COVID-19, Schools Closures, and Outcomes
Rebecca Jack and Emily Oster

Rebecca Jack is a PhD student in Economics, University of Nebraska-Lincoln, Lincoln, Nebraska. Emily Oster is Professor of Economics, Brown University, Providence, Rhode Island. Their email addresses are bjack2@unl.edu and emily_oster@brown.edu.

One of the earliest, and clearest, facts that emerged at the start of the COVID-19 pandemic was that children were among the groups least affected in terms of health outcomes. Despite this, the pandemic imposed enormous costs on children: loss of parents and caregivers, illness, disruptions to daily routine and loss of opportunities for social contact. Among the most significant disruptions, and the focus of this paper, was the closure of schools.

In March 2020, when the pandemic began, schools closed in nearly every country worldwide. Many expected schools to reopen after a few weeks, but it quickly became clear that school closures were going to extend through the end of the school year. Before the following 2020-2021 school year began, school and education leaders had to decide whether to reopen for in-person education or to continue with virtual schooling (or adopt a hybrid approach). At this stage of the pandemic there was relatively little data to rely on. Because of the uncertainty and various political climates, reopening was slow and partial. In some locations, schools stayed closed for months or years. Students learned at home with support from family, curriculum materials, online collaboration tools like Zoom, even through the radio. But these methods worked poorly, or worse, for a number of students.

In the end, a number of commentators (Leonhardt, 2022; The Economist, 2022) have pointed to prolonged school closures, and their attendant effects on children, as one of the greatest negative impacts of the pandemic. This article details what we know about the patterns of closures and their effects.

We begin with the question of data, and our perspective on the importance of public, accessible, and contemporaneous data in the face of public crisis. Then, we present data on the extent of school closures, both globally and within the United States. We describe the available data on the degree of these closures, which will provide a set of resources for studying longer-term consequences as they emerge. We also highlight what we know about the demographic patterns of school closures.

Second, we discuss the emerging estimates of the short-term impacts of school closures. This section will highlight possible identification strategies for estimation of the effects, but the analytical task of effects of closures from other economic and health consequences of the pandemic is challenging. A central finding throughout our discussion is that school closures during the pandemic tended to increase inequality, both within and across countries. School closures were more common in less developed countries and, within the United States, more common for lower-income students. Estimates of short-term impacts were also larger for these groups, too.

We also emphasize that fully understanding the long-run impact of COVID-related school closures on students will take time— by definition, long-term consequences can only be measured in the long run—and will surely be influenced by events and policies in the next few years. In particular, estimates of early-grade disruptions on high school graduation rates, college-going, and labor market outcomes are a decade or more away.

Data During a Public Crisis

In March of 2020, virtually every school in the United States (and worldwide) closed for in-person instruction. In the United States, schools remained closed through the end of the 2019-2020 school year. After these initial school closures, schools had only the short summer months to decide whether or not to return to in-person school in Fall 2020.

At this stage of the pandemic, the evidence on how (and whether) to safely reopen schools was limited. Several European countries reopened their schools during the summer of 2020, but it was unclear whether the reassuring lessons learned there would translate to the United States. With relatively little data-based guidance, school district reopening decisions were varied. Some schools chose to remain virtual while others opened part- or full-time and instituted various mitigation efforts, including masking, distancing by 3 or 6 feet, and extensive cleaning or air purification measures.

As some schools began opening in the late Summer of 2020, it became clear that there was an opportunity to learn from the schools that did reopen, to rapidly inform those schools which had not yet made reopening decisions. Unfortunately, there was no coordinated effort by any federal agency to assemble data on school reopening, or on COVID cases in schools. Beginning in the fall of 2020, we embarked on an effort to collect these data, which we briefly describe below.

Initial COVID-19 Case Data

We began collecting COVID-19 case data in Fall 2020. We collected data on student and staff cases from any school district that volunteered their data, and from states that were collecting and reporting district level data (New York, Texas, and Massachusetts). The dataset was eventually expanded to cover 30 states, and as many as 12.9 million students, approximately 24% of the US student population (COVID-19 School Response Dashboard).

In the midst of a public health crisis, it was important to us that these data be made available quickly. We published data on a bi-weekly basis, showing COVID case rates in schools as they

evolved over time. These data allowed us, initially, to show that COVID cases in school populations were limited and were reflective of case rates in the overall population.

Later in that school year, we were able to leverage these data to influence policy. Collecting this data and working with data partners from Massachusetts allowed us to show that there were no statistical differences in caseloads between schools who implemented 3 feet of distancing compared to schools who implemented 6 feet of distancing, ultimately contributing to the CDC decision to abandon these distancing requirements (van den Berg et al, 2021).

School Learning Models

Our data collection effort also focused on understanding school learning modes. As we collected information on COVID cases, we also collected information on school reopening modes. This allowed us to generate some early evidence on disparities in student experience. Black and Hispanic students were more likely to be in districts that only provided virtual schooling compared to white students who were more likely to have the option of attending in person (Oster et al., 2021).

These initial disparities made it clear that, in order to eventually understand the long term consequences of what students experienced during COVID, it would be important to have universal data on school closures and school learning modes during the 2020-2021 school year.

Real-time data on school closures was somewhat haphazard during the 2020-2021 school year. Similar to the COVID data, this information was not tracked in a systematic way by any federal agency.

The most complete data available in real time came from the Burbio K-12 School Opening Tracker (2021) which covered up to 1,200 (of 13,000 school districts) and approximately 47 percent of the U.S. public school enrollment. A second private company, SafeGraph, made data on cell phone traffic to public schools available, allowing for a measure to approximate school closures by looking for drops in typical cell phone traffic (Parolin and Lee, 2021). Following the end of the school year, better data became available through state-level education agencies. The state-level agencies often had to collect these data for reporting to the Pandemic Electronic Benefits Transfer (P-EBT) program, in which schoolchildren from qualifying lower-income families were given a pre-loaded card that allowed them to access nutritional benefits. However, these state-level data were generally not published or accessible without contacting each state-level agency individually.

We were involved in creating the COVID-19 School Data Hub, financed by several foundations, which provides data on opening patterns by school district, from official state agency records, for 48 states and the District of Columbia. Data are available at the district- and school- level (CSDH, 2023a, 2023b). The data have been used in a number of analyses (Christian et al., 2022; Cohodes and Pitts, 2022; Heise, 2023; Singer et al., 2022; Weber and Baker, 2023).

In this paper, we use these data in the analysis of the impacts of school closures on test scores. Long term, they may be useful for thinking about the further effects of school closures during the COVID year.

Important Lessons from Data Collection during COVID

Based on our experience collecting data both on COVID cases and learning model data, we highlight three lessons for collecting data during times of crisis and, more broadly, data intended to impact policy.

1. When possible, make aggregated data public, not proprietary: Public data allows for real-time feedback and correction. Making data public quickly will allow media, policy makers, and researchers to use the data early on, which led to faster policy change during an important time of upheaval.
2. There is a need for systems to collate data that are already being collected for other purposes: Much of our data in the COVID-19 School Data Hub came from the data states collected for the Pandemic Electronic Benefits Transfer (P-EBT) program. While states had comprehensive data on district policies, without collating this data, it was unavailable for researchers to use to understand the impacts of the pandemic.
3. When collecting data, it is important to keep both short-run and long-run in mind: During initial shut-downs, it was important to understand how COVID spread in schools in order to determine what the best policies were regarding schools. For long-term analysis, it is most important to know what students experienced. Keeping both of these in mind influenced our decision to collect learning model data along with caseload data.

Patterns and Experiences of School Closures

Worldwide

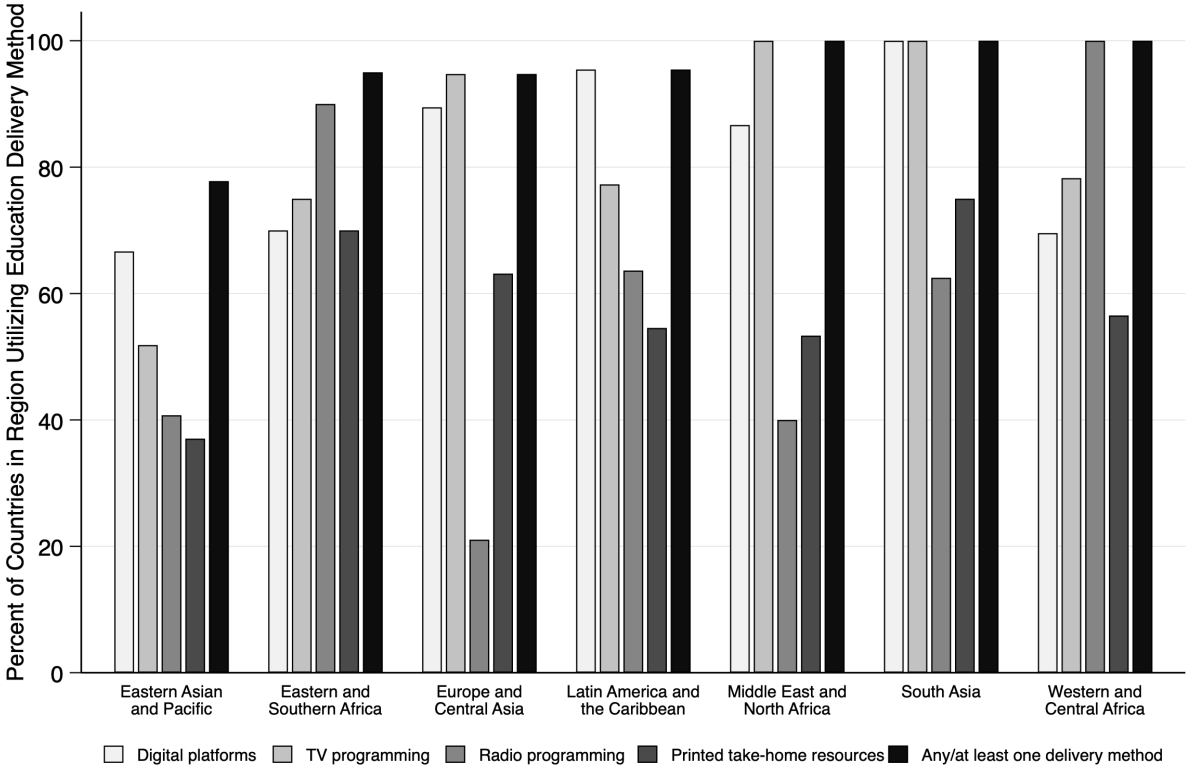
Virtually every country in the world closed its schools in March 2020, when the pandemic hit. According to the Oxford COVID-19 Government Response Tracker, a global database of

pandemic policies, only three countries did not require any school closures in 2020: Burundi, Tajikistan and Turkmenistan (Hale et al., 2021).

During this initial period of school closures in spring 2020, countries used a variety of approaches to continue education. TV programming and government-supported online platforms were the most widely used formats of education delivery (78 and 74 percent of countries, respectively), but the majority of countries also used radio programming, printed resources, and mobile and social media methods. Many of these methods provided students resources for self-learning, rather than synchronous learning with a teacher (UNICEF, 2021).

Figure 1 illustrates the cross-country variation in technologies used in the absence of in-person school (UNICEF, 2021). While digital platforms, including both government-run platforms and others, were commonly used in Europe and South Asia, in other regions (Africa, in particular) radio was more common. For some regions, including the Middle East and North Africa, South Asia, and Western and Central Africa, there was universal coverage of at least one type of education delivery method, while in other regions, including the Eastern Asia and Pacific region, not all countries provided these resources during the initial shutdowns.

Figure 1: Education Delivery Methods by Region, March-May 2020

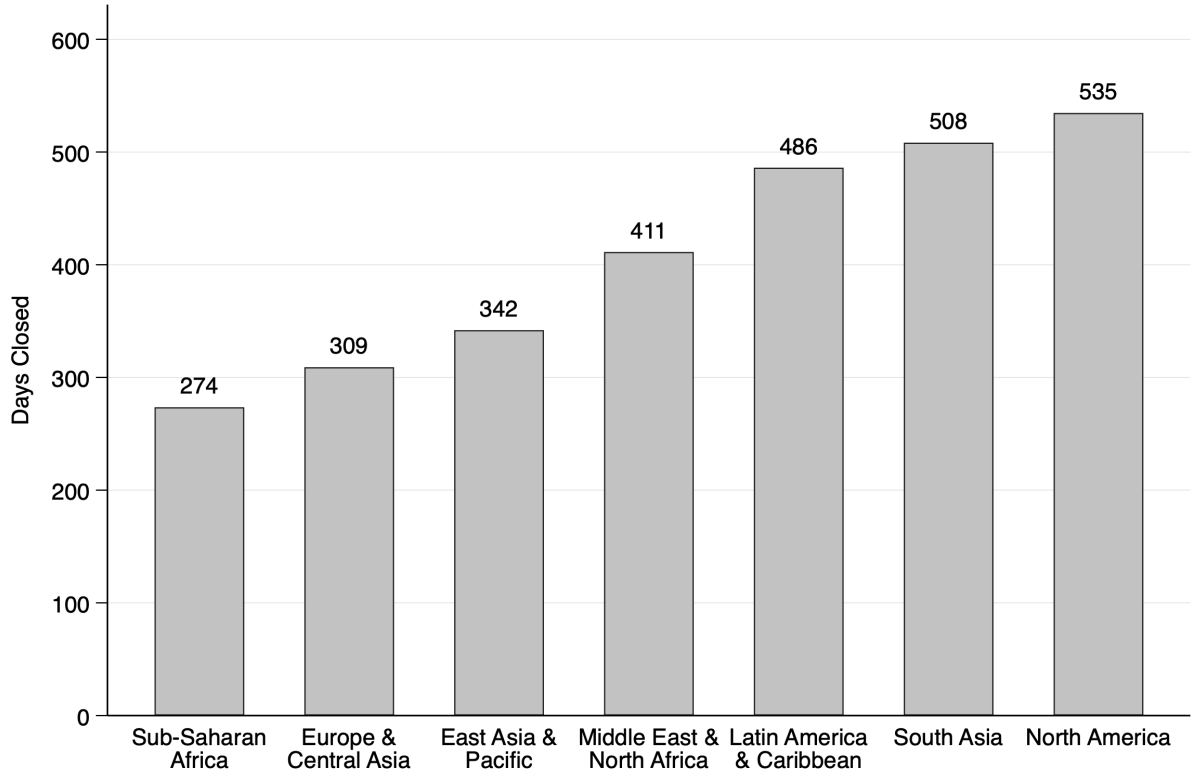


Source: UNICEF. (2021). National education responses to COVID-19: UNICEF Global Tracker, May 21. (COVID-19 Page, COVID-19 Resources). Available at https://public.tableau.com/app/profile/unicefdata/viz/EduViewv1_0/home

Schools gradually reopened starting later in 2020, depending on a combination of school calendars and COVID restrictions. Munro et al. (2023) document the full range of school experiences using data from the Oxford COVID-19 Policy Tracker. The coding of these openings and closings at the national level is challenging, because in many cases there is within-country variation. With this caveat, the data make clear there was considerable variation, even within countries with comparable income levels. Some countries (for example, Iceland) reopened as early as May 2020, with some alterations. Others (for example, Germany) were not fully open until mid-2021. At the tail end is Saudi Arabia, with school closures lasting well into 2021.

We summarize these data by region in Figure 2. North America had the highest average number of days of school closed at 535 days in the two years between January 2020-December 2021, which is around 73 percent of the two-year period, while sub-Saharan Africa had the least with fewer than 300 days closed, or around 38 percent of the two-year period. Thus, students in countries with the longest closures spent more than twice the amount of time without traditional in-person schooling compared to students in countries with the shortest closures.

Figure 2: Average Number of Days with School Closed, by Region, January 2020-December 2021



Notes: Regional closures aggregated from country-level closures using data from the Oxford COVID-19 Policy Tracker (Hale et al., 2021). A closure is defined as a Tracker score of 2 or 3 following the method used for Figure 2 in Munro et al. (2023).

United States

Relative to the global picture, the United States was on the upper end in terms of length of school closures. The database in Munro et al. (2003) estimates that schools in the United States were either closed or partially closed for around 667 days over the two-year period from January 2020-December 2021, inclusive of typical school and summer breaks.

This overall number masks enormous variation across the United States. Virtually all schools closed in March 2020. When it came time to decide about school reopening in the fall 2020, while there was state-level pressure on both sides, the decision about whether to open and in what way was ultimately made by each of the roughly 13,000 school districts individually.

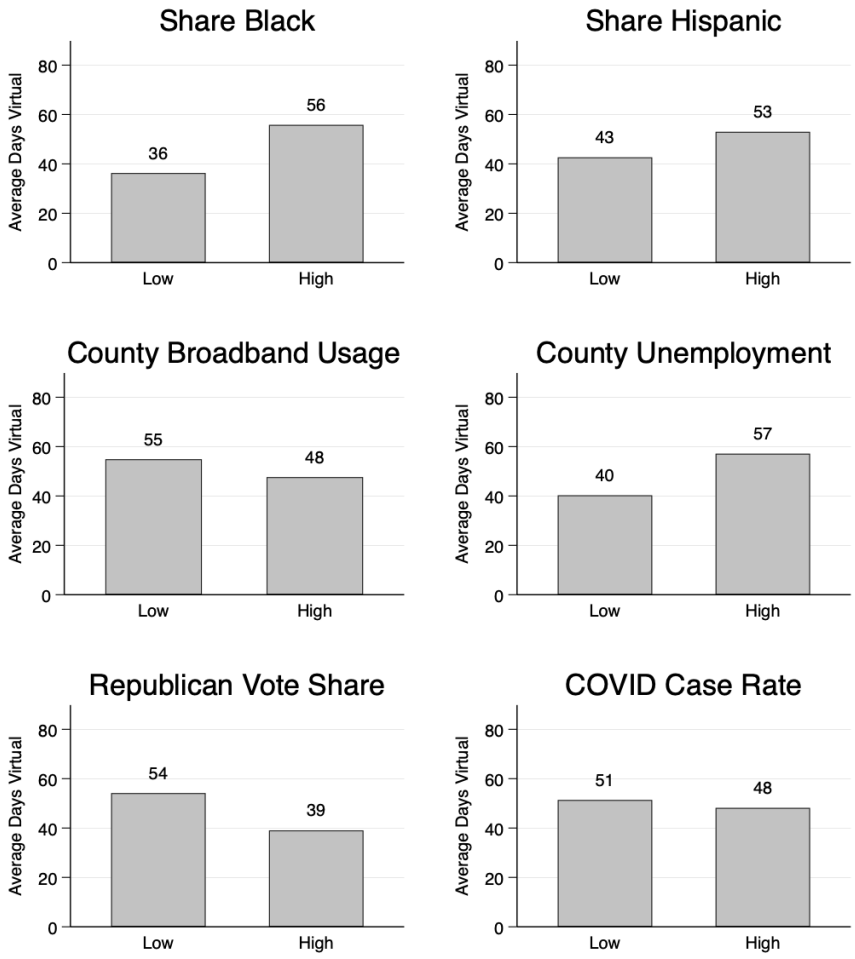
School districts chose one of three primary paths, although within these there were significant variations. First, some school districts opened for full-time in-person schooling for all students at the start of the school year (which varies in the United States from late July to early September). These districts engaged in varying levels of COVID mitigation, including additional ventilation and masking, surveillance testing, and quarantine procedures. Second, some school districts

adopted hybrid schooling models, where students came to school in person some of the time, but either not all days of the week or not all hours in a day. These models had a huge range -- from partial days, to partial weeks, to complicated schedules like eight days on, eight days off. In many cases, these hybrid options were created to ensure that the social distancing recommended by the Centers for Disease Control could be maintained in school (at least in principle). Finally, some school districts opened in a fully virtual mode. In these cases, students often "attended" via some form of distance learning, like via Zoom. An important note is that during the school year virtually *all* school districts, regardless of their opening mode, offered fully virtual learning options to students, either within the district or in state-led virtual academies.

During the 2020-2021 school year, schools moved between modes. Some schools which had opened in the early fall closed for short periods around the winter surge. More importantly for overall trends, in the later winter, after vaccines became available, there was a stronger push for school reopening. To get a general sense of reopening, in September 2020, 32% of the districts in the COVID School Data Hub spent a majority of the month in virtual schooling and 40% of districts spent a majority of the month with in-person schooling available. By the end of the school year, less than 5% of districts had a majority of May with only virtual schooling, and 59% of districts had a majority of May with in-person schooling available.

There is significant variation in opening by demographics, both across and within states. Figure 3 shows correlations between various district and county characteristics and the average number of days spent in virtual school, weighted by district enrollment, and calculated based on the United States average of 180 days per school year. We include data on the following characteristics: the share of the school population that is Black or Hispanic during the 2020-21 school year; county broadband usage rates; county-level unemployment rates; the Republican vote share in the 2020 presidential election; and county-level data on the COVID-19 case rate. We assign high and low categories for each characteristic by state, so the results are driven by variation within states, not across states. Of course, these are descriptive correlations; not causal arguments.

Figure 3: Average Days in Virtual School by Local Characteristics during the 2020-21 School Year



Notes: Demographic variables are from the U.S. Department of Education's Common Core of Data (2022) for the most recent year available and include students who are Black or Hispanic (2020-21 school year). County broadband usage data come from the U.S. Broadband Usage Percentages Dataset (Kahan, 2020); county unemployment rate data come from the U.S. Bureau of Labor Statistics (2021); Republican vote share data come from the United States General Election Presidential Results by County Dataset (McGovern, 2021); and COVID-19 case rate data come from the COVID-19 School Data Hub (2021).

Figure 3 shows that, within state, school districts with higher shares of Black students and Hispanic students spent more of the 2020-2021 school year with only virtual schooling compared to districts with lower shares of Black students and Hispanic students. In addition, school districts located in counties with lower broadband usage and school districts located in counties with higher unemployment rates had more of the 2020-2021 school year in virtual schooling. Virtual schooling was also correlated with the political leanings of an area, with more Republican-leaning areas having fewer days of virtual school on average. Days of schooling mode had a very low correlation with county-level COVID case rates.

Taken together: access to in-person education was unequal across demographic and county characteristics, with more disadvantaged districts spending more of the school year in virtual schooling. These results echo existing work done with other reopening data (Hodgman et al., 2021; Oster et al., 2021).

The COVID-19 School Data Hub focuses on US public schools, which are attended by approximately 91 percent of children in the US (Irwin et al., 2022). Although the data for private schools is less systematic, a parent survey from November 2020 found that private school students were more likely to have access to in-person instruction as compared to their public school peers (Henderson et al., 2021). This pattern likely reinforces the income inequality in school opening, as private schools generally serve a population which comes from higher-income families (Murnane et al., 2018).

It would be interesting compare specific methods of virtual learning. Reports during 2020-21 indicate that district approaches to virtual learning varied widely and included paper packets sent home with students, Zoom sessions with teachers and classmates, and tools provided via various digital platforms (Kamenetz, 2020). However, there is a little or no systematic data on the precise approaches districts took. Similarly, hybrid learning environments varied tremendously and there is limited data to be precise about the variation.

Consequences of School Closures

Many of the questions about the effects of school closures are only likely to be answered as consequences appear in the long term. Thus, we focus here on the emerging short-term evidence. An analytical challenge arises in estimating causal impacts of school closures. Generally, papers in this small but growing literature have used variation in school closures across areas within a country, region or state and related them to changes in student outcomes. Although this approach is naturally subject to concerns that there may be a reason places had varying closures, appropriately chosen comparison groups and pre-trend adjustments may be able to address these concerns. We focus primarily here on test scores, which have been the best studied outcome, but then briefly turn to non-test-score outcomes like enrollment and mental health.

Pre-Pandemic Literature on School Closures and Learning Loss

Before the pandemic, there was a modestly sized economic literature on how school closures in the past affected learning and earnings, with data typically drawn from short-term episodes. For example, Jaume and Willén (2019) show that teacher strikes in Argentina, which closed schools for an average of 88 days across provinces, reduced long-term labor earnings of males by 3.2 percent and females by 1.9 percent.

Several studies look at the aftermath of natural disasters that disrupted schooling. Andrabi, Daniels, and Das (2020) look at the aftermath of an earthquake in Pakistan in 2005, and find that students in regions affected by the quake lost 1.5-2 years of schooling compared to students in other regions—and a substantial part of that loss happened after the earthquake, when students who had fallen behind had a hard time catching up. In a study of the long-term academic outcomes of students evacuated from their neighborhood forced to switch schools by Hurricanes Katrina and Rita (Sacerdote 2012) found that while such students experienced test score losses in the first year after the hurricanes, they began to experience academic *gains* by the third and fourth year, with the gains concentrated among student who had previously been the lowest-performing. Other papers considering the aftereffects of hurricanes on education include Pane et al. (2008) on the Louisiana hurricanes of 2005 and Lamb et al. (2013) on the effects of Hurricane Katrina in Mississippi. Harmey and Moss (2021) consider a group of 15 papers, including hurricanes, earthquakes in New Zealand and Japan, a school district in rural Illinois that was closed for eight days in preparation for flooding. Along with evidence of learning loss, these authors emphasize the challenges of adapting teaching and curriculum for the disrupted students.

It has also been widely observed that student time out of school in the summer causes learning loss, and more so for low-income students. For example, McCombs et al. (2011) argue that the average student loses the equivalent of one month of education during summer break, but with a wide distribution around that average. Alexander et al. (2016) edit a collection of essays on this literature, and von Hippel, Workman, and Downey (2018) emphasize some difficulties of measurement (for example, the tests taken during fall term of one grade are often not the same as those taken spring of the preceding grade).

This literature is certainly suggestive of possible effects of the COVID-19 school closures on learning. However: the pandemic school disruptions went far beyond what had been experienced in prior episodes. The scope for inference about the pandemic period from this earlier work is limited.

Test Scores During the COVID Pandemic: Losses

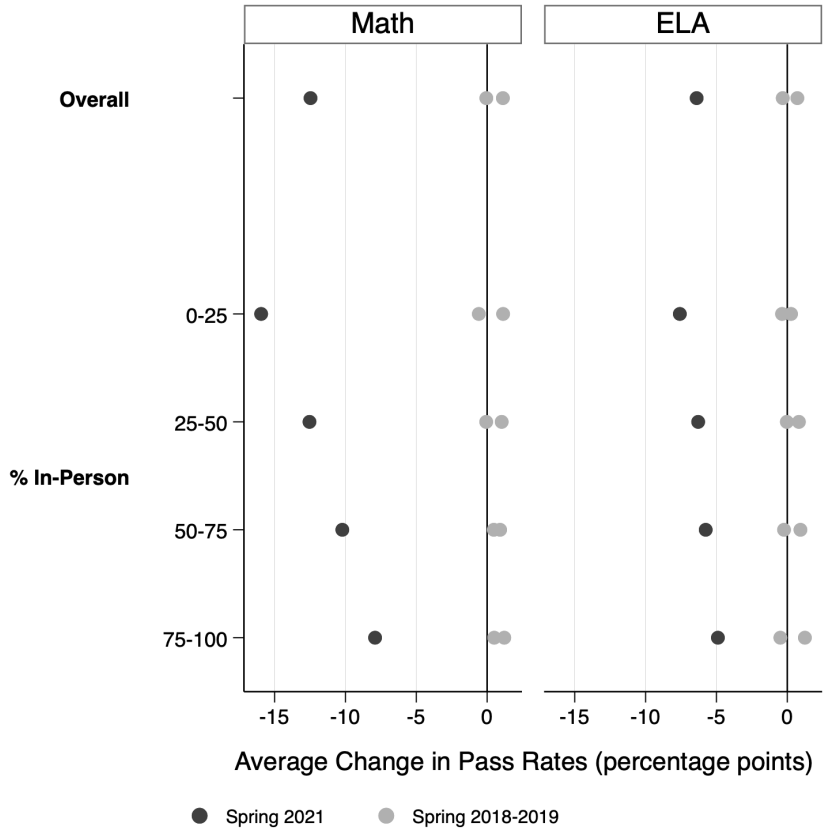
Test score impacts have been most studied in the US context, likely because of the longer period of school closures and the widely available test score data. Comparisons from before and during the pandemic can be useful for understanding the size of the learning loss problem, but viewed strictly from the standpoint of the causal effects of school closings, such comparisons will inevitably mix together the effects of school closures with other aspects of the pandemic like

economic and health disruptions for many households, social isolation, mental stress, and so on. When looking at variation across whether schools were open, closed, or in a hybrid arrangement during the pandemic, the existence of the pandemic is in some sense held constant across these groups. However, it remains important to consider whether the school districts that remained open are systematically different in other ways that might affect education from those that closed.

Overall, US students experienced an historic decline in test scores during the pandemic period. The National Assessment of Educational Progress (NAEP) is given to a nationally representative sample of 4th, 8th, and 12th grade students every few years. It is sometimes called the "Nation's Report Card," because it offers a unified way of looking at student progress over time. Nationally, NAEP test score declines from 2019 to 2022 were most significant in math, but also evident in reading (NCES 2022a, 2022b), with declines large enough overturn the gradual but clear process of the last 2-3 decades. Testing by the private research organization NWEA comparing Spring 2021 scores to pre-pandemic outcomes in Spring 2019 (using its "MAP growth assessments") show similar overall declines (Lewis et al., 2021). At least two papers have specifically looked at the impact of remote schooling on test score declines.

Our work in Jack et al. (2023) uses state-level assessment data from 12 states that have district-level data available (Colorado, Connecticut, Florida, Massachusetts, Minnesota, Nevada, Ohio, Rhode Island, Virginia, West Virginia, Wisconsin and Wyoming) to estimate the effect of schooling mode, measured at the district level, on test scores. Our findings show that within even small geographic areas -- within a county or commuting zone -- a greater degree of remote schooling during the 2020-2021 school year was associated with a larger decline in student test scores between spring 2019 and spring 2021. Our estimates suggest that moving a district from fully in-person to fully remote learning would predict a 13 percentage point larger decline in student pass rates in math and an 8 percentage point larger decline in ELA. Moving to fully hybrid learning for the school year had about half of that effect in the data.

Figure 4: Average Change in Pass Rates on State Standardized Assessments in Spring 2021 versus Spring 2018–2019



Notes: The above figure uses district-level standardized assessment data from 12 states to calculate the change in pass rates year-to-year and schooling mode data from the COVID-19 School Data Hub to calculate the district-level share of the 2020-2021 school year with in-person learning available (Jack et al. 2023).

Goldhaber et al. (2022) use individual-level test score data for 2.1 million students in 10,000 schools in 49 states from NWEA to relate student academic *growth* to the schooling mode available. They find that remote and hybrid learning environments led to lower student achievement growth, while, for example, the dispersion in math scores remained much the same during the pandemic in schools that mostly remained in-person.

Importantly, both of these papers show larger negative of remote learning for less advantaged schools or students. Goldhaber et al. (2022), for example, demonstrates a much larger impact on math scores for students in high- or mid-poverty districts. In both cases, the equity impacts are twofold. First, schools with lower resources (and students with fewer resources) are less likely to have access to in-person schooling, as noted in the previous section. Second, the *consequences* of that lack of in-person schooling are larger. This may be due to fewer resources invested by the schools in such students with remote learning, or to greater challenges that such students face with at-home learning environments.

Moving to the worldwide picture, there have been efforts in a number of countries using to study the impact of spring 2020 school closures on learning. In general, these papers either exploit variation across regions or simply look at how the test data from during the pandemic compares to prior years. Generally, studies of both types show significant test score losses. For example, using data for the Netherlands, Engzell et al. (2021) found that elementary students experienced learning losses equivalent to approximately one-fifth of a school year following eight weeks of school closures in spring 2020.

Using data for Italy, Contini et al. (2021) compare the pre-COVID and COVID cohorts of 2nd-grade students, and find the losses are largest for high-performing children with less-educated parents. Looking at students in the last year of primary school in the Dutch-speaking Flemish region of Belgium, Maldonado and De Witte (2021) find sizeable learning losses, again largest for more disadvantaged students. With data on fifth-graders in Baden-Württemberg, Germany, Schult et al. (2021) find considerable learning loss, and again particularly for low-achieving students. In a number of German-speaking cantons in Switzerland, the schools use a computer-based system for ongoing feedback in grades 3-9, which allows Tomasik et al. (2021) to look at what students were learning in the eight weeks of school before the pandemic compared to the eight weeks that schools moved to virtual learning. They found: "In the 8 weeks before the school closures, learning in primary schools took place rather uniformly and with hardly observable differences between single pupils, but during the school closures, interindividual differences skyrocketed." Their dataset did not have socioeconomic data for students, but other surveys suggested that students from higher-income families were more likely to receive tutoring when the schools were closed.

Outside high-income countries and sing data for South Africa – where the school year spans four terms between mid-January through mid-December – Ardington and colleagues (2021) learning losses for students equalled roughly 60 percent of a year of learning for students in grades 2 and 4. Given the very large disruptions in schooling throughout much of the developing world, it seems likely that there will be devastating long term consequences for student learning. However, data is not yet available to test that hypothesis.

The most important implication of these facts is the COVID-19 school closures most negatively affected the students who were most vulnerable. The result was a widening of the already large inequality gap.

Test Scores: Recovery

To help support schools respond to and recover from COVID-19, policymakers established the Elementary and Secondary School Emergency Relief (ESSER) Fund in 2020 through significant investments that were part of broader federal relief packages: the Coronavirus Aid, Relief, and Economic Security Act , known as the CARES Act, signed into law March 27, 2020; the Coronavirus Response and Relief Supplemental Appropriations Act of 2021, known as CRRSAA, signed into law on December 27, 2020; and the American Rescue Plan Elementary and Secondary School Emergency Relief, known as ARP ESSER, signed into law on March 11, 2021 (Skinner, Fountain and Dortch, 2023).

The first two funding allocations to the ESSER Fund from CARES and CRRSAA (ESSER I and ESSER II) totaled $13 billion and $54 billion, respectively. ESSER I and ESSER II allowed school districts to have flexibility in how funds were allocated, but generally targeted COVID-19 preparedness and response initiatives. The third federal relief package, however, designated over $122 billion dollars to the ESSER Fund as part of the American Rescue Plan (ARP ESSER). These funds again could support an array of initiatives, but had two important requirements: Districts needed to a) develop a plan for students to safely return to in-person instruction in schools, and b) allocate at least 20 percent of their funding specifically to address learning loss in an effort to support student recovery.

The results of these ESSER investments, and the extent of the hoped-for recovery of test scores in general, remains unclear as of summer 2023. In Halloran et al. (2023), we use state-level test score data through spring 2022 to illustrate large variation in the extent of test score recovery across 21 states over the 2021-2022 school year. Kuhfeld and Lewis (2022) explored learning loss and recovery at a national level from the 2021-22 school year based on NWEA data and found that, overall, student achievement continued to lag relative to a typical year and that declines were greater in math compared to reading. In comparing Spring 2019 to Spring 2022 outcomes across districts on state assessments, Fahle and colleagues (2022) found that test score declines were greater among districts with more remote learning during 2020-21, but that this was not the main factor and that substantial variation was observed among districts.

Overall, the literature on recovery of test scores is still underdeveloped. Unfortunately, this is another example where limited data infrastructure may affect our ability to learn from the data. Despite the very large federal expenditures, little effort has been made to document how these funds are being spent. As a result, it may be difficult (in the short or long term) to point to a particular approach to recovery which has worked better.

Enrollment

Another concern with school closures and extended amounts of time without in-person education is a drop in school enrollment. A few studies have tried to look at global enrollment changes. For a literature review, Moscoviz and Evans (2022) review 14 studies that cover 13 middle- and low-income countries looking at dropout rates (along with 29 studies looking at learning loss, with some studies doing both). They find a wide variation in dropout rates during the pandemic. Among the research they survey, the highest dropout rates are from Nigeria and Brazil; for example, school enrollment in Nigeria dropped from 90 percent in 2019 to 82 percent after schools reopened in 2020. In contrast, reported changes in dropout rates in a number of African countries were only a few percent, as in Liberia, Malawi, Senegal, Sierra Leone, South Africa, Uganda. However, even in the countries with low overall dropout rates, certain groups like those who had been about to leave school, girls, and those from households with lower incomes were often more affected. Better understanding of global school enrollment changes will be important for addressing the long-term impacts of the pandemic.

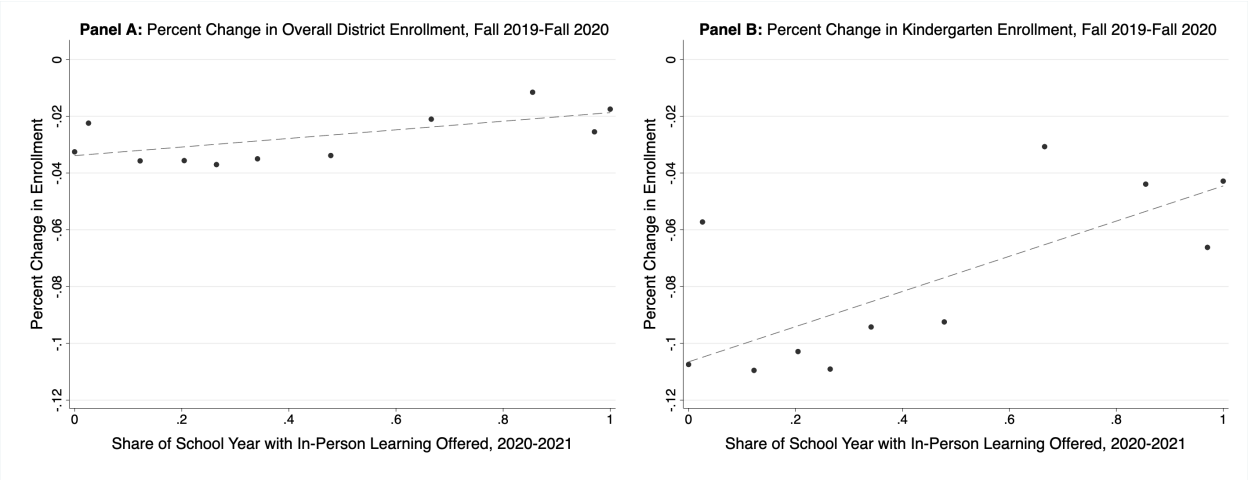
In the United States, public school enrollment was affected through several channels, including movement to private schools and homeschooling, delays in enrollment for young students, and potential drop outs for older students. With schools closed, parents may have looked for other educational options for their children, including private school and homeschooling. Looking at Michigan public school enrollment, Musaddiq et al. (2021) found enrollment declines in fall 2020 that averaged 3 percent among K-12 students and 10 percent among kindergarten students compared to the prior year—roughly similar to evidence across the country. They highlighted the heterogeneous responses based on schooling mode. Specifically, students in districts with more virtual schooling switched to private schools at higher rates, while students in districts with more in-person schooling switched to homeschooling at higher rates, reflecting parental preferences.

Because of the uncertainty around schooling modes and the pandemic in general, some parents chose to delay kindergarten, concentrating a lot of the enrollment changes in kindergarten. Combining federal data from the Common Core collected by the US Department of Education with state-level enrollment data, Dee et al. (2021) find that overall public school enrollment in the United States fell by 1.1 million students in the 2020-2021 school year. They also found that school districts offering remote-only instead of in-person instruction saw their enrollment reduced by 1.1 percentage points (from -2.6 to -3.7 percent). and these drops in enrollment were largest for kindergarten compared to other grades. Of course, kindergarten is easier to delay because it is not universally mandatory and the practice of "redshirting" (that is, starting students a year later than they were eligible to enter) is common.

We examine this correlation between drops in enrollment and schooling mode in Figure 5 by comparing Fall 2020 enrollment with Fall 2019 enrollment using data from the US Department of Education's Common Core of Data (2022). We calculate the share of the 2020-2021 school year with in-person learning offered for each district and then divide districts into 11 groups based on this share. Finally, we can see the correlation between enrollment and schooling mode by comparing the percent change in enrollment for each of these groups. In Panel A, there were overall enrollment declines across the board, but districts that offered more in-person schooling during the 2020-2021 school year had smaller drops in enrollment compared to districts that had more virtual schooling.

We also examine the correlation between only kindergarten enrollment and schooling mode in Panel B of Figure 5 because we might expect that virtual schooling would be most difficult for young students, giving parents of kindergartners a stronger incentive to look for other schooling options. We find a stronger correlation between in-person schooling share and enrollment drops across school districts. Districts with the highest amounts of virtual schooling experienced around a 10 percent decrease in kindergarten enrollment for the 2020-2021 school year compared to the previous school year, while the districts that offered the most in-person schooling only saw a decrease of around 3 to 4 percent.

Figure 5: Percent Change in District Enrollment by Schooling Mode



Source: Schooling mode data accessed via the COVID-19 School Data Hub. District enrollment data accessed via the US Department of Education's Common Core of Data (2022) from the Urban Institute's Data Explorer.

Mental Health

National data has shown a rise in youth reports of poor mental health over the past decade (CDC, 2020). However, the pandemic appears to have accelerated the decline in students' reported

mental health, with the number of high school students reporting persistent feelings of sadness or hopelessness reaching 44 percent in 2021, an increase of over 7 percentage points in just two years (up from 36.7 percent in 2019) (Jones, Ethier, and Hertz et al., 2022; CDC, 2020), along with an increase in adolescents receiving care for eating disorders (Hartman-Munick et al., 2022).

The evidence on the extent to which student mental health is linked to school closures—as opposed to other stresses of the pandemic or rising engagement with social media— is limited and mixed. For example, school closures may also have reduced school bullying. About one-fifth of high school students report being bullied in a given year, but Bacher-Hicks et al. (2021) use data on search patterns from Google Trends to suggest that remote learning *decreased* bullying in the spring of 2020, with bullying patterns returning to normal as in-person schooling returned in some cases in fall of 2020. In contrast, Hawrilenko et al. (2021) use nationally representative survey data from parents that used what is called the Strengths and Difficulties Questionnaire to assess their children in the categories of emotional problems, peer problems, conduct, and hyperactivity. School closures as opposed to in-person learning were associated with reduced mental health; in particular, the costs to mental health seemed largest for high school children.

Slightly further afield, Gassman-Pines et al. (2022) collected daily data from 645 service workers paid hourly wages, who also have a young child aged 2-7, in a large US city from February to April 2020. They study a link between childcare disruptions and child behavior and parental mood. They find that childcare disruptions were more common for families with children in remote schooling, and these disruptions worsened child behavior and parental mood.

There is a lot more work to do to understand the full impacts of the pandemic on students' mental health. It is difficult to collect data on mental health and to disentangle all of the various things that impact mental health, but it remains an important area to understand as we work to understand the full impacts of school closures on children.

The Current Situation

Although it can be tempting to take short-term estimates of COVID-related learning loss or estimates from other non-COVID disruptions and project them into long-term consequences of COVID, such temptations should be resisted. Such extrapolation is potentially so distant—say, effects on long-term wages of current middle-school students—as to be ridiculous. Moreover, how the short term translates to the long term depends on what happens in the middle term. This length of school closure is unprecedented and the recovery efforts are likely to be, as well.

That said, it seems clear from the emerging evidence that the pandemic in general and school closures in particular imposed costs of learning loss, attendance, and mental health. In the medium term, there is a continued need for research and policy to engage on remediating these consequences, both globally and within the United States.

References

Alexander, K., Pitcock, S., and Boulay, M.C., eds. (2016). *The summer slide: What we know and can do about summer learning loss.* New York, Teachers College Press.

Andrabi, T., Daniels, B., Das, J. (2020). *Human capital accumulation and disasters: Evidence from the Pakistan earthquake of 2005.* (RISE Working Paper Series No. 20/039). https://doi.org/10.35489/BSG-RISE-WP_2020/039

Ardington, C., Wills, G., and Kotze, J. (2021). "COVID-19 learning losses: Early grade reading in South Africa." *International Journal of Educational Development 86*(102480), 1–11.

Bacher-Hicks, Andrew, Joshua Goodman, and Christine Mulhern. (2021). "Inequality in Household Adaptation to Schooling Shocks: COVID-Induced Online Learning Engagement in Real Time." *Journal of Public Economics, 193* (104345), 1–17

Burbio K-12 School Opening Tracker (2021) https://about.burbio.com/school-opening-tracker

Centers for Disease Control and Prevention (CDC). (2020). *Youth Risk Behavior Survey: Data summary & trends report, 2009-2019*. https://www.cdc.gov/healthyyouth/data/yrbs/pdf/YRBSDataSummaryTrendsReport2019-508.pdf

Christian, A., Jacob, B., and Singleton, J.D. (2022). "Pandemic schooling mode and student test scores: Evidence from US states." NBER Working Paper 29497, National Bureau of Economic Research, Cambridge, MA.

Cohodes, S., and Pitts, C. (2022). "A new COVID–19 data source for answering emerging pandemic questions." CRPE. https://crpe.org/a-new-covid-19-data-source-for-answering-emerging-pandemic-questions

Contini, D., Di Tommaso, M.L., Muratori, C., Piazzalunga, D., and Schiavon, L. (2021). "The COVID-19 pandemic and school closure: Learning loss in mathematics in primary education". IZA Discussion Paper No. 14785, IZA Institute of Labor Economics, Bonn, Germany.

"Covid learning loss has been a global disaster." (2022). *The Economist.* https://www.economist.com/international/2022/07/07/covid-learning-loss-has-been-a-global-disaster

COVID-19 School Data Hub. (2021). "Community Case Rate Data by District". *Data Resources*. Available at https://www.covidschooldatahub.com/data-resources.

COVID-19 School Data Hub. (2023a). "All District Learning Model Data". *Data Resources* (Version 2/28/23). Available at https://www.covidschooldatahub.com/data-resources.

COVID-19 School Data Hub. (2023b). "All School Learning Model Data". *Data Resources* (Version 2/28/23). Available at https://www.covidschooldatahub.com/data-resources.

COVID-19 School Response Dashboard. (2021). https://covidschooldashboard.com/

Dee, T., Huffaker, E., Phillips, C., and Sagara, E. (2021). "The revealed preferences for school reopening: Evidence from public-school disenrollment". NBER Working Paper 29156, National Bureau of Economic Research, Cambridge, MA

Engzell, P., Frey, A., and Verhagen, M.D. (2021). "Learning loss due to school closures during the COVID-19 pandemic". Proceedings of the National Academy of Sciences (PNAS), 118 (17).

Fahle, E., Kane, T.J., Patterson, T., Reardon, S.F., and Staiger, D.O. (2022). Local achievement impacts of the pandemic. Education Recovery Scorecard.

Gassman-Pines, A., Ananat, E., Ii, J. F.-H., and Leer, J. (2022). *Effects of daily school and care disruptions during the COVID-19 pandemic on child mental health* (No. w29659). National Bureau of Economic Research. https://doi.org/10.3386/w29659

Goldhaber, D., Kane, T.J., McEachin, A., Morton, E., Patterson, T., and Staiger, D.O. (2022). "The consequences of remote and hybrid instruction during the pandemic." Research Report. Cambridge, MA: Center for Education Policy Research, Harvard University.

Hale, T., Angrist, N., Goldszmidt, R., Kira , B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, L., Majumdar, S., and Tatlow, H. (2021). "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)." *Nature Human Behaviour*. https://www.nature.com/articles/s41562-021-01079-8

Halloran, C., Hug, C., Jack, R., and Oster, E. (2023). "Post COVID-19 test score recovery: Initial evidence from state testing data." NBER Working Paper 31113, National Bureau of Economic Research, Cambridge, MA.

Harmey, S., and Moss, G. (2021). “Learning disruption or learning loss: Using evidence from unplanned closures to inform returning to school after COVID-19". *Educational Review*, 1-20. 10.1080/00131911.2021.1966389

Hartman-Munick, S.M., Lin, J.A., Milliren, C.E., et al. (2022). Association of the COVID-19 pandemic with adolescent and young adult eating disorder care volume. *JAMA Pediatr., 176*(12), 1225–1232. doi:10.1001/jamapediatrics.2022.4346

Hawrilenko, M., Kroshus, E., Tandon, P., and Christakis, D. (2021). The association between school closures and child mental health during COVID-19. *JAMA Network Open*, *4*(9), e2124092. https://doi.org/10.1001/jamanetworkopen.2021.24092

Heise, M. (2023). The distribution of in-person public K-12 education in the time of COVID: An empirical perspective. *Cornell Legal Studies Research Paper.* Available at https://ssrn.com/abstract=4255799 or http://dx.doi.org/10.2139/ssrn.4255799

Henderson, M.B., Peterson, P.E., and West, M.R. (2021). Pandemic parent survey finds perverse pattern: Students are more likely to be attending school in person where Covid is spreading more rapidly. *Education Next, 21*(2), 34-49. https://www.educationnext.org/pandemic-parent-survey-finds-perverse-pattern-students-more-likely-to-be-attending-school-in-person-where-covid-is-spreading-more-rapidly/

Hodgman, S., Rickles, J., Carminucci, J., and Garet, M. (2021). “District approaches to instruction in 2020–21: Differences in instructional modes and instruction time across contexts.” Research Brief. American Institutes for Research. https://www.air.org/sites/default/files/2021-07/research-brief-covid-survey-differences-instructional-modes-june-2021_0.pdf

Irwin, V., De La Rosa, J., Wang, K., Hein, S., Zhang, J., Burr, R., Roberts, A., Barmer, A., Bullock Mann, F., Dilig, R., and Parker, S. (2022). Report on the Condition of Education 2022 (NCES 2022-144). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved Apr 6 2023 from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2022144.

Jack, R., Halloran, C., Okun, J.C., and Oster, E. (2023). “Pandemic schooling mode and student test scores: Evidence from US States.” *American Economic Review: Insights, 5*(2).

Jaume, D., and Willén, A. (2019). The long-run effects of teacher strikes: Evidence from Argentina. *Journal of Labor Economics, 37*(4), 1097-1139.

Jones, S. E., Ethier, K. A., Hertz, M., DeGue, S., Le, V. D., Thornton, J., ... and Geda, S. (2022). Mental health, suicidality, and connectedness among high school students during the COVID-19 pandemic—Adolescent Behaviors and Experiences Survey, United States, January–June 2021. MMWR supplements, 71(3), 16. https://www.cdc.gov/mmwr/volumes/71/su/pdfs/su7103a1-a5-H.pdf

Kahan, J. (2020). *United States Broadband Usage Percentages Dataset*. Github Repository. https://github.com/microsoft/USBroadbandUsagePercentages

Kamenetz, A. (2020). "5 things we've learned about virtual school in 2020." *NPR News*. https://www.npr.org/2020/12/04/938050723/5-things-weve-learned-about-virtual-school-in-2020

Kuhfeld, M., and Lewis, K. (2022). Student achievement in 2021–2022: Cause for hope and continued urgency. NWEA Research Brief. Portland, Oregon: NWEA.

Lamb, J., Gross, S., and Lewis, M. (2013). "The Hurricane Katrina effect on mathematics achievement in Mississippi." *School Science and Mathematics, 113*(2), 80-93.

Leonhardt, D. (2022). "Not Good for Learning." *The New York Times.* https://www.nytimes.com/2022/05/05/briefing/school-closures-covid-learning-loss.html

Lewis, K., Kuhfeld, M., Ruzek, E., and McEachin, A. (2021). *Learning during COVID-19: Reading and math achievement in the 2020-21 school year*. Portland, Oregon: NWEA.

Maldonado, J.E., and De Witte, K. (2021). "The effect of school closures on standardised student test outcomes." *British Educational Research Journal, 48*(1), 49–94.

McCombs, J.S., Augustine, C.H., Schwartz, H.L., Bodilly, S.J., McInnis, B., Lichter, D.S., and Cross, A.B. (2011). *Making summer count: How summer programs can boost children's learning.* Santa Monica, California: RAND Corporation.

McGovern, T. (2021). *United States General Election Presidential Results by County from 2009 to 2020*. Github Repository. https://github.com/tonmcg/US_County_Level_Election_Results_08-20

Moscoviz, L. and Evans, D.K. (2022). *Learning Loss and Student Dropouts during the COVID-19 Pandemic: A Review of the Evidence Two Years after Schools Shut Down.* CGD

Working Paper 609. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/ learning-loss-and-student-dropouts-during-covid-19-pandemic-review-evidence-two-years

Munro, A., Buonsenso, D., González-Dambrauskas, S., Hughes, R., Bhopal, S., Vásquez-Hoyos, P., Cevik, M., Rubio, M., and Roland, D. (forthcoming). "In-person schooling is essential even during periods of high transmission of Covid-19." *BMJ Evidence-Based Medicine.*

Murnane, R.J., Reardon, S.F., Mbekeani, P.P., and Lamb, A. (2018). Who goes to private school? Long-term enrollment trends by family income. *Education Next, 18*(4), 58-66.

Musaddiq, T., Stange, K.M., Bacher-Hicks, A., and Goodman, J. (2021). "The pandemic's effect on demand for public schools, homeschooling, and private schools". NBER Working Paper 29262, National Bureau of Economic Research, Cambridge, MA.

National Center for Education Statistics, U.S. Department of Education. (2022a). 2022 NAEP Mathematics Assessment: Highlighted Results at Grades 4 and 8 for the Nation, States, and Districts. NCES 2022124. https://www.nationsreportcard.gov/highlights/mathematics/2022/

National Center for Education Statistics, U.S. Department of Education.. (2022b). 2022 NAEP Reading Assessment: Highlighted Results at Grades 4 and 8 for the Nation, States, and Districts. NCES 2022126. https://www.nationsreportcard.gov/highlights/reading/2022/

Oster, E., Jack, R., Halloran, C., Schoof, J., McLeod, D., Yang, H., Roche, J., and Roche, D. (2021). "Disparities in learning mode access among K–12 students during the COVID-19 pandemic, by race/ethnicity, geography, and grade level — United States, September 2020–April 2021." *MMWR Morb Mortal Wkly Rep*, *70*(26), 953–958. DOI: http://dx.doi.org/10.15585/mmwr.mm7026e2

Pane, J.F., McCarey, D.F., Kalra, N., and Zhou, A.J. (2008). "Effects of student displacement in Louisiana during the first academic year after the Hurricanes of 2005". *Journal of Education for Students Placed at Risk (JESPAR) 13*(2-3), 168-211.

Parolin, Z., Lee, E.K. Large socio-economic, geographic and demographic disparities exist in exposure to school closures. Nat Hum Behav 5, 522–528 (2021). https://doi.org/10.1038/s41562-021-01087-8

Sacerdote, B. (2012). When the saints go marching out: Long-term outcomes for student evacuees from Hurricanes Katrina and Rita. *American Economic Journal: Applied Economics*, 4(1), 109-135

Schult, J., Mahler, N., Fauth, B., and Lindner, M.A. (2021). "Did students learn less during the COVID-19 pandemic? Reading and mathematics competencies before and after the first pandemic wave". PsyArXiv.

Singer, J., Marsh, J.A., Menefee-Libey, D., Alonso, J., Bradley, D., and Tracy, H. (2022). *The politics of school reopening during COVID-19: A multiple case study of five urban districts in the 2020-21 school year.* (EdWorkingPaper: 22-605). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/0bke-pz42

Skinner, R.R., Fountain, J.H., and Dortch, C. (2023). "Education Stabilization Fund programs funded by the CARES Act, CRRSAA, and ARPA: Background and analysis". Report R47027. Congressional Research Service. https://crsreports.congress.gov/product/pdf/R/R47027

Tomasik, M. J., Helbling, L.A., and Moser, U. (2021). "Educational gains of in-person vs. distance learning in primary and secondary schools: A natural experiment during the COVID-19 pandemic school closures in Switzerland." *International Journal of Psychology, 56*(4): 566–576.

UNICEF. (2021). *National education responses to COVID-19: UNICEF Global Tracker, May 21.* (COVID-19 Page, COVID-19 Resources). Available at https://public.tableau.com/app/profile/unicefdata/viz/EduViewv1_0/home

U.S. Bureau of Labor Statistics. (2021). *County-level unemployment data (la.data.64.County)*. Washington, DC: U.S. Bureau of Labor Statistics. https://download.bls.gov/pub/time.series/la/

U.S. Census Bureau. (2020). "Nearly 93% of households with school-age children report some form of distance learning during COVID-19." Available at https://www.census.gov/library/stories/2020/08/schooling-during-the-covid-19-pandemic.html

U.S. Department of Education (ED). (2022). "National Center for Education Statistics Common Core of Data". Accessed via Urban Institute Education Data Portal (Version 0.16.0) on November 16, 2022, https://educationdata.urban.org/documentation/

van den Berg, P., Schechter-Perkins, E. M., Jack, R. S., Epshtein, I., Nelson, R., Oster, E., & Branch-Elliman, W. (2021). Effectiveness of 3 versus 6 ft of physical distancing for controlling spread of coronavirus disease 2019 among primary and secondary students and staff: a retrospective, statewide cohort study. Clinical Infectious Diseases, 73(10), 1871-1878.

von Hippel, P.T., Workman, J., and Downey, D.B. (2018). Inequality in reading and math skills forms mainly before kindergarten: A replication, and partial correction, of `Are schools the great equalizer?'" *Sociology of Education, 91*(4), 323-357.

Weber, M., and Baker, B.D. (2023). *Does school funding matter in a pandemic? COVID-19 instructional models and school funding adequacy*. (EdWorkingPaper: 23-736). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/406b-hy46