TECHNICAL BRIEF

Technical appendix for:
Learning during COVID-19: An update on student achievement and growth at the start of the 2021-22 school year

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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, *Learning during COVID-19: An update on student achievement and growth at the start of the 2021-22 school year.*[i] We investigated two research questions in this brief:

1. How does student achievement in fall 2021 compare to pre-pandemic levels (namely fall 2019)?
2. How did academic gains between fall 2019 and fall 2021 compare to normative growth expectations?

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 growth, 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 2019-20 school-level Common Core of Data (CCD) files from the National Center for Education Statistics.[ii]

In total, our sample consists of approximately 6.1 million students[1] in grades 3-8 in 14,256 public schools who took MAP Growth reading and math assessments in fall 2019 and/or fall 2021. Student test scores for grades 3-8 from the fall of the 2019-20 school year were treated as the reference distribution (representing a "typical" school year), while test scores for grades 3-8 in fall 2021 describe trends at the start of the third school year impacted by COVID-19.

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[1] Our previous COVID research has excluded students tested in grades K-2 given concerns about whether remote and in-person assessments were sufficiently comparable in those grades. In this study we continue to restrict our data to students in grades 3-8, given some inconsistencies we observe in achievement trends for younger students. For example, in preliminary analyses of fall 2021 data, we observe trends for first and second grade students that are roughly comparable with trends for students in grades 3-8 (i.e., lower achievement in fall 2021 relative to pre-pandemic historic averages). However, data for kindergarteners are less consistent with these trends, with some data showing that kindergarten student achievement may be higher than in prior years. Sample-related factors make it challenging to confidently interpret these inconsistencies and understand if these are real and meaningful differences in achievement patterns. For example, drops in public school enrollment during the pandemic have been especially sharp for the youngest learners. [iii,iv] As a result, there is less comparability between current and previous groups of K-2 students (in terms of factors such as age, socioeconomic status, exposure to preschool, etc.) which makes comparisons of achievement trends over time challenging. However, with the near universal return to in-person learning in the 2021-22 school year, we intend to fill this critical information gap with future studies on achievement patterns for the youngest students currently in school, especially in the context of district and state recovery efforts.

We limited our sample of schools to a consistent set of U.S. public schools that tested at least ten students in both fall 2019 and fall 2021. This sample restriction guards against the competing explanation that any differences we observe in achievement over time are potentially driven by systematic differences between schools that did and did not consistently test students in both years. Descriptive information for the students in our sample by grade is provided in Table 1 (for reading) and Table 2 (for math). These tables show a comparison of the students in the reference group (fall 2019) and the pandemic impacted group (fall 2021). Overall, the samples of students who tested in 2019 and of same-grade students who tested in fall 2021 were very similar in terms of gender and race/ethnicity, though the number of students tested in each grade was consistently larger in fall 2019. Additionally, Table 3 provides the descriptive statistics for our longitudinal sample (e.g., the students who tested in fall 2019 and tested again two grades later in fall 2021) that was examined using our skip-year norms.[v]

Descriptive information for the schools in our cross-sectional and longitudinal samples along with comparison information on the population of U.S. schools is provided in Table 4. The schools in our cross-sectional sample represent roughly 20% of U.S. public schools in any given grade. Our sample reflects a diversity of schools from across various locales (urban, suburban, rural, and town). However, our sample reflects schools serving slightly higher average percentages of white students, lower average percentages of Hispanic students, and slightly lower percentages of students eligible for FRPL relative to national averages.

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. The 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.

In this study, we used achievement percentile ranks calculated using the NWEA 2020 MAP Growth norms.[vi] These norms reflect pre-pandemic achievement trends as they are based on a nationally representative sample of students from the 2015-16, 2016-17, and 2017-18 school years. Since MAP Growth can be estimated at any point during the school year, the MAP Growth achievement norms condition on each student's grade, subject, and instructional week of testing (i.e., the week in the school calendar in which a student tested). Instructional weeks were calculated for each student based on their school start date and the individual student's testing dates (for more details on the calculation of instructional weeks, see the norms study). Within each subject, let Y_{igt} be a student *i*'s RIT score in grade *g* at instructional week *t*. The predicted mean $(\widehat{Y}_{gt})$ and standard deviation $\left(\text{SD}(Y_{gt})\right)$ for a given grade/subject/instructional week combination were pre-calculated based on the NWEA norms model (see Chapter 4 of the norms report). Based on these values, we calculated a standardized estimate of the student's RIT score:

$$z\left(Y_{igt}\right) = \frac{\left(Y_{igt} - \widehat{Y}_{gt}\right)}{\text{SD}\left(Y_{gt}\right)}.$$

From the standardized score, we calculated the percentile rank (e.g., the proportion of the distribution that the student scored as well as, or better than):

$$p(Y_{igt}) = Pr(Y_{igt} \leq y_{gt}) = \int_{-\infty}^{y_{gt}} \phi(z)dz,$$

where $\phi(z)$ represents the probability density function. The student normative percentile used in this study was scaled to range from 1 to 99:

$$\text{Perc} = 100 \times p_s(Y_{igt}).$$

Additionally, we calculated students' expected fall-to-fall growth across two school years (say fall of grade 3 to fall of grade 5) using NWEA's skip-year growth norms.[v] Let Y_{igt} be a student i's RIT score in grade g at instructional week t, while $Y_{ig+2,t}$ is that same student's RIT score two grades later (in grade $g+2$) at instructional week t (though students need not test in exactly the same week across years). We denote the observed growth student i from grade g to grade $g+2$ as G_{igt}, and the expected growth conditional on the student's prior score (Y_{igt}) as $\widehat{G}_{gt}$. Based on these values, we calculated the conditional growth index (CGI) as:

$$z(G_{igt}) = \frac{(G_{igt} - \widehat{G}_{gt})}{SD(\widehat{G}_{gt})}.$$

The conditional growth percentile (CGP) is calculated in the same manner as the status percentile. More details on the CGP calculations can be found in the NWEA 2020 MAP Growth norms report.[vi]

3. Methods

RQ1: How does student achievement in fall 2021 compare to pre-pandemic levels?

We calculated the median student achievement percentile for each grade level and subject in fall 2019 and fall 2021 based on the NWEA 2020 MAP Growth norms. The results are presented in Tables 5a and 5b. Additionally, we calculated the standardized gap between average test scores in grade g between fall 2019 and fall 2021:

$$\frac{\overline{RIT}_{21g} - \overline{RIT}_{19g}}{\sqrt{\dfrac{(N_{21g} - 1)SD^2_{21g} + (N_{19g} - 1)SD^2_{19g}}{N_{21g} + N_{19g} - 2}}},$$

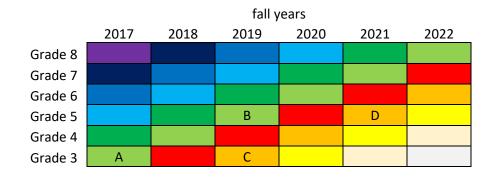where $\overline{RIT}_{21g}$ is the average fall 2021 test score in grade g, $\overline{RIT}_{19g}$ is the average fall 2019 test score in grade g, SD_{21g} and SD_{19g} are the corresponding SD estimates, and N_{21g} and N_{19g} are the observed sample size in grade g in fall 2021 and 2019 respectively. The mean, SDs, Ns, and standardized effect sizes are also reported in Table 5.

RQ2: How did academic gains between fall 2019 and fall 2021 compare to normative growth expectations?

To address the second research question, we calculated the median CGP across fall 2019 and fall 2021 by grade/subject. These results are presented in Tables 6a and 6b. Additionally, we report on differences in median CGP by race/ethnicity, school poverty level, and prior achievement (based on fall 2019 achievement quintile). Achievement quintiles were calculated based on student's fall 2019 percentile (Q1: <20th, Q2 >=20th & <40th, Q3 >=40th & <60th, Q4: >=60th & <80th, Q5: >=80th). Figure 1 shows the median CGP by race/ethnicity and Figure 2 shows the median CGP by school poverty.

4. Attrition analyses

We examined attrition rates to better understand how representative the students with observed test scores in fall 2021 are of NWEA's typical testing population. Following the "match rate" formula described by Andrew Ho,[vii] we calculated the percentage of students with observed test scores for a school year who were also observed two years prior (see figure below for a depiction).

fall years

	2017	2018	2019	2020	2021	2022
Grade 8						
Grade 7						
Grade 6						
Grade 5			B		D	
Grade 4						
Grade 3	A		C			

Baseline (fall 2017 to 2019) match rate: $N_{AB} = A \cap B,\ m_{19} = \frac{N_{AB}}{N_A},\ att_{19} = 1 - m_{19}$

COVID-19 (fall 2019 to 2021) match rate: $N_{CD} = C \cap D,\ m_{21} = \frac{N_{CD}}{N_C}, att_{21} = 1 - m_{21}$

Students were counted as "observed" in a school year if they had an observed test score in the fall term (typically between instructional week 1 and 12) in a given subject within a school where testing was offered. We have chosen to present these findings as attrition rates (e.g., 1 minus the observed match rate), which are presented in Table 7 by grade level and subject. Overall, the attrition rates during the COVID-19 impacted year ranged from 24 to 42% (average of 35%) of students, when looking at all students testing. As a reference, the attrition rates ranged from 18 to 38% (average of 25%) during a typical period. Subgroup attrition rates are presented in Table 8 separately by math and reading. We find higher attrition among Asian American, Black, Hispanic, and American Indian or Alaska Native (AIAN) students relative to White students in some grades/subjects, though the pattern is not consistently present for all grades and subjects. Likewise, when considering students' prior MAP Growth score quintile, we see the largest attrition rates amongst students in the lowest and second lowest quintiles of the distribution in the earlier grades in math, but this pattern does not replicate in reading. It is possible for a student to not show up in the sample two years later for many reasons, including (a) switching schools or districts (to a non-tested school), (b) testing opt-out, and (c) selective testing in later

year (e.g., the school may have decided to only test a subset of students in the subsequent fall). These attrition rates do not imply all of the missing students have unenrolled from the schools.

5. Limitations

There are several important limitations worth noting. Most importantly, we only included schools that tested in both fall 2019 and fall 2021. Schools that consistently tested across this two-year span are likely different than schools that tested in just one or the other year. Given the composition of the schools that met our inclusion criteria and the stability inherent in testing consistently across a two-year span, we expect percentile declines in the schools excluded from our sample would be more severe than what is reported here. In addition, the higher attrition rate observed between 2019-2021 as compared to the 2017-2019 period is another factor in the observed percentile rank declines. Given the higher attrition rate among students of color and students at the lowest quintiles of the MAP Growth score distributions from the prior year, we expect that the magnitude of our results is perhaps less pronounced than in the larger U.S. student population. Finally, we had access to limited demographic information on students and are unable to disaggregate our data by student-level poverty, English Language status, or special education status.

6. Conclusion

Our study found that academic achievement in fall 2021 was lower than a typical year for all students, with larger relative declines in math than in reading. Black, Hispanic, and AIAN students, as well as students in high poverty schools were disproportionately impacted, particularly in the elementary grades we studied. We also find that math gains between fall 2019 and fall 2021, more so than reading gains, were well below typical normative growth trends. We are currently working with school districts across the country to better understand the most effective recovery efforts for students most impacted by the pandemic.[viii] Through our ongoing work, we seek to provide data to inform evidence-based policies to support our students, teachers, and families on the path to recovery and deploy resources where they are most needed, now and into the future.

Table 1. Description of the student sample in reading

Grade	Male	White	Black	Hispanic	Asian	AIAN	Other Race	Sample Size Students	Sample Size Schools
				Fall 2019 Sample					
3	51	48	16	20	4	2	10	621,402	9,304
4	51	48	16	20	4	2	10	618,488	9,264
5	51	48	16	20	4	2	10	631,734	8,840
6	51	47	16	21	4	2	10	629,016	5,639
7	51	48	16	21	4	2	10	617,913	4,873
8	51	49	15	21	4	2	10	579,616	4,705
				Fall 2021 Sample					
3	51	47	16	20	5	2	11	584,334	9,270
4	51	48	16	20	5	2	10	556,077	9,231
5	51	48	16	20	4	2	10	538,860	8,813
6	51	48	15	21	4	2	10	542,489	5,625
7	51	47	16	21	4	2	10	547,651	4,860
8	51	48	15	21	4	2	10	536,968	4,690
				Overall Sample					
All	51	48	16	21	4	2	10	6,148,350	14,256

Note. AIAN= American Indian or Alaska Native. As a point of comparison, the projected percentage distribution of students enrolled in public elementary and secondary schools in fall 2021 was 46% White, 15% Black, 28% Hispanic/Latinx, 6% Asian, 1% AIAN, and 4% Other Race. [ix]

Table 2. Description of the student sample in math

Grade	Male	White	Black	Hispanic	Asian	AIAN	Other Race	Sample Size Students	Sample Size Schools
				Fall 2019 Sample					
3	51	48	15	20	5	2	10	681,061	9,468
4	51	48	15	21	5	2	10	689,404	9,415
5	51	48	15	21	4	2	10	710,024	9,027
6	51	48	15	21	4	2	10	712,538	5,696
7	51	48	15	21	4	2	10	703,356	4,908
8	51	49	15	21	4	2	10	654,028	4,692
				Fall 2021 Sample					
3	51	47	15	20	5	2	11	639,920	9,429
4	51	48	15	21	5	2	10	644,762	9,381
5	51	48	15	21	5	2	10	650,207	8,993
6	51	47	15	21	5	2	10	641,749	5,680
7	51	48	15	21	4	1	10	648,608	4,892
8	51	47	15	22	4	2	10	601,457	4,675
				Overall Sample					
All	51	48	15	21	4	2	10	6,001,315	14,074

Note. AIAN= American Indian or Alaska Native. As a point of comparison, the projected percentage distribution of students enrolled in public elementary and secondary schools in fall 2021 was 46% White, 15% Black, 28% Hispanic/Latinx, 6% Asian, 1% AIAN, and 4% Other Race. [ix]

Table 3. Description of the longitudinal student sample

Grade (F19)	Grade (F21)	Male	White	Black	Hispanic	Asian	American Indian and Alaska Native	Other Race	Sample Size	
									Students	Schools
Reading										
3	5	51	50	15	19	4	2	10	403,561	8,632
4	6	51	50	15	20	4	2	9	370,610	5,427
5	7	51	50	15	20	4	2	9	368,175	4,625
6	8	52	49	15	21	4	2	10	387,496	4,524
Math										
3	5	51	49	14	21	5	2	10	523,979	8,879
4	6	51	50	14	21	5	2	10	477,498	5,488
5	7	51	49	14	21	4	2	9	478,597	4,687
6	8	51	49	14	22	4	2	10	479,447	4,522

Note. AIAN= American Indian or Alaska Native. As a point of comparison, the projected percentage distribution of students enrolled in public elementary and secondary schools in fall 2021 was 46% White, 15% Black, 28% Hispanic/Latinx, 6% Asian, 1% AIAN, and 4% Other Race. [ix]

Table 4. Sample school information relative to U.S. population of schools

	Grade (F21)	Number of schools	Average School Enrollment	% FRPL	% White	% Black	% Hispanic	% Asian American	% City	% Rural	% Suburb	% Town
NWEA Sample (Cross-sectional)	3	9,782	470	53%	53%	15%	21%	4%	30%	25%	35%	10%
NWEA Sample (Cross-sectional)	4	9,731	471	53%	53%	15%	21%	4%	30%	26%	35%	10%
NWEA Sample (Cross-sectional)	5	9,370	477	54%	52%	15%	22%	4%	30%	26%	34%	10%
NWEA Sample (Cross-sectional)	6	6,072	534	53%	54%	15%	20%	3%	29%	31%	29%	11%
NWEA Sample (Cross-sectional)	7	5,070	560	52%	54%	16%	20%	3%	28%	33%	28%	11%
NWEA Sample (Cross-sectional)	8	4,991	561	52%	54%	15%	20%	3%	27%	33%	28%	12%
NWEA Sample (Longitudinal)	5	9,295	479	54%	52%	15%	22%	4%	30%	25%	34%	10%
NWEA Sample (Longitudinal)	6	5,869	540	53%	54%	15%	20%	3%	29%	31%	30%	11%
NWEA Sample (Longitudinal)	7	4,098	596	53%	51%	17%	21%	3%	30%	29%	29%	11%
NWEA Sample (Longitudinal)	8	3,998	598	53%	51%	17%	21%	3%	30%	29%	29%	11%
U.S. public schools	3	53,903	453	56%	48%	15%	26%	4%	30%	26%	33%	10%
U.S. public schools	4	53,665	453	56%	48%	15%	26%	4%	30%	26%	33%	10%
U.S. public schools	5	52,385	456	57%	47%	15%	26%	4%	31%	27%	33%	10%
U.S. public schools	6	37,355	482	57%	49%	15%	26%	4%	29%	31%	29%	11%
U.S. public schools	7	32,265	484	56%	50%	16%	24%	3%	27%	34%	27%	12%
U.S. public schools	8	32,507	486	56%	50%	16%	24%	3%	27%	34%	27%	12%

Note: F21=Fall 2021; FRPL=free or reduced priced lunch. The cross-sectional sample is the sample of schools that tested at least ten students in a grade in both fall 2019 and fall 2021, while the longitudinal sample represents the schools that had at least ten students with longitudinal data observed across both years. This table is presented for the schools included in the reading samples, but results are highly similar for math. The sources of the variables are the Common Core of Data (CCD) collected by the National Center for Educational Statistics. 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 5a. Student reading RIT score means, SDs by grade level, year, and subgroup

Grade	Group	Fall 2019 N	Median Perc.	Mean RIT	SD RIT	Fall 2021 N	Median Perc.	Mean RIT	SD RIT	Effect Size
					Full Sample					
3	All	621,154	55	187.0	16.9	584,144	48	184.1	17.8	-0.17
4	All	618,293	57	197.6	16.7	555,989	51	194.8	17.5	-0.16
5	All	631,462	57	205.0	16.6	538,734	51	202.4	17.3	-0.15
6	All	628,654	55	210.0	16.3	542,239	50	208.1	17.0	-0.11
7	All	617,546	54	213.9	16.6	547,361	51	212.3	17.1	-0.10
8	All	579,276	55	217.9	16.8	536,514	51	216.3	17.4	-0.09
					Racial/ethnic Groups					
3	White	299,944	63	190.3	16.2	276,372	58	187.8	17.0	-0.15
4	White	298,733	65	201.0	15.7	265,082	60	198.8	16.2	-0.14
5	White	303,948	64	208.5	15.4	258,212	60	206.3	15.9	-0.14
6	White	298,700	63	213.5	15.1	258,609	59	212.0	15.6	-0.10
7	White	295,287	63	217.6	15.3	259,306	59	216.1	15.7	-0.10
8	White	281,130	62	221.5	15.5	256,288	59	219.9	16.0	-0.10
3	Black	98,381	41	181.5	16.2	92,476	31	177.5	17.1	-0.24
4	Black	96,965	43	191.6	16.3	87,229	34	188.0	17.1	-0.21
5	Black	99,196	41	198.9	16.2	85,669	33	195.5	16.9	-0.21
6	Black	98,135	39	203.8	15.8	82,697	32	201.0	16.6	-0.17
7	Black	95,969	39	207.5	16.0	85,243	33	205.5	16.8	-0.12
8	Black	87,828	39	211.5	16.1	82,116	35	209.5	16.9	-0.12
3	Hispanic	122,035	42	181.8	16.5	117,756	33	178.4	17.1	-0.20
4	Hispanic	124,233	46	192.6	16.7	113,004	37	189.0	17.3	-0.21
5	Hispanic	128,858	45	200.0	16.8	108,190	37	196.8	17.4	-0.19
6	Hispanic	132,954	43	204.9	16.5	113,781	38	202.7	17.0	-0.13
7	Hispanic	130,982	42	208.5	17.0	116,615	38	206.9	17.4	-0.10
8	Hispanic	120,292	43	212.2	17.3	113,728	40	210.9	17.8	-0.07
3	Asian	27,119	73	194.3	16.2	26,366	70	193.0	17.1	-0.08
4	Asian	27,037	74	204.7	15.9	25,468	70	203.0	16.6	-0.10
5	Asian	26,874	74	212.3	16.0	23,696	71	211.0	16.5	-0.08
6	Asian	26,354	73	218.0	15.8	23,369	71	217.1	16.2	-0.05
7	Asian	24,539	73	222.1	15.9	23,208	73	221.9	16.1	-0.02
8	Asian	22,877	73	226.1	16.2	22,472	74	226.3	16.2	0.02
3	AIAN	9,715	44	182.5	17.1	9,238	37	179.7	17.9	-0.16
4	AIAN	10,223	46	192.9	17.5	9,015	40	190.2	18.0	-0.16
5	AIAN	10,384	45	200.2	17.3	8,882	38	197.4	17.7	-0.16
6	AIAN	9,920	44	205.8	16.5	8,925	39	203.9	17.3	-0.11
7	AIAN	9,979	45	210.4	16.7	8,506	41	208.4	17.4	-0.12
8	AIAN	8,960	46	214.0	17.0	8,297	43	212.8	17.4	-0.07
					School Poverty Groups					
3	High Poverty	146,530	38	180.4	16.5	133,445	27	176.2	16.9	-0.25
4	High Poverty	147,721	42	190.9	16.8	126,525	31	186.7	17.2	-0.24
5	High Poverty	148,714	41	198.3	16.9	118,052	31	194.2	17.4	-0.24
6	High Poverty	131,210	38	203.2	16.6	107,698	31	200.3	17.1	-0.17
7	High Poverty	126,432	37	206.7	16.9	107,068	32	204.5	17.3	-0.13
8	High Poverty	115,430	38	210.5	17.2	102,358	34	208.8	17.6	-0.10
3	Mid Poverty	298,402	56	187.4	16.4	283,542	49	184.5	17.1	-0.17
4	Mid Poverty	297,868	58	198.0	16.1	270,359	52	195.4	16.7	-0.16
5	Mid Poverty	306,741	57	205.4	15.9	263,524	51	202.8	16.4	-0.16
6	Mid Poverty	327,316	55	210.3	15.7	282,456	51	208.5	16.2	-0.12
7	Mid Poverty	323,773	55	214.3	15.9	287,128	51	212.6	16.4	-0.10
8	Mid Poverty	307,360	55	218.3	16.1	284,451	51	216.4	16.7	-0.11
3	Low Poverty	130,915	72	194.4	15.2	123,004	69	192.7	16.0	-0.11
4	Low Poverty	127,999	72	205.0	14.5	116,200	70	203.4	15.0	-0.11
5	Low Poverty	129,090	73	212.7	14.0	113,979	69	211.0	14.5	-0.12
6	Low Poverty	119,435	71	217.7	13.9	106,689	68	216.3	14.6	-0.10
7	Low Poverty	117,168	71	221.7	14.0	108,702	68	220.3	14.5	-0.10
8	Low Poverty	109,315	70	225.7	14.1	106,494	67	224.3	14.7	-0.09

Note. AIAN= American Indian or Alaska Native. These results were calculated using our cross-sectional sample (described in Table 2). We classified schools into three poverty levels: (a) "Low Poverty" - less than 25% FRPL eligibility, (b) "Mid Poverty" - 25-75% FRPL eligibility, and (c) "High Poverty" - greater than 75% FRPL eligibility.

Table 5b. Student math RIT score means, SDs by grade level, year, and subgroup

Grade	Group	N	Median Perc.	Mean RIT	SD RIT	N	Median Perc.	Mean RIT	SD RIT	Effect Size
			Fall 2019				**Fall 2021**			
				Full Sample						
3	All	681,061	55	188.9	13.7	639,920	46	185.4	14.8	-0.24
4	All	689,404	58	200.9	14.3	644,762	48	197.0	15.4	-0.26
5	All	710,024	57	210.1	15.6	650,207	46	206.1	16.4	-0.25
6	All	712,538	53	214.8	15.4	641,749	44	211.4	15.8	-0.22
7	All	703,356	55	221.3	17.2	648,608	45	217.4	17.0	-0.23
8	All	654,028	56	226.6	18.4	601,457	45	221.9	17.9	-0.26
				Racial/ethnic Groups						
3	White	326,220	63	191.8	12.8	302,046	56	189.0	13.5	-0.21
4	White	331,119	66	203.8	13.2	306,934	59	200.9	13.8	-0.22
5	White	339,801	64	213.4	14.4	309,397	57	210.2	14.9	-0.22
6	White	342,276	61	218.2	14.3	304,755	54	215.2	14.6	-0.20
7	White	341,000	64	225.2	16.0	308,493	55	221.6	15.8	-0.23
8	White	319,472	65	230.9	17.1	284,110	55	226.4	16.8	-0.27
3	Black	104,312	38	182.9	13.2	97,839	24	177.6	14.3	-0.39
4	Black	104,508	39	194.2	14.0	96,519	24	188.5	14.8	-0.39
5	Black	109,004	37	202.6	14.8	98,978	23	197.0	15.4	-0.37
6	Black	107,351	34	207.0	14.3	93,969	24	202.6	14.5	-0.31
7	Black	106,087	34	212.6	15.9	97,790	26	208.4	15.4	-0.27
8	Black	96,981	36	217.3	17.1	92,399	27	212.8	16.1	-0.27
3	Hispanic	139,073	44	184.9	13.1	130,735	31	180.6	14.0	-0.32
4	Hispanic	142,444	48	196.9	14.0	133,879	33	191.8	14.7	-0.36
5	Hispanic	148,949	47	205.9	15.1	135,486	32	200.8	15.5	-0.33
6	Hispanic	148,773	42	210.3	14.4	136,995	33	206.5	14.5	-0.26
7	Hispanic	146,056	43	216.0	16.3	139,451	34	212.2	15.6	-0.24
8	Hispanic	135,752	43	220.6	17.6	131,578	34	216.2	16.4	-0.25
3	Asian	30,791	75	196.7	14.1	30,737	72	195.0	15.2	-0.12
4	Asian	31,648	79	209.7	15.0	31,457	73	206.9	15.8	-0.18
5	Asian	31,411	79	220.5	16.4	30,378	73	217.5	17.5	-0.17
6	Asian	31,343	77	226.1	16.7	29,601	71	223.2	17.1	-0.17
7	Asian	28,927	81	233.9	18.3	27,417	72	229.7	18.2	-0.23
8	Asian	25,745	81	239.8	19.8	22,339	71	235.0	20.1	-0.24
3	AIAN	10,533	46	185.8	14.1	9,982	36	182.2	15.2	-0.24
4	AIAN	10,937	46	196.9	15.0	9,873	36	193.2	16.3	-0.24
5	AIAN	10,987	44	205.6	16.0	10,106	32	201.1	16.9	-0.27
6	AIAN	10,739	43	211.1	16.3	9,851	34	207.1	16.6	-0.24
7	AIAN	11,256	45	217.3	17.1	9,675	35	213.2	17.2	-0.24
8	AIAN	10,240	46.5	222.4	18.4	9,426	38	218.5	18.0	-0.21
				School Poverty Groups						
3	High Poverty	164,387	39	183.3	13.4	147,774	25	178.1	14.3	-0.37
4	High Poverty	166,577	42	194.9	14.4	147,804	26	189.2	15.0	-0.39
5	High Poverty	170,003	41	203.7	15.3	145,615	25	197.8	15.6	-0.38
6	High Poverty	144,238	36	207.9	14.6	126,732	27	203.7	14.8	-0.29
7	High Poverty	137,191	36	213.2	16.3	123,838	28	209.4	15.7	-0.24
8	High Poverty	126,231	37	217.7	17.5	117,759	29	213.8	16.6	-0.23
3	Mid Poverty	323,345	56	189.0	13.0	305,873	46	185.7	13.9	-0.25
4	Mid Poverty	328,008	59	201.0	13.5	308,772	49	197.3	14.3	-0.27
5	Mid Poverty	341,238	57	210.3	14.7	312,044	46	206.3	15.3	-0.27
6	Mid Poverty	371,279	53	214.8	14.6	330,248	44	211.4	14.8	-0.23
7	Mid Poverty	373,063	55	221.4	16.3	341,936	46	217.5	16.1	-0.24
8	Mid Poverty	352,095	56	226.9	17.4	321,487	45	222.1	17.1	-0.28
3	Low Poverty	145,582	72	195.5	12.3	139,068	68	193.6	12.9	-0.16
4	Low Poverty	147,196	74	207.8	12.8	141,100	69	205.5	13.4	-0.18
5	Low Poverty	148,004	73	218.1	14.0	143,254	68	215.4	14.5	-0.19
6	Low Poverty	140,508	71	223.1	14.3	132,112	65	220.3	14.7	-0.19
7	Low Poverty	137,087	74	230.6	15.8	130,829	65	226.5	15.8	-0.26
8	Low Poverty	122,998	75	236.6	16.8	112,972	64	231.4	16.9	-0.31

Note. AIAN= American Indian or Alaska Native. These results were calculated using our cross-sectional sample (described in Table 1). We classified schools into three poverty levels: (a) "Low Poverty" - less than 25% FRPL eligibility, (b) "Mid Poverty" - 25-75% FRPL eligibility, and (c) "High Poverty" - greater than 75% FRPL eligibility.

Table 6a. Student reading skip-year growth results by grade level and subgroup

Grade (F19)	Grade (F21)	Group	N	Fall 2019 Median Perc.	Fall 2019 Mean RIT	Fall 2019 SD RIT	Fall 2021 Median Perc.	Fall 2021 Mean RIT	Fall 2021 SD RIT	Median CGP
				Full Sample						
3	5	All	403,561	54	186.7	16.9	51	202.7	17.0	47
4	6	All	370,610	57	197.3	16.7	51	208.6	16.7	45
5	7	All	368,175	57	205.1	16.6	52	213.0	16.8	45
6	8	All	387,496	55	210.2	16.5	51	216.4	17.1	43
				Racial/ethnic Groups						
3	5	White	200,523	62	190.0	16.2	59	206.3	15.7	51
4	6	White	185,449	64	200.8	15.7	59	212.1	15.5	48
5	7	White	183,381	65	208.6	15.4	60	216.4	15.7	49
6	8	White	188,125	63	213.8	15.2	58	219.9	16.0	45
3	5	Black	61,653	40	181.2	16.1	33	195.5	16.8	35
4	6	Black	54,542	41	191.0	16.3	32	201.1	16.5	35
5	7	Black	55,099	40	198.7	16.2	34	205.6	16.7	35
6	8	Black	57,632	39	203.7	16.0	34	209.3	16.8	34
3	5	Hispanic	78,515	39	181.0	16.5	37	197.2	16.9	42
4	6	Hispanic	73,919	44	191.9	16.8	39	203.6	16.4	41
5	7	Hispanic	74,231	44	199.7	17.0	40	207.9	16.6	40
6	8	Hispanic	82,699	43	204.8	16.7	39	211.2	16.9	38
3	5	Asian	17,113	72	194.3	16.5	71	211.4	15.7	57
4	6	Asian	15,808	73	204.6	16.1	71	217.6	15.7	57
5	7	Asian	15,656	74	212.6	16.1	74	222.7	15.5	60
6	8	Asian	16,189	75	218.8	16.0	74	226.9	15.7	56
3	5	AIAN	6,386	43	182.2	17.0	39	197.6	17.5	40
4	6	AIAN	6,363	48	193.3	17.4	41	204.3	17.2	41
5	7	AIAN	6,050	48	201.1	17.5	43	209.2	17.1	41
6	8	AIAN	5,918	47	206.9	16.5	43	213.1	17.0	40
				School Poverty Groups						
3	5	High Poverty	88,035	35	179.5	16.4	31	194.5	17.1	36
4	6	High Poverty	71,299	39	190.1	16.8	32	200.8	16.8	37
5	7	High Poverty	68,443	39	197.7	17.0	33	205.1	16.9	36
6	8	High Poverty	75,481	38	203.1	16.7	34	209.1	17.2	35
3	5	Mid Poverty	200,334	55	186.8	16.4	51	203.1	16.1	47
4	6	Mid Poverty	198,500	57	197.5	16.2	51	208.7	15.9	45
5	7	Mid Poverty	198,174	57	205.2	16.1	52	213.0	16.3	45
6	8	Mid Poverty	207,041	55	210.4	15.9	51	216.4	16.5	42
3	5	Low Poverty	86,311	71	194.2	15.4	69	211.1	14.2	56
4	6	Low Poverty	75,042	71	204.4	14.8	68	216.5	14.4	54
5	7	Low Poverty	76,393	72	212.3	14.3	68	220.8	14.3	54
6	8	Low Poverty	77,113	71	217.9	14.1	67	224.4	14.7	50

Note. Perc. = percentile. These results were calculated using our longitudinal sample (described in Table 3).

Table 6b. Student math skip-year growth results by grade level and subgroup

Grade (F19)	Grade (F21)	Group	N	Fall 2019 Median Perc.	Fall 2019 Mean RIT	Fall 2019 SD RIT	Fall 2021 Median Perc.	Fall 2021 Mean RIT	Fall 2021 SD RIT	Median CGP
Full Sample										
3	5	All	523,979	57	189.5	13.3	48	206.9	16.0	37
4	6	All	477,498	60	201.4	14.0	46	212.2	15.5	34
5	7	All	478,597	58	210.6	15.0	47	218.3	16.7	32
6	8	All	479,447	52	214.5	14.9	47	222.9	17.7	33
Racial/ethnic Groups										
3	5	White	257,869	64	192.2	12.4	58	210.7	14.6	42
4	6	White	237,232	67	204.3	12.8	55	215.8	14.4	37
5	7	White	236,874	65	213.8	13.9	57	222.3	15.6	36
6	8	White	233,604	60	217.8	13.9	56	227.2	16.6	37
3	5	Black	74,563	39	183.5	13.0	24	197.6	15.2	22
4	6	Black	65,302	40	194.5	13.7	25	203.0	14.3	24
5	7	Black	68,008	38	203.1	14.5	26	208.8	15.2	23
6	8	Black	68,914	34	207.0	13.8	28	213.4	15.9	25
3	5	Hispanic	107,876	45	185.3	12.8	34	201.6	15.0	30
4	6	Hispanic	98,902	48	197.3	13.6	34	207.3	14.1	30
5	7	Hispanic	101,141	47	206.2	14.6	35	213.0	15.2	27
6	8	Hispanic	103,654	41	209.9	13.9	35	217.2	16.0	28
3	5	Asian	23,865	76	197.0	13.8	73	218.0	17.0	54
4	6	Asian	21,871	78	209.7	14.7	71	223.6	16.8	47
5	7	Asian	19,894	76	219.3	15.8	73	230.2	17.8	46
6	8	Asian	17,778	72	223.8	16.3	73	235.9	19.6	47
3	5	AIAN	7,998	47	186.4	14.0	35	202.4	16.7	30
4	6	AIAN	7,426	49	197.6	14.7	37	208.2	16.8	32
5	7	AIAN	7,253	48	207.0	15.7	39	214.7	17.1	31
6	8	AIAN	7,362	48	212.9	16.1	41	220.0	18.0	28
School Poverty Groups										
3	5	High Poverty	117,434	40	183.6	13.1	27	198.6	15.3	24
4	6	High Poverty	92,805	42	195.3	14.0	28	204.3	14.6	26
5	7	High Poverty	90,984	41	204.1	15.0	29	210.0	15.4	24
6	8	High Poverty	92,337	36	208.1	14.2	30	214.8	16.3	26
3	5	Mid Poverty	254,940	57	189.4	12.7	48	207.0	14.9	37
4	6	Mid Poverty	251,156	59	201.3	13.3	46	212.1	14.5	34
5	7	Mid Poverty	256,113	57	210.5	14.4	47	218.2	15.9	32
6	8	Mid Poverty	258,095	52	214.6	14.2	47	222.9	16.9	33
3	5	Low Poverty	116,846	73	195.8	12.0	69	215.9	14.1	50
4	6	Low Poverty	101,946	74	207.8	12.7	66	220.7	14.4	44
5	7	Low Poverty	99,888	72	217.4	13.6	66	227.1	15.5	41
6	8	Low Poverty	93,362	68	221.6	13.8	65	232.2	16.6	41

Note. Perc. = percentile. These results were calculated using our longitudinal sample (described in Table 3).

Table 7. Overall attrition rates by school year

Subject	Grade (Y1)	Grade (Y2)	Fall 2017 to Fall 2019			Fall 2019 to Fall 2021		
			Total # of Students Tested in 2017	# of Students Tested Across Years	Attrition Rate	Total # of Students Tested in 2019	# of Students Tested Across Years	Attrition Rate
Reading	3	5	535,983	399,089	0.26	626,045	403,992	0.35
Reading	4	6	139,633	92,913	0.33	623,999	370,836	0.41
Reading	5	7	94,108	58,483	0.38	637,230	368,374	0.42
Reading	6	8	422,421	301,657	0.29	634,234	387,785	0.39
Math	3	5	588,608	482,477	0.18	686,685	524,205	0.24
Math	4	6	164,348	121,629	0.26	695,700	477,709	0.31
Math	5	7	115,871	80,608	0.30	716,418	478,765	0.33
Math	6	8	511,200	404,122	0.21	718,003	479,669	0.33

Note. We are calculating attrition rates or (1 -match rages) based on whether a student who tested in either fall 2017 or fall 2019 also had an observed test two falls later (fall 2019 and fall 2021, respectively).

Table 8. Subgroup attrition rates by school year

Grade (Y1)	Grade (Y2)	Subject	Year	Attrition Rates by Gender		Attrition Rates by Race/Ethnicity					Attrition Rates by Prior Score Quintile				
				Female	Male	Asian	Black	Hispanic	AIAN	White	Lowest Quin.	2nd Quin.	3rd Quin.	4th Quin.	Highest Quin.
3	5	Reading	17-19	25.6%	25.5%	28.0%	30.7%	24.8%	25.3%	22.7%	28.7%	26.3%	26.0%	25.0%	21.5%
3	5	Reading	19-21	35.7%	35.2%	37.7%	38.0%	36.2%	35.0%	33.5%	33.0%	33.8%	35.4%	36.9%	37.5%
4	6	Reading	17-19	33.7%	33.2%	36.6%	41.9%	31.4%	34.3%	29.6%	34.1%	34.0%	33.8%	33.0%	32.2%
4	6	Reading	19-21	40.8%	40.3%	42.3%	44.6%	41.0%	38.2%	38.3%	38.6%	39.9%	40.7%	41.4%	41.6%
5	7	Reading	17-19	38.2%	37.5%	38.7%	46.3%	35.1%	34.9%	33.7%	39.2%	39.1%	38.0%	37.2%	35.5%
5	7	Reading	19-21	42.5%	41.9%	43.0%	45.2%	42.8%	42.4%	40.1%	41.4%	42.3%	42.8%	43.0%	41.2%
6	8	Reading	17-19	28.6%	28.6%	27.3%	32.5%	28.9%	29.3%	26.5%	31.5%	30.6%	29.5%	27.5%	23.5%
6	8	Reading	19-21	39.2%	38.6%	40.1%	42.0%	38.1%	40.9%	37.5%	38.7%	39.9%	39.8%	39.7%	35.8%
3	5	Math	17-19	17.8%	18.2%	19.8%	25.9%	17.1%	19.5%	14.8%	25.4%	19.9%	16.9%	15.3%	14.0%
3	5	Math	19-21	23.6%	23.8%	23.7%	29.4%	23.0%	24.7%	21.4%	28.9%	25.1%	23.3%	21.7%	20.5%
4	6	Math	17-19	26.0%	26.0%	25.2%	37.1%	26.1%	29.7%	20.9%	33.5%	28.8%	25.4%	22.6%	21.2%
4	6	Math	19-21	31.2%	31.5%	31.8%	38.4%	31.1%	32.5%	28.9%	36.2%	32.9%	31.3%	29.8%	28.5%
5	7	Math	17-19	30.4%	30.4%	30.5%	41.3%	29.2%	29.0%	25.0%	36.9%	32.8%	29.2%	26.7%	26.9%
5	7	Math	19-21	33.1%	33.3%	37.9%	38.4%	32.6%	34.7%	30.8%	37.8%	33.9%	31.9%	31.0%	32.6%
6	8	Math	17-19	20.5%	21.3%	23.7%	27.3%	20.9%	21.7%	18.3%	27.7%	22.5%	19.4%	17.8%	18.9%
6	8	Math	19-21	33.1%	33.3%	44.0%	36.6%	30.6%	31.9%	32.2%	34.3%	30.5%	30.1%	33.0%	39.3%

Note. Quin. = Quintile. Test score quintiles were calculated based on the prior fall test scores (fall 2017 for the 2017-2019 comparison, fall 2019 for the 2019-2021 attrition. Student percentiles calculated using the NWEA 2020 norms were used to group students into quintiles.
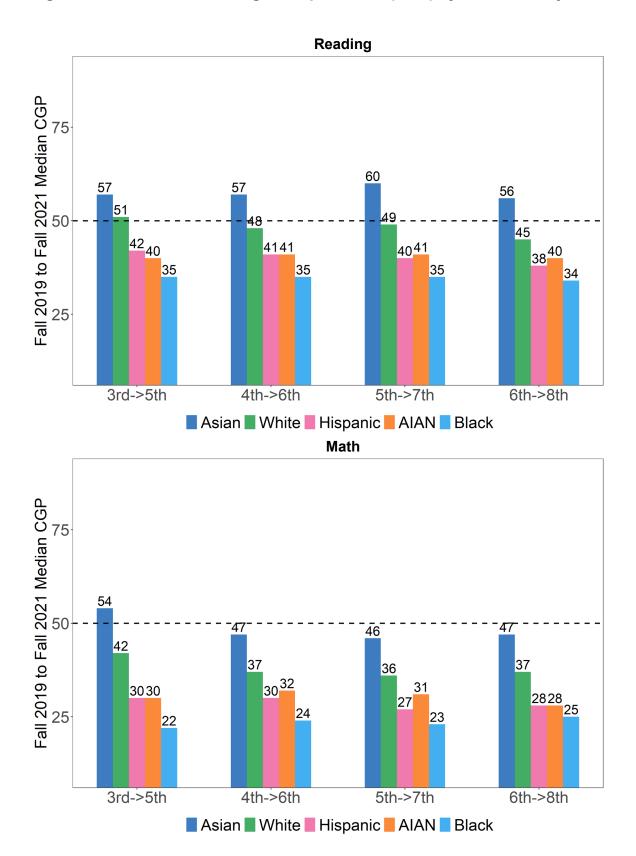
Figure 1. Median conditional growth percentile (CGP) by race/ethnicity

Reading

Math

Figure 2. Median conditional growth percentile (CGP) by school poverty level

7. References

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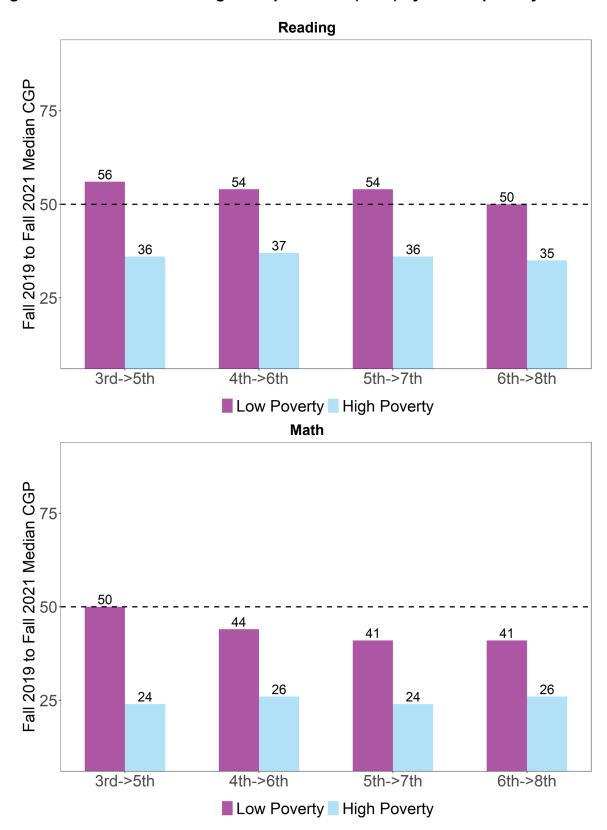[ii] U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), 2019 - 2020, Public Elementary/Secondary School Universe Survey Data, (v.1a).

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