISD	SNYDER EL	4

Table 16: Matched Control Schools (CTRL Dataset)

PID	State	District	School Name	GRADE
1044554	TX	CORPUS CHRISTI	MEADOWBROOK EL	4
1030838	TX	COVINGTON ISD	COVINGTON SCHOO	4
1052898	TX	FORT WORTH ISD	EASTERN HILLS E	5
1053385	TX	FORT WORTH ISD	RICHARD J WILSO	4
1053488	TX	FORT WORTH ISD	W J TURNER EL	3
4919439	TX	FORT WORTH ISD	LOWERY ROAD	4
5344538	TX	FORT WORTH ISD	SEMINARY HILLS	3
5010775	TX	GATEWAY CHARTER	GATEWAY CHARTER	4
2895095	TX	GRAPEVINE-COLLE	TAYLOR EL	4
997398	TX	HARLANDALE ISD	CARROLL BELL EL	4
1003811	TX	HARLINGEN CISD	CROCKETT EL	4
1003859	TX	HARLINGEN CISD	HOUSTON EL	4
1003902	TX	HARLINGEN CISD	TRAVIS EL	4
11446918	TX	HARMONY PUBLIC	HARMONY SCHOOL	3
1053751	TX	HURST-EULESS-BE	BELLAIRE EL	4
1053763	TX	HURST-EULESS-BE	BELL MANOR EL	4
4867989	TX	JASPER ISD	JEAN C FEW PRI	3
1034494	TX	JIM HOGG COUNTY	HEBBRONVILLE EL	3
12044630	TX	JUBILEE ACADEMI	JUBILEE HARLING	5
1035474	TX	KENEDY ISD	KENEDY EL	3
1036260	TX	KINGSVILLE ISD	HARVEY EL	4
1036301	TX	KINGSVILLE ISD	PEREZ EL	4
2104535	TX	LA JOYA ISD	GUILLERMO FLORE	3
3323423	TX	LA JOYA ISD	E B REYNA EL	4
5278977	TX	LA JOYA ISD	EMILIANO ZAPATA	5
10914417	TX	LA JOYA ISD	WILLIAM J CLINT	3
1018323	TX	LAMAR CISD	SMITH EL	4
1047063	TX	LEGGETT ISD	LEGGETT EL	5
1038830	TX	LUBBOCK ISD	OVERTON EL	4
4801777	TX	MARBLE FALLS IS	HIGHLAND LAKES	4
4850388	TX	MESQUITE ISD	GRAY EL	3
2890966	TX	MEXIA ISD	R Q SIMS INT	5
1058024	TX	SAN FELIPE-DEL	NORTH HEIGHTS E	4
999449	TX	SOUTH SAN ANTON	HUTCHINS EL	5
1027130	TX	SPRING BRANCH I	LANDRUM MIDDLE	5
11014890	TX	STEP CHARTER SC	STEP CHARTER II	3, 5
996734	TX	TEMPLE ISD	CATER EL	3
3007045	TX	TEXARKANA ISD	SPRING LAKE PAR	5
1019523	TX	TEXAS CITY ISD	KOHFELDT EL	3
11932632	TX	VANGUARD ACADEM	VANGUARD MOZART	4
1032628	TX	WOLFE CITY ISD	WOLFE CITY EL	4
10756617	UT	American Preparatory Academy	American Preparatory Academy - Salem	3
1065704	UT	Murray District	Mcmillan School	3, 5
1067673	UT	Nebo District	Taylor School	4
2105993	UT	Uintah District	Discovery School	4
5343003	UT	Weber District	West Haven School	5
1137448	WI	Cashton	Cashton Elementary	5
1117149	WI	Green Bay Area Public	Baird Elementary	3
1117230	WI	Green Bay Area Public	Elmore Elementary	3
4014493	WI	Green Bay Area Public	King Elementary	5
1140835	WI	Racine Unified	Wadewitz Elementary	4
1123394	WI	Sturgeon Bay	Sunrise Elementary	4
1137668	WI	Tomah Area	Warrens Elementary	4

Table 17: Matched Control Schools (CTRL Dataset)

9 Appendix

Figure 6 charts the grade-aggregated trends of treatment and control for mean Z-Score of Proficient or Advanced.

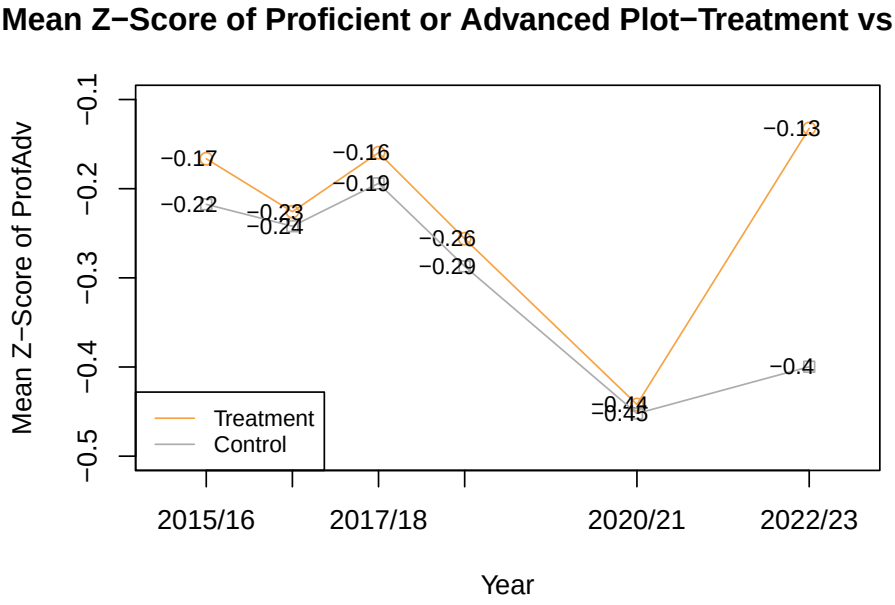

Figure 6: Grade-aggregated Match of Z-Score of Proficient or Advanced for Treatment and Control Datasets for 2015/16, 2016/17, 2017/18, 2018/19, 2020/21, in addition to changes between 2020/21 and 2022/23

Table 18 shows the statistics for the grade-aggregated match between Treatment and Control for these same Z-Score of Proficient or Advanced changes as shown in Figure 6.

	TRT	CTRL	P-Value	Effect Size (Hedges' G)
2015/16	-0.17	-0.22	0.64	0.06
2016/17	-0.23	-0.24	0.88	0.02
2017/18	-0.16	-0.19	0.75	0.04
2018/19	-0.26	-0.29	0.78	0.04
2020/21	-0.44	-0.45	0.92	0.01

Table 18: Statistics for the Grade-aggregated Match of Z-Score of Proficient or Advanced Between Treatment and Control

Figure 7 charts the grade 3 trends of treatment and control for mean Z-Score of Proficient or Advanced.

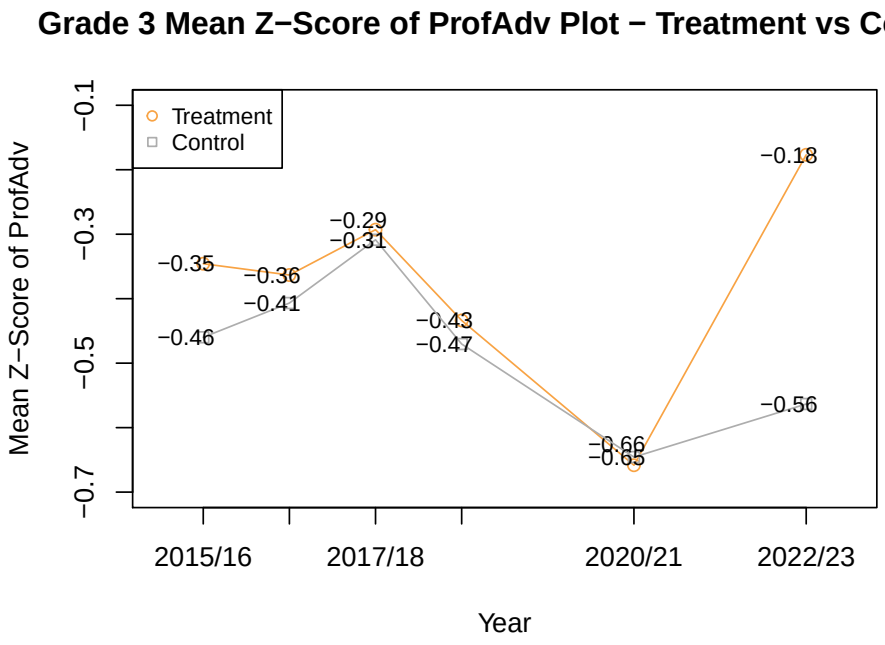

Figure 7: Grade 3 Match of Z-Score of Proficient or Advanced for Treatment and Control Datasets for 2015/16, 2016/17, 2017/18, 2018/19, 2020/21, in addition to changes between 2020/21 and 2022/23

Table **??** shows the statistics for the grade 3 match between Treatment and Control for these same Z-Score of Proficient or Advanced changes as shown in Figure 7.

	TRT	CTRL	P-Value	Effect Size (Hedges' G)
2015/16	-0.35	-0.46	0.53	0.15
2016/17	-0.36	-0.41	0.83	0.05
2017/18	-0.29	-0.31	0.94	0.02
2018/19	-0.43	-0.47	0.85	0.05
2020/21	-0.66	-0.65	0.93	-0.02

Table 19: Statistics for the Grade 3 Match of Z-Score of Proficient or Advanced Between Treatment and Control

Figure 8 charts the grade 4 trends of treatment and control for mean Z-Score of Proficient or Advanced.

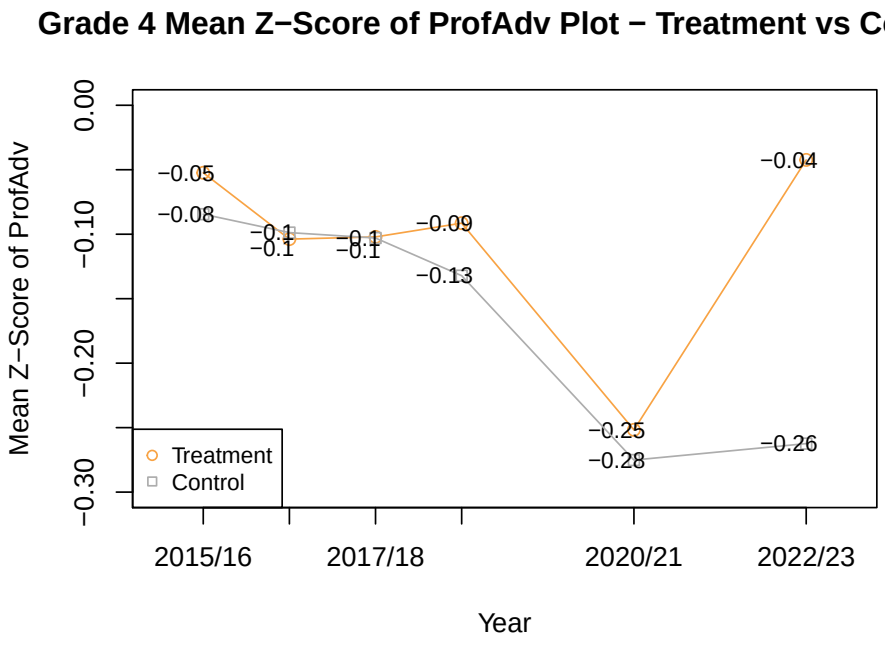

Figure 8: Grade 4 Match of Z-Score of Proficient or Advanced for Treatment and Control Datasets for 2015/16, 2016/17, 2017/18, 2018/19, 2020/21, in addition to changes between 2020/21 and 2022/23

Table 20 shows the statistics for the grade 4 match between Treatment and Control for these same Z-Score of Proficient or Advanced changes as shown in Figure 8.

	TRT	CTRL	P-Value	Effect Size (Hedges' G)
2015/16	-0.05	-0.08	0.85	0.04
2016/17	-0.10	-0.10	0.97	-0.01
2017/18	-0.10	-0.10	1.00	0.00
2018/19	-0.09	-0.13	0.80	0.05
2020/21	-0.25	-0.28	0.88	0.03

Table 20: Statistics for the Grade 4 Match of Z-Score of Proficient or Advanced Between Treatment and Control

Figure 9 charts the grade 5 trends of treatment and control for mean Z-Score of Proficient or Advanced.

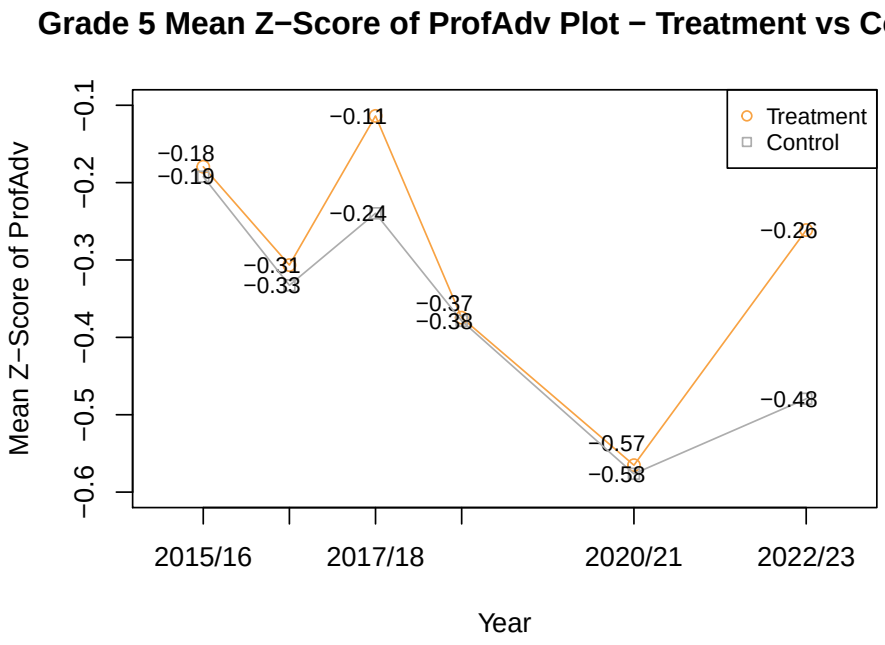

Figure 9: Grade 5 Match of Z-Score of Proficient or Advanced for Treatment and Control Datasets for 2015/16, 2016/17, 2017/18, 2018/19, 2020/21, in addition to changes between 2020/21 and 2022/23

Table 21 shows the statistics for the grade 5 match between Treatment and Control for these same Z-Score of Proficient or Advanced changes as shown in Figure 9.

	TRT	CTRL	P-Value	Effect Size (Hedges' G)
2015/16	-0.18	-0.19	0.95	0.02
2016/17	-0.31	-0.33	0.91	0.03
2017/18	-0.11	-0.24	0.56	0.16
2018/19	-0.37	-0.38	0.99	0.00
2020/21	-0.57	-0.58	0.96	0.01

Table 21: Statistics for the Grade 5 Match of Z-Score of Proficient or Advanced Between Treatment and Control