TECHNICAL BRIEF

Technical appendix for: From Loss to Recovery: Diverging Paths and Uneven Gains Across Schools

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1. Introduction

The purpose of this technical appendix is to more fully describe the sample, methods, and results of the research brief **From Loss to Recovery: Diverging Paths and Uneven Gains Across Schools.** We investigated two research questions in this brief:

1. What is the distribution of recovery across schools, measured as (a) recovery to 2019 achievement levels and (b) post-pandemic achievement gains from 2021 to 2024?
2. How do these measures of recovery vary by grade and school demographics?

2. Data

The data for this study are from the NWEA anonymized longitudinal student achievement database and the NCES Common Core of Data (CCD). Schools use MAP Growth assessments to monitor elementary and secondary students' reading and math achievement and gains, administering assessments up to three times per year: in the fall, winter, and spring. Additional details about MAP Growth's reliability and validity are available in the 2019 MAP Growth technical report (Meyer, 2019). We match schools in the NWEA sample to publicly available school enrollment and demographic data from the CCD using their NCES school identifier.

The sample for our study is drawn from the set of U.S. public schools that used MAP Growth to test students in both math and reading in grades 3-8 in fall 2019, 2021, and 2024. To be included in the analytic sample, a school had to test at least 50% of enrolled students (based on CCD enrollment) across all tested grades and at least 10 students and 60% of enrolled students per grade included in the analysis across each of the three terms. Schools had to meet these criteria for both subjects. The resulting sample includes 9,326 schools that generally reflect the population of U.S. public schools in terms of enrollment and demographics (see Appendix Table 1). Average achievement and recovery metrics are presented in Appendix Table 2, and average school demographics and achievement by school demographic group (i.e., urbanicity, poverty level, and racial majority) are presented in Appendix Table 3.

3. Methods

To allow for changes in test scores to be compared on a common scale, we standardize MAP Growth scores within each grade-, subject-, and instructional week using the means and standard deviations from the pre-pandemic NWEA MAP Growth norms (Thum & Kuhfeld, 2020):

$$A_{igsw} = \frac{RIT_{igsw} - \mu_{gsw}}{\sigma_{gsw}}$$

where A_{igsw} is the norms-standardized score for student i in grade g, subject s, and instructional week w, RIT_{igsw} is the student's MAP Growth RIT score, μ_{gsw} is the mean score for grade g, subject s, and instructional week w in the 2020 norms, and σ_{gsw} is the corresponding standard deviation. For the purposes of this analysis, the standardized scores are aggregated to the school- or school-grade level for each term by averaging all students' scores in the relevant school or school-grade.

In the 2023-24 school year, NWEA began the phased implementation of an enhanced item selection algorithm (EISA) for the MAP Growth assessment, which altered the test scale of the math assessment. To account for the differences in test version, we converted the fall 2024

math test scores impacted by EISA in our sample to the traditional MAP Growth scale. For more detail on the score conversion process, see NWEA's EISA documentation.

For each subject, we construct three school-level measures of achievement change using the aggregated norms-standardized scores from fall 2019, fall 2021, and fall 2024: initial declines, post-pandemic gains, and total recovery. Specifically, for school j and subject s,

$$Initial\ declines_{js} = A_{js,Fall\ 2021} - A_{js,Fall\ 2019}$$
$$Post-pandemic\ gains_{js} = A_{js,Fall\ 2024} - A_{js,Fall\ 2021}$$
$$Total\ recovery_{js} = A_{js,Fall\ 2024} - A_{js,Fall\ 2019}$$

where A_{sj} denotes the mean norms-standardized achievement score for school j in subject s at time t. The initial declines measure is negative on average in both math and reading, reflecting widespread achievement losses between fall 2019 and fall 2021. However, some schools experienced stable or increasing achievement over this period and therefore have positive values for initial declines. Similarly, while post-pandemic gains are positive on average, some schools did not experience gains between fall 2021 and fall 2024 and thus have negative values for this measure. We use these labels for descriptive clarity, recognizing that they do not uniformly characterize the experience of all schools.

Among schools that were recovered as of fall 2024 (i.e., $Total\ recovery_{js} \geq 0$), we further delineate schools that are "rebounders" versus "resisters" in each subject. Rebounders are defined as schools with total recovery greater than or equal to zero whose initial declines were at least as large as (i.e., more negative than) the average school's initial declines. In contrast, resisters are schools with total recovery greater than or equal to zero whose initial declines were smaller than (i.e., more positive than) the average school's initial declines. This classification differentiates schools that fully recovered despite experiencing relatively large initial losses from those that recovered after experiencing comparatively smaller losses.

Table 1. Sample School Demographics Relative to U.S. Population of Schools

	NWEA Sample Average	U.S. Public Schools Average
School enrollment	482	451
% FRPL	55.9	57.8
% Asian	4.3	4.3
% Black	14.0	14.4
% White	51.2	46.8
% Hispanic	22.5	27.2
% City	26.3	29.0
% Suburb	36.9	31.3
% Town	9.4	10.3
% Rural	27.4	29.4
N schools	9,326	77,451

Note. FRPL=free or reduced priced lunch. The analytic sample is drawn from the set of U.S. public schools that used MAP Growth to test students in both math and reading in grades 3-8 in fall 2019, 2021, and 2024. To be included in the analytic sample, schools had to test at least 50% of enrolled students across all tested grades and at least 10 students and 60% of enrolled students per school-grade included in the sample, in all three terms. The source of the variables is the Common Core of Data (CCD) collected by the National Center for Educational Statistics for the 2023-24 school year. The U.S. public school population comparison was determined by limiting CCD data to the schools that were operational in 2023-24 and enrolled students in grades 3-8.

Table 2. Average MAP Growth Achievement and Recovery by Recovered Status

	Math			Reading		
	Average school	Not recovered school	Recovered school	Average school	Not recovered school	Recovered school
Fall standardized achievement (SD)						
2019	0.05	0.06	0.00	0.05	0.08	-0.05
2021	-0.20	-0.22	-0.12	-0.06	-0.06	-0.06
2024	-0.11	-0.17	0.12	-0.08	-0.12	0.06
Pandemic achievement loss and recovery (SD)						
Change from 2019 to 2021	-0.25	-0.28	-0.12	-0.11	-0.14	-0.01
Change from 2021 to 2024	0.09	0.05	0.24	-0.02	-0.06	0.12
Net recovery from 2019 to 2024	-0.15	-0.23	0.12	-0.13	-0.20	0.11
N schools	9,326	7,309	2,017	9,326	7,110	2,216

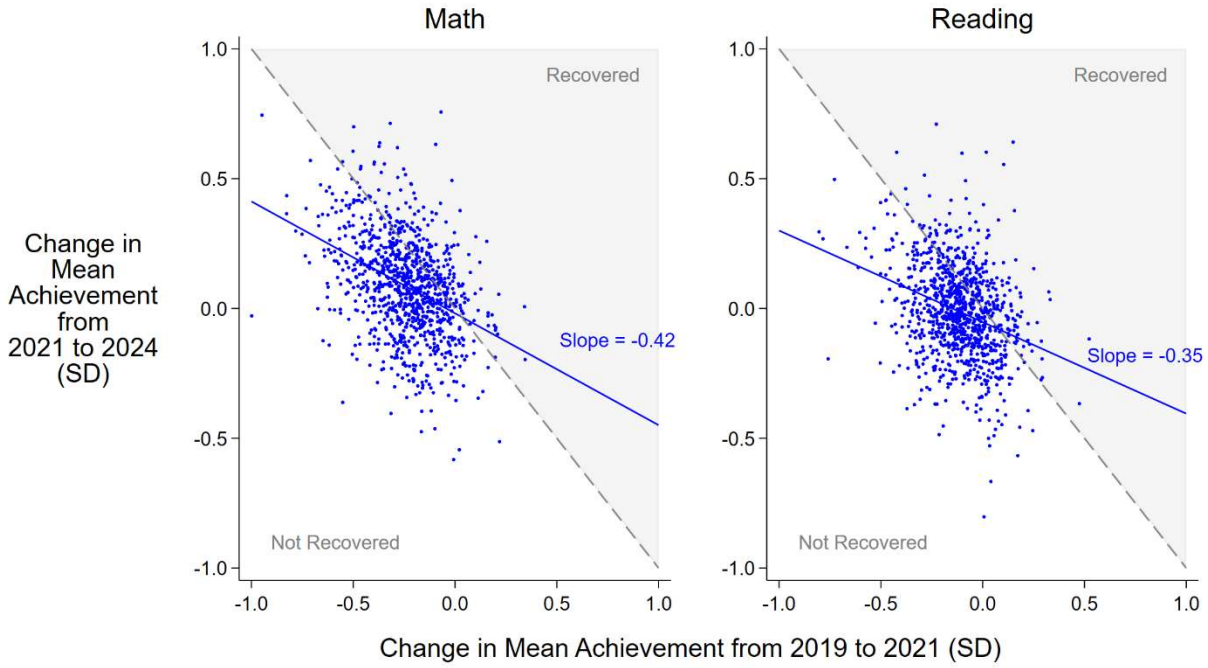
Note. Achievement metrics are standardized using the 2020 NWEA MAP Growth norms and are reported in standard deviation units. Schools were “recovered” in a subject if their average fall 2024 achievement levels were greater than or equal to their fall 2019 achievement levels.

Table 3. Demographics and Achievement by School Demographic Group

	School Locale				School Poverty Level			Racial Majority in School				
	City	Suburb	Town	Rural	Low	Mid	High	White	Asian	Black	Hispanic	None
Demographics												
School enrollment	530	556	435	351	540	471	502	437	638	473	538	554
% FRPL	65.4	49.9	57.3	54.1	15.5	49.8	90.9	43.3	25.6	86.4	79.0	64.4
% Asian	5.1	7.1	1.1	1.0	10.0	3.2	2.6	2.8	64.4	1.4	2.3	8.6
% Black	23.9	15.7	5.9	4.8	3.9	8.9	26.0	4.1	4.1	74.9	9.4	19.0
% White	30.2	46.8	67.2	71.8	70.1	61.3	24.5	76.5	18.5	8.0	12.6	31.0
% Hispanic	32.4	24.1	17.9	12.5	9.4	19.1	36.9	10.2	7.7	10.6	72.2	25.1
% City	100.0	0.0	0.0	0.0	18.4	20.2	41.2	11.8	29.3	49.3	45.8	41.0
% Suburb	0.0	100.0	0.0	0.0	53.5	31.2	29.4	34.3	66.7	41.6	38.5	39.5
% Town	0.0	0.0	100.0	0.0	4.8	12.8	8.3	13.2	0.0	1.3	5.2	6.1
% Rural	0.0	0.0	0.0	100.0	23.2	35.8	21.0	40.8	4.0	7.9	10.4	13.5
Fall Standardized Achievement												
Math												
2019	-0.09	0.15	0.01	0.04	0.55	0.10	-0.32	0.22	0.72	-0.45	-0.26	-0.03
2021	-0.39	-0.10	-0.19	-0.15	0.40	-0.12	-0.64	0.03	0.55	-0.84	-0.58	-0.31
2024	-0.27	0.00	-0.12	-0.08	0.46	-0.05	-0.50	0.10	0.62	-0.65	-0.45	-0.22
Reading												
2019	-0.06	0.15	0.03	0.04	0.49	0.10	-0.27	0.21	0.54	-0.35	-0.25	-0.01
2021	-0.19	0.03	-0.07	-0.06	0.44	0.01	-0.43	0.13	0.50	-0.54	-0.40	-0.14
2024	-0.21	0.01	-0.08	-0.06	0.40	-0.02	-0.42	0.11	0.44	-0.49	-0.42	-0.17
N schools	2,457	3,441	875	2,553	1,259	4,265	2,204	5,092	75	777	1,370	2,012

Note. Low, mid, and high school poverty levels respectively refer to schools with free or reduced-price lunch eligibility at the following levels: 25 percent or less, between 25 and 75 percent, and 75 percent or more. Racial majority categories indicate 50% or more of a school's enrolled students identified as the given race. School demographics are from the 2023 CCD. Achievement metrics are standardized using the 2020 NWEA MAP Growth norms and are reported in standard deviation units.

Figure 1. Association Between School-Level Declines and Recovery (Grades 3-8)



Note. Each point on the scatterplots represents one school from a random sample of 1,000 schools drawn from the analytic sample (N=9,326 schools), for clarity purposes. School-level mean achievement for each subject is calculated based on the average standardized NWEA MAP score across the grades included in the analytic sample. The slopes indicate the recovery gains associated with an additional 1 SD gain in change in mean achievement during the pandemic, from 2019 to 2021. This means each additional 1 SD initial decline in math is associated with gaining 0.42 SD more in the post-pandemic years. In reading, each additional 1 SD initial decline in reading is associated with gaining 0.35 SD more in the post-pandemic years.