



Puzzling Over Declining Academic Achievement

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Puzzling Over Declining Academic Achievement*

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Abstract

Many are concerned about the large decline in K-12 student achievement since 2019. And rightly so, given what it signals about student learning and later life outcomes. Less noted is the pre-pandemic sustained decline in student achievement growth that followed 30 years of increases. We examine the nature of achievement decline as measured by national and state NAEP scores to better understand the magnitude of these pre-pandemic losses, where and when they occurred, and which students were most affected. We then discuss some of the hypothesized causes of the achievement declines and briefly reconcile these hypotheses with the available evidence. Our analysis suggests that pre-pandemic achievement declines are large, began earlier than commonly thought, vary substantially among states, and that a good portion of the pandemic learning losses have their roots well before 2020. These achievement declines likely result from several influences that vary across states and over time. Improving student achievement, especially among lower-performing students, will require a systematic shift in education policy.

Keywords: student achievement, learning loss.

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Introduction

With the onset of the pandemic in spring 2020—and the move by many K-12 schools to virtual instruction—parents, educators, policymakers and others were concerned about the effects on students, including their learning. The 2022 National Assessment of Educational Progress (NAEP) results confirmed these concerns, documenting a dramatic decline in achievement since 2019. Schools implemented a variety of policies, such as intensive tutoring and extended school years, to remediate these effects. Still, post-pandemic recovery has been, at best, slow. The 2024 NAEP results indicate reading scores have fallen even further and math scores, while faring better, have not made meaningful recovery. Given these large achievement losses and evidence linking students' test score performance to longer-run academic and later life outcomes, the focus on learning losses since 2020 is understandable. Yet, the post-pandemic focus obscures a decline in academic achievement that began well before 2020, about which we know remarkably little. This paper examines NAEP achievement declines from 2009 to 2019.

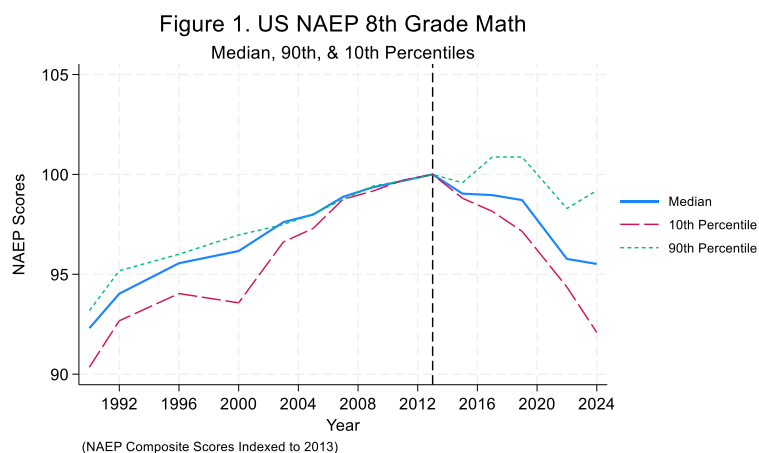
National NAEP achievement shows two sustained trends between 1990 and 2024. From 1990 to about 2013, students at the 10th, 50th, and 90th percentiles of the performance distribution of 8th grade math improved by 8 to 10 percent (see Figure 1), which translates to gains of more than 50 percent of a student achievement standard deviation. Eighth grade math increases are indicative of other grades and subjects (see Appendix Table A1 and Figure A1).

This extended period of achievement gains has been followed by a plateau, and sustained declines. While about two-thirds of these losses have occurred since the pandemic, declines

began well before 2020. Between 2013 and 2019, for example, 8th grade math scores at the 10th percentile fell by 17 percent of a standard deviation (SD) of student achievement.

The pandemic brought an extraordinary set of circumstances that exacerbated ongoing achievement declines. Though we don't know what would have occurred in the absence of the pandemic, simple extrapolation suggests that pre-existing influences explain about 40 percent of the learning loss that has occurred since the onset of the pandemic. In the remainder of this paper, we explore these and other aspects of the NAEP achievement declines that occurred from 2009 to 2019. That analysis resulted in five notable features of pre-pandemic learning loss:

- Pre-pandemic learning losses among low-performing students were large.
- The roots of these losses began earlier than commonly understood, before 2013.
- Other tests (not just NAEP) show similar magnitudes and timing of achievement losses.



- Sustained learning loss is most evident among lower-performing students, but most of the performance distribution has been adversely affected.
- Losses were experienced differently across states. Some states have suffered very large losses, while others show small losses—or even gains.

Understanding these and other NAEP achievement trends informs hypotheses about potential causes of learning loss and policies that may remediate them. Toward that end, we next examine the nature of pre-pandemic learning loss. Then, we discuss the extent that prevailing learning loss hypotheses map onto these features of pre-pandemic learning loss.

The Nature of Declining Achievement

There is remarkably little understanding of the nature of either the sustained achievement gains prior to 2013 or the subsequent losses thereafter. A more detailed examination of national and state trends of NAEP achievement from about 2009 to 2019 can help shape an understanding of the influences that continue to affect student achievement.

Pre-pandemic learning losses among low-performing students were large. Declining academic achievement as measured by the NAEP began about 2013. By 2019, student performance at the 10th percentile fell between 13 and 27 percent of a student achievement standard deviation, depending on the subject and grade (Appendix Table A1). Declines in standardized achievement test scores of this magnitude are considered large by almost any metric. For example, the 0.17 SD loss in 8th grade math represents nearly a quarter of the Black-white achievement gap, and is roughly equivalent to 4.5 months of learning.¹ Changes in standardized achievement are not only meaningful because they signal significant learning benchmarks in school but also because, more importantly, such changes are linked to later life educational and economic outcomes, including college attainment and employment compensation (Doty et. al., 2022).

Although large, observed losses from 2009 to 2019 likely understate a reasonable counterfactual. Suppose the trends of the 1990s and early 2000s continued. Pre-2009 improvements in student performance suggest that, in the absence of other changes, learning would have continued to rise beyond 2009. If these gains had continued, how much greater would student performance have been by 2019? Figure 2 shows the linear time trend for the 10th percentile in 8th grade math from 1990 to 2009 projected forward. The difference between predicted and actual scores in 2019 is 38 percent of an SD, equivalent to about 8 months of learning. In 4th grade math and reading, and 8th grade reading,

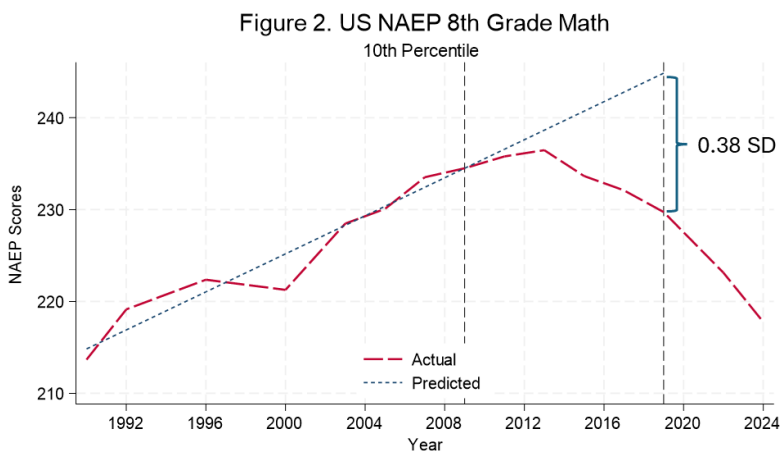
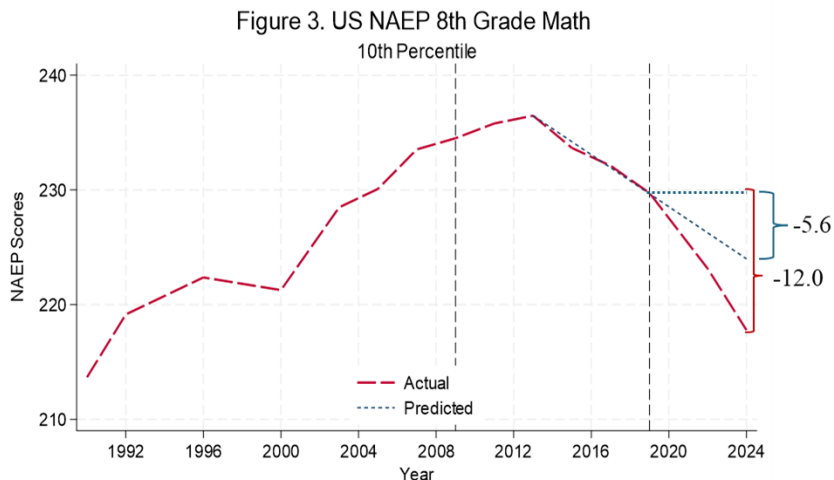


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¹ For benchmarking changes in standardized achievement tests to months of learning, see Hill et al. (2008).

extrapolating trends from the 1990s and early 2000s to 2019 implies losses of 0.57, 0.37 and 0.24 SD respectively (see Appendix Figure A2 and Table A2). Using prior experience to predict future performance also suggests losses throughout the performance distribution in math (Appendix Table A2). Sustaining achievement gains beyond 2009 may not have been feasible; we know very little about what led to the gains during that period. However, it is very reasonable to posit a counterfactual resulting in larger achievement losses than those actually observed by 2019.

The magnitude of pre-pandemic declines is also meaningful when considering their effect on pandemic learning loss. Much has been made, both in the research literature (see, for example, Fahle et al., 2023; Kuhfeld et al., 2025) and the popular press (for example, Leonhardt, 2025; Turner, 2022), of the magnitude and implications of learning loss during and following the pandemic. And rightly so. Yet, projecting earlier achievement trends for the 10th-percentile students forward suggests that a substantial portion of pandemic-era learning loss is rooted in the pre-pandemic period. More specifically, extrapolating the trajectory of 2013-2019 NAEP



scores predicts 8th grade math achievement in 2024 would decline by 5.6 scale score points. Actual declines were 12.0 scale score points—so 47 percent of the decline since the pandemic would have been predicted by pre-pandemic trends (Figure 3). Large shares of learning losses for 4th grade math (44 percent), 4th grade reading (44 percent) and 8th grade reading (92 percent) were also predicted by declines between 2013 and 2019 (Appendix Table A3). Predictions for post-pandemic learning loss for students at the 50th percentile yield similar results. While these trends may not have continued, they make clear that—absent better information to the contrary—losses since 2020 likely involve factors predating the pandemic.

The roots of these losses began earlier than commonly understood, well before 2013.

Throughout this paper, 2013 has been employed as the year in which learning losses began. The signs of learning loss began before actual reductions were experienced, however. The early 2000s were marked, on average, by large achievement gains: between 2000 and 2007, 8th grade math scores at the 10th percentile increased by 12 scale score points (0.30 SD). Thereafter, score-increases declined. Between 2007 and 2013, scores increased by only 3 scale score points (0.07 SD)—before falling 6 points between 2013 and 2019 (0.17 SD). Similar trends also occurred in 4th grade reading and math, and in 8th grade reading (Table 1). The forces behind the large increases of the early 2000s had thus begun to dissipate by about 2007, turning to decreases about 2013.² Whether the factors that led to the slowing of achievement growth from 2007 to

² The years demarcating these periods vary across tests and states. In a broad sense, we differentiate between periods of rising and falling scores with the year 2009. As this section suggests, the plateauing of scores before declines is a

2013 are the same as those that led to declining achievement in the six years that followed is unclear. Ultimately, we would like to understand what accounts for the differing achievement-growth patterns in the four periods leading up to the pandemic (Table 1).

Table 1. Average Annual U.S. NAEP 10th Percentile Scale Score Change by Period and Test

Test	1990-2000	2000-2007	2007-2013	2013-2019	2019-2024
Math 4th	0.89	2.65	0.19	-0.70	-1.58
Math 8th	0.76	1.75	0.49	-1.12	-2.39
Reading 4th	-1.15	1.34	-0.12	-0.86	-1.94
Reading 8th	N/A	0.23	0.98	-1.70	-1.85

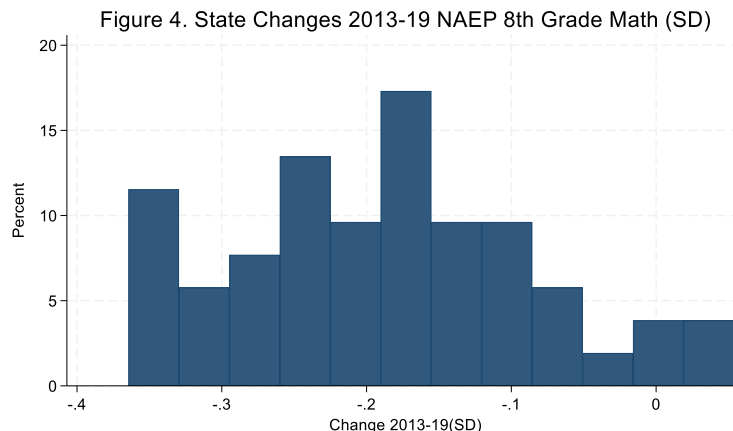
Notes: All values represent annual average change for the period. Reading scores changes for 1992-2000 reflect changes between 1992 and 1998; reading score changes for 2000-2007 represent changes between 1998 and 2007.

Sustained learning loss is most evident among lower-performing students, but most of the performance distribution has been adversely affected. Between 2013 and 2019, NAEP scores for low-achieving students showed substantial reductions across subjects and grades, while those in the middle of the achievement distribution experienced moderate reductions (Appendix Table A1). For example, students performing at the median on the 8th grade NAEP math test lost 9 percent of an SD from 2013-2019, with similar losses for 8th grade reading and smaller losses for 4th grade math and reading. And, while achievement at the 90th percentile generally increased from 2013-19, it did so at a much lower rate than it had from 1992-2013.

Other tests show similar magnitudes and timing of achievement losses. The Trends in International Mathematical and Sciences Study (TIMSS) scores in math show that 10th-percentile students experienced increased scores from 1995 to 2011. From 2011 to 2019, students at the 10th percentile declined by 0.20 SD in 4th grade math and 0.24 SD in 8th grade math—very similar to the NAEP declines (Appendix Figure A3). Additionally, the Stanford Education Data Archive (SEDA) has employed proficiency data from school-level performance on state achievement tests to produce consistent measures of academic performance by subject, grade, state and district from 2009 to 2019 (Fahle et al., 2021). Changes in state-level academic performance from 2009 to 2019 employing the SEDA data are positively correlated with changes over this period in the NAEP data; these correlations range from 0.82 to 0.93, depending on subject and grade. The similarity in trends across three different measures of performance—administered in different ways for different purposes—increases confidence that the NAEP data measure actual changes in underlying academic understanding of students.

general pattern which any attempt at a causal explanation should consider—though exact patterns vary by test and state.

Some states have suffered large losses, others show small losses or even gains. Between 2013 and 2019, fourteen states experienced large achievement declines of more than 0.30 SD in 8th grade math performance at the 10th percentile. By contrast, six states experienced modest increases over the same period (Figure 4 and Appendix Figure A4 for all states). Similar state-based differences exist across NAEP tests in other grades and subjects, and for other percentiles in the achievement distribution (Appendix Table A4).



The timing of pre-pandemic learning losses also varied across states. Depending on the subject and grade, some states experienced their highest level of achievement in the early 2000s, while others didn't peak until the mid-2010s (Appendix Table A5). For example, 38 percent of states realized their highest NAEP scores for students at the 10th percentile in 8th grade math by 2009; another 12 percent did so by 2015 or later. The timing of peaks for the other tests is even more temporally disparate.

In other ways, though, changes in NAEP performance across states occur in systematic ways. Between 2013 and 2019, states with greater achievement reductions at the 10th percentile also experienced greater losses at the 50th and 90th percentiles: the cross-state correlations vary between 0.60 and 0.90, depending on the test. In addition, states that experienced larger losses on one test typically experienced larger losses on other tests. For example, changes in achievement at the 10th percentile for 4th grade math is correlated with that for 8th grade math at 0.77, 4th grade reading at 0.72 and 8th grade reading at 0.51. So, low-performing students within a given state who struggle on one test struggle on other tests, too—suggesting there are state-based factors influencing declining achievement.

Summary. At the national level, reductions in student-achievement growth begin to occur from 2007-2009, with actual declines in achievement beginning about 2013. And, while most prominent among low-performing students, these losses affect students across the achievement distribution. Perhaps most noteworthy, however, are the substantial differences in the extent and timing of achievement decline across states. A policy-relevant description of declining achievement will account for many of the temporal and geographic features described above.

Accounting for Learning Loss Will Be Challenging

Hypotheses explaining the aforementioned patterns of NAEP student-achievement losses need to be grounded in the conceptual and empirical evidence surrounding student achievement outcomes. A wealth of conceptual and empirical research supports three broad influences on student achievement:

- student attributes such as ability, focus, and persistence,
- community and family factors, and

- school-based factors, such as the quality of teaching, school leadership, curriculum, and supports for learning.

Each of these are subject to underlying social, economic and political forces. Some are influenced by education policies. Disentangling the causes of recent student-achievement declines is ambitious, and perhaps unrealistic. Substantial speculation, however, does exist regarding the potential factors that contribute to the learning losses, including:

- a) the end of consequential school accountability (Aldeman, 2023; Daly, 2025a; Daly 2025b; Malkus, 2025, Petrilli, 2023),
- b) reductions in school funding owing to the Great Recession (Malkus, 2025; Daly, 2025b; Petrilli, 2021),
- c) the widespread use of smartphones and social media among students (Malkus, 2025; Petrilli, 2023),
- d) school policies differentially embraced by states, for example, the science of reading (Schwartz, 2025), and
- e) changes in the attributes of students over time (Di Carlo, 2012; Petrilli, 2021; Petrilli, 2025).

Typically, this speculation loosely matches temporal changes in national achievement to school policies, or demographic and social trends. Although a beginning, this speculation provides little guidance in defining the characteristics of declining achievement or in limiting competing explanations. Malkus (2025) provides useful analytic details of achievement declines, including declines among adults, and suggests that none of these commonly mentioned causes fit achievement fact patterns cleanly. Importantly, none of the discussions to date address the wide variations in achievement-score changes experienced across states, and how these relate to differences in potential causes among states. Nor does current speculation provide much guidance to limit competing explanations.

Further, most of the speculation regarding the causes of declining achievement cite factors that are either endogenous or have effects that potentially operate through several mechanisms that make isolating the causes challenging. For example, the Great Recession meaningfully reduced school spending, especially in some states and districts, but it also had a variety of other effects. In addition to reduced economic activity lowering school spending, school spending was likely influenced by political forces—as expenditures per pupil in several states remained depressed long after economic conditions improved. These political forces at play in some states were likely also correlated with other factors that may have influenced student achievement contemporaneously. One approach is to simply examine the relationship between educational spending and student achievement. However, ignoring these potential sources of bias—as would occur in a naïve regression of achievement on expenditures per pupil—will likely result in misinformed policies. Other hypotheses regarding the causes of declining achievement raise similar concerns.

That said, some of the suggested hypotheses of declining achievement cite influences on student outcomes for which there is causal evidence. Even so, it doesn't necessarily follow that the changes in any of the cited influences account for the full extent of declining achievement over

this whole period, or in every state. We briefly summarize the evidence associated with each of the hypotheses below.

Diminished consequential school accountability. The evidence suggests that consequential school accountability improved student outcomes, at least for some students. Dee and Jacob (2011) find that accountability that is transparent, sets meaningful standards, offers support to schools struggling to meet those standards, and sanctions for those who do not, improves student achievement among poor, Black students, particularly in math. The authors leverage differences among states that implemented such accountability systems prior to NCLB—as well as among the remaining states who were required to implement such systems under NCLB. The authors estimate the effects of consequential school accountability on state math achievement tests are on the order of 0.04 SD. Reading achievement was unaffected.

NCLB had begun to wane by about 2013, as the flaws in some provisions coupled with increasingly powerful political pushback weakened enforcement resulting in less consequential accountability in many states. The Every Student Succeeds Act (ESSA), which became law in 2015, maintained some key features of NCLB, but devolved most aspects of school accountability to the states. While each state is still required to identify about 5 percent of its lowest performing schools for attention, most observers conclude that, in the wake of consequential school accountability largely being left to state discretion, many states implemented less rigorous accountability beginning about 2013. A GAO report provides several examples where, under ESSA, states and districts have backed away from consequential accountability (Norwicki, 2024). This temporal aspect coupled with conceptual and empirical evidence that consequential accountability is expected to disproportionately affect schools with concentrations of low-performing students remains the crux of the school-accountability hypothesis for declining academic achievement.

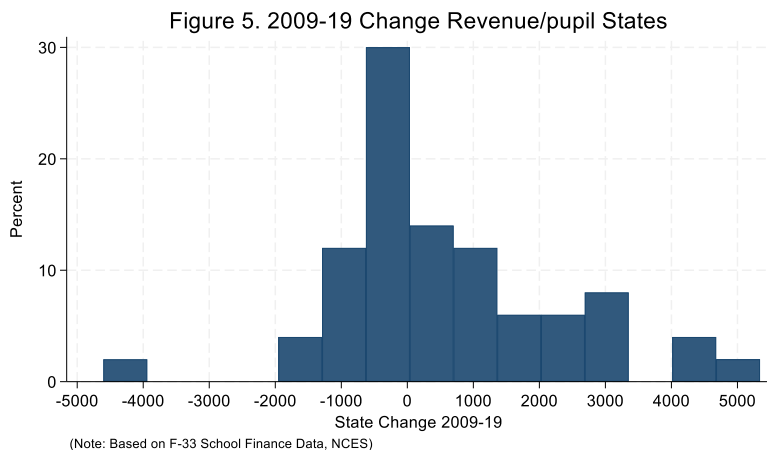
Measuring whether state school accountability is consequential is challenging under ESSA, however. We are unaware of research that summarizes the extent to which states have implemented consequential school accountability and, by implication, are unaware of causal research that links summaries of state accountability to student achievement during the ESSA era. At worst, states have reverted to pre-NCLB levels of accountability which, based on the Dee and Jacob estimates, would suggest reductions in average math achievement of at most 0.04 SD for 10th-percentile students.

Great-Recession-induced funding reductions. A strong body of evidence finds that school spending influences student achievement. See Jackson and Mackevicius (2021) for a summary. Employing estimates from 31 causal studies of the effect of school spending, the authors find that an increase of \$1000 per pupil over four years raises achievement by an average of 0.035 SD. Jackson, Wigger and Xiong (2021) link the reductions in education spending resulting from the Great Recession to declining NAEP achievement. The authors isolate the effect of recession-induced spending reductions by employing an instrumental variable based on the share of expenditures in each state sourced from state revenue. The authors find that a \$1000 reduction in per-pupil expenditures results in a 0.039 SD decline in NAEP achievement. They also show poor students were disproportionately affected by expenditure reductions and therefore achievement

declines. In sum, there is a broad base of evidence demonstrating that reductions in school spending will reduce achievement on standardized tests on the order of about 0.035-0.040 SD per \$1000/pupil reductions in spending.

In 2013—following the reduction in federal assistance that had been enacted in response to the

Great Recession—states were, on average, spending about \$1000 per pupil (real dollars) less than they had in 2009. Reductions in 8 states exceeded \$2000 per pupil.³ Even by 2019, nearly half of the states were spending less than they had in 2009 (Figure 5). Large, sustained reductions in spending likely contributed to achievement decline. The extent to which this occurs varies across states and over time—but we might approximate this effect as roughly 0.04 SD on average, or roughly about a quarter of the overall



2009-19 decline in achievement in 8th grade math for students at the 10th percentile. In some states, this effect may be two or three times as large.

Common Core. In the late 2000s, policymakers became concerned that learning standards employed in most states lacked rigor. In response, the Council of Chief State School Officers and the National Governors Association spearheaded a collaboration with states to design and implement common, rigorous content standards to guide instruction and learning. Assessing the impact of the Common Core on student learning is challenging given that most states adopted it at roughly the same time. Conceptually, the Common Core could have increased student achievement as students, teachers and others were challenged to meet more rigorous standards and rose to that challenge. Alternatively, some have argued that the Common Core’s more challenging learning standards may have resulted in reduced achievement among lower-performing students if they did not receive the supports needed to meet the tougher standards and, as a result, became less motivated in their learning. Evaluating the effect of Common Core immediately following implementation, Bleiberg (2021) finds improved math outcomes, but only among more economically advantaged students. Song and colleagues (2022)—assessing impacts through 2017—find no effects in math, but negative 4th grade reading effects of -0.06 SD one year following adoption, and -0.10 SD ($p < 0.10$) seven years after adoption. English language learners and students with disabilities tended to perform more poorly under Common Core as did students of color. However, these results varied by subject and grade, and were rarely consistently statistically significant (Song et al., 2022). Overall, the evidence linking Common Core to a decline in student achievement is thin and, at best, a partial explanation for losses among students who are disproportionately low performing in 4th grade reading.

³ Author’s calculations from the NCES National Public Education Financial Survey Data.

Effects of smartphones and social media. Given the alignment between the timing of the rise of smartphones and social media and declining test scores, many have speculated there is a causal connection between the two. There is correlational evidence linking the two (for a summary, see Thompson, 2023). Surveys provide evidence that several of the mechanisms (e.g., distraction from schoolwork, lack of focus in school, decreased mental well-being) which are hypothesized to link phone/social-media use to decreased academic outcomes are indeed associated with smartphones and social media (Office of U.S. Surgeon General, 2023). Some causal evidence links smartphone bans to increased academic engagement, but direct causal evidence on the connection between smartphone and social-media use and declining academic achievement is limited.

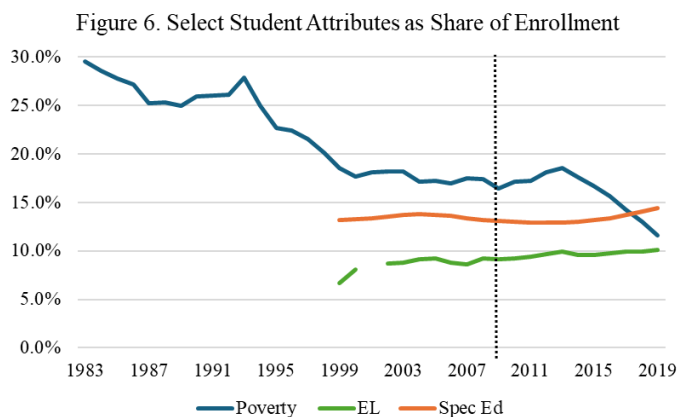
Certainly, the consistent growth in the use of smartphones and social media is consistent with the timeline of declining achievement. In 2004, it is estimated that 45 percent of adolescents aged 12-17 owned a cell phone (Lenhart et al., 2010). By 2015, 73 percent of those aged 13-17 owned a smartphone and, by 2022, the share had increased to 95 percent (Pew Research Center, 2024). The intensity of smartphone use has grown as well. Rough estimates indicate average daily use increased from about 6 hours in 2010 to 7-9 hours by 2023. Seventy-two percent of high school teachers believe that smart phones distractions are a major problem in classrooms (Pew Research Center, 2024). The growth in smart-phone/social-media use is associated with a reduction in long form, immersive, book-reading for pleasure (National Literacy Trust, 2025). In sum, there is strong intuition and correlational evidence of the negative effects of smart-phones and social-media on the learning development of students. Even so, there is little basis on which to estimate the magnitude of the effect of smartphone and social-media use on achievement.

Impact of state/district policies. To improve student learning and address low achievement, states and districts implement a variety of policies. When successful, such policies may reduce the effect of factors inducing achievement decline. For example, some have speculated that Mississippi largely avoided declining achievement due to its early and rigorous embrace of the science of reading. In 2013, Mississippi enacted the Literacy-Based Promotion Act that required the use of the science of reading via a detailed process which increased implementation and support for K-3 reading with the goal that all children would read by the end of 3rd grade.

Although there are few causal analyses, the available evidence suggests a strong link between implementation of the science of reading and test score improvement. Dee and Novicoff (2023) find that professional development for some California teachers based on the components of the science of reading resulted in gains for 3rd graders of 0.14 SD in ELA and 0.11 SD in math. Mississippi's 4th grade reading achievement scores are consistent with this argument, with scores increasing by 12 points between 2013 and 2019—a time when the national average declined by 5 points (Appendix Figure A5). If we simply transpose the Dee and Novicoff findings to Mississippi, the science of reading would account for about 30 percent of Mississippi's differential gain in 4th grade reading. Generalizing the Dee and Novicoff results to Mississippi's implementation of the science of reading requires several assumptions. However, the evidence on the science of reading is consistent with the notion that state and district policies could reduce, or reverse, the effect of factors that would otherwise have led to achievement declines.

Increased incidence of students experiencing challenges during learning. A variety of factors inside and outside of school lead some students to perform better on standardized achievement tests than others. There is robust evidence that, on average, student economic disadvantage lowers academic achievement—including evidence from a large number of correlational studies conducted in widely varying contexts, over decades. In addition, quasi-experimental and experimental research document this relationship (see Duncan & Le Menestrel, 2019, for a recent summary). Given the high correlation of poverty with other family attributes that may also negatively affect student achievement, the precise causal triggers and their mechanisms may be difficult to disentangle. A few causal studies find that, for families near the poverty line, increasing annual income by \$1000 yields 0.05-0.08 SD increase in student achievement (summarized in Page, 2024).

Petrilli (2019) argues that much of the improvement in student achievement among low-performing students from 1980 to 2010 was attributable to the large reductions in child poverty—as measured by the anchored supplemental poverty measure (a broad-based measure inclusive of cash and in-kind transfers), which fell from 30 percent in 1983 to less than 17 percent in 2010.⁴ Such large reductions in child poverty likely did affect achievement among low-performing students. However, from 2013 to 2019, the anchored supplemental poverty measure continued to fall to 12 percent (Figure 6) during the same time that student



achievement among low-performing students was declining. This is not to suggest that poverty doesn't influence achievement. Rather, it illustrates that there is likely a more complicated story at play.

Students whose first language is not English and who score below a specified level on an English proficiency exam are designated as English language learners (ELs), which identifies them for supplementary learning supports until they are determined to be sufficiently English proficient. Since EL status is often correlated with influences, such as poverty, that may reduce achievement, identifying the causal effect of EL status is challenging. Numerous descriptive studies across a variety of contexts find that EL status is associated with lower standardized academic achievement. For example, in 2019, EL students scored 33 points lower (0.85 SD) on the NAEP 4th grade reading exam than students who are not EL (NAEP, 2025). So, while this is not necessarily a causal effect of EL status, a meaningful increase in the proportion of students identified as EL may therefore reduce achievement test scores. The percentage of EL students has increased from 8.1 percent in 2000 to 10.1 percent in 2019—with half of that increase occurring since 2009 (Figure 6). The one percentage point increase since 2009 may contribute to a modest observed decline in NAEP achievement over this period. However, EL trends in states

⁴ From Columbia University Center on Poverty and Social Policy “Historical SPM Data” downloaded 4/29/25 from: <https://povertycenter.columbia.edu/historical-spm-data>

vary widely. In a handful of states, the percentage of ELs increased by more than 10 percentage points and likely led to much larger achievement declines.

Students with learning or cognitive disabilities identified under IDEA typically experience lower academic achievement. Descriptively, students with a learning disability, on average, score 42 points lower (more than 1 SD) on the NAEP 4th grade reading than students without a disability (NAEP, 2025). From 2009 to 2019, the percentage of students with identified disabilities increased by 1.3 percentage points, but, in a few states, increased by more than 10 percentage points and could well have resulted in moderate declines in achievement.

Summary. Each of the hypothesized causes of achievement declines is conceptually grounded and has experienced trends that are, at least superficially, aligned with declining achievement trends. In some cases, there is strong evidence connecting these hypotheses to reductions in achievement. Our summary suggests that no one hypothesis accounts for the observed pre-pandemic learning loss, and that each may well have contributed—though some appear to have stronger potential causal effects, or greater temporal plausibility, than others. The currently available evidence is insufficient to differentiate among these influences to draw more specific conclusions.

Discussion

Over 25 years of sustained, large improvements in academic achievement came to an end around 2009. The subsequent learning losses were large. Between 2013 and 2024 students at the 10th percentile of achievement lost about 0.40 SD reading and math in both 4th and 8th grade, equivalent to about a year of learning and undoing most of the earlier gains. Learning losses for other students were smaller, but nonetheless meaningful. Losses for all students are even larger when compared to what might have occurred if the trajectory of 1990-2009 gains had continued. Finally, the influences behind the drop in achievement from 2009 to 2019 likely account for a sizeable portion—about 40 percent—of the much-noted learning losses ascribed to the pandemic. Addressing the learning losses experienced since 2009 is therefore one of the most pressing problem confronting educational policymakers and researchers.

In this paper, we, first, explored the nature of pre-pandemic learning loss. How large were the losses? Where and when did losses occur? Who experienced the greatest losses? This analysis suggests, as Matt Di Carlo noted in 2012, a range of educational and social events likely contributed to declining NAEP scores at various times and places. Second, rather than attempting to empirically estimate the causes of pre-pandemic achievement decline—doing so credibly goes beyond the scope of our analysis—we briefly summarize the evidence base surrounding some of the more popular learning loss hypotheses. Each of the hypothesized causes of the decline in achievement growth may well have contributed to the large reductions experienced between 2009 and 2019. Given the overall magnitude of the decline and its variability over time and across states, no one hypothesis provides a singular explanation. More rigorous empirical work, similar to Jackson and colleagues (2021), will be necessary to more deeply understand what led to the large and heterogeneous pre-pandemic learning losses.

Reversing these learning losses will require engagement across several dimensions: from policies focused on families, to early childhood education, and improving the quality of K-12 education, especially for poor and low-performing students. The realization that achievement has been declining for an extended period, and that a substantial portion of “pandemic learning losses” were seeded much earlier, suggests policies should not only focus on short-term pandemic recovery efforts among a couple of cohorts, but embrace more fundamental change to address a broader set of influences. It is difficult to imagine that schools will realize better educational outcomes for all students without improving the quality of teaching. This, in turn, means increased spending to attract, develop and retain effective teachers and to provide the supports teachers need to be effective. Consequential school accountability can promote the effective use of these resources to set meaningful standards, target supports to realize those standards, and impose consequences when standards are not realized.

As educational outcomes for a broad set students diminish, families with means search out better options for their kids further weakening the social bond supporting the public goods aspects of education—the features of education necessary for a well-functioning democracy and civil society that will be underproduced if left to the market. Declining achievement is just a signal of this larger problem. As the leadership and responsibility for education policy is further devolved to states, they can embrace this challenge by partnering with researchers to target policies to their specific circumstances.

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Appendix

Figure A1. NAEP Achievement Over Time Indexed to 2009 by Percentile, Subject and Grade

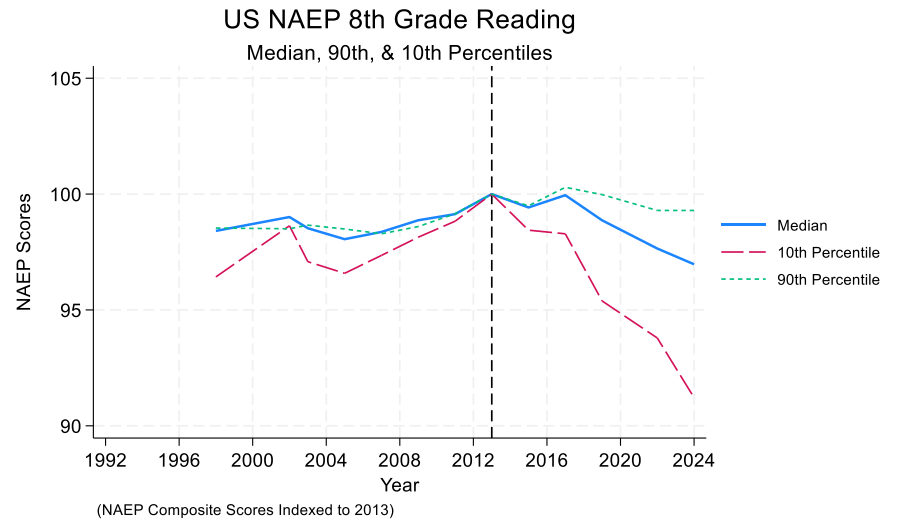
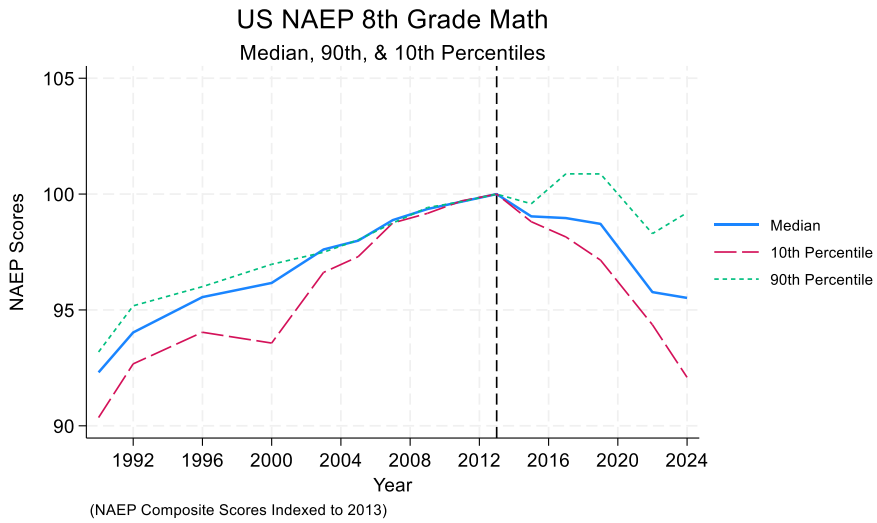
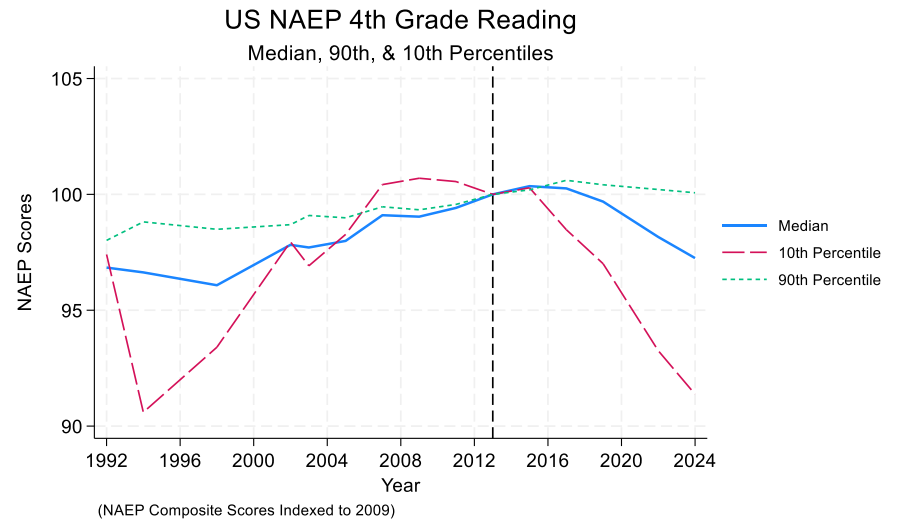
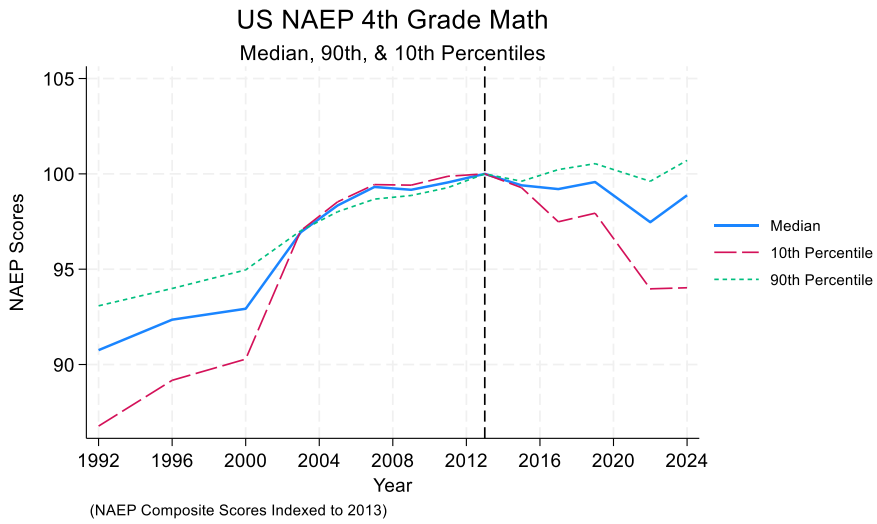
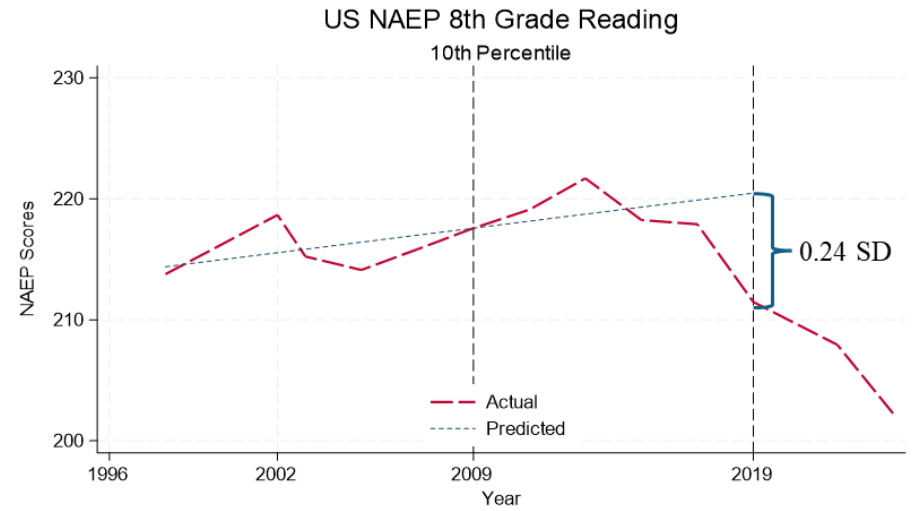
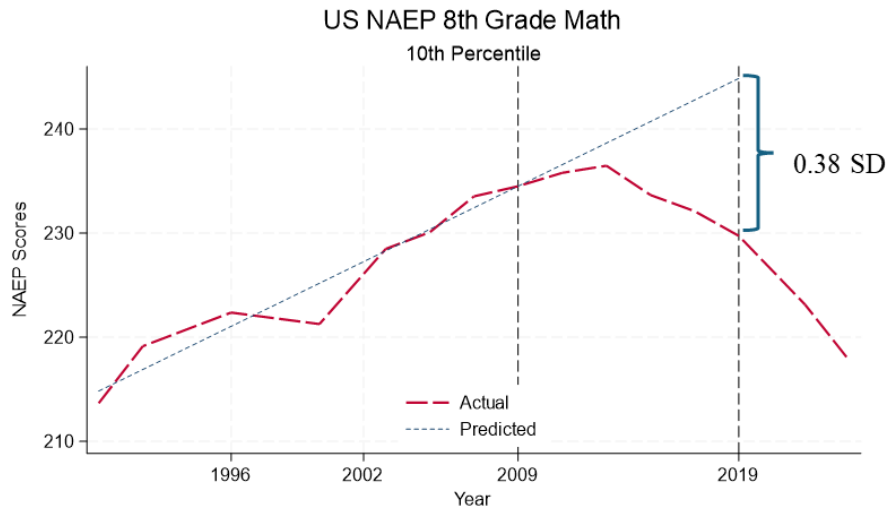
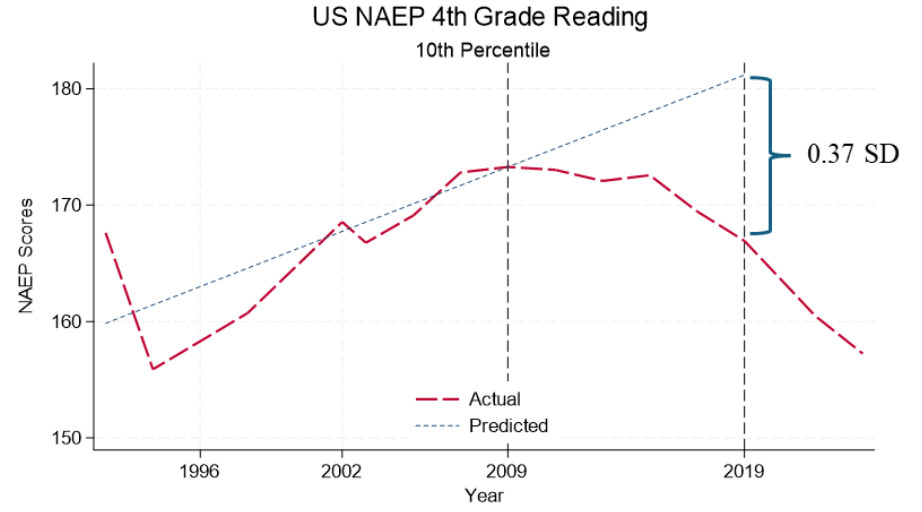
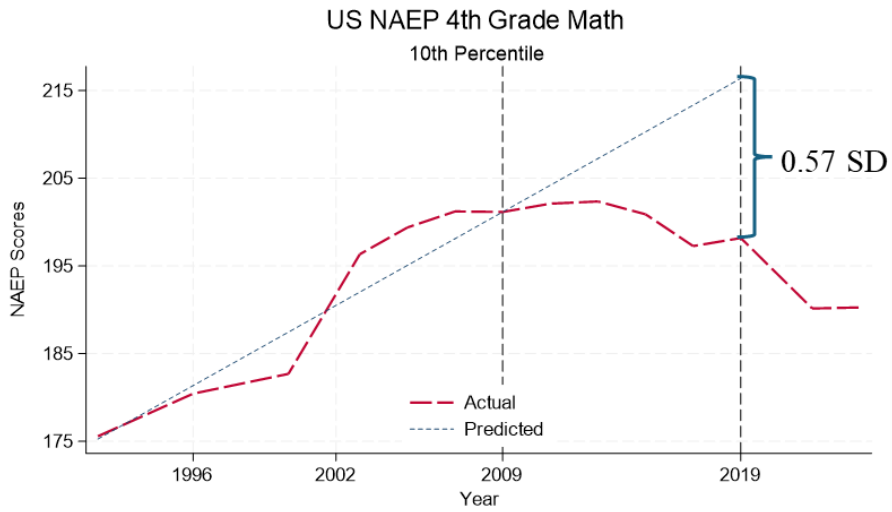
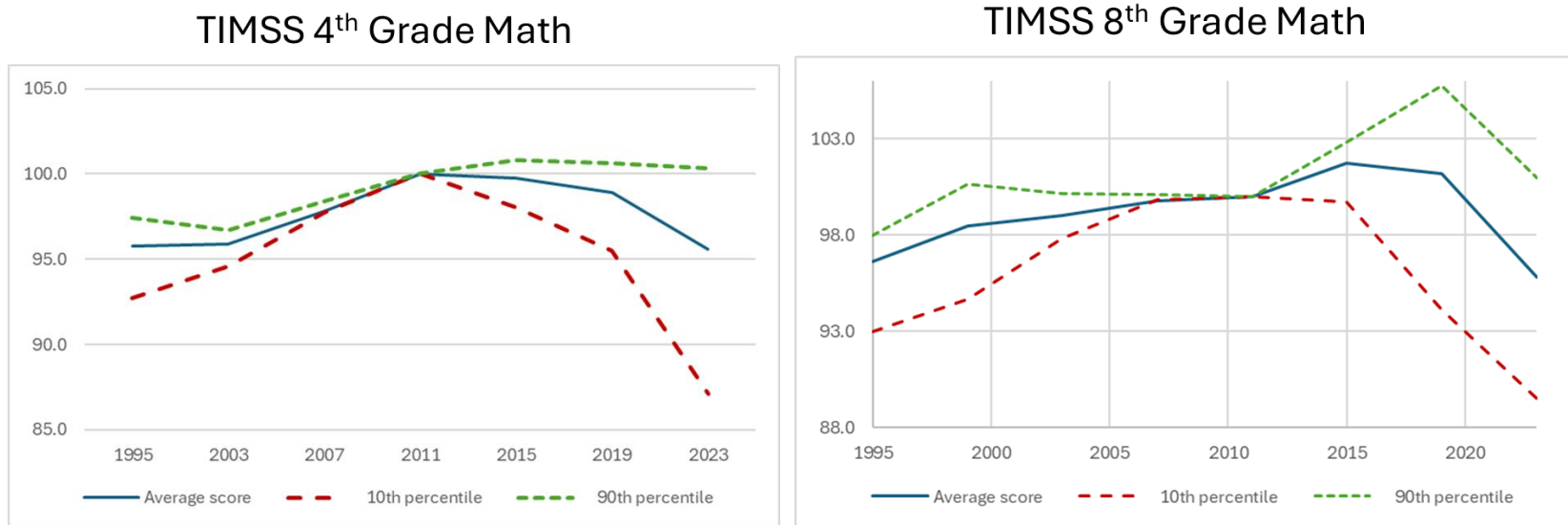


Figure A2. NAEP Actual Predicted Scores by Test



Note: NAEP actual and predicted. Predicted based on linear regression 1992-2009

Figure A3. TIMSS U.S. Scores Over Time Indexed to 2011



SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS)

Figure A4. Changes in NAEP Scores, 8th Grade Math, 2009-2019, by State

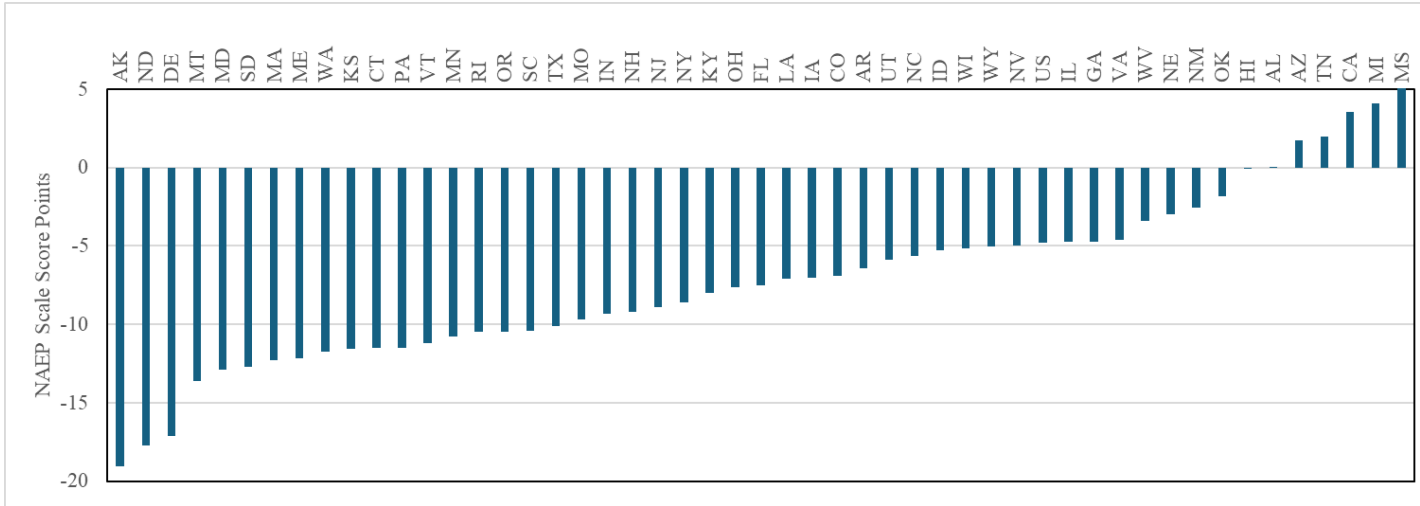


Figure A5. NAEP 4th and 8th Grade Reading, US and Mississippi, Various Years

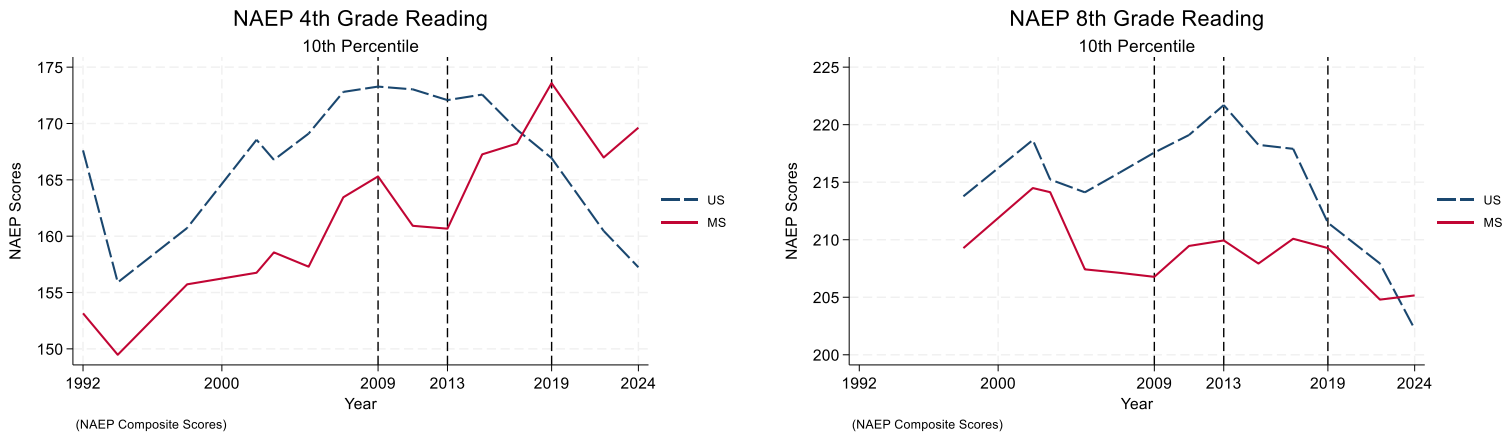


Table A1. Changes in NAEP Scores Across Time by Percentile, Subject and Grade (SD)

Test	1992-2013			2013-2019			2019-2024		
	10th	50th	90th	10th	50th	90th	10th	50th	90th
Math 4th	0.84	0.70	0.60	-0.13	-0.03	0.05	-0.25	-0.05	0.01
Math 8th	0.43	0.42	0.40	-0.17	-0.09	0.07	-0.30	-0.23	-0.14
Reading 4th	0.11	0.18	0.13	-0.13	-0.02	0.03	-0.25	-0.14	-0.02
Reading 8th	0.21	0.11	0.12	-0.27	-0.08	0.00	-0.24	-0.13	-0.06

Note: Values are in standard deviation of student achievement units using 2019 standard deviations (4th math=32, 4th reading=39, 8th math=40, 8th reading=38). Values for 8th grade reading for 1992-13 based on scores for 1998-13 due to data availability.

Table A2. 2019 Actual Minus Predicted NAEP Achievement (SD) by Subject, Grade and Percentile

Test	10th	25th	50th	75th	90th
Math 4th	-0.57	-0.46	-0.36	-0.26	-0.16
Math 8th	-0.38	-0.35	-0.28	-0.19	-0.12
Reading 4th	-0.37	-0.21	-0.06	0.01	0.03
Reading 8th	-0.24	-0.14	-0.03	0.05	0.10

Note: Values in standard deviation units. Based on predicting 2019 NAEP scores from 1992-2009 scores by subject and grade.

Table A3. The Share of 2019-24 Achievement Declines that Reflect Ongoing 2013-19 Trends

Test	Mean Annual Scale Score Change					
	10th Percentile			50th Percentile		
	2013-19	2019-24	Ratio	2013-19	2019-24	Ratio
Math 4th	-0.70	-1.58	0.44	-0.17	-0.34	0.51
Math 8th	-1.12	-2.39	0.47	-0.61	-1.82	0.34
Reading 4th	-0.86	-1.94	0.44	-0.12	-1.09	0.11
Reading 8th	-1.70	-1.85	0.92	-0.50	-1.02	0.50

Note: Values for time periods are average annual scale score changes for period, by test and percentile. Ratio is 2013-19 value divided by 2019-24 value. This assumes that the same annual decline in achievement continues to occur.

Table A4. NAEP Score Change from 2013-2019 at Various Percentiles of Student Achievement (SD) by Various Percentiles of State-Mean Achievement Change

Test	State Rank Percentile	Student Achievement Percentile		
		10th	50th	90th
Math 4th	10th	-0.35	-0.19	-0.08
	50th	-0.19	-0.06	0.03
	90th	-0.03	0.05	0.12
Math 8th	10th	-0.33	-0.19	-0.05
	50th	-0.18	-0.08	0.06
	90th	-0.06	0.00	0.16
Reading 4th	10th	-0.31	-0.13	-0.04
	50th	-0.16	-0.04	0.02
	90th	0.04	0.08	0.12
Reading 8th	10th	-0.38	-0.16	-0.08
	50th	-0.26	-0.07	-0.02
	90th	-0.15	-0.01	0.10

Table A5. Year States Achieved Highest NAEP Score for the 10th Percentile by Subject and Grade

Test	2002	2003	2005	2007	2009	2011	2013	2015	2017	2019
Math 4th	0	0	4	9	5	11	15	4	1	1
Math 8th	0	0	1	6	12	12	13	3	2	1
Reading 4th	4	2	1	13	6	6	5	11	0	2
Reading 8th	10	0	1	2	6	8	18	3	2	0