TECHNICAL BRIEF

Technical appendix for:
Progress towards pandemic recovery: Continued signs of rebounding achievement at the start of the 2022-23 school year

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nwea

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1. Introduction

The purpose of this technical appendix is to share more detailed results and to describe more fully the sample and methods used in the research included in the brief, *Progress towards pandemic recovery: Continued signs of rebounding achievement at the start of the 2022-23 school year.*[i] We investigated two main research questions in this brief:

1) How do summer learning patterns in summer 2022 compare to a pre-pandemic summer?
2) Do we continue to see signs of test scores rebounding at the start of the 2022-23 school year?

2. Data

Sample

The data for this study are from the NWEA anonymized longitudinal student achievement database. School districts use [NWEA® MAP® Growth™](#) assessments to monitor elementary and secondary students' reading and math achievement and gains, with assessments typically administered in the fall (usually between August and November), winter (usually December to March), and spring (late March through June). The NWEA data also include demographic information, including student race/ethnicity, gender, and age at assessment. An indicator of student-level socioeconomic status is not available. However, a set of school-level characteristics, including school-level free or reduced priced lunch (FRPL) eligibility was obtained from the 2020-21 school-level Common Core of Data (CCD) files from the National Center for Education Statistics[ii]

To measure achievement gains across the course of the COVID-19 pandemic, we follow separate cohorts of students across the most recent three school years impacted by the pandemic. The left (dark green) side of the table below illustrates the grades and years used for our "COVID sample" of students. Each cell in this table indicates the grade level that a given cohort is in across the three school years in our panel. In total, our COVID analytic sample consists of approximately 6.9 million students in grades 3-8 in 22,000 public schools who took MAP Growth reading and math assessments across the 2020-21 to 2022-23 school years.

Cohort	COVID Sample (6.9 million students in 22K schools)			Pre-COVID Sample (7.8 million students in 25K schools)		
	2020-21	2021-22	Fall 2022	2017-18	2018-19	Fall 2019
1-3	1	2	3	1	2	3
2-4	2	3	4	2	3	4
3-5	3	4	5	3	4	5
4-6	4	5	6	4	5	6
5-7	5	6	7	5	6	7
6-8	6	7	8	6	7	8

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We also defined a "pre-COVID sample" to serve as a reference distribution for each of the grade cohorts from the COVID sample (see the right side of the table above in light green). The pre-COVID sample serves as a counterfactual for the achievement gains that may have been expected if the COVID-19 pandemic had not occurred. The pre-COVID cohort covered the same grade spans as the COVID sample but across 2017-18, 2018-19, and the fall of the 2019-20 school year. The pre-COVID sample consisted of 7.8 million unique students in 25,000 public schools. Descriptive information for the students in our overall sample by cohort, subject, and pre-COVID/COVID sample is provided in Table 1.[1]

Descriptive information for the schools in our sample along with comparison information on the population of U.S. schools is provided in Table 2. The schools in our sample represent roughly one in three U.S. public schools in any given grade. Our sample reflects a diversity of schools from across various locales (urban, suburban, rural, and town). Relative to the population of U.S. schools, our sample reflects schools serving a slightly higher average percentage of White students and a lower average percentage of Hispanic students.

Measure of achievement

Student test scores from the NWEA MAP Growth reading and math assessments, called RIT scores, were used in this study. MAP Growth is a computer adaptive test that precisely measures achievement even for students above or below grade level and is vertically scaled to allow for the estimation of gains across time. MAP Growth assessments are typically administered three times a year (fall, winter, and spring) and are aligned to state content standards. Test scores are reported on the RIT (Rasch unIT) scale, which is a linear transformation of the logit scale units from the Rasch item response theory model. RIT score means, SDs, and sample sizes are presented for each cohort/grade/term in Table 3 for reading and Table 4 for math.

3. Methods

RQ1: How do summer learning patterns in summer 2022 compare to a pre-pandemic summer?

To examine how summer learning patterns in 2022 compared to prior years, we estimated a series of multilevel linear growth models to produce model-based estimates of summer gains/losses. Specifically, with our COVID sample we estimated growth rates across three school years (2020-21, 2021-22, and the start of 2022-23) and the two summer breaks in between (summer 2021 and summer 2022). For the pre-COVID sample, the corresponding growth rates were across three school years (2017-18, 2018-19, and the start of 2019-20) and the two summer breaks in between (summer 2018 and summer 2019). Our three-level models included longitudinal test scores nested within students within schools. Following other seasonal

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[1] We do not separately report estimates for American Indian and Alaska Native (AI/AN) students as we have in previous reports given there is more dramatic shifting of samples over time for this group when we include additional years in these analyses. As a result, the estimates of achievement gaps for these students are less comparable across terms.

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learning research,[iii, iv] we estimated student learning rates as a function of the months that elapsed during the three school years and two summers. This model was estimated with each grade cohort, subject, and sample (e.g., the COVID sample and the pre-COVID sample) using HLM Version 7.[v] In the description of the model below, we refer to the school years from the COVID sample for simplicity. This model was estimated with each grade cohort, subject, and sample (e.g., the COVID sample and the pre-COVID sample) using HLM Version 7.[vi] In the description of the model below, we refer to the school years from the COVID sample for simplicity.

Under this model, the test score y_{tij} for student i in school j at timepoint t was modeled as a linear function of the months that a student had been exposed to the 2020-21 school year ($\mathrm{MonY1}_{ij}$), the summer of 2021 ($\mathrm{Sum1}_{ij}$), the 2021-22 school year ($\mathrm{MonY2}_{ij}$), the summer of 2022 ($\mathrm{Sum2}_{ij}$), and the start of the 2022-23 school year ($\mathrm{MonY3}_{ij}$). Each of the growth terms was calculated based on students' school start date, end date, and test event date. District calendars were collected for the 2020-21 and 2021-22 school years from tested school districts. We calculated "months of exposure" to school at each test event as the total number of days elapsed between the school's start date and testing date(s) divided by 30. For example, a hypothetical student testing at the beginning of October 2021 in fourth grade may have 9.58 months of exposure to third grade, 2.83 months exposure to summer break following third grade, and 1.8 months of exposure to fourth grade by the time of fall testing. Example time coding for all seven possible timepoints for this hypothetical student in the grade 3-5 cohort is shown below:

Grade/Term	School Start Date	School End Date	Test date	Monthly Exposure Variables					
				Int.	MonY1	Sum1	MonY2	Sum2	MonY3
Fall 3rd	8/20/2020	6/12/2021	9/1/2020	1	0.39	0	0	0	0
Winter 3rd	8/20/2020	6/12/2021	2/1/2021	1	5.50	0	0	0	0
Spring 3rd	8/20/2020	6/12/2021	5/15/2021	1	8.93	0	0	0	0
Fall 4th	8/8/2021	6/4/2022	10/1/2021	1	9.58	2.83	1.8	0	0
Winter 4th	8/8/2021	6/4/2022	1/31/2022	1	9.58	2.83	5.87	0	0
Spring 4th	8/8/2021	6/4/2022	4/1/2022	1	9.58	2.83	7.87	0	0
Fall 5th	8/15/2022	6/8/2023	9/3/2022	1	9.58	2.83	9.53	2.93	0.56

At level 1, the growth model can be expressed as:

$$y_{tij} = \pi_{0ij} + \pi_{1ij}\mathrm{MonY1}_{tij} + \pi_{2ij}\mathrm{Sum1}_{tij} + \pi_{3ij}\mathrm{MonY2}_{tij} + \pi_{4ij}\mathrm{Sum2}_{tij} \\ + \pi_{5ij}\mathrm{MonY3}_{tij} + e_{tij}.$$

The intercept (π_{0ij}) is the predicted score for student i in school j tested on the first day of the 2020-21 school year; π_{1ij} is the linear rate of change at the start of the 2020-21 school year; π_{2ij} is the monthly summer 2021 gain/loss rate; π_{3ij} is the linear growth term in the 2021-22 school year; π_{4ij} is the monthly summer 2022 gain/loss rate; and π_{5ij} is the linear growth term at the start of the 2022-23 school year. At level 2 and 3 of the model, the intercept was allowed to vary among students within schools and between schools:

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Level-2 Model (student (i) within school (j)):
$$\pi_{0ij} = \beta_{00j} + r_{0ij}$$
$$\pi_{1ij} = \beta_{10j}$$
$$\pi_{2ij} = \beta_{20j}$$
$$\pi_{3ij} = \beta_{30j}$$
$$\pi_{4ij} = \beta_{40j}$$
$$\pi_{5ij} = \beta_{50j}$$

Level-3 Model (school (j)):
$$\beta_{00j} = \gamma_{000} + u_{00j}$$
$$\beta_{10j} = \gamma_{100}$$
$$\beta_{20j} = \gamma_{200}$$
$$\beta_{30j} = \gamma_{300}$$
$$\beta_{40j} = \gamma_{400}$$
$$\beta_{50j} = \gamma_{500}$$

Table 5 displays the reading and math coefficients from the growth model estimated using the full analytic sample. The estimates included in this table allow us to compare the school year and summer growth rates pre-COVID and COVID periods. For example, focusing on the grade 2-4 cohort in reading, we see that students' pre-COVID school year growth rate in second grade was significantly higher than the COVID (2020-21) growth rate (1.74 RIT points per month compared to 1.35 RIT points; see *Year 1 Growth* column), while the third-grade growth rates for the same cohort was slightly higher in COVID than pre-COVID (1.37 RIT points per month in 2021-22 compared to 1.35 RIT points in 2018-19; see *Year 2 Growth* column). Additionally, the students transitioning from third to fourth grade during the COVID summer of 2022 lost significantly less ground per month than the pre-COVID summer of 2019 (a drop of 0.74 RIT points per month for the COVID sample compared to 0.92 RIT points per month in the pre-COVID sample; see *Summer 2 Growth* column).

To facilitate comparisons across grades and subjects, we standardized the summer loss estimates relative to the SD of the prior spring score. Specifically, we converted our monthly summer 2022 drop coefficient (γ_{400}) to represent the entire summer by multiplying by 2.5 (the length in months of an average summer break), then divided the estimate by the SD for the corresponding grade in spring 2022. The monthly estimates, SDs, and standardized estimates (and their corresponding standard errors) are all reported by grade and subject in Table 6. For Figure 1 in the main brief, we collapsed across grades to present an average elementary and middle school summer drop. Specifically, the reported elementary drop is the average of the standardized summer drop for the students in grades 3-5 in fall 2022, and the middle school drop is the average of the standardized summer drop for the students in grades 6-8 in fall 2022.

Additionally, we also estimated a series of conditional growth models to compare summer learning rates separately by student race/ethnicity and school poverty level. The estimates from these models are reported in Tables 7A-7D. The subgroup summer drop estimates were then standardized using the same approach as described above (using the spring 2022 overall sample SD rather than the subgroup SD). The standardized estimates by subgroup and grade band are shown in Figures A2 and A3.

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RQ2: Do we continue to see signs of test scores rebounding at the start of the 2022-23 school year?

We calculated the average test score ($\overline{\text{RIT}}_{tgs}$) in term *t* within cohort *g* (grades 1-3, 2-4, 3-5, 4-6, 5-7, 6-8) for sample *s* (where *s=PC* for the pre-COVID sample and *C* for the COVID sample). These averages are reported in Tables 3 and 4 (reading and math, respectively), while plots connecting the mean RIT scores for each cohort/subject combination are shown in Figure A1. RIT score means within each term of the COVID sample (fall 2020, spring 2021, fall 2021, spring 2022, and fall 2022) are plotted in dark green, while the pre-COVID reference line (light green) displays the means of the pre-COVID sample (students in the same grade span during fall 2017, spring 2018, fall 2018, spring 2019, and fall 2019).

Additionally, we calculated the standardized mean difference between average test scores in a grade/term between the pre-COVID and COVID samples. We use the term "achievement gap" to describe differences between the pre-COVID sample and the COVID sample. For example, the achievement gap (as an effect size) in the most recent fall term *t* in grade *g* was calculated as:

$$ES_{tg} = \frac{\overline{\text{RIT}}_{tgC} - \overline{\text{RIT}}_{tgPC}}{\sqrt{\dfrac{(N_{tgC}-1)\text{SD}^2_{tgC} + (N_{tgPC}-1)\text{SD}^2_{tgPC}}{N_{tgC} + N_{tgPC} - 2}}},$$

where $\overline{\text{RIT}}_{tgC}$ is the average COVID sample (*t*=fall 2022) test score in grade *g*; $\overline{\text{RIT}}_{tgPC}$ is the average pre-COVID (*t*=fall 2019) test score in grade *g*; SD_{tgC} and SD_{tgPC} are the corresponding standard deviation (SD) estimates; and N_{tgC} and N_{tgPC} are the observed sample size in grade *g* in fall 2022 and 2019, respectively. The standardized effect sizes by grade, term, and subject are reported in Tables 3 and 4 (for reading and math, respectively) and are displayed below the points in Figure A1.

We disaggregated the rebounding results by school poverty level and race/ethnicity. We compared two school poverty levels: (a) "Low Poverty" - less than 25% FRPL eligibility based on the 2019-20 CCD data and (b) "High Poverty" - greater than 75% FRPL eligibility. Results are presented for each cohort/subject combination in Tables 9A and 9B (for reading and math, respectively) and displayed in Figure A4.

We calculated two metrics to quantify changes in the achievement gaps across terms within a cohort. To calculate timeline for recovery we compared fall 2022 achievement gaps to each group's achievement gap nadir (i.e., the term in which the gap between the COVID and pre-Covid sample was largest for a cohort across timepoints). This was spring 2021 for most groups with the exception of the 6-8 cohort in math and the 1-3 cohort in both subjects, all of whom experienced their nadir in fall 2021.

First, we calculated the percentage change in effect size as

$$\%\text{Change} = \frac{ES_{F22g} - ES_{S21g}}{ES_{S21g}} * 100,$$

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where ES_{F22g} is the estimated achievement gap in fall 2022 (pre-COVID sample: fall 2019) and ES_{S21g} is the gap in spring 2021 (pre-COVID sample: spring 2018). Second, we calculated the number of years that would be needed to close the achievement gap assuming the cumulative change observed by fall 2022 holds constant moving forward. Specifically, we divided the remaining gap in fall 2022 by the rate of change in the effect sizes between the nadir and the current term (e.g., spring 2021 and fall 2022 for most grades, fall 2021 to fall 2022 for the 1-3 cohort and 6-8 cohort in math):

$$\text{Years to recovery} = \frac{ES_{F22g}}{(ES_{F22g} - ES_{S1g})/1.5}$$

We divided by 1.5 in the denominator to indicate that a year and half has elapsed between the spring 2021 and fall 2022 testing terms (though for the 1-3 and 6-8 cohorts where the largest achievement gap occurred in fall 2021, we divide by one year instead). Both percent change and years to recovery are reported in Table 8. Because this calculation involves dividing by a rate of change that may be close to or below zero (as in the final two math cohorts), it is possible to have estimates of the years needed to close gaps that approach infinity. To address this issue, we binned any reported year estimates that were greater than 5 into a "5+ years" category. It is important to note that the "years to recovery" metric relies on strong assumptions that (a) our effect sizes are precisely estimated and (b) improvements will continue at the same rate,[2] but we provide these numbers as a rough estimate of the time it will take to reach recovery at the current pace of rebounding.

Sensitivity of results to sample inclusion criteria

Our descriptive analyses used an inclusive sample of students who tested in any fall/spring term during the three school year span (2020-21, 2021-22, fall 2022 for the COVID sample; 2017-18, 2018-19, and fall 2019 for the pre-COVID sample). As a result, the number and composition of students included in the sample shifts across school years within a cohort as well as across the pre-COVID and COVID samples. To test the sensitivity of our results to this sample inclusion rule, we also re-ran our analyses under two more restrictive conditions: (a) restricting the schools included in the sample to schools that tested both during the pre-COVID and COVID time spans, and (b) requiring that students test in the most recent spring and fall terms (spring 2022 and fall 2022 for the COVID sample, spring 2019 and fall 2019 for the pre-COVID sample). A comparison of the standardized differences between our preferred inclusive sample versus samples with these restrictive conditions is provided in Table 10 (comparisons of the size and characteristics for each sample available upon request). Overall, results did not appear to be sensitive to imposing stricter inclusion criteria.

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[2] We see in the brief[i] (Figure 2) that rebounding is not a linear process, so we know this assumption may not be met in some grades. However, we believe our best estimate for years to full recovery is based on the cumulative change from the widest achievement gap to now (which averages over some of the non-linearity by season).

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Table 1. Description of the pre-COVID and COVID student samples

Grade (start of Cohort)	Grade (end of Cohort)	Sample	N Students	N Schools	N Districts	Male	Female	White	Black	Hispanic/ Latino	Asian
			Full Sample (across grades and subjects)								
—	—	Pre-COVID	7,750,777	25,226	6,515	48.9	51.1	45.4	17.8	20.1	4.3
—	—	COVID	6,945,370	21,994	5,764	49.0	51.0	44.3	16.7	22.3	4.6
—	—	Combined	12,101,442	27,879	7,065	48.9	51.1	44.4	17.5	21.3	4.5
			Reading								
1	3	Pre-COVID	1,191,128	16,719	5,535	48.8	51.2	45.5	18.4	19.2	4.3
2	4	Pre-COVID	1,218,857	17,228	5,641	48.8	51.2	45.7	18.2	19.3	4.3
3	5	Pre-COVID	1,238,228	17,244	5,702	48.9	51.1	45.6	18.2	19.6	4.2
4	6	Pre-COVID	1,297,455	19,238	5,852	48.9	51.1	45.9	17.8	19.7	4.2
5	7	Pre-COVID	1,312,571	18,579	5,870	48.9	51.1	46.0	17.5	20.1	4.1
6	8	Pre-COVID	1,243,299	11,827	5,687	48.9	51.1	46.5	17.4	19.8	4.0
1	3	COVID	1,085,848	14,525	4,860	49.0	51.0	44.4	17.2	21.7	4.6
2	4	COVID	1,103,208	14,975	5,007	49.0	51.0	44.5	17.0	21.7	4.7
3	5	COVID	1,108,377	15,253	5,062	48.9	51.1	44.5	16.8	22.0	4.7
4	6	COVID	1,150,829	17,266	5,227	49.0	51.0	44.3	16.7	22.5	4.5
5	7	COVID	1,166,528	16,805	5,283	48.9	51.1	44.6	16.5	22.3	4.4
6	8	COVID	1,160,374	10,226	5,120	49.1	50.9	45.0	16.6	22.0	4.3
			Math								
1	3	Pre-COVID	1,208,485	16,843	5,581	48.7	51.3	45.3	18.0	19.8	4.4
2	4	Pre-COVID	1,229,640	17,233	5,678	48.8	51.2	45.5	17.7	19.9	4.4
3	5	Pre-COVID	1,248,659	17,348	5,724	48.9	51.1	45.2	17.9	20.1	4.3
4	6	Pre-COVID	1,307,725	19,386	5,879	48.9	51.1	45.6	17.4	20.2	4.4
5	7	Pre-COVID	1,320,413	18,676	5,885	48.9	51.1	45.8	17.2	20.3	4.3
6	8	Pre-COVID	1,243,050	11,863	5,711	48.9	51.1	46.1	17.2	20.2	4.2
1	3	COVID	1,110,512	14,722	4,901	48.9	51.1	44.1	17.1	22.1	4.7
2	4	COVID	1,112,744	15,082	5,035	49.0	51.0	44.4	16.8	21.8	4.8
3	5	COVID	1,115,739	15,227	5,085	48.9	51.1	44.4	16.7	22.2	4.8
4	6	COVID	1,164,457	17,441	5,248	49.0	51.0	44.2	16.6	22.6	4.6
5	7	COVID	1,184,260	17,036	5,305	48.9	51.1	44.4	16.5	22.6	4.5
6	8	COVID	1,170,734	10,316	5,148	49.0	51.0	45.0	16.7	22.0	4.3

Note. The pre-COVID samples cover 2017-18 to the start of the 2019-20 school year, while the COVID samples cover 2020-21 to the start of the 2022-23 school years. Many students tested in both math and reading, which is why the unique count of students for each sample (top two rows) is not a sum of the sample sizes reported in the table. As a point of comparison, the projected percentage distribution of students enrolled in public elementary and secondary schools in the 2021-22 school year was 46% White, 15% Black, 28% Hispanic/Latino, 6% Asian, and 5% Other Race. [ii]

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Table 2. Sample school information relative to U.S. population of schools

	Grade	Number of schools	Average School Enrollment	% FRPL	% White	% Black	% Hispanic	% Asian American	City	Rural	Suburb	Town
NWEA pre-COVID Cohort	3-8	23,180	474	0.54	0.52	0.16	0.21	0.04	0.30	0.31	0.28	0.11
NWEA COVID Cohort	3-8	20,446	483	0.54	0.52	0.15	0.21	0.04	0.29	0.32	0.29	0.11
U.S. public schools	3-8	76,960	472	0.55	0.49	0.15	0.25	0.04	0.28	0.32	0.28	0.12
NWEA pre-COVID Cohort	3	16,878	449	0.55	0.50	0.17	0.21	0.04	0.32	0.32	0.26	0.10
NWEA pre-COVID Cohort	4	16,769	450	0.55	0.50	0.17	0.21	0.04	0.32	0.32	0.26	0.10
NWEA pre-COVID Cohort	5	16,281	454	0.56	0.49	0.18	0.22	0.04	0.33	0.31	0.27	0.09
NWEA pre-COVID Cohort	6	11,004	492	0.56	0.50	0.18	0.21	0.03	0.32	0.26	0.32	0.10
NWEA pre-COVID Cohort	7	9,286	510	0.56	0.50	0.18	0.21	0.03	0.31	0.25	0.33	0.10
NWEA pre-COVID Cohort	8	9,178	511	0.56	0.50	0.18	0.21	0.03	0.31	0.25	0.33	0.11
NWEA COVID Cohort	3	14,888	458	0.55	0.51	0.16	0.22	0.04	0.31	0.32	0.27	0.09
NWEA COVID Cohort	4	14,800	458	0.55	0.51	0.16	0.22	0.04	0.31	0.32	0.27	0.09
NWEA COVID Cohort	5	14,361	462	0.55	0.50	0.16	0.22	0.04	0.32	0.32	0.27	0.09
NWEA COVID Cohort	6	9,484	499	0.55	0.52	0.16	0.21	0.03	0.30	0.27	0.33	0.10
NWEA COVID Cohort	7	8,020	516	0.55	0.52	0.16	0.20	0.03	0.29	0.25	0.35	0.11
NWEA COVID Cohort	8	7,927	517	0.55	0.52	0.16	0.20	0.03	0.29	0.25	0.35	0.11
U.S. public schools	3	54,037	453	0.56	0.48	0.15	0.26	0.04	0.30	0.33	0.26	0.10
U.S. public schools	4	53,801	453	0.56	0.48	0.15	0.26	0.04	0.30	0.33	0.26	0.10
U.S. public schools	5	52,523	455	0.56	0.47	0.15	0.26	0.04	0.31	0.33	0.27	0.10
U.S. public schools	6	37,493	482	0.56	0.49	0.15	0.26	0.04	0.29	0.29	0.32	0.11
U.S. public schools	7	32,375	483	0.56	0.50	0.16	0.24	0.03	0.27	0.27	0.34	0.12
U.S. public schools	8	32,616	485	0.56	0.50	0.16	0.24	0.03	0.27	0.27	0.34	0.12

Note: FRPL=free or reduced priced lunch. The NWEA pre-COVID Sample is defined as schools that administered MAP Growth in a given grade (or grade range) during the 2017-18 to 2019-20 school years, while the NWEA COVID Sample is defined as schools that administered MAP Growth during the 2020-21 to 2022-23 school years. The source of the variables is the Common Core of Data (CCD) collected by the National Center for Educational Statistics.[ii] The U.S. public school population comparison for each grade was determined by limiting to the schools that were operational in 2020-21 and enrolled students in that grade level.

Table 3. Student reading RIT score means, SDs by cohort and sample

Grades	Terms	Pre-COVID Sample					COVID Sample					Standardized difference between samples
		School year	N	M	SD	Med Perc.	School year	N	M	SD	Med Perc.	
1-3	2F	2018-19	816,219	172.84	16.07	51	2021-22	750,656	169.98	17.27	43	-0.172
1-3	2S	2018-19	843,154	186.54	16.00	56	2021-22	768,608	183.72	17.40	49	-0.169
1-3	3F	2019-20	885,677	187.36	16.88	56	2022-23	768,181	184.67	18.04	50	-0.154
2-4	2F	2017-18	789,294	173.09	16.09	52	2020-21	649,476	174.81	17.72	55	0.102
2-4	2S	2017-18	818,655	186.65	15.88	56	2020-21	690,431	184.30	17.28	50	-0.142
2-4	3F	2018-19	868,328	187.49	16.73	57	2021-22	832,556	185.19	18.00	51	-0.132
2-4	3S	2018-19	843,601	197.85	16.25	57	2021-22	775,286	195.71	17.61	53	-0.126
2-4	4F	2019-20	886,660	197.73	16.57	58	2022-23	778,686	195.86	17.68	54	-0.109
3-5	3F	2017-18	857,019	187.44	16.89	57	2020-21	723,545	188.40	17.53	59	0.056
3-5	3S	2017-18	824,620	197.89	16.23	57	2020-21	728,636	195.60	17.41	52	-0.136
3-5	4F	2018-19	870,905	197.76	16.44	58	2021-22	839,123	195.99	17.30	54	-0.105
3-5	4S	2018-19	837,957	205.15	15.97	56	2021-22	770,715	203.65	17.00	53	-0.091
3-5	5F	2019-20	919,541	204.90	16.34	56	2022-23	786,523	203.45	17.23	54	-0.087
4-6	4F	2017-18	848,022	197.44	16.62	57	2020-21	729,216	198.01	16.72	58	0.034
4-6	4S	2017-18	811,830	205.19	16.00	56	2020-21	723,751	203.13	16.97	51	-0.125
4-6	5F	2018-19	893,556	205.04	16.15	57	2021-22	852,207	203.38	16.81	53	-0.101
4-6	5S	2018-19	851,167	210.81	15.73	55	2021-22	777,661	209.18	16.65	52	-0.101
4-6	6F	2019-20	944,894	210.39	16.06	56	2022-23	798,125	209.14	16.56	53	-0.077
5-7	5F	2017-18	864,925	204.81	16.40	56	2020-21	741,116	205.03	16.36	57	0.013
5-7	5S	2017-18	816,346	210.99	15.76	55	2020-21	731,751	208.89	16.72	51	-0.13
5-7	6F	2018-19	889,808	210.52	15.92	56	2021-22	846,861	208.99	16.52	53	-0.094
5-7	6S	2018-19	831,519	214.66	15.78	53	2021-22	754,244	212.97	16.43	49	-0.105
5-7	7F	2019-20	924,147	214.20	16.21	55	2022-23	786,587	212.79	16.59	52	-0.086
6-8	6F	2017-18	845,544	210.19	16.30	56	2020-21	717,694	210.73	15.98	57	0.033
6-8	6S	2017-18	783,664	214.87	15.92	54	2020-21	712,913	212.96	16.68	50	-0.117
6-8	7F	2018-19	838,985	214.74	15.99	56	2021-22	865,088	213.05	16.55	52	-0.104
6-8	7S	2018-19	783,495	218.09	16.12	54	2021-22	756,539	216.16	16.81	50	-0.117
6-8	8F	2019-20	880,743	217.95	16.34	55	2022-23	798,456	216.34	16.79	51	-0.097

Note. N=number of students, M=mean, SD=standard deviation, Med perc. = median percentile rank, 2F=fall of 2nd grade, 2S=spring of 2nd grade. We do not report the estimates for 1st grade in the Grade 1-3 cohort due to concerns about test score comparability in the youngest grades during the 2020-21 school year, when many students were still testing at home (see our comparison of remote and in-person testing[vi] for more detail). For information about how the test score percentiles are calculated, see our July 2022 technical brief.[vii]

Table 4. Student math RIT score means, SDs by cohort and sample

| Grades | Terms | Pre-pandemic Sample | | | | | Pandemic Sample | | | | | Standardized difference between samples |
		School year	N	M	SD	Med Perc.	School year	N	M	SD	Med Perc.	
1-3	2F	2018-19	832,950	175.45	13.64	54	2021-22	807,314	172.53	14.81	46	-0.205
1-3	2S	2018-19	854,594	190.55	13.93	57	2021-22	817,679	187.41	15.21	49	-0.215
1-3	3F	2019-20	888,083	188.68	13.75	55	2022-23	781,285	186.23	15.08	49	-0.171
2-4	2F	2017-18	805,919	175.71	13.63	55	2020-21	662,768	176.20	15.06	54	0.034
2-4	2S	2017-18	832,344	190.19	13.82	55	2020-21	720,969	186.92	15.08	46	-0.227
2-4	3F	2018-19	873,646	188.55	13.66	55	2021-22	851,892	185.35	14.88	45	-0.224
2-4	3S	2018-19	836,377	201.91	14.34	57	2021-22	784,549	199.06	15.81	51	-0.189
2-4	4F	2019-20	895,737	200.57	14.41	57	2022-23	786,724	198.20	15.84	52	-0.157
3-5	3F	2017-18	860,192	188.75	13.57	55	2020-21	723,765	187.43	14.16	49	-0.095
3-5	3S	2017-18	820,473	201.84	14.29	56	2020-21	738,030	197.98	15.57	46	-0.259
3-5	4F	2018-19	882,217	200.51	14.31	57	2021-22	855,273	196.82	15.45	47	-0.248
3-5	4S	2018-19	841,959	211.60	15.74	56	2021-22	787,150	208.38	17.10	50	-0.196
3-5	5F	2019-20	927,797	209.77	15.69	56	2022-23	794,949	207.07	17.00	49	-0.166
4-6	4F	2017-18	850,442	200.54	14.21	57	2020-21	738,574	198.30	14.33	50	-0.157
4-6	4S	2017-18	810,216	211.77	15.78	57	2020-21	748,519	207.26	16.58	46	-0.279
4-6	5F	2018-19	906,102	209.95	15.64	56	2021-22	870,189	205.88	16.44	45	-0.254
4-6	5S	2018-19	856,492	219.64	17.56	55	2021-22	797,129	215.63	18.45	46	-0.223
4-6	6F	2019-20	951,577	214.49	15.51	52	2022-23	794,949	211.98	16.11	46	-0.159
5-7	5F	2017-18	870,591	209.97	15.62	56	2020-21	754,098	207.75	15.50	49	-0.143
5-7	5S	2017-18	818,533	219.96	17.59	55	2020-21	760,931	215.17	17.89	44	-0.27
5-7	6F	2018-19	904,329	214.69	15.66	53	2021-22	854,902	211.27	15.84	44	-0.217
5-7	6S	2018-19	839,453	222.43	17.35	52	2021-22	766,208	219.08	17.62	43	-0.192
5-7	7F	2019-20	914,065	220.70	17.16	54	2022-23	779,227	217.82	17.36	46	-0.167
6-8	6F	2017-18	852,412	214.68	16.04	53	2020-21	725,693	212.79	15.16	48	-0.121
6-8	6S	2017-18	791,637	222.73	17.63	53	2020-21	722,634	219.18	17.47	44	-0.202
6-8	7F	2018-19	846,536	221.12	17.28	55	2021-22	866,964	217.28	17.03	45	-0.224
6-8	7S	2018-19	786,557	227.32	18.68	54	2021-22	764,929	223.45	18.59	44	-0.207
6-8	8F	2019-20	825,657	225.36	18.46	53	2022-23	738,035	221.85	18.35	44	-0.191

Note. N=number of students, M=mean, SD=standard deviation, Med perc. = median percentile rank, 2F=fall of 2nd grade, 2S=spring of 2nd grade. We do not report the estimates for 1st grade in the Grade 1-3 cohort due to concerns about test score comparability in the youngest grades during the 2020-21 school year, when many students were still testing at home (see our comparison of remote and in-person testing[vi] for more detail). For information about how the test score percentiles are calculated, see our July 2022 technical brief.[vii]

Table 5. Coefficients from the hierarchical linear model estimating school year and summer growth

Subject	Grade (Y1)	Grade (Y3)	Year	Intercept	Year 1 Growth	Summer 1 Growth	Year 2 Growth	Summer 2 Growth	Year 3 Growth
Reading	1	3	Pre-COVID	154.61 (0.06) ***	2.09 (0.00) ***	-1.14 (0.01) ***	1.76 (0.00) ***	-0.86 (0.02) ***	1.46 (0.07) ***
Reading	1	3	COVID	156.95 (0.09) ***	1.45 (0.01) ***	-0.84 (0.02) ***	1.76 (0.00) ***	-0.62 (0.02) ***	0.80 (0.10) ***
Reading	2	4	Pre-COVID	171.47 (0.06) ***	1.74 (0.00) ***	-0.67 (0.01) ***	1.35 (0.00) ***	-0.92 (0.02) ***	0.79 (0.06) ***
Reading	2	4	COVID	171.67 (0.08) ***	1.35 (0.01) ***	-0.24 (0.01) ***	1.37 (0.00) ***	-0.74 (0.02) ***	0.57 (0.08) ***
Reading	3	5	Pre-COVID	185.99 (0.06) ***	1.35 (0.00) ***	-0.88 (0.01) ***	0.95 (0.00) ***	-0.61 (0.01) ***	0.44 (0.05) ***
Reading	3	5	COVID	185.64 (0.07) ***	1.04 (0.01) ***	-0.36 (0.01) ***	0.98 (0.00) ***	-0.59 (0.02) ***	0.44 (0.07) ***
Reading	4	6	Pre-COVID	195.48 (0.06) ***	0.99 (0.00) ***	-0.64 (0.01) ***	0.75 (0.00) ***	-0.55 (0.02) ***	0.13 (0.07) *
Reading	4	6	COVID	195.30 (0.07) ***	0.73 (0.00) ***	-0.23 (0.01) ***	0.76 (0.00) ***	-0.44 (0.02) ***	0.22 (0.09) **
Reading	5	7	Pre-COVID	202.80 (0.07) ***	0.79 (0.00) ***	-0.69 (0.01) ***	0.56 (0.00) ***	-0.40 (0.02) ***	0.06 (0.07)
Reading	5	7	COVID	202.84 (0.07) ***	0.55 (0.00) ***	-0.23 (0.01) ***	0.51 (0.00) ***	-0.33 (0.02) ***	0.11 (0.09)
Reading	6	8	Pre-COVID	208.42 (0.08) ***	0.60 (0.00) ***	-0.45 (0.01) ***	0.46 (0.00) ***	-0.24 (0.02) ***	0.16 (0.06) **
Reading	6	8	COVID	208.97 (0.09) ***	0.33 (0.00) ***	-0.12 (0.01) ***	0.39 (0.00) ***	-0.15 (0.02) ***	0.37 (0.09) ***
Math	1	3	Pre-COVID	157.85 (0.05) ***	2.22 (0.00) ***	-2.00 (0.01) ***	1.93 (0.00) ***	-1.68 (0.02) ***	1.25 (0.07) ***
Math	1	3	COVID	160.37 (0.09) ***	1.64 (0.01) ***	-1.93 (0.02) ***	1.89 (0.00) ***	-1.38 (0.02) ***	0.93 (0.10) ***
Math	2	4	Pre-COVID	173.57 (0.05) ***	1.85 (0.00) ***	-1.57 (0.01) ***	1.71 (0.00) ***	-1.30 (0.02) ***	0.69 (0.06) ***
Math	2	4	COVID	172.39 (0.07) ***	1.52 (0.01) ***	-1.15 (0.01) ***	1.75 (0.00) ***	-1.09 (0.02) ***	0.41 (0.08) ***
Math	3	5	Pre-COVID	186.62 (0.05) ***	1.68 (0.00) ***	-1.52 (0.01) ***	1.41 (0.00) ***	-1.14 (0.01) ***	0.47 (0.05) ***
Math	3	5	COVID	183.78 (0.07) ***	1.48 (0.01) ***	-1.10 (0.01) ***	1.47 (0.00) ***	-1.04 (0.02) ***	0.44 (0.07) ***
Math	4	6	Pre-COVID	197.44 (0.06) ***	1.44 (0.00) ***	-1.40 (0.01) ***	1.23 (0.00) ***	-2.27 (0.02) ***	0.15 (0.08) *
Math	4	6	COVID	194.10 (0.07) ***	1.26 (0.01) ***	-0.98 (0.01) ***	1.24 (0.00) ***	-1.88 (0.02) ***	0.38 (0.10) ***
Math	5	7	Pre-COVID	206.86 (0.07) ***	1.27 (0.00) ***	-2.59 (0.02) ***	0.99 (0.01) ***	-0.79 (0.02) ***	0.20 (0.08) **
Math	5	7	COVID	204.26 (0.08) ***	1.03 (0.01) ***	-1.84 (0.02) ***	0.98 (0.01) ***	-0.67 (0.02) ***	0.20 (0.09) *
Math	6	8	Pre-COVID	211.67 (0.09) ***	1.02 (0.01) ***	-1.01 (0.01) ***	0.80 (0.01) ***	-0.59 (0.02) ***	0.30 (0.07) ***
Math	6	8	COVID	209.26 (0.09) ***	0.92 (0.01) ***	-0.82 (0.01) ***	0.77 (0.01) ***	-0.49 (0.02) ***	0.35 (0.10) ***

Note. Standard errors are shown in parentheses. The pre-COVID estimates represent the 2017-18 (year 1) to 2019-20 (year 3) school years, while the COVID estimates represent growth across the 2020-21 (year 1) to 2022-23 (year 3) school years.
*p<.05, **p<.01, ***p<.001.

Table 6. Estimated summer drops in other scale units

Subject	Cohort	Spring Grade	Fall Grade	Year	Summer drop per month (RIT points) Est.	SE	Spring SD	Total summer drop (SD units) Est.	SE	Summer drop as a proportion of total school year growth Summer Est.	School year Est.	Perc.
Reading	1-3	2	3	Summer 2019	-0.86	0.02	16.68	-0.13	0.003	-2.16	16.76	-12.9%
Reading	2-4	3	4	Summer 2019	-0.92	0.02	16.92	-0.14	0.002	-2.29	12.79	-17.9%
Reading	3-5	4	5	Summer 2019	-0.61	0.01	16.47	-0.09	0.002	-1.52	9.05	-16.8%
Reading	4-6	5	6	Summer 2019	-0.55	0.02	16.17	-0.09	0.003	-1.38	7.12	-19.3%
Reading	5-7	6	7	Summer 2019	-0.40	0.02	16.09	-0.06	0.003	-1.00	5.30	-18.9%
Reading	6-8	7	8	Summer 2019	-0.24	0.02	16.47	-0.04	0.003	-0.59	4.35	-13.5%
Reading	1-3	2	3	Summer 2022	-0.62	0.02	16.68	-0.09	0.004	-1.55	16.75	-9.2%
Reading	2-4	3	4	Summer 2022	-0.74	0.02	16.92	-0.11	0.003	-1.84	13.02	-14.2%
Reading	3-5	4	5	Summer 2022	-0.59	0.02	16.47	-0.09	0.002	-1.47	9.31	-15.8%
Reading	4-6	5	6	Summer 2022	-0.44	0.02	16.17	-0.07	0.003	-1.11	7.18	-15.5%
Reading	5-7	6	7	Summer 2022	-0.33	0.02	16.09	-0.05	0.003	-0.83	4.83	-17.2%
Reading	6-8	7	8	Summer 2022	-0.15	0.02	16.47	-0.02	0.003	-0.37	3.75	-9.9%
Math	1-3	2	3	Summer 2019	-1.68	0.02	14.57	-0.29	0.004	-4.19	18.32	-22.9%
Math	2-4	3	4	Summer 2019	-1.30	0.02	15.07	-0.22	0.003	-3.26	16.21	-20.1%
Math	3-5	4	5	Summer 2019	-1.14	0.01	16.41	-0.17	0.002	-2.84	13.44	-21.1%
Math	4-6	5	6	Summer 2019	-2.27	0.02	18.00	-0.32	0.003	-5.68	11.67	-48.6%
Math	5-7	6	7	Summer 2019	-0.79	0.02	17.48	-0.11	0.003	-1.96	9.42	-20.8%
Math	6-8	7	8	Summer 2019	-0.59	0.02	18.63	-0.08	0.003	-1.47	7.57	-19.4%
Math	1-3	2	3	Summer 2022	-1.38	0.02	14.57	-0.24	0.004	-3.44	17.93	-19.2%
Math	2-4	3	4	Summer 2022	-1.09	0.02	15.07	-0.18	0.003	-2.73	16.60	-16.4%
Math	3-5	4	5	Summer 2022	-1.04	0.02	16.41	-0.16	0.003	-2.60	14.00	-18.6%
Math	4-6	5	6	Summer 2022	-1.88	0.02	18.00	-0.26	0.003	-4.69	11.81	-39.7%
Math	5-7	6	7	Summer 2022	-0.67	0.02	17.48	-0.10	0.003	-1.68	9.31	-18.1%
Math	6-8	7	8	Summer 2022	-0.49	0.02	18.63	-0.07	0.003	-1.23	7.31	-16.8%

Note. The reported summer drop estimate and SE are taken from the "Summer 2 Growth" column in Table 5. The spring SD represents the pooled SD from spring 2019 and spring 2022. Total summer drop in SD units is estimated by multiplying the monthly summer drop ("Est" column) by 2.5 months and dividing by the spring SD. The percentage column is calculated as total summer drop ("Est" column multiplied by 2.5 months) divided by total school year gain in prior year ("Year 2 Growth" estimate from Table 5 times 9.5 months).

Table 7A. Coefficients from the reading hierarchical linear model conditional on student race/ethnicity

Parameter	Grades 1-3	Grades 2-4	Grades 3-5	Grades 4-6	Grades 5-7	Grades 6-8
			Pre-COVID			
Intercept (first fall)	156.55 (0.06)***	173.62 (0.07)***	188.51 (0.06)***	198.27 (0.07)***	205.71 (0.07)***	211.25 (0.08)***
Black	-3.88 (0.08) ***	-5.00 (0.08) ***	-5.94 (0.08) ***	-6.76 (0.10) ***	-7.22 (0.11) ***	-7.28 (0.12) ***
Hispanic	-5.44 (0.08) ***	-6.03 (0.08) ***	-6.62 (0.08) ***	-7.12 (0.09) ***	-7.15 (0.10) ***	-6.95 (0.11) ***
Asian	-1.66 (0.14) ***	1.27 (0.14) ***	0.87 (0.13) ***	0.68 (0.15) ***	0.61 (0.16) ***	0.75 (0.17) ***
AIAN	-3.85 (0.25) ***	-5.20 (0.23) ***	-6.36 (0.21) ***	-6.57 (0.22) ***	-6.96 (0.24) ***	-6.57 (0.25) ***
Other race	-1.61 (0.09) ***	-1.60 (0.09) ***	-1.93 (0.09) ***	-2.33 (0.10) ***	-2.31 (0.10) ***	-2.44 (0.10) ***
Year 1 Growth	2.16 (0.00) ***	1.81 (0.00) ***	1.37 (0.00) ***	1.00 (0.00) ***	0.78 (0.00) ***	0.60 (0.00) ***
Black	-0.22 (0.01) ***	-0.18 (0.01) ***	-0.07 (0.01) ***	-0.04 (0.01) ***	0.02 (0.01) ***	0.00 (0.01)
Hispanic	-0.15 (0.01) ***	-0.12 (0.01) ***	-0.02 (0.01) ***	0.01 (0.01) *	0.04 (0.01) ***	0.00 (0.01)
Asian	0.01 (0.01)	-0.18 (0.01) ***	-0.10 (0.01) ***	-0.06 (0.01) ***	0.01 (0.01)	0.03 (0.01) **
AIAN	-0.18 (0.03) ***	-0.16 (0.02) ***	-0.09 (0.02) ***	-0.03 (0.02)	0.01 (0.02)	-0.03 (0.02)
Other race	-0.06 (0.01) ***	-0.05 (0.01) ***	-0.04 (0.01) ***	-0.02 (0.01) *	-0.01 (0.01)	-0.02 (0.01) *
Summer 2 Growth	-1.36 (0.02) ***	-0.83 (0.01) ***	-0.97 (0.01) ***	-0.72 (0.01) ***	-0.73 (0.01) ***	-0.50 (0.01) ***
Black	0.31 (0.03) ***	0.28 (0.03) ***	0.04 (0.02) *	0.05 (0.02) **	-0.09 (0.03) ***	0.02 (0.03)
Hispanic	0.49 (0.02) ***	0.41 (0.02) ***	0.23 (0.02) ***	0.21 (0.02) ***	0.16 (0.02) ***	0.17 (0.03) ***
Asian	1.43 (0.04) ***	0.74 (0.03) ***	0.45 (0.02) ***	0.40 (0.03) ***	0.39 (0.03) ***	0.25 (0.02) ***
AIAN	0.18 (0.08) *	0.27 (0.06) ***	0.30 (0.05) ***	0.31 (0.05) ***	0.34 (0.05) ***	0.40 (0.06) ***
Other race	0.21 (0.03) ***	0.08 (0.03) **	0.11 (0.02) ***	0.10 (0.02) ***	0.02 (0.03)	0.09 (0.03) ***
Year 2 Growth	1.82 (0.00) ***	1.37 (0.00) ***	0.96 (0.00) ***	0.74 (0.00) ***	0.56 (0.00) ***	0.45 (0.00) ***
Black	-0.17 (0.01) ***	-0.08 (0.01) ***	-0.04 (0.01) ***	0.01 (0.01) *	0.00 (0.01)	0.02 (0.01) **
Hispanic	-0.10 (0.01) ***	-0.01 (0.01)	0.03 (0.01) ***	0.03 (0.01) ***	0.01 (0.01)	0.00 (0.01)
Asian	-0.18 (0.01) ***	-0.11 (0.01) ***	-0.04 (0.01) ***	0.01 (0.01)	0.03 (0.01) **	0.05 (0.01) ***
AIAN	-0.13 (0.02) ***	-0.13 (0.02) ***	-0.06 (0.02) **	-0.04 (0.02) *	-0.03 (0.02)	-0.08 (0.02) ***
Other race	-0.06 (0.01) ***	-0.02 (0.01) **	-0.02 (0.01) **	-0.01 (0.01)	-0.02 (0.01) *	0.00 (0.01)
Summer 2 Growth	-1.05 (0.02) ***	-1.02 (0.02) ***	-0.69 (0.02) ***	-0.58 (0.02) ***	-0.43 (0.02) ***	-0.27 (0.02) ***
Black	0.50 (0.04) ***	0.27 (0.03) ***	0.26 (0.03) ***	0.08 (0.04) *	0.09 (0.05) *	0.06 (0.05)
Hispanic	0.32 (0.03) ***	0.19 (0.03) ***	0.13 (0.03) ***	0.13 (0.03) ***	0.13 (0.04) ***	0.18 (0.04) ***
Asian	0.62 (0.06) ***	0.44 (0.05) ***	0.38 (0.04) ***	0.30 (0.04) ***	0.15 (0.04) ***	0.18 (0.04) ***
AIAN	0.52 (0.11) ***	0.45 (0.09) ***	0.35 (0.10) ***	0.30 (0.08) ***	0.19 (0.09) *	0.22 (0.10) *
Other race	0.09 (0.04) *	0.03 (0.04)	0.02 (0.03)	-0.11 (0.05) **	-0.05 (0.04)	-0.04 (0.04)
			COVID			
Intercept (first fall)	156.94 (0.08)***	172.49 (0.08)***	187.85 (0.07)***	198.08 (0.07)***	205.70 (0.07)***	211.64 (0.08)***
Black	1.39 (0.18) ***	-1.10 (0.14) ***	-4.60 (0.11) ***	-6.26 (0.10) ***	-6.85 (0.11) ***	-7.00 (0.11) ***
Hispanic	-0.71 (0.17) ***	-3.08 (0.13) ***	-6.20 (0.10) ***	-7.27 (0.11) ***	-7.43 (0.12) ***	-7.17 (0.12) ***
Asian	5.08 (0.23) ***	5.77 (0.19) ***	2.64 (0.15) ***	1.60 (0.15) ***	1.82 (0.16) ***	1.88 (0.17) ***
AIAN	-3.27 (0.51) ***	-3.84 (0.40) ***	-5.79 (0.31) ***	-6.43 (0.29) ***	-6.86 (0.29) ***	-6.73 (0.28) ***
Other race	-0.18 (0.14)	-0.36 (0.13) **	-1.51 (0.10) ***	-1.93 (0.11) ***	-1.94 (0.12) ***	-2.21 (0.12) ***
Year 1 Growth	1.78 (0.01) ***	1.62 (0.01) ***	1.17 (0.01) ***	0.80 (0.00) ***	0.58 (0.00) ***	0.36 (0.00) ***
Black	-0.89 (0.02) ***	-0.75 (0.02) ***	-0.43 (0.01) ***	-0.28 (0.01) ***	-0.16 (0.01) ***	-0.14 (0.01) ***
Hispanic	-0.83 (0.02) ***	-0.60 (0.02) ***	-0.25 (0.01) ***	-0.11 (0.01) ***	-0.01 (0.01)	-0.04 (0.01) ***
Asian	-0.53 (0.03) ***	-0.55 (0.02) ***	-0.27 (0.01) ***	-0.12 (0.01) ***	-0.02 (0.01)	0.06 (0.01) ***
AIAN	-0.36 (0.06) ***	-0.35 (0.05) ***	-0.22 (0.03) ***	-0.12 (0.03) ***	-0.08 (0.02) ***	-0.03 (0.02)
Other race	-0.23 (0.02) ***	-0.22 (0.02) ***	-0.12 (0.01) ***	-0.09 (0.01) ***	-0.06 (0.01) ***	-0.04 (0.01) ***
Summer 2 Growth	-1.15 (0.02) ***	-0.47 (0.02) ***	-0.58 (0.01) ***	-0.44 (0.01) ***	-0.36 (0.01) ***	-0.24 (0.01) ***
Black	0.28 (0.04) ***	0.31 (0.03) ***	0.49 (0.02) ***	0.55 (0.03) ***	0.29 (0.03) ***	0.29 (0.03) ***
Hispanic	0.87 (0.04) ***	0.70 (0.03) ***	0.61 (0.02) ***	0.55 (0.02) ***	0.32 (0.03) ***	0.34 (0.03) ***
Asian	1.24 (0.06) ***	0.57 (0.04) ***	0.45 (0.03) ***	0.39 (0.03) ***	0.32 (0.03) ***	0.12 (0.03) ***
AIAN	0.47 (0.09) ***	0.34 (0.08) ***	0.38 (0.06) ***	0.34 (0.06) ***	0.34 (0.06) ***	0.14 (0.06) *
Other race	0.20 (0.04) ***	0.17 (0.03) ***	0.15 (0.03) ***	0.17 (0.02) ***	0.15 (0.03) ***	0.09 (0.03) **

Year 2 Growth	1.87 (0.01) ***	1.41 (0.00) ***	0.98 (0.00) ***	0.74 (0.00) ***	0.51 (0.00) ***	0.40 (0.00) ***
Black	-0.23 (0.01) ***	-0.08 (0.01) ***	-0.02 (0.01) ***	0.03 (0.01) ***	0.00 (0.01)	-0.01 (0.01)
Hispanic	-0.22 (0.01) ***	-0.03 (0.01) ***	0.05 (0.01) ***	0.07 (0.01) ***	0.01 (0.01)	-0.02 (0.01) **
Asian	-0.29 (0.01) ***	-0.18 (0.01) ***	-0.05 (0.01) ***	-0.01 (0.01)	0.02 (0.01) *	0.03 (0.01) **
AIAN	-0.26 (0.04) ***	-0.19 (0.03) ***	-0.07 (0.03) **	-0.05 (0.02) **	0.00 (0.02)	-0.03 (0.02)
Other race	-0.07 (0.01) ***	-0.03 (0.01) ***	0.00 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.01 (0.01)
Summer 2 Growth	-0.93 (0.03) ***	-0.89 (0.02) ***	-0.67 (0.02) ***	-0.47 (0.02) ***	-0.35 (0.02) ***	-0.19 (0.02) ***
Black	0.60 (0.05) ***	0.28 (0.04) ***	0.20 (0.03) ***	0.04 (0.04)	0.05 (0.05)	0.12 (0.05) **
Hispanic	0.65 (0.05) ***	0.32 (0.04) ***	0.17 (0.03) ***	0.11 (0.04) **	0.11 (0.04) **	0.14 (0.04) ***
Asian	0.63 (0.06) ***	0.50 (0.05) ***	0.33 (0.04) ***	0.31 (0.05) ***	0.13 (0.05) **	0.10 (0.05) *
AIAN	0.56 (0.17) ***	0.62 (0.11) ***	0.44 (0.12) ***	0.58 (0.14) ***	0.21 (0.12) *	0.26 (0.12) *
Other race	0.22 (0.05) ***	0.00 (0.04)	0.02 (0.04)	0.00 (0.05)	-0.04 (0.05)	0.01 (0.05)

Note. Standard errors are shown in parentheses. The pre-COVID estimates represent the 2017-18 (year 1) to 2019-20 (year 3) school years, while the COVID estimates represent growth across the 2020-21 (year 1) to 2022-23 (year 3) school years. The refence group in this model is White students.

*p<.05, **p<.01, ***p<.001.

Table 7B. Coefficients from the math hierarchical linear model conditional on student race/ethnicity

Parameter	Grades 1-3	Grades 2-4	Grades 3-5	Grades 4-6	Grades 5-7	Grades 6-8
			Pre-COVID			
Intercept (first fall)	160.10 (0.05) ***	175.61 (0.06) ***	188.70 (0.06) ***	199.75 (0.06) ***	209.44 (0.08) ***	214.47 (0.09) ***
Black	-5.44 (0.07) ***	-5.61 (0.07) ***	-5.86 (0.07) ***	-6.67 (0.09) ***	-7.67 (0.10) ***	-8.26 (0.12) ***
Hispanic	-5.57 (0.07) ***	-4.94 (0.07) ***	-4.73 (0.07) ***	-5.17 (0.08) ***	-5.59 (0.10) ***	-6.13 (0.13) ***
Asian	-1.02 (0.13) ***	1.93 (0.12) ***	2.05 (0.11) ***	2.72 (0.13) ***	3.70 (0.16) ***	3.57 (0.19) ***
AIAN	-4.32 (0.22) ***	-4.50 (0.21) ***	-4.50 (0.18) ***	-4.59 (0.20) ***	-5.63 (0.29) ***	-5.75 (0.24) ***
Other race	-1.98 (0.08) ***	-1.78 (0.08) ***	-1.81 (0.07) ***	-2.28 (0.09) ***	-2.46 (0.10) ***	-2.75 (0.11) ***
Year 1 Growth	2.27 (0.00) ***	1.90 (0.00) ***	1.71 (0.00) ***	1.49 (0.00) ***	1.33 (0.01) ***	1.08 (0.01) ***
Black	-0.18 (0.01) ***	-0.16 (0.01) ***	-0.14 (0.01) ***	-0.20 (0.01) ***	-0.22 (0.01) ***	-0.18 (0.01) ***
Hispanic	-0.07 (0.01) ***	-0.08 (0.01) ***	-0.05 (0.01) ***	-0.10 (0.01) ***	-0.13 (0.01) ***	-0.13 (0.01) ***
Asian	0.12 (0.01) ***	-0.05 (0.01) ***	0.04 (0.01) ***	0.12 (0.01) ***	0.18 (0.01) ***	0.15 (0.01) ***
AIAN	-0.11 (0.03) ***	-0.11 (0.02) ***	-0.14 (0.02) ***	-0.17 (0.02) ***	-0.19 (0.02) ***	-0.17 (0.02) ***
Other race	-0.04 (0.01) ***	-0.05 (0.01) ***	-0.06 (0.01) ***	-0.06 (0.01) ***	-0.05 (0.01) ***	-0.06 (0.01) ***
Summer 2 Growth	-2.24 (0.02) ***	-1.70 (0.01) ***	-1.58 (0.01) ***	-1.46 (0.01) ***	-2.72 (0.02) ***	-1.10 (0.01) ***
Black	0.46 (0.03) ***	0.25 (0.02) ***	0.09 (0.02) ***	0.15 (0.02) ***	0.41 (0.03) ***	0.17 (0.03) ***
Hispanic	0.56 (0.02) ***	0.34 (0.02) ***	0.08 (0.02) ***	0.10 (0.02) ***	0.29 (0.03) ***	0.20 (0.03) ***
Asian	0.99 (0.03) ***	0.49 (0.03) ***	0.35 (0.02) ***	0.23 (0.03) ***	-0.29 (0.04) ***	0.22 (0.03) ***
AIAN	0.37 (0.08) ***	0.08 (0.06)	0.22 (0.05) ***	0.25 (0.05) ***	0.87 (0.05) ***	0.39 (0.05) ***
Other race	0.22 (0.03) ***	0.10 (0.02) ***	0.09 (0.02) ***	0.08 (0.02) ***	0.12 (0.03) ***	0.09 (0.03) ***
Year 2 Growth	1.97 (0.00) ***	1.73 (0.00) ***	1.47 (0.00) ***	1.28 (0.00) ***	1.04 (0.01) ***	0.84 (0.01) ***
Black	-0.13 (0.01) ***	-0.11 (0.01) ***	-0.19 (0.01) ***	-0.20 (0.01) ***	-0.17 (0.01) ***	-0.12 (0.01) ***
Hispanic	-0.05 (0.01) ***	-0.03 (0.01) ***	-0.09 (0.01) ***	-0.11 (0.01) ***	-0.12 (0.01) ***	-0.13 (0.01) ***
Asian	-0.07 (0.01) ***	0.02 (0.01) **	0.09 (0.01) ***	0.17 (0.01) ***	0.12 (0.01) ***	0.13 (0.01) ***
AIAN	-0.10 (0.02) ***	-0.10 (0.02) ***	-0.17 (0.02) ***	-0.21 (0.02) ***	-0.22 (0.02) ***	-0.20 (0.02) ***
Other race	-0.05 (0.01) ***	-0.03 (0.01) ***	-0.05 (0.01) ***	-0.05 (0.01) ***	-0.07 (0.01) ***	-0.05 (0.01) ***
Summer 2 Growth	-1.75 (0.02) ***	-1.36 (0.02) ***	-1.25 (0.02) ***	-2.42 (0.03) ***	-0.85 (0.02) ***	-0.66 (0.02) ***
Black	0.19 (0.04) ***	0.16 (0.03) ***	0.35 (0.03) ***	0.58 (0.04) ***	0.23 (0.04) ***	0.18 (0.04) ***
Hispanic	0.04 (0.03)	-0.04 (0.03)	0.10 (0.03) ***	0.33 (0.04) ***	0.07 (0.04) *	0.12 (0.05) **
Asian	0.56 (0.06) ***	0.37 (0.05) ***	0.24 (0.06) ***	-0.17 (0.08) *	0.17 (0.08) *	0.01 (0.06)
AIAN	0.20 (0.10) *	0.18 (0.09) *	0.31 (0.09) ***	0.66 (0.11) ***	0.39 (0.09) ***	0.44 (0.09) ***
Other race	0.04 (0.04)	0.02 (0.03)	0.07 (0.03) *	-0.03 (0.04)	-0.04 (0.04)	0.06 (0.05)
			COVID			
Intercept (first fall)	160.31 (0.08) ***	172.96 (0.07) ***	185.09 (0.07) ***	195.79 (0.07) ***	206.28 (0.08) ***	211.33 (0.09) ***
Black	0.17 (0.17)	-1.95 (0.13) ***	-3.62 (0.11) ***	-4.76 (0.11) ***	-6.14 (0.11) ***	-6.57 (0.12) ***
Hispanic	0.03 (0.20)	-1.53 (0.13) ***	-3.20 (0.10) ***	-3.81 (0.11) ***	-4.55 (0.12) ***	-4.90 (0.13) ***
Asian	7.36 (0.24) ***	7.09 (0.19) ***	5.50 (0.16) ***	5.24 (0.17) ***	6.15 (0.22) ***	5.86 (0.22) ***
AIAN	-2.91 (0.50) ***	-2.72 (0.39) ***	-3.57 (0.32) ***	-4.15 (0.33) ***	-5.63 (0.30) ***	-5.46 (0.31) ***
Other race	-0.55 (0.14) ***	-0.65 (0.12) ***	-1.29 (0.10) ***	-1.45 (0.11) ***	-1.68 (0.12) ***	-2.17 (0.13) ***
Year 1 Growth	1.98 (0.01) ***	1.80 (0.01) ***	1.70 (0.01) ***	1.47 (0.01) ***	1.21 (0.01) ***	1.04 (0.01) ***
Black	-0.89 (0.02) ***	-0.75 (0.02) ***	-0.67 (0.01) ***	-0.63 (0.01) ***	-0.54 (0.01) ***	-0.41 (0.01) ***
Hispanic	-0.77 (0.03) ***	-0.62 (0.02) ***	-0.44 (0.01) ***	-0.43 (0.01) ***	-0.36 (0.01) ***	-0.27 (0.01) ***
Asian	-0.54 (0.03) ***	-0.55 (0.02) ***	-0.36 (0.01) ***	-0.20 (0.01) ***	-0.08 (0.02) ***	0.01 (0.02)
AIAN	-0.40 (0.05) ***	-0.33 (0.05) ***	-0.36 (0.04) ***	-0.39 (0.04) ***	-0.33 (0.03) ***	-0.25 (0.04) ***
Other race	-0.22 (0.02) ***	-0.21 (0.01) ***	-0.19 (0.01) ***	-0.20 (0.01) ***	-0.18 (0.01) ***	-0.12 (0.01) ***
Summer 2 Growth	-2.10 (0.02) ***	-1.32 (0.02) ***	-1.29 (0.01) ***	-1.16 (0.01) ***	-2.12 (0.02) ***	-0.90 (0.01) ***
Black	0.05 (0.04)	0.23 (0.03) ***	0.43 (0.02) ***	0.41 (0.02) ***	0.82 (0.03) ***	0.15 (0.02) ***
Hispanic	0.50 (0.04) ***	0.48 (0.02) ***	0.40 (0.02) ***	0.42 (0.02) ***	0.67 (0.03) ***	0.19 (0.02) ***
Asian	0.22 (0.06) ***	0.43 (0.04) ***	0.35 (0.03) ***	0.19 (0.03) ***	-0.23 (0.05) ***	-0.03 (0.04)
AIAN	0.57 (0.09) ***	0.09 (0.08)	0.38 (0.06) ***	0.38 (0.05) ***	0.90 (0.07) ***	0.25 (0.06) ***
Other race	0.12 (0.04) **	0.10 (0.03) **	0.16 (0.03) ***	0.21 (0.03) ***	0.28 (0.03) ***	0.05 (0.03) *

Year 2 Growth	1.95 (0.00) ***	1.78 (0.00) ***	1.52 (0.00) ***	1.30 (0.01) ***	1.05 (0.01) ***	0.83 (0.01) ***
Black	-0.13 (0.01) ***	-0.11 (0.01) ***	-0.17 (0.01) ***	-0.20 (0.01) ***	-0.22 (0.01) ***	-0.15 (0.01) ***
Hispanic	-0.12 (0.01) ***	-0.01 (0.01) *	-0.06 (0.01) ***	-0.11 (0.01) ***	-0.16 (0.01) ***	-0.17 (0.01) ***
Asian	-0.15 (0.01) ***	-0.03 (0.01) ***	0.09 (0.01) ***	0.19 (0.01) ***	0.13 (0.01) ***	0.10 (0.01) ***
AIAN	-0.18 (0.04) ***	-0.19 (0.03) ***	-0.25 (0.03) ***	-0.22 (0.02) ***	-0.19 (0.02) ***	-0.16 (0.02) ***
Other race	-0.04 (0.01) ***	-0.03 (0.01) ***	-0.04 (0.01) ***	-0.08 (0.01) ***	-0.05 (0.01) ***	-0.07 (0.01) ***
Summer 2 Growth	-1.58 (0.03) ***	-1.23 (0.02) ***	-1.18 (0.02) ***	-2.15 (0.03) ***	-0.78 (0.03) ***	-0.60 (0.03) ***
Black	0.39 (0.05) ***	0.27 (0.04) ***	0.34 (0.03) ***	0.90 (0.04) ***	0.27 (0.04) ***	0.14 (0.04) ***
Hispanic	0.22 (0.05) ***	0.16 (0.03) ***	0.16 (0.03) ***	0.60 (0.04) ***	0.14 (0.05) **	0.11 (0.04) **
Asian	0.63 (0.06) ***	0.48 (0.05) ***	0.28 (0.05) ***	-0.19 (0.07) **	0.24 (0.08) **	0.13 (0.07) *
AIAN	0.31 (0.16) *	0.47 (0.12) ***	0.61 (0.12) ***	1.04 (0.11) ***	0.28 (0.08) ***	0.42 (0.08) ***
Other race	0.17 (0.05) ***	0.05 (0.04)	0.07 (0.04)	0.21 (0.05) ***	0.01 (0.05)	0.14 (0.06) **

Note. Standard errors are shown in parentheses. The pre-COVID estimates represent the 2017-18 (year 1) to 2019-20 (year 3) school years, while the COVID estimates represent growth across the 2020-21 (year 1) to 2022-23 (year 3) school years. The refence group in this model is White students.
*p<.05, **p<.01, ***p<.001.

Table 7C. Coefficients from the reading hierarchical linear model conditional on school poverty level

Parameter	Grades 1-3	Grades 2-4	Grades 3-5	Grades 4-6	Grades 5-7	Grades 6-8
			Pre-COVID			
Intercept	149.61 (0.09) ***	165.44 (0.10) ***	179.56 (0.10) ***	188.99 (0.11) ***	196.18 (0.12) ***	201.58 (0.15) ***
Low poverty	11.15 (0.14) ***	13.96 (0.14) ***	14.40 (0.14) ***	14.31 (0.15) ***	14.38 (0.17) ***	14.44 (0.21) ***
Mid poverty	5.57 (0.11) ***	6.51 (0.12) ***	7.11 (0.12) ***	7.28 (0.13) ***	7.58 (0.14) ***	7.91 (0.17) ***
Year 1 Growth	1.97 (0.01) ***	1.67 (0.01) ***	1.36 (0.01) ***	1.00 (0.01) ***	0.84 (0.01) ***	0.63 (0.01) ***
Low poverty	0.21 (0.01) ***	0.07 (0.01) ***	-0.05 (0.01) ***	-0.06 (0.01) ***	-0.11 (0.01) ***	-0.06 (0.01) ***
Mid poverty	0.14 (0.01) ***	0.10 (0.01) ***	0.00 (0.01)	0.00 (0.01)	-0.05 (0.01) ***	-0.04 (0.01) ***
Summer 1 Growth	-1.11 (0.03) ***	-0.54 (0.02) ***	-0.92 (0.02) ***	-0.62 (0.02) ***	-0.75 (0.03) ***	-0.47 (0.04) ***
Low poverty	0.16 (0.04) ***	-0.16 (0.04) ***	0.13 (0.03) ***	0.04 (0.03)	0.19 (0.04) ***	0.06 (0.04)
Mid poverty	-0.12 (0.03) ***	-0.19 (0.03) ***	0.02 (0.03)	-0.05 (0.03) *	0.03 (0.04)	0.02 (0.04)
Year 2 Growth	1.71 (0.01) ***	1.35 (0.01) ***	0.98 (0.01) ***	0.78 (0.01) ***	0.60 (0.01) ***	0.48 (0.01) ***
Low poverty	0.07 (0.01) ***	-0.04 (0.01) ***	-0.07 (0.01) ***	-0.08 (0.01) ***	-0.07 (0.01) ***	-0.05 (0.02) **
Mid poverty	0.07 (0.01) ***	0.01 (0.01)	-0.02 (0.01) **	-0.03 (0.01) ***	-0.05 (0.01) ***	-0.02 (0.01)
Summer 2 Growth	-0.70 (0.04) ***	-0.85 (0.03) ***	-0.50 (0.03) ***	-0.42 (0.04) ***	-0.35 (0.06) ***	-0.18 (0.06) ***
Low poverty	-0.23 (0.06) ***	0.01 (0.05)	-0.01 (0.04)	0.01 (0.05)	0.00 (0.07)	-0.01 (0.07)
Mid poverty	-0.27 (0.05) ***	-0.14 (0.04) ***	-0.19 (0.04) ***	-0.22 (0.05) ***	-0.07 (0.06)	-0.07 (0.06)
			COVID			
Intercept	154.30 (0.19) ***	166.91 (0.15) ***	178.95 (0.12) ***	188.20 (0.11) ***	195.74 (0.13) ***	201.80 (0.17) ***
Low poverty	8.38 (0.25) ***	12.40 (0.21) ***	15.07 (0.16) ***	15.25 (0.16) ***	14.96 (0.17) ***	14.40 (0.22) ***
Mid poverty	2.14 (0.22) ***	4.60 (0.17) ***	7.17 (0.14) ***	7.91 (0.14) ***	8.00 (0.15) ***	7.89 (0.19) ***
Year 1 Growth	0.94 (0.02) ***	0.95 (0.02) ***	0.84 (0.01) ***	0.60 (0.01) ***	0.49 (0.01) ***	0.25 (0.01) ***
Low poverty	0.80 (0.03) ***	0.57 (0.02) ***	0.26 (0.01) ***	0.16 (0.01) ***	0.08 (0.01) ***	0.12 (0.01) ***
Mid poverty	0.66 (0.03) ***	0.52 (0.02) ***	0.26 (0.01) ***	0.16 (0.01) ***	0.08 (0.01) ***	0.09 (0.01) ***
Summer 1 Growth	-0.74 (0.04) ***	0.02 (0.03)	-0.03 (0.02)	0.16 (0.03) ***	0.00 (0.04)	0.11 (0.04) **
Low poverty	0.02 (0.05)	-0.34 (0.04) ***	-0.44 (0.03) ***	-0.48 (0.03) ***	-0.21 (0.04) ***	-0.25 (0.05) ***
Mid poverty	-0.26 (0.04) ***	-0.37 (0.03) ***	-0.43 (0.03) ***	-0.48 (0.03) ***	-0.31 (0.04) ***	-0.29 (0.04) ***
Year 2 Growth	1.66 (0.01) ***	1.37 (0.01) ***	1.01 (0.01) ***	0.80 (0.01) ***	0.52 (0.01) ***	0.40 (0.01) ***
Low poverty	0.14 (0.01) ***	-0.07 (0.01) ***	-0.10 (0.01) ***	-0.11 (0.01) ***	-0.04 (0.01) **	0.00 (0.02)
Mid poverty	0.15 (0.01) ***	0.03 (0.01) ***	-0.02 (0.01) **	-0.04 (0.01) ***	0.00 (0.01)	0.00 (0.01)
Summer 2 Growth	-0.33 (0.05) ***	-0.66 (0.04) ***	-0.53 (0.04) ***	-0.42 (0.05) ***	-0.28 (0.06) ***	-0.10 (0.06) *
Low poverty	-0.45 (0.07) ***	-0.07 (0.05)	0.06 (0.04)	0.09 (0.06)	0.05 (0.07)	0.05 (0.07)
Mid poverty	-0.44 (0.06) ***	-0.13 (0.05) **	-0.11 (0.04) **	-0.05 (0.06)	-0.10 (0.07)	-0.09 (0.06)

Note. Standard errors are shown in parentheses. The pre-COVID estimates represent the 2017-18 (year 1) to 2019-20 (year 3) school years, while the COVID estimates represent growth across the 2020-21 (year 1) to 2022-23 (year 3) school years. The reference group in this model is high-poverty schools.
*$p<.05$, **$p<.01$, ***$p<.001$.

Table 7D. Coefficients from the math hierarchical linear model conditional on school poverty level

Parameter	Grades 1-3	Grades 2-4	Grades 3-5	Grades 4-6	Grades 5-7	Grades 6-8
			Pre-COVID			
Intercept	152.98 (0.08) ***	168.59 (0.08) ***	181.50 (0.08) ***	192.01 (0.10) ***	200.78 (0.12) ***	204.78 (0.15) ***
Low poverty	10.72 (0.13) ***	11.58 (0.12) ***	11.89 (0.13) ***	12.73 (0.16) ***	14.11 (0.19) ***	15.26 (0.25) ***
Mid poverty	5.45 (0.10) ***	5.37 (0.10) ***	5.59 (0.10) ***	5.92 (0.12) ***	6.81 (0.14) ***	7.95 (0.18) ***
Year 1 Growth	2.15 (0.01) ***	1.77 (0.01) ***	1.63 (0.01) ***	1.33 (0.01) ***	1.13 (0.01) ***	0.92 (0.01) ***
Low poverty	0.16 (0.01) ***	0.09 (0.01) ***	0.08 (0.01) ***	0.20 (0.01) ***	0.26 (0.01) ***	0.20 (0.02) ***
Mid poverty	0.08 (0.01) ***	0.11 (0.01) ***	0.06 (0.01) ***	0.12 (0.01) ***	0.14 (0.01) ***	0.11 (0.01) ***
Summer 1 Growth	-1.88 (0.02) ***	-1.43 (0.02) ***	-1.56 (0.02) ***	-1.37 (0.02) ***	-2.34 (0.03) ***	-0.93 (0.03) ***
Low poverty	-0.19 (0.04) ***	-0.12 (0.03) ***	0.12 (0.03) ***	-0.06 (0.03) *	-0.47 (0.05) ***	-0.12 (0.04) **
Mid poverty	-0.16 (0.03) ***	-0.21 (0.03) ***	0.02 (0.02)	-0.03 (0.03)	-0.26 (0.04) ***	-0.11 (0.04) **
Year 2 Growth	1.90 (0.01) ***	1.68 (0.01) ***	1.33 (0.01) ***	1.12 (0.01) ***	0.92 (0.01) ***	0.72 (0.01) ***
Low poverty	0.00 (0.01)	0.04 (0.01) ***	0.17 (0.01) ***	0.23 (0.01) ***	0.18 (0.02) ***	0.19 (0.02) ***
Mid poverty	0.05 (0.01) ***	0.03 (0.01) ***	0.10 (0.01) ***	0.11 (0.01) ***	0.07 (0.01) ***	0.07 (0.01) ***
Summer 2 Growth	-1.72 (0.05) ***	-1.34 (0.04) ***	-1.02 (0.03) ***	-1.92 (0.05) ***	-0.74 (0.05) ***	-0.48 (0.05) ***
Low poverty	0.36 (0.06) ***	0.15 (0.05) ***	-0.18 (0.05) ***	-0.58 (0.07) ***	-0.11 (0.06) *	-0.20 (0.07) **
Mid poverty	-0.11 (0.05) *	-0.05 (0.04)	-0.22 (0.04) ***	-0.43 (0.06) ***	-0.09 (0.05)	-0.16 (0.06) **
			COVID			
Intercept	157.78 (0.21) ***	168.39 (0.15) ***	178.84 (0.11) ***	188.75 (0.12) ***	198.31 (0.12) ***	202.85 (0.16) ***
Low poverty	7.88 (0.26) ***	10.38 (0.19) ***	11.96 (0.16) ***	12.80 (0.17) ***	14.10 (0.19) ***	14.07 (0.25) ***
Mid poverty	2.14 (0.23) ***	3.88 (0.17) ***	5.11 (0.13) ***	5.83 (0.14) ***	6.42 (0.15) ***	6.89 (0.19) ***
Year 1 Growth	1.17 (0.03) ***	1.13 (0.02) ***	1.14 (0.01) ***	0.91 (0.01) ***	0.72 (0.01) ***	0.67 (0.01) ***
Low poverty	0.75 (0.03) ***	0.58 (0.02) ***	0.52 (0.02) ***	0.58 (0.02) ***	0.52 (0.02) ***	0.41 (0.02) ***
Mid poverty	0.60 (0.03) ***	0.51 (0.02) ***	0.43 (0.02) ***	0.40 (0.02) ***	0.34 (0.02) ***	0.26 (0.02) ***
Summer 1 Growth	-1.88 (0.04) ***	-0.99 (0.03) ***	-0.86 (0.02) ***	-0.69 (0.02) ***	-1.29 (0.03) ***	-0.69 (0.03) ***
Low poverty	-0.07 (0.05)	-0.09 (0.04) **	-0.30 (0.03) ***	-0.43 (0.03) ***	-0.94 (0.04) ***	-0.16 (0.04) ***
Mid poverty	-0.14 (0.05) ***	-0.29 (0.03) ***	-0.35 (0.02) ***	-0.37 (0.02) ***	-0.60 (0.04) ***	-0.17 (0.03) ***
Year 2 Growth	1.84 (0.01) ***	1.72 (0.01) ***	1.39 (0.01) ***	1.13 (0.01) ***	0.83 (0.01) ***	0.65 (0.01) ***
Low poverty	0.05 (0.01) ***	0.03 (0.01) ***	0.16 (0.01) ***	0.26 (0.01) ***	0.28 (0.02) ***	0.25 (0.02) ***
Mid poverty	0.09 (0.01) ***	0.05 (0.01) ***	0.09 (0.01) ***	0.11 (0.01) ***	0.15 (0.01) ***	0.12 (0.01) ***
Summer 2 Growth	-1.34 (0.05) ***	-1.05 (0.04) ***	-0.88 (0.03) ***	-1.33 (0.05) ***	-0.53 (0.05) ***	-0.47 (0.05) ***
Low poverty	0.15 (0.07) **	-0.01 (0.05)	-0.27 (0.05) ***	-1.04 (0.07) ***	-0.22 (0.07) ***	-0.12 (0.07) *
Mid poverty	-0.23 (0.06) ***	-0.14 (0.05) **	-0.26 (0.04) ***	-0.56 (0.06) ***	-0.25 (0.06) ***	-0.09 (0.06) *

Note. Standard errors are shown in parentheses. The pre-COVID estimates represent the 2017-18 (year 1) to 2019-20 (year 3) school years, while the COVID estimates represent growth across the 2020-21 (year 1) to 2022-23 (year 3) school years. The reference group in this model is high-poverty schools.
*p<.05, **p<.01, ***p<.001.

Table 8. Achievement gaps between spring 2021 and fall 2022 in reading and math by cohort

Subject	Cohort	Achievement gap between pre-COVID & COVID Test Scores by term				Cumulative reduction in gap	% Reduction	Years to close gap at current rate
		S21	F21	S22	F22			
Reading	1-3		-0.17	-0.17	-0.15	0.02	10%	5+
	2-4	-0.14	-0.13	-0.13	-0.11	0.03	23%	5+
	3-5	-0.14	-0.11	-0.09	-0.09	0.05	36%	2.7
	4-6	-0.13	-0.10	-0.10	-0.08	0.05	38%	2.4
	5-7	-0.13	-0.09	-0.11	-0.09	0.04	34%	2.9
	6-8	-0.12	-0.10	-0.12	-0.10	0.02	17%	5+
Math	1-3		-0.21	-0.21	-0.17	0.03	16%	5+
	2-4	-0.23	-0.22	-0.19	-0.16	0.07	31%	3.4
	3-5	-0.26	-0.25	-0.20	-0.17	0.09	36%	2.7
	4-6	-0.28	-0.25	-0.22	-0.16	0.12	43%	2.0
	5-7	-0.27	-0.22	-0.19	-0.17	0.10	38%	2.4
	6-8	-0.20	-0.22	-0.21	-0.19	0.03	15%	5+

Note. The achievement gaps reported in this table are the standardized difference between the pre-COVID and COVID samples in a given grade/term. We compared the fall 2022 achievement gaps relative to the largest observed achievement gap across timepoints and report this as a raw difference ("cumulative reduction in the gap" column) and as a percentage ("% reduction"). These were calculated using unrounded achievement gaps, and as a result, the estimates may not match calculations with the rounded numbers that appear in the table. Estimates in the "years to close the gaps" column were calculated by dividing the gap in fall 2022 by the cumulative rate of change in the gaps. Given the potential imprecision in these estimates, we report the 5+ year estimates as "5+ years".

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Table 9A. Reading RIT score means, SDs by cohort, sample, and subgroup in spring 2022 and fall 2022

Coh.	Subgroup	Gr.	Term	Pre-pandemic Sample				Pandemic Sample				Standardized difference between samples
				N	M	SD	Med. Perc.	N	M	SD	Med. Perc.	
3	White	2S	S22	329,971	190.33	14.95	65	286,495	188.30	16.04	61	-0.13
3	White	3F	F22	415,878	190.79	16.22	64	345,163	188.62	17.13	60	-0.13
4	White	3S	S22	337,481	201.71	14.87	66	291,787	200.14	15.95	63	-0.10
4	White	4F	F22	418,126	201.23	15.53	65	350,188	199.89	16.32	63	-0.08
5	White	4S	S22	341,305	208.82	14.53	64	294,616	207.85	15.19	62	-0.07
5	White	5F	F22	432,329	208.46	15.13	64	355,867	207.44	15.69	63	-0.07
6	White	5S	S22	336,982	214.40	14.25	63	285,515	213.19	14.79	61	-0.08
6	White	6F	F22	446,588	213.86	14.83	63	359,824	212.95	15.13	61	-0.06
7	White	6S	S22	332,022	218.29	14.31	61	283,864	217.04	14.71	58	-0.09
7	White	7F	F22	437,559	217.77	14.91	63	358,850	216.61	15.16	60	-0.08
8	White	7S	S22	314,683	221.64	14.62	62	287,697	220.13	15.08	58	-0.10
8	White	8F	F22	422,948	221.43	15.09	62	362,546	220.06	15.39	59	-0.09
3	Asian	2S	S22	28,626	192.48	15.69	71	27,981	191.45	17.15	70	-0.06
3	Asian	3F	F22	38,909	194.27	16.38	73	36,919	192.99	17.43	71	-0.08
4	Asian	3S	S22	29,088	204.29	15.17	72	30,265	203.42	16.34	71	-0.06
4	Asian	4F	F22	38,434	204.58	15.88	73	38,064	203.69	16.81	72	-0.05
5	Asian	4S	S22	28,074	211.54	15.06	71	30,375	211.00	15.82	71	-0.04
5	Asian	5F	F22	38,871	211.74	15.90	72	38,063	210.95	16.45	71	-0.05
6	Asian	5S	S22	27,309	217.70	14.93	71	28,185	216.97	15.50	70	-0.05
6	Asian	6F	F22	39,932	217.86	15.56	72	36,868	217.32	15.86	72	-0.04
7	Asian	6S	S22	26,666	221.89	14.94	70	28,583	221.67	15.30	70	-0.01
7	Asian	7F	F22	38,052	221.92	15.41	73	36,318	221.42	15.69	72	-0.03
8	Asian	7S	S22	24,353	225.56	15.45	71	28,367	225.20	15.52	71	-0.02
8	Asian	8F	F22	35,431	225.59	15.88	71	36,046	225.19	15.94	71	-0.03
3	Black	2S	S22	116,747	181.25	15.12	41	95,008	177.30	16.57	30	-0.25
3	Black	3F	F22	149,512	181.93	16.20	42	120,138	178.43	17.57	33	-0.21
4	Black	3S	S22	113,748	192.15	15.93	42	95,349	189.17	17.45	36	-0.18
4	Black	4F	F22	147,174	191.92	16.22	43	122,265	189.43	17.54	38	-0.15
5	Black	4S	S22	116,173	199.08	15.86	41	92,420	196.73	17.16	36	-0.14
5	Black	5F	F22	154,830	198.99	16.02	41	122,620	196.91	17.28	37	-0.13
6	Black	5S	S22	110,488	204.79	15.57	40	88,952	202.80	16.67	35	-0.12
6	Black	6F	F22	154,428	204.41	15.72	41	123,460	202.92	16.39	37	-0.09
7	Black	6S	S22	106,949	208.48	15.52	38	86,583	206.53	16.22	33	-0.12
7	Black	7F	F22	149,302	208.09	15.83	40	121,285	206.43	16.26	36	-0.10
8	Black	7S	S22	99,798	212.03	15.73	40	88,124	210.16	16.50	35	-0.12
8	Black	8F	F22	141,037	211.96	15.90	40	123,943	210.44	16.38	37	-0.09
3	Hispanic	2S	S22	129,605	181.81	15.43	43	131,365	178.14	16.76	32	-0.23
3	Hispanic	3F	F22	171,101	182.29	16.44	43	172,009	179.13	17.40	35	-0.19
4	Hispanic	3S	S22	132,070	193.28	16.05	46	135,878	190.59	17.56	39	-0.16

Coh	Group	Gr	Term	N	M	SD	Med. Perc.	N	M	SD	Med. Perc.	stdized diff
4	Hispanic	4F	F22	173,204	192.83	16.64	46	173,028	190.42	17.74	41	-0.14
5	Hispanic	4S	S22	129,856	200.72	15.93	45	137,421	198.78	17.16	41	-0.12
5	Hispanic	5F	F22	182,114	200.15	16.59	45	175,871	198.26	17.49	42	-0.11
6	Hispanic	5S	S22	123,647	206.65	15.66	45	130,717	204.73	16.77	40	-0.12
6	Hispanic	6F	F22	186,883	205.69	16.37	45	179,811	204.15	16.78	41	-0.09
7	Hispanic	6S	S22	124,701	210.32	15.83	43	134,422	208.35	16.49	38	-0.12
7	Hispanic	7F	F22	186,278	209.36	16.67	44	175,450	207.57	16.86	40	-0.11
8	Hispanic	7S	S22	115,617	213.48	16.34	44	138,749	211.46	17.06	39	-0.12
8	Hispanic	8F	F22	174,096	212.99	16.91	44	180,817	211.13	17.21	40	-0.11
3	Low Poverty	2S	S22	141,306	194.06	14.23	74	130,259	192.43	15.37	71	-0.11
3	Low Poverty	3F	F22	184,038	194.84	15.15	73	167,583	192.98	16.18	70	-0.12
4	Low Poverty	3S	S22	144,972	205.34	13.64	73	141,491	203.96	14.72	70	-0.10
4	Low Poverty	4F	F22	183,244	205.13	14.32	73	171,600	204.00	15.09	71	-0.08
5	Low Poverty	4S	S22	145,279	212.50	13.20	71	141,359	211.32	14.08	70	-0.09
5	Low Poverty	5F	F22	187,842	212.36	13.82	72	172,642	211.24	14.52	71	-0.08
6	Low Poverty	5S	S22	136,972	217.79	13.08	70	135,373	216.38	13.82	67	-0.11
6	Low Poverty	6F	F22	185,209	217.64	13.63	71	171,033	216.52	14.14	69	-0.08
7	Low Poverty	6S	S22	133,941	221.65	13.32	68	133,913	220.25	13.86	65	-0.10
7	Low Poverty	7F	F22	176,226	221.49	13.71	70	168,067	220.10	14.19	67	-0.10
8	Low Poverty	7S	S22	124,485	225.04	13.59	68	133,156	223.37	14.20	65	-0.12
8	Low Poverty	8F	F22	166,496	225.09	13.91	69	166,239	223.62	14.42	66	-0.10
3	High Poverty	2S	S22	179,800	180.53	15.44	39	153,290	176.35	16.62	27	-0.26
3	High Poverty	3F	F22	230,957	180.78	16.48	39	190,815	176.91	17.42	29	-0.23
4	High Poverty	3S	S22	179,522	191.76	16.33	42	154,754	188.39	17.76	34	-0.20
4	High Poverty	4F	F22	229,690	191.14	16.72	42	192,958	188.17	17.90	35	-0.17
5	High Poverty	4S	S22	174,285	198.80	16.29	41	149,971	196.28	17.56	35	-0.15
5	High Poverty	5F	F22	238,059	198.38	16.65	41	191,489	195.81	17.76	35	-0.15
6	High Poverty	5S	S22	147,993	204.43	16.06	39	123,227	202.24	17.16	34	-0.13
6	High Poverty	6F	F22	210,613	203.71	16.38	40	167,910	201.73	16.89	35	-0.12
7	High Poverty	6S	S22	140,500	208.18	16.01	38	121,006	206.10	16.75	33	-0.13
7	High Poverty	7F	F22	202,684	207.32	16.61	39	160,970	205.40	16.93	34	-0.12
8	High Poverty	7S	S22	130,147	211.45	16.40	39	123,124	209.44	17.21	34	-0.12
8	High Poverty	8F	F22	188,018	211.05	16.80	39	164,171	209.19	17.15	35	-0.11

Note. Coh=cohort, Gr=grade, N=number of students, M=mean, SD=standard deviation, Med. Perc. = median percentile rank, stdized diff=standardized difference between cohorts. We focus on schools in two poverty levels: (a) "Low Poverty" - less than 25% FRPL eligibility and (b) "High Poverty" - greater than 75% FRPL eligibility.

Table 9B. Math RIT score means, SDs by grade level and subgroup in spring 2022 and fall 2022

Coh.	Subgroup	Gr.	Term	Pre-pandemic Sample				Pandemic Sample				Standardized difference between samples
				N	M	SD	Med. Perc.	N	M	SD	Med. Perc.	
3	White	2S	S22	332,253	193.96	12.61	66	298,455	191.80	13.29	61	-0.17
3	White	3F	F22	415,304	191.77	12.84	63	350,306	189.98	13.69	59	-0.14
4	White	3S	S22	336,494	205.31	12.94	66	296,841	203.32	13.81	62	-0.15
4	White	4F	F22	419,495	203.79	13.22	66	353,246	202.09	14.19	61	-0.12
5	White	4S	S22	341,368	215.28	14.30	65	298,366	213.10	15.06	61	-0.15
5	White	5F	F22	433,606	213.35	14.46	64	358,229	211.40	15.34	59	-0.13
6	White	5S	S22	338,272	223.78	16.05	64	285,030	220.64	16.65	57	-0.19
6	White	6F	F22	446,308	218.07	14.43	61	357,687	216.06	14.90	56	-0.14
7	White	6S	S22	329,010	226.42	15.76	61	281,859	223.69	15.94	54	-0.17
7	White	7F	F22	433,112	224.87	15.98	63	353,215	222.38	16.19	57	-0.16
8	White	7S	S22	292,907	231.21	17.07	62	264,200	227.58	17.00	53	-0.21
8	White	8F	F22	391,641	230.00	17.22	63	332,414	226.79	17.26	55	-0.19
3	Asian	2S	S22	29,162	197.29	14.07	75	30,722	195.19	15.55	71	-0.14
3	Asian	3F	F22	39,333	196.33	14.37	75	38,216	194.94	15.99	73	-0.09
4	Asian	3S	S22	29,921	209.88	14.46	76	31,659	208.33	15.81	74	-0.10
4	Asian	4F	F22	39,665	209.23	15.28	78	39,099	208.04	16.75	75	-0.07
5	Asian	4S	S22	29,401	221.31	16.34	77	31,603	218.96	17.45	74	-0.14
5	Asian	5F	F22	40,025	219.96	16.85	78	39,169	218.13	18.18	76	-0.11
6	Asian	5S	S22	28,123	231.68	18.09	81	28,574	228.36	19.17	74	-0.18
6	Asian	6F	F22	40,723	225.57	16.80	76	36,870	223.62	17.56	72	-0.11
7	Asian	6S	S22	24,966	233.00	17.75	75	26,600	230.75	18.16	70	-0.13
7	Asian	7F	F22	36,482	232.52	18.25	78	34,008	230.02	18.84	73	-0.14
8	Asian	7S	S22	20,441	238.66	20.08	76	22,124	234.91	20.49	68	-0.19
8	Asian	8F	F22	30,216	237.67	20.37	77	28,994	234.61	20.93	70	-0.15
3	Black	2S	S22	113,223	184.81	13.56	39	99,463	180.26	14.82	27	-0.32
3	Black	3F	F22	145,253	182.79	13.20	37	121,808	179.15	14.83	28	-0.26
4	Black	3S	S22	109,520	195.31	13.99	38	94,137	191.16	15.70	28	-0.28
4	Black	4F	F22	144,027	194.02	13.99	39	122,223	190.41	15.62	30	-0.25
5	Black	4S	S22	113,296	203.95	15.01	38	93,506	199.27	16.59	26	-0.30
5	Black	5F	F22	152,194	202.36	14.90	36	122,819	198.24	16.34	26	-0.27
6	Black	5S	S22	109,275	210.99	16.31	34	89,593	205.71	17.05	23	-0.32
6	Black	6F	F22	153,134	206.90	14.36	33	123,293	203.68	14.93	26	-0.22
7	Black	6S	S22	103,760	213.33	16.14	31	87,063	209.53	15.83	23	-0.24
7	Black	7F	F22	145,355	212.15	15.86	34	121,493	208.83	15.72	26	-0.21
8	Black	7S	S22	93,941	217.28	17.18	32	84,776	213.45	16.41	24	-0.23
8	Black	8F	F22	133,260	216.34	16.85	34	118,685	212.91	16.37	27	-0.21
3	Hispanic	2S	S22	133,692	186.85	13.55	46	147,141	183.16	14.45	35	-0.26
3	Hispanic	3F	F22	177,419	184.75	13.26	43	176,836	181.81	14.38	35	-0.21
4	Hispanic	3S	S22	135,260	198.34	13.79	47	144,793	195.16	15.32	39	-0.22
4	Hispanic	4F	F22	181,295	196.68	14.10	47	176,662	193.78	15.39	39	-0.20

Coh	Group	Gr		N	M	SD	Med. Perc.	N	M	SD	Med. Perc.	stdized diff
5	Hispanic	4S	S22	133,270	207.69	15.07	47	146,418	204.00	16.41	38	-0.23
5	Hispanic	5F	F22	188,971	205.66	15.24	46	180,157	202.24	16.23	36	-0.22
6	Hispanic	5S	S22	128,753	215.47	16.57	45	134,149	210.65	17.03	34	-0.29
6	Hispanic	6F	F22	193,558	210.21	14.58	42	177,958	207.30	14.85	34	-0.20
7	Hispanic	6S	S22	127,118	217.79	16.19	41	135,112	214.14	16.06	32	-0.23
7	Hispanic	7F	F22	186,751	215.76	16.28	42	176,093	212.66	16.08	35	-0.19
8	Hispanic	7S	S22	113,704	221.46	17.51	41	127,906	217.14	16.85	31	-0.25
8	Hispanic	8F	F22	169,211	219.79	17.54	42	168,310	216.25	16.86	33	-0.21
3	Low Poverty	2S	S22	144,273	196.79	12.17	73	138,886	194.93	12.82	69	-0.15
3	Low Poverty	3F	F22	186,895	195.37	12.39	72	170,530	193.93	13.29	69	-0.11
4	Low Poverty	3S	S22	148,268	208.79	12.59	73	145,225	207.24	13.29	70	-0.12
4	Low Poverty	4F	F22	189,400	207.59	12.91	74	173,869	206.40	13.93	71	-0.09
5	Low Poverty	4S	S22	149,480	219.57	14.06	73	145,446	217.42	14.82	70	-0.15
5	Low Poverty	5F	F22	193,357	217.76	14.23	73	175,011	216.16	15.19	70	-0.11
6	Low Poverty	5S	S22	140,166	228.35	15.93	73	136,207	225.44	16.64	68	-0.18
6	Low Poverty	6F	F22	188,052	222.56	14.44	70	170,928	220.59	15.04	66	-0.13
7	Low Poverty	6S	S22	131,662	230.73	15.48	69	132,172	227.98	15.89	63	-0.18
7	Low Poverty	7F	F22	174,992	229.71	15.80	72	164,056	226.96	16.23	66	-0.17
8	Low Poverty	7S	S22	111,128	236.02	17.03	71	117,419	231.94	17.31	62	-0.24
8	Low Poverty	8F	F22	150,030	235.06	17.14	72	145,617	231.38	17.58	64	-0.21
3	High Poverty	2S	S22	180,623	185.38	13.84	41	166,610	180.99	14.89	29	-0.31
3	High Poverty	3F	F22	233,905	183.09	13.44	39	196,910	179.35	14.85	29	-0.27
4	High Poverty	3S	S22	178,905	196.32	14.24	41	157,866	192.21	15.95	31	-0.27
4	High Poverty	4F	F22	233,876	194.69	14.36	41	196,160	190.94	15.83	32	-0.25
5	High Poverty	4S	S22	174,734	204.96	15.30	40	155,489	200.57	16.91	29	-0.27
5	High Poverty	5F	F22	241,875	203.31	15.29	39	195,320	199.04	16.62	28	-0.27
6	High Poverty	5S	S22	150,436	212.29	16.76	37	124,640	206.96	17.41	25	-0.31
6	High Poverty	6F	F22	213,536	207.76	14.60	36	167,241	204.19	15.02	27	-0.24
7	High Poverty	6S	S22	137,377	214.52	16.42	34	120,019	210.87	16.19	25	-0.22
7	High Poverty	7F	F22	198,470	212.83	16.20	35	159,667	209.51	16.07	28	-0.21
8	High Poverty	7S	S22	125,173	218.24	17.54	34	114,967	214.38	16.89	26	-0.22
8	High Poverty	8F	F22	180,136	216.90	17.27	35	154,827	213.40	16.78	28	-0.21

Note. Coh=cohort, Gr=grade, N=number of students, M=mean, SD=standard deviation, Med. Perc. = median percentile rank, stdized diff=standardized difference between cohorts. We focus on schools in two poverty levels: (a) "Low Poverty" - less than 25% FRPL eligibility and (b) "High Poverty" - greater than 75% FRPL eligibility.

Table 10. Comparison of standardized effect sizes based on sample restriction criteria

Subject	Cohort	pre-COVID term	COVID Term	Estimated Achievement Gap		
				All students	Consistent Schools	Consistent Students
Reading	1-3	S19	S22	-0.17	-0.17	-0.17
Reading	1-3	F19	F22	-0.15	-0.16	-0.15
Reading	2-4	S19	S22	-0.13	-0.14	-0.13
Reading	2-4	F19	F22	-0.11	-0.12	-0.10
Reading	3-5	S19	S22	-0.09	-0.11	-0.09
Reading	3-5	F19	F22	-0.09	-0.10	-0.08
Reading	4-6	S19	S22	-0.10	-0.12	-0.10
Reading	4-6	F19	F22	-0.08	-0.09	-0.08
Reading	5-7	S19	S22	-0.11	-0.12	-0.10
Reading	5-7	F19	F22	-0.09	-0.10	-0.09
Reading	6-8	S19	S22	-0.12	-0.13	-0.11
Reading	6-8	F19	F22	-0.10	-0.10	-0.10
Math	1-3	S19	S22	-0.22	-0.21	-0.22
Math	1-3	F19	F22	-0.17	-0.17	-0.17
Math	2-4	S19	S22	-0.19	-0.20	-0.18
Math	2-4	F19	F22	-0.16	-0.16	-0.15
Math	3-5	S19	S22	-0.20	-0.21	-0.19
Math	3-5	F19	F22	-0.17	-0.17	-0.16
Math	4-6	S19	S22	-0.22	-0.23	-0.22
Math	4-6	F19	F22	-0.16	-0.16	-0.16
Math	5-7	S19	S22	-0.19	-0.21	-0.18
Math	5-7	F19	F22	-0.17	-0.18	-0.17
Math	6-8	S19	S22	-0.21	-0.22	-0.22
Math	6-8	F19	F22	-0.19	-0.19	-0.20

Note. The "All students" column represents the least restrictive sample (where all students are included even if they did not test consistently across terms), the "Consistent schools" column represents students from the subset of schools that tested both pre-COVID and COVID, and the "Consistent students" were students who tested in both the most recent spring and fall terms (spring 2022 and fall 2022 for the COVID sample, spring 2019 and fall 2019 for the pre-COVID sample).

Figure A1. Average MAP Growth achievement across three school years for all cohorts and subjects.

Reading – G1–G3 cohort
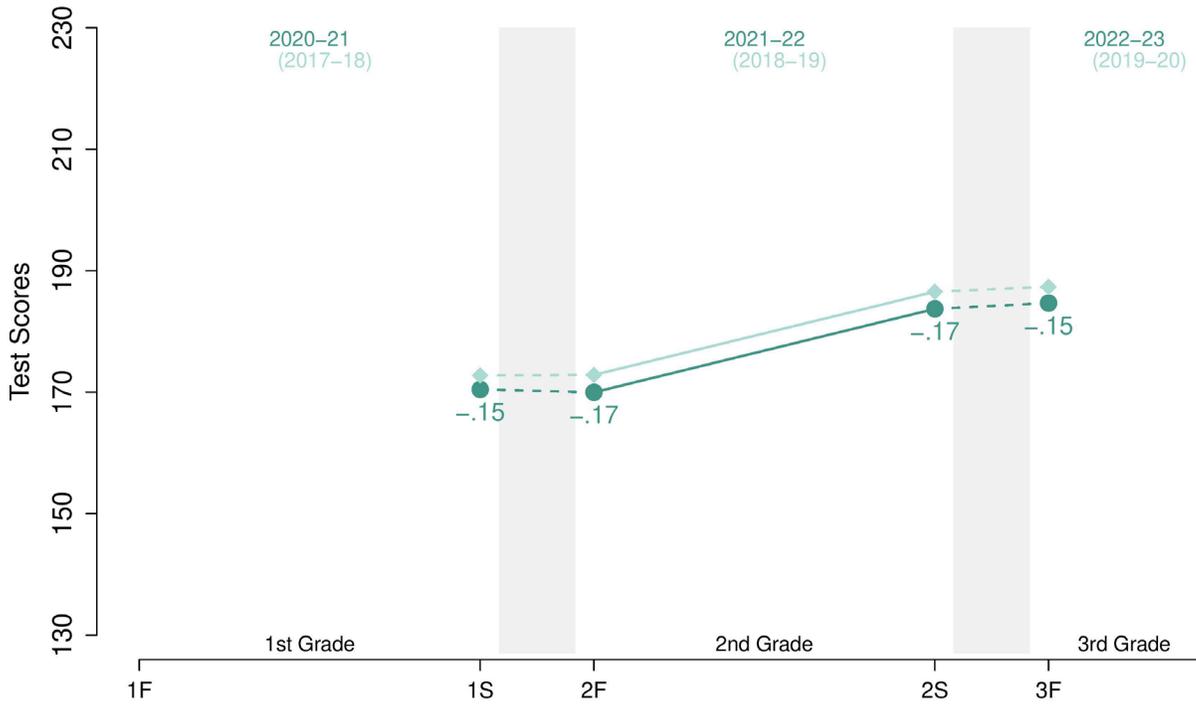
Reading – G2–G4 cohort
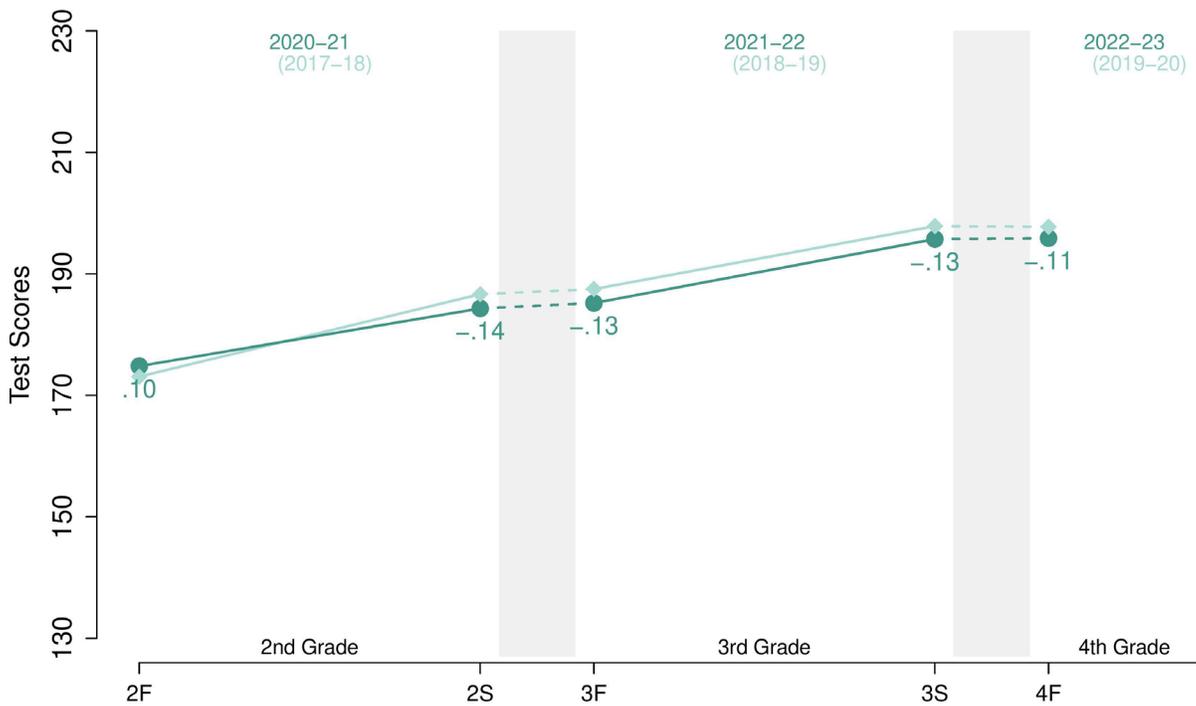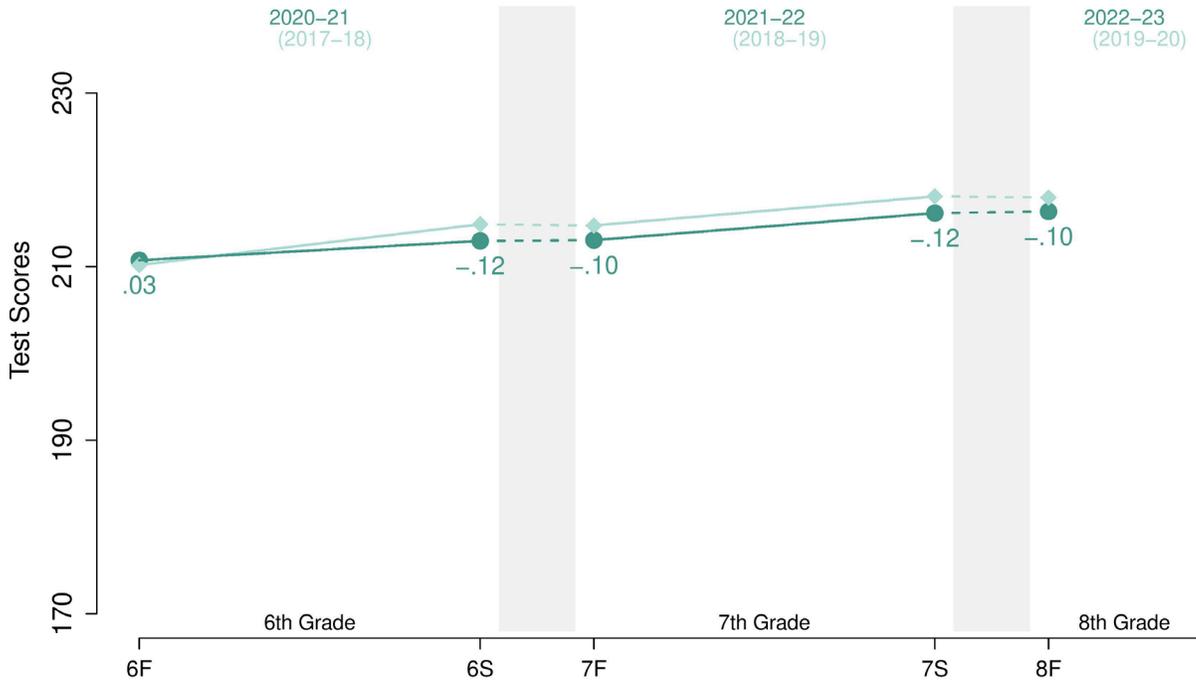
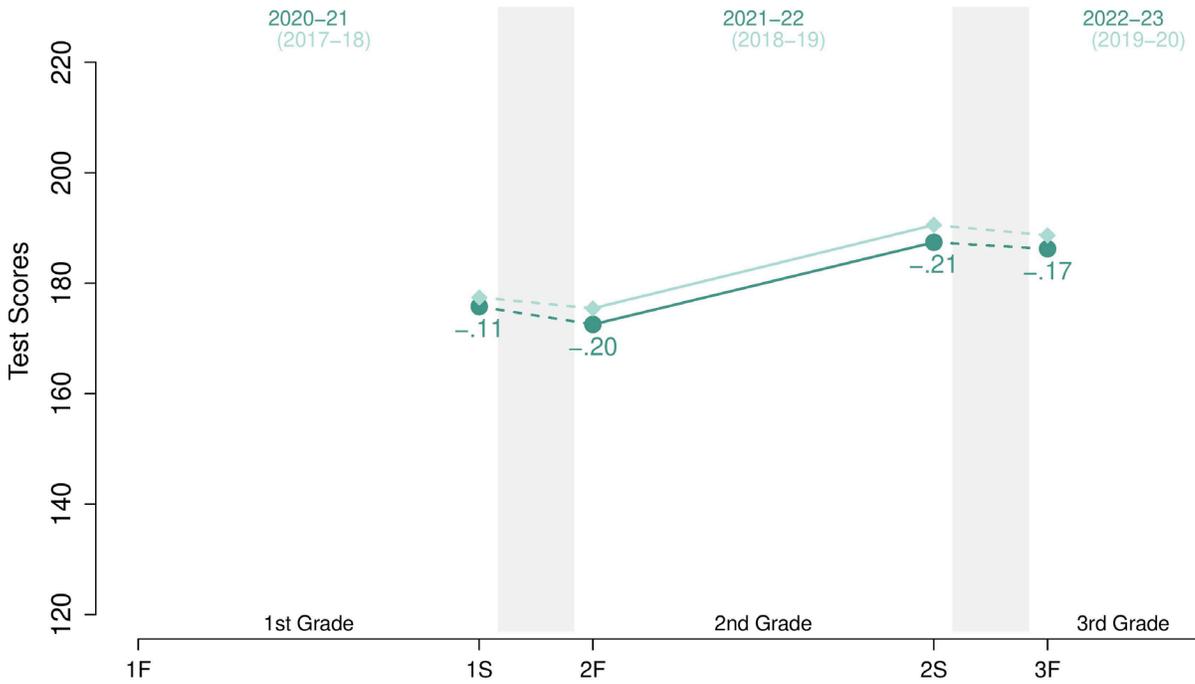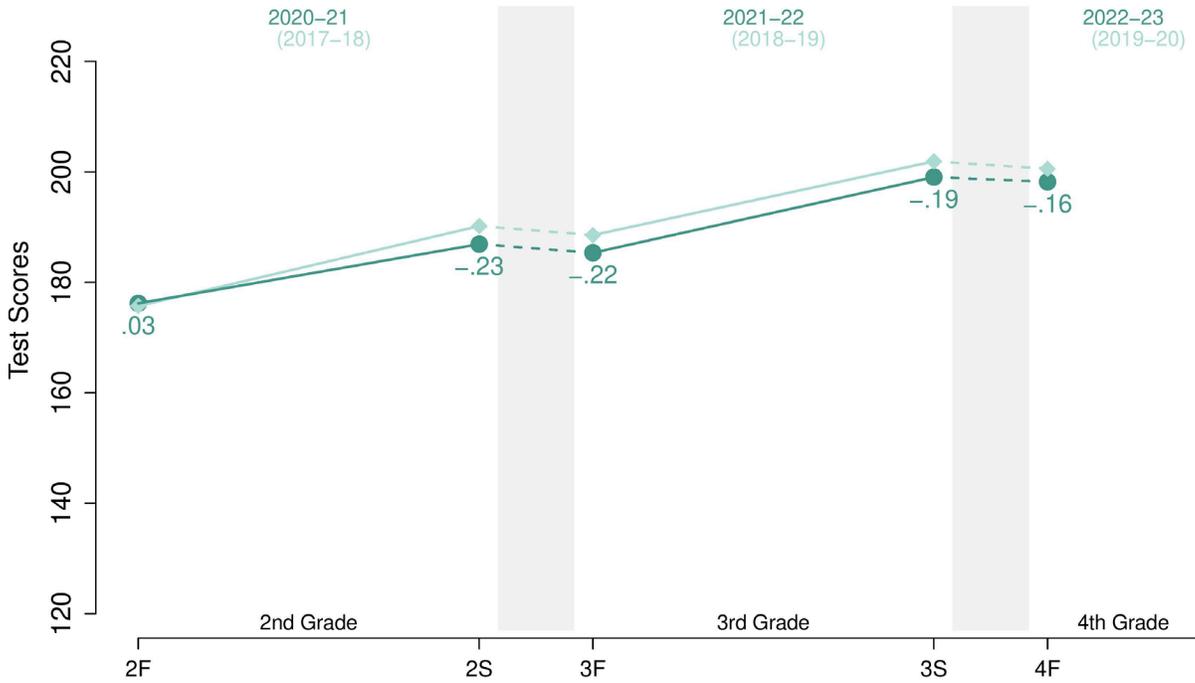## Reading – G3–G5 cohort
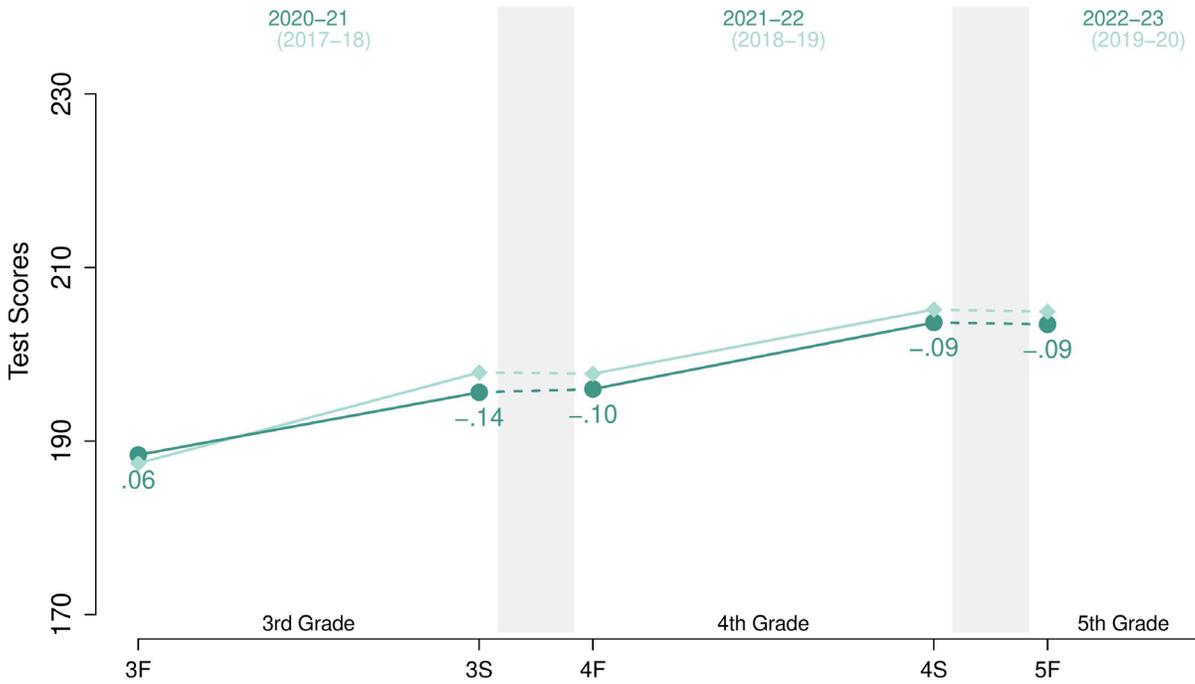
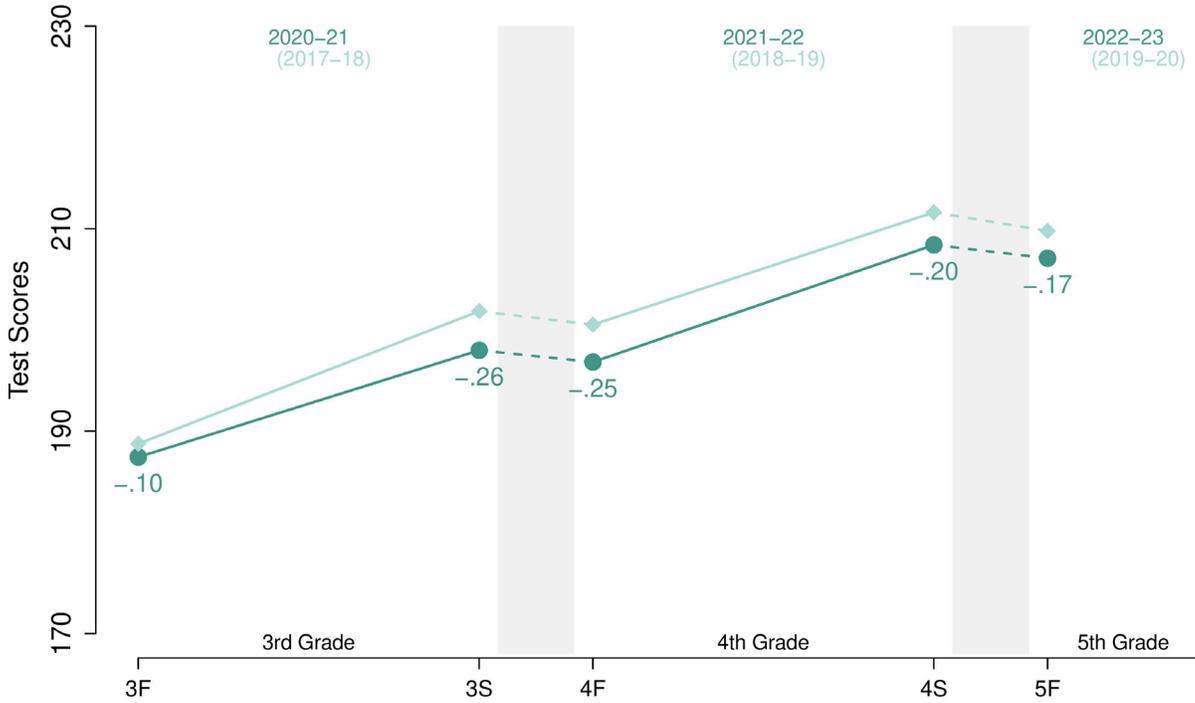## Reading – G4–G6 cohort
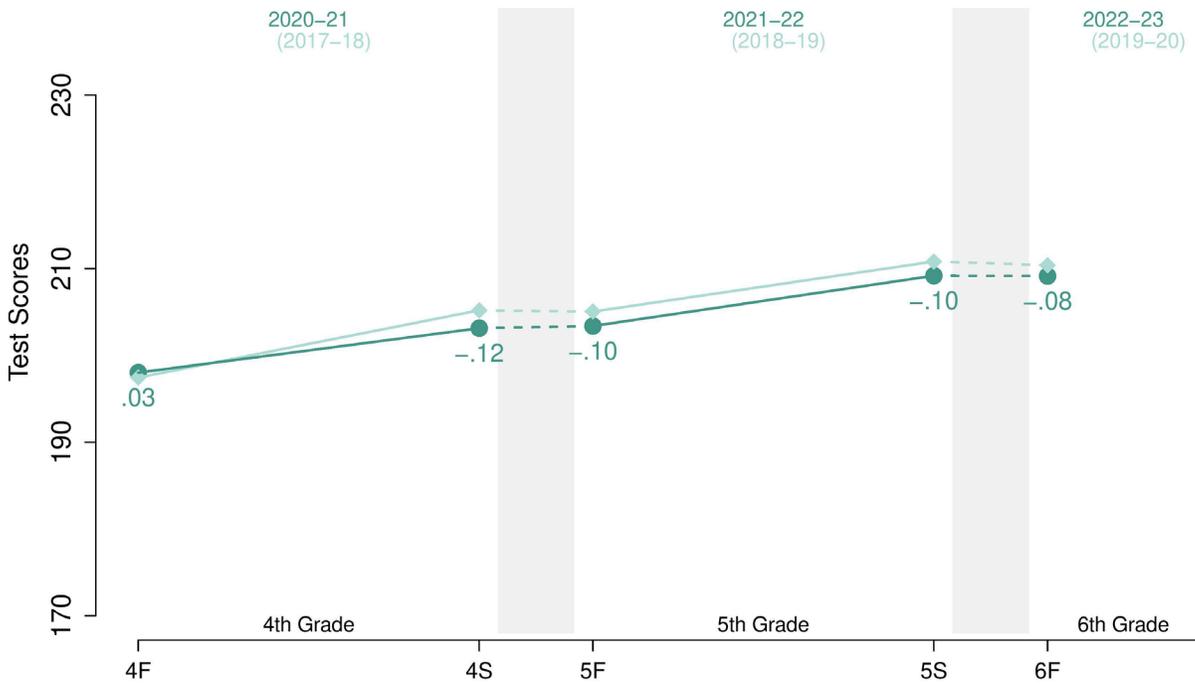
Reading – G5–G7 cohort
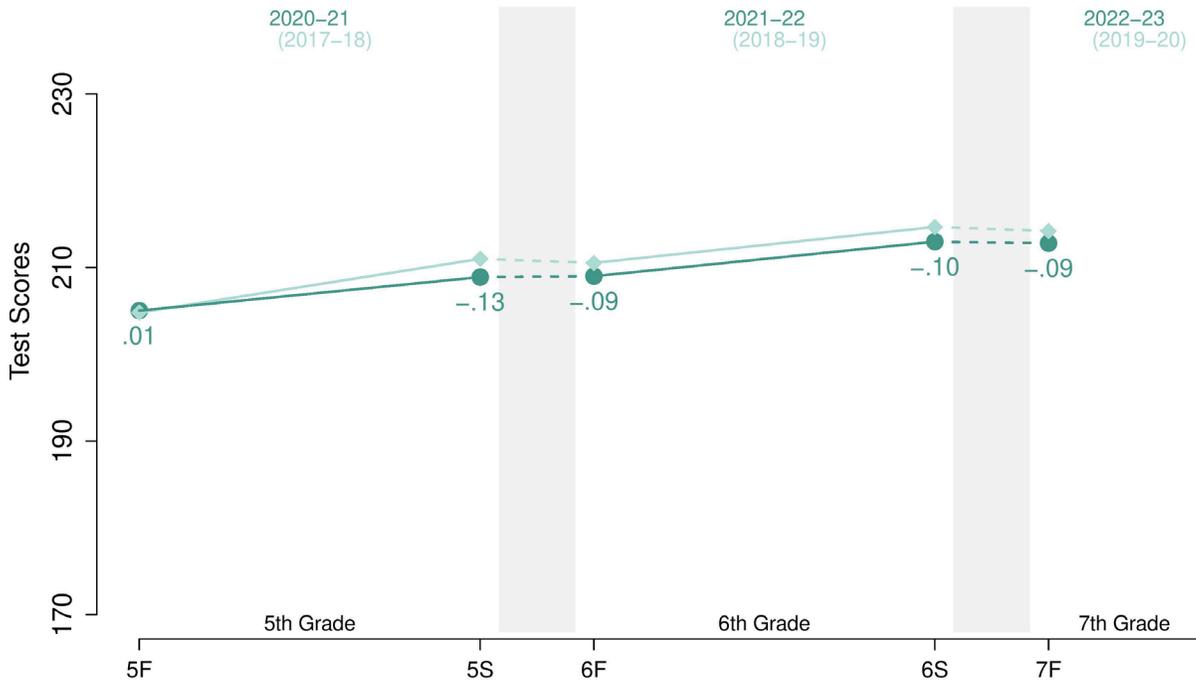
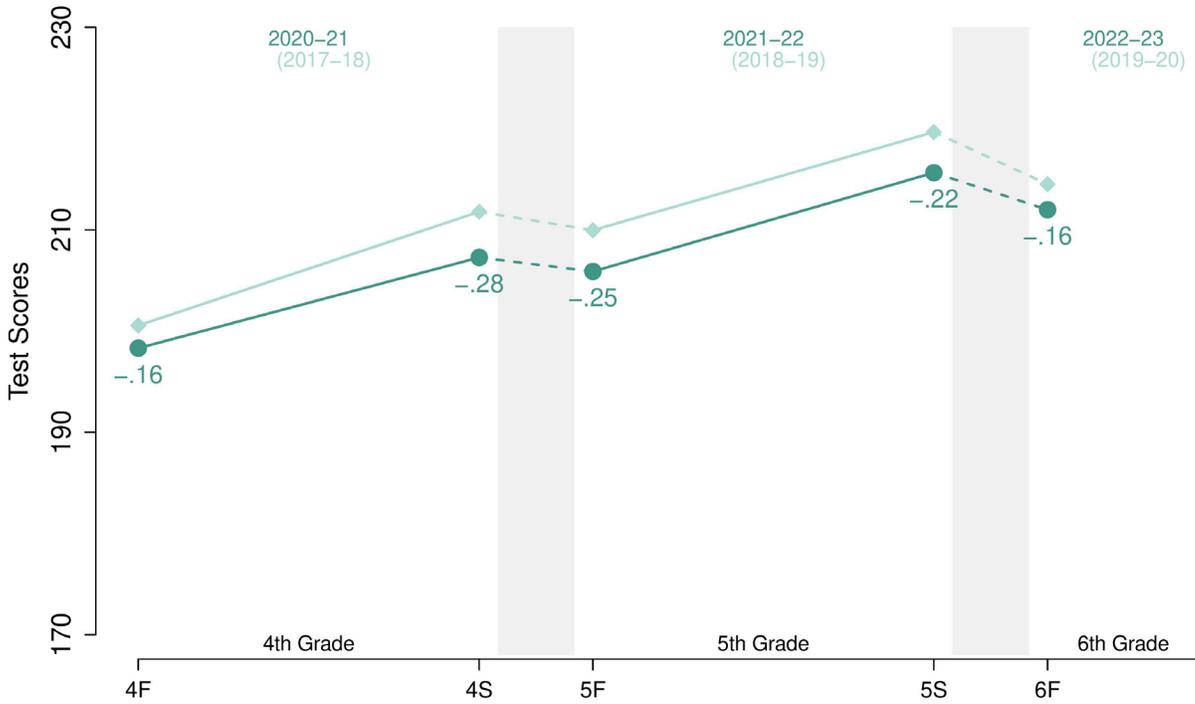## Reading – G6–G8 cohort

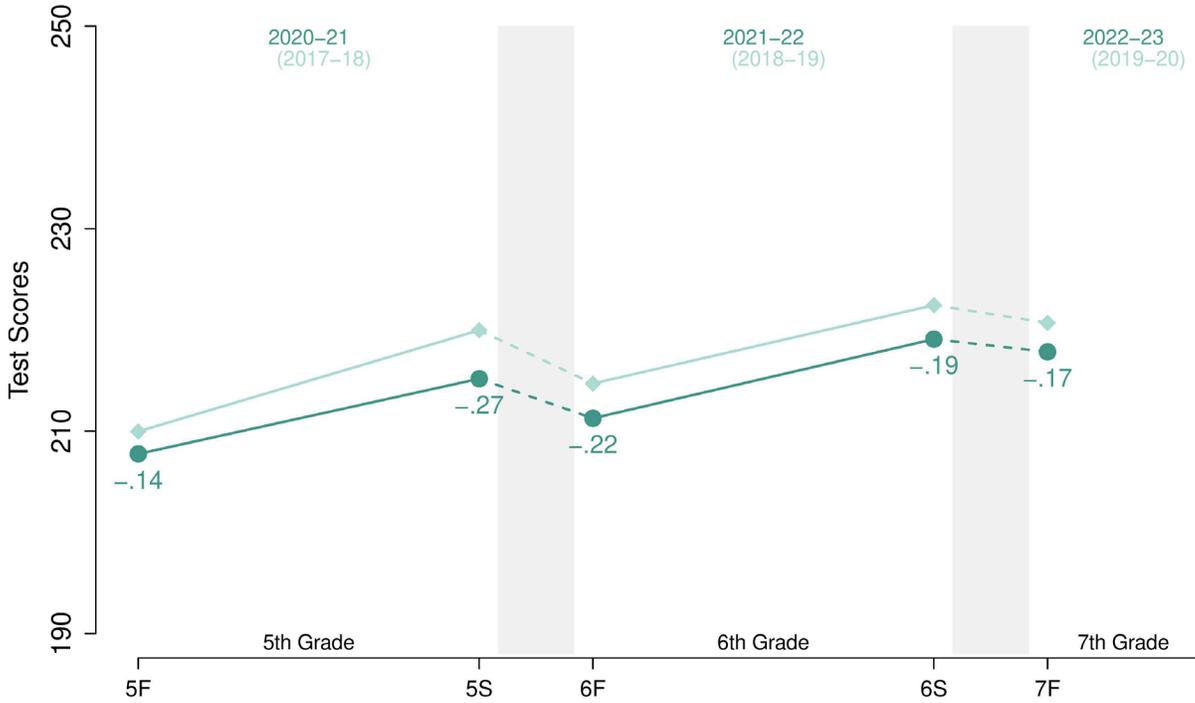## Math – G1–G3 cohort

Math – G2–G4 cohort

Math – G3–G5 cohort

Math – G4–G6 cohort

Math – G5–G7 cohort

Math – G6–G8 cohort
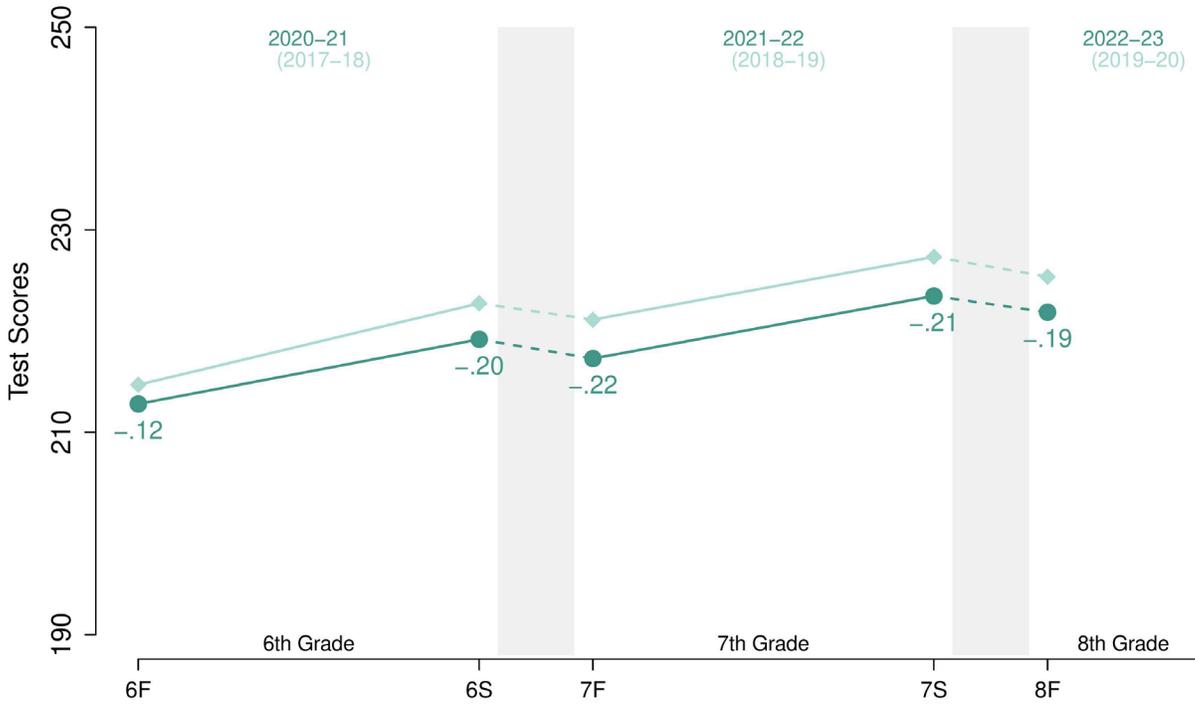
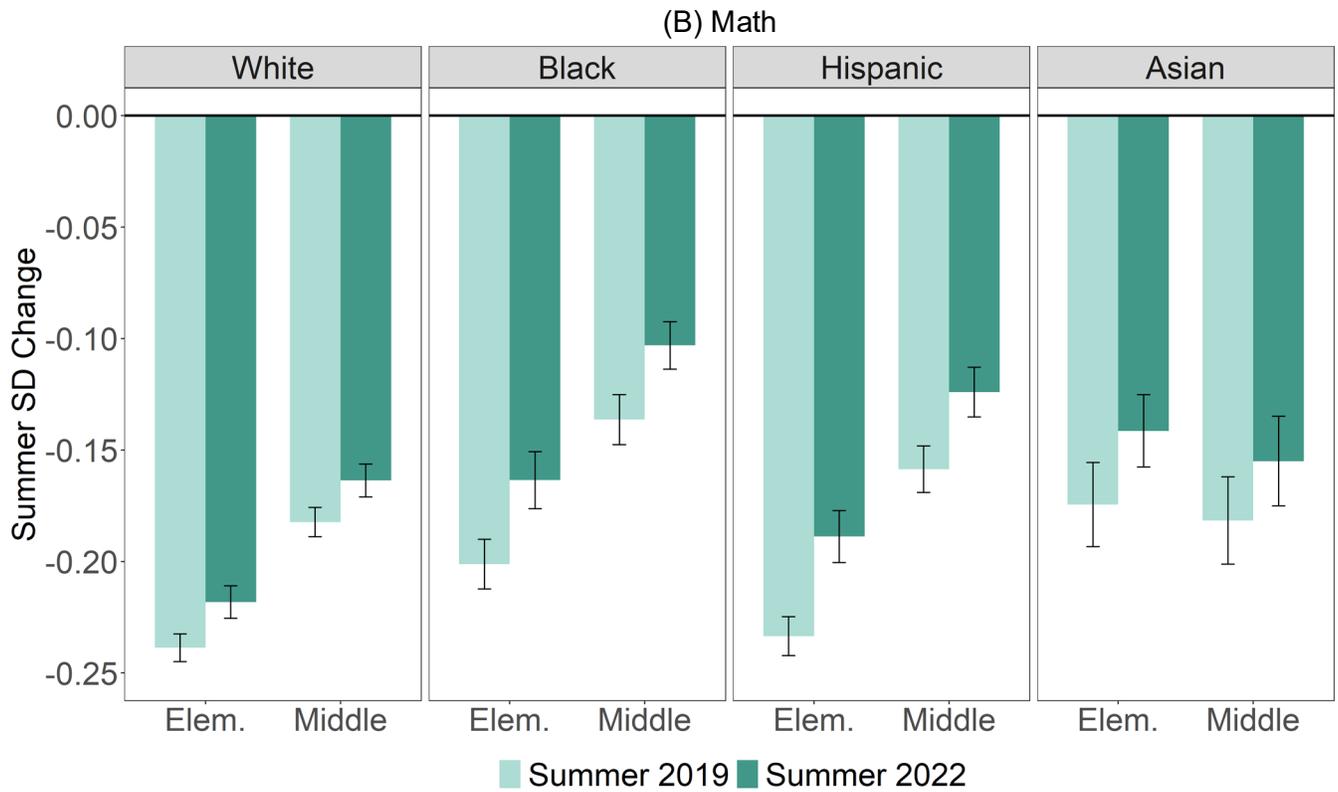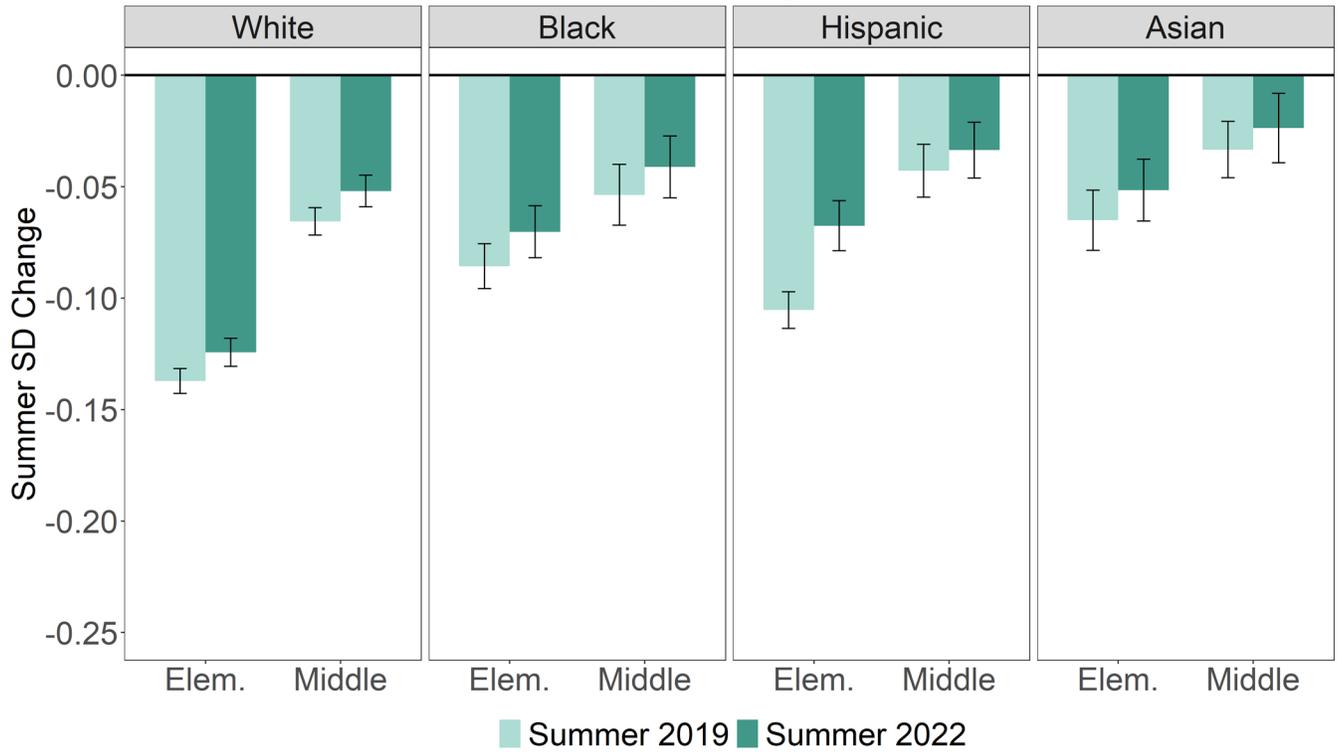Figure A2. Estimated summer learning patterns by race/ethnicity
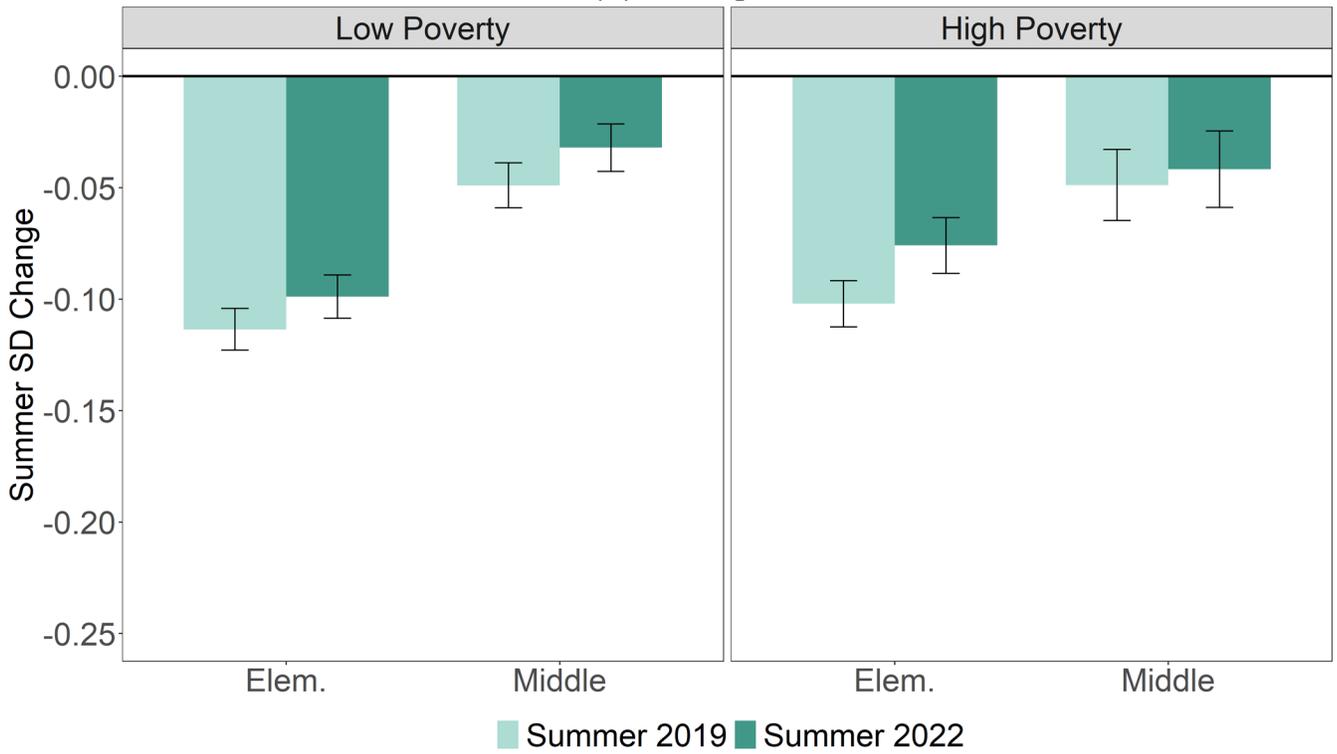

(A) Reading

(B) Math

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Figure A3. Estimated summer learning patterns by school poverty level

(A) Reading

(B) Math

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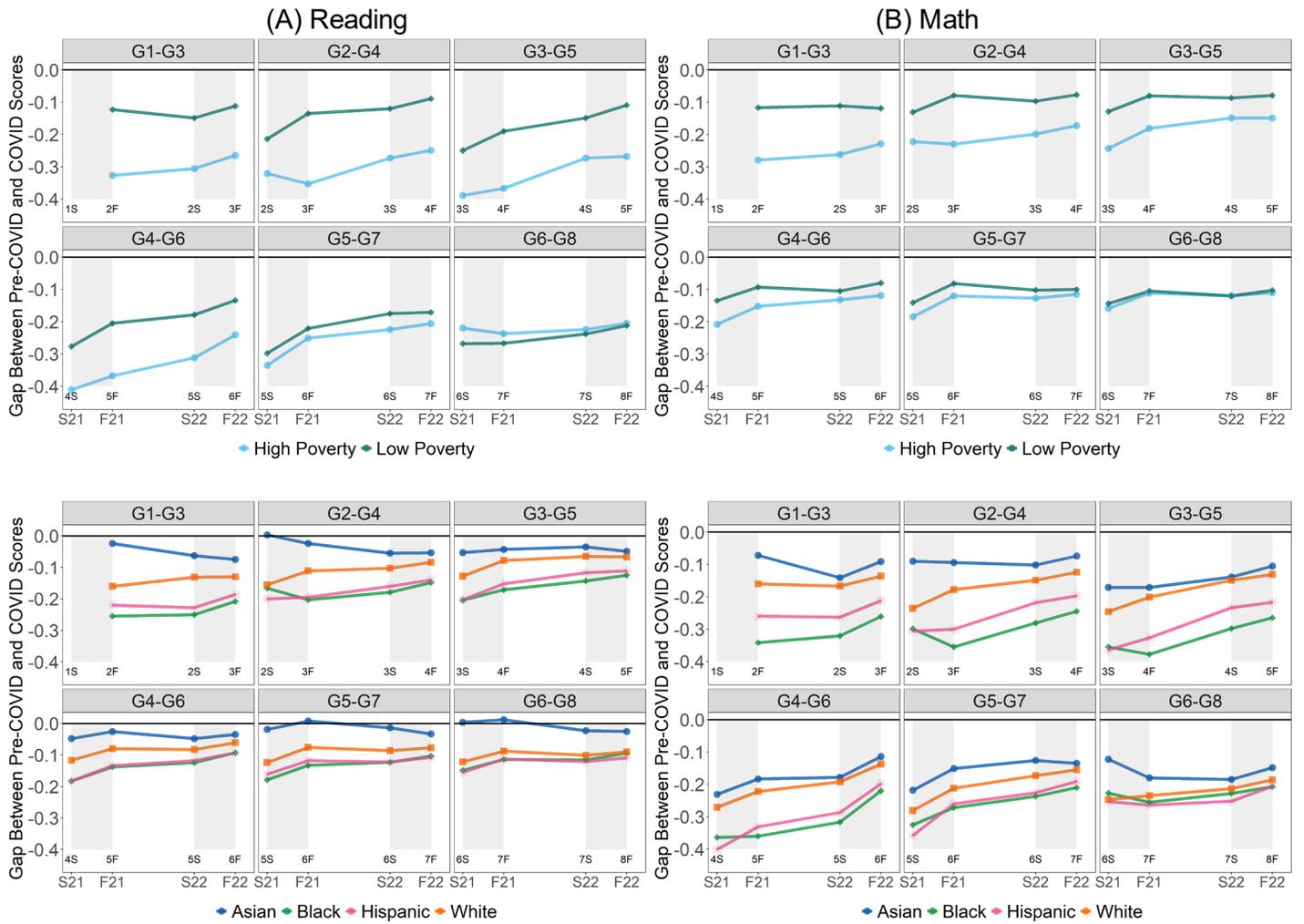
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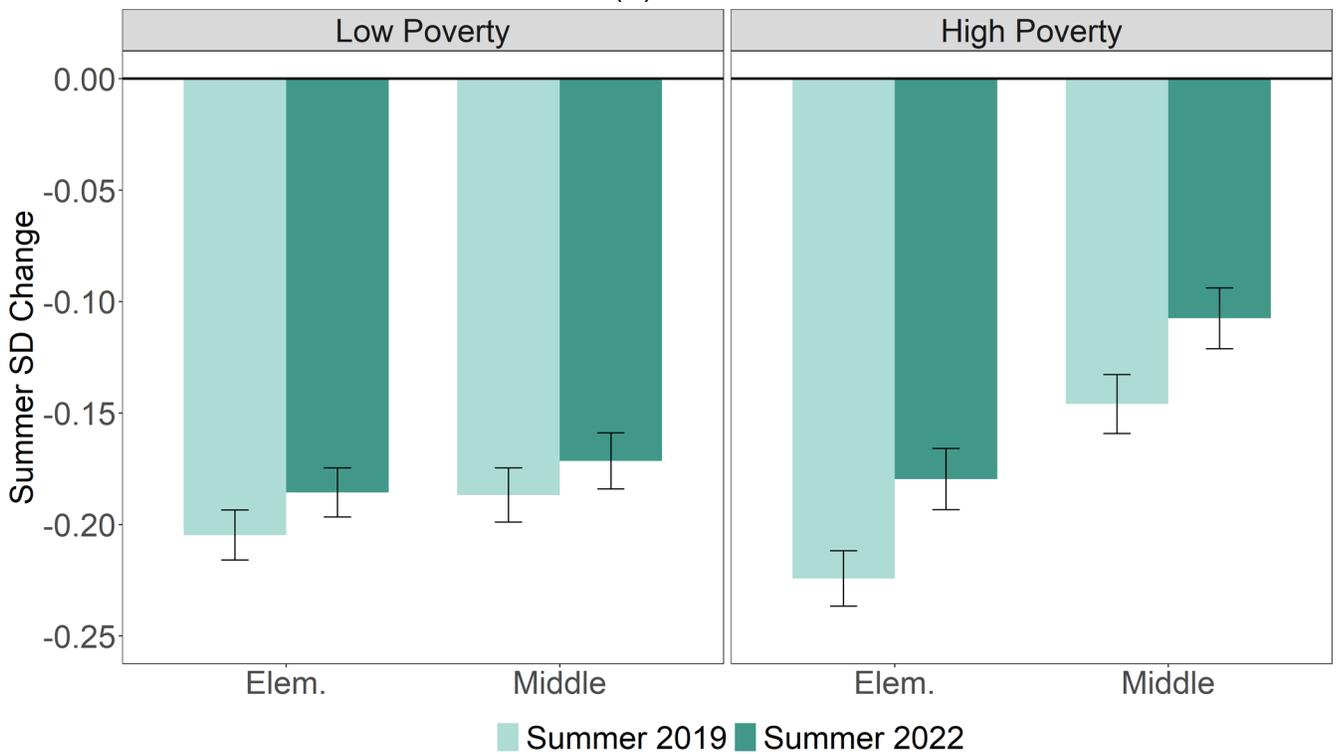
Figure A4. Changes in achievement gaps between pre-COVID and COVID test scores in reading (left panel) and math (right panel) by school-poverty level (top rows) and race/ethnicity (bottom rows)

4. References

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