Learning Loss and Student Dropouts during the COVID-19 Pandemic: A Review of the Evidence Two Years after Schools Shut Down

Laura Moscoviz and David K. Evans

Abstract

Following the outbreak and spread of COVID-19 in 2020, schools around the world closed for significant periods of time. Many scholars provided projections of the likely impacts on educational outcomes, with potentially dire impacts on learning loss and—especially in low-income contexts–dropout rates. Now, two years after schools began shutting down, we identify 40 empirical studies directly estimating student learning loss (29 studies) or dropout rates (15 studies) for students in pre-primary, primary, or secondary school in countries at any income level. Most estimates of average learning loss are negative, although–especially in low- and middle-income countries–this is not always the case, and average losses are not as significant as some models predicted. Furthermore, learning loss was consistently much higher among students with lower socioeconomic status in high-, middle-, and low-income countries, even in contexts with little or no average learning loss. In other words, the pandemic consistently boosted learning inequality. Dropout rates ranged dramatically, from under 1 percent to more than 35 percent, with much higher rates for older students, suggesting that pandemic school closures–together with other pandemic-related shocks–may have curtailed many adolescents' schooling careers. In some countries (e.g., Kenya and Nigeria), girls are at higher risk of dropping out. The vast majority of studies report results for students of primary school age (83 percent of studies), with fewer reporting results for students of secondary school age (45 percent) and even fewer studies (8 percent) for younger students.

Keywords: COVID-19, learning loss, review, dropout rates

JEL codes: I14, I15, I20, I24, I25, O15

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1. Introduction

The COVID-19 pandemic has had dramatic impacts across every aspect of people's lives. For children and youth, the largest disruption beyond direct health impacts may have been the extended school closures associated with the pandemic. Schools closed completely in 19 out of every 20 countries around the world, for a median of 17 weeks (UNESCO 2021). In some countries, such lengthy closures added up to a major proportion of youth's expected total years of schooling: as much as 10 percent in Chad and 16 percent in South Sudan (Evans et al., 2021).[1] Learning loss during regular, scheduled school closures is already a well-documented challenge in both high-income and low-income countries (Cooper et al., 1996; Slade et al., 2017); the pandemic introduces additional challenges in that it was unexpected and combines school closures with additional shocks, such as adverse health impacts in the household, either from COVID-19 (Kidman et al., 2021) or from other illnesses (Jain and Dupas, 2022), and economic impacts through parental job loss (Jain et al., 2020; Saenz and Sparks, 2020). Taken together, it should be unsurprising that youth may have lost some of the academic skills they had previously acquired and missed out on gaining new ones. Evidence from previous crises backs this up. For example, four years after an earthquake in Pakistan, household and adult outcomes had recovered but learning losses endured (Andrabi, et al., 2021). Beyond learning loss, evidence during a previous health crisis suggests that dropout rates rose dramatically (Bandiera et al., 2019).

Soon after schools began closing, researchers and organizations began simulating potential learning loss. Kaffenberger (2021) estimated that a three-month school closure could translate into as much as a year of learning lost. Azevedo (2020) forecast a global increase in "learning poverty" (i.e., children unable to read with comprehension by age ten) of about ten percentage points (from 53 to 63 percent); later estimates predicted significant lost earnings as a result (Azevedo et al., 2021). Models based on Sub-Saharan African data predicted up to almost three years of learning loss (Angrist et al., 2021a; Sabates et al., 2021), with impacts enduring for many years to come (Gustafsson and Nuga Deliwe, 2020). Organizations also predicted that some students would not return to schools when they reopened. 23.8 million students were estimated to be at risk of dropping from school globally (UNESCO, 2020). Concerns were also raised for the most vulnerable children, especially girls that might be forced into early marriage and pregnancy during school closures.[2]

Two years after schools began closing, dozens of studies in low-, middle-, and high-income countries have estimated the short-term impact of the pandemic. In this review, we bring together 29 studies on learning loss and 15 studies on dropout rates, including studies

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[1] The effectiveness of school closures on the spread of the pandemic has been debated. Some studies find a positive association between school closures and a decrease in COVID-19 incidence and mortality (Neidhöfer and Neidhöfer, 2020; Auger et al., 2020) while others find no impact of reopening schools on disease spread (Lichand et al., 2022a) or highlight the limited impact of school closure to prevent the spread of the COVID-19 outbreak (Abdollahi et al., 2020; Iwata et al., 2020; Kurita et al., 2021; Fukumoto et al., 2021).

[2] In the South African district of Gauteng, 23,000 teen pregnancies were reported between April 2020 and March 2021 (Gauteng Department of Health, 2021).

covering both. We find that children's learning has been negatively impacted by the COVID-19 crisis in most studies. The evidence for average learning loss is more consistent in high-income countries, but in virtually every case (in both high-income and low-income settings), learning loss is concentrated among the poorest children. We observe wide variation in dropout estimates across countries, ranging from 0.14 percent to 35 percent, likely underlining differences in contexts, both in baseline dropout rates and other schooling norms. Dropout rates are consistently higher for adolescent students. Our findings suggest value in targeting learning remediation efforts towards the poorest students and return-to-school efforts among adolescents. We complement earlier synthesis work on education by Donnelly and Patrinos (2021), completed when only eight studies on learning loss and one study on dropout rates were available, all from high-income countries. We also complement broader synthesis research on children's and adolescents' well-being (such as Baird et al., 2021).

2. Methods

2.1 Search and review strategy

We searched for studies published between September 2020 (6 months after the onset of COVID-19-related school closures) and February 2022 that report empirical estimates of the dropout rate, learning loss, or both. We focus on basic education: i.e., we include pre-primary, primary, and secondary school estimates, but we exclude studies at the post-secondary level. We did not restrict the search to any specific geographical area. We only reviewed English-language publications. We included both peer-reviewed articles and gray literature (e.g., reports or working papers). We excluded simulations or forecasting studies that use predictive modeling to forecast learning loss and dropout rates. We used the search terms "(learning OR learning loss OR dropout OR school participation OR school attendance) AND (COVID-19)" in the title, keywords, and abstract of the study. We reviewed papers from Google Scholar and PubMed, and we complemented that with snowball sampling (i.e., identifying studies cited in other studies) and studies that came to our attention via social media to find studies that did not come up in the original search. In total, we identified 40 studies that match the above inclusion and exclusion criteria.

For each study, we reviewed the title, abstract, and full text to extract and code the following data: year of publication, country of intervention, income level, sample representativeness (national or not), education level of reported outcomes (pre-primary, primary, and secondary), key results (average effect in terms of learning and dropout rate), and heterogeneity across groups (if reported).

2.2 Definitions

"Learning loss," defined as the difference between how much students know versus how much they would have known in the absence of school shutdowns, includes two elements:

forgotten learning and foregone learning (Angrist et al., 2021a). Forgotten learning is the deterioration of skills that students gained before school closures. Foregone learning is the learning that students would have gained but did not because of educational interruptions. Net measures such as the ones in the reviewed studies combine both of these, but the two elements may call for distinct policy responses: e.g., forgotten learning may be recovered more quickly than foregone learning (Christodoulou 2021). Most studies of learning loss in our sample use a simple counterfactual, comparing test scores after school closures to test scores in a recent year before school closures. One study draws on a longer time trend in test scores (Gambi and De Witte 2021). These are crucial first estimates for just-in-time policymaking, but more sophisticated analysis will continue extrapolating from past trends—rather than simply the most recent measured level—or comparing similar groups of students in areas with shorter shutdowns to those in areas with longer shutdowns.

For "dropout rates," in most of the studies that we review, students, parents, or schools identify how many students have "dropped out" as they understand the term. Some studies report a simple rate, lacking even the simple counterfactual in most learning loss studies. When absolute rates of dropout are low, one might assume that the impact of COVID school closures has not been large in absolute terms. But with higher rates, the importance of separating the COVID effect from standard year-to-year dropouts grows. Other studies in our sample compare dropout rates to those in previous years; we discuss those in the results.

As Lichand et al. (2021) highlight, even defining dropout rates can be complicated. Some education systems automatically re-enroll students from one year to the next, so students may not be listed as dropouts despite not having returned to school. For example, official statistics listed dropouts in São Paulo state as 0 in 2021. As an alternative, in that study the researchers focus on "dropout risk," defined as high if students had no language or math grades on record over the course of an entire school quarter and low if they had any grades on records. They then use the increase in dropout risk to scale past estimates of dropout rates in the context of the pandemic. Hopefully, an increasing number of future studies will draw on the best methods available to illuminate the challenges of dropout as a consequence of this and future crises.

2.3 Characteristics of the sample

The studies in our sample provide evidence on learning loss or dropout in 27 countries (Figure 1). Half of the studies we identified report outcomes from high income countries, all focusing on learning loss (Table 1).[3] The focus on learning loss in these countries is unsurprising, as base dropout rates are lower, and school attendance norms may be stronger in high income countries. The highest concentration of evidence comes from the United Kingdom (with 10 percent of studies in our sample) and from the United States and South Africa (8 percent each). The studies that measured learning loss conducted

[3] Higher income countries tended to have shorter full, countrywide school closures, although there is no significant relationship between income per capita and partial school closures (Appendix Figure A1).

measures between 2020 and 2021, with the vast majority later than August 2020 (Table 1). The full list of studies and estimates are included in Appendix Table A1 (learning loss) and Appendix Table A2 (dropout).

The effects of the pandemic on educational outcomes have mostly been estimated on primary school level children (94 percent of studies in high-income countries and 78 percent of studies in low- and middle-income countries). We find only 3 studies covering the preschool level (Figure 2). This is concerning, as previous literature has shown that the years from birth to 5 years old are a critical period for children's development and that we need to understand the short- and longer-term effects of education disruption during the pandemic for early graders (Trawick-Smith, 2014; Bakken et al., 2017).

Figure 1. From what countries do we have evidence on learning loss or dropout rates?

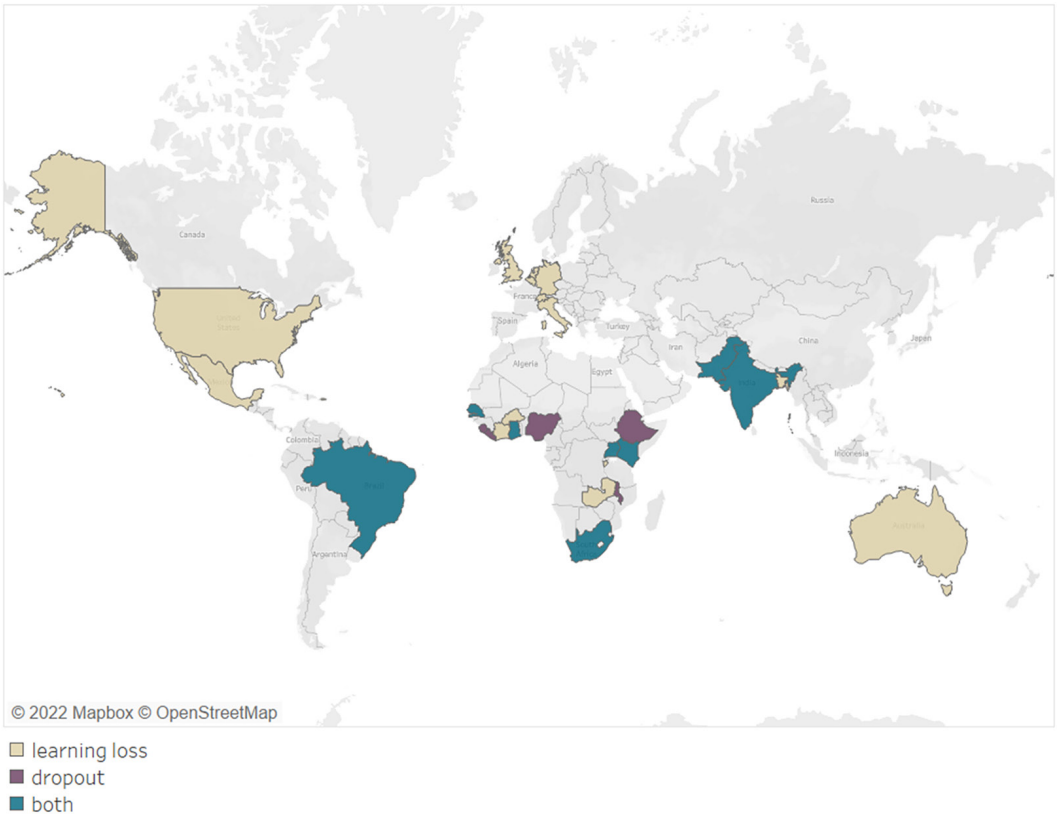
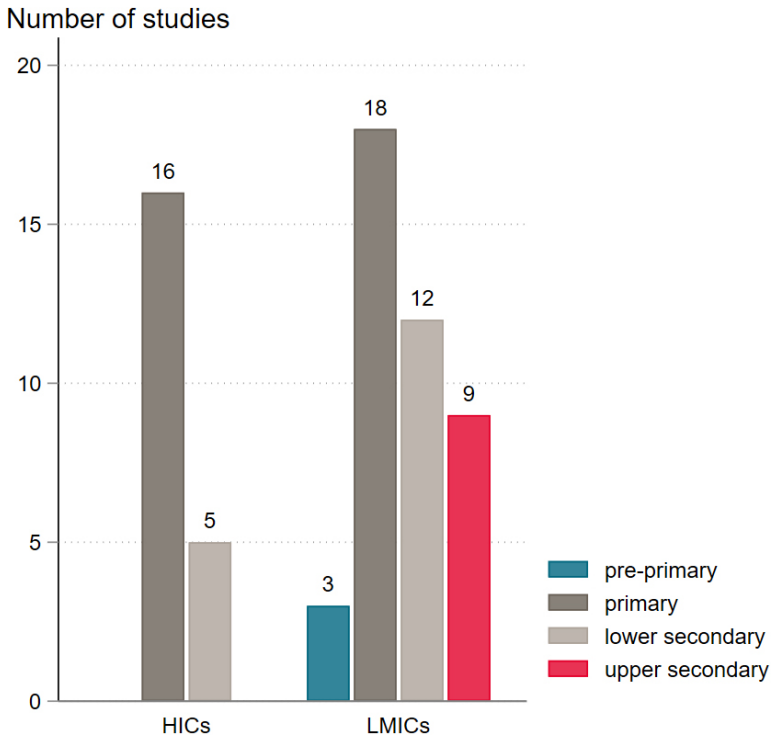


Table 1. Where do the studies come from?

Country Classification	Learning Loss	Dropout Rate	Studies Covering Both	Total
High income	17	0	0	17
(percent of studies)	(68)	(0)	(0)	(43)
Low & middle income	8	11	4	23
(percent of studies)	(32)	(100)	(100)	(58)
Total	25	11	4	40
(percent of studies)	(100)	(100)	(100)	(100)

Figure 2. Learning loss and dropout evidence is reported for pre-primary, primary and secondary school aged children



Note: The same study may appear multiple times in this figure if it covers more than one education level.

3. Results

3.1 Learning loss

3.1.1 Average effects

On average, learning fell short relative to where it normally would be in high-income countries (Appendix Table A1). High-income countries are an important case because those are settings where the conditions for distance learning may have been the best, with broader access to the internet and the hardware for students to learn from home. For example, one study used national exam data from the Netherlands before and after an eight-week school closure to estimate the impact on 8- to 11-year-old students. Learning decreased by 0.08 SD, roughly the amount that researchers estimate that students normally learn during the period that schools were closed (Engzell et al., 2021). In Belgium, primary school students taking standardized tests in 2020 performed worse in both math and language than those in previous years, after a nine-week COVID-induced school closure (Maldonado and De Witte, 2020). In 2021, the deficits grew larger in language but stayed constant in math (Gambi and De Witte, 2021). Although high-income countries do have higher penetration of internet and hardware, these are still not universal: in Belgium, there were reports that

a large minority of students could not be reached for distance education and that many students lacked laptops or a quiet place to study at home (Maldonado and De Witte, 2020). In Germany, fifth-grade students in late 2020 (after nine weeks of school closures) had lower test scores (in reading and math), although the effects were smaller than those in Belgium (Schult and Lindner, 2022). In Italy, fourth-grade students' math scores fell about 0.19 SDs after 15 weeks of school closures (Piazzalunga, 2021). A computer-based assessment of both primary and secondary school students in Switzerland found a slowdown in learning among primary-age students but not secondary students over the course of an eight-week shutdown (Tomasik et al., 2020). Studies in the United Kingdom—which records the largest number of publications estimating student learning loss (6 studies)—consistently find learning loss, ranging from 0.05 SDs to 0.17 SDs (plus some studies that report other units—see Appendix Table A1), at both the primary (Blainey and Hannay, 2021; GL Assessment, 2021; Juniper, 2021; Renaissance Learning & Education Policy Institute, 2021; Rose et al., 2021) and to some degree at the secondary level (Renaissance Learning & Education Policy Institute, 2021). In the United States, studies likewise find learning loss consistently, both in national samples (Kuhfeld et al., 2020; Kuhfeld et al., 2022), a subnational sample from 22 states (Domingue et al., 2021), and in a state sample for California (Pier et al., 2021).

We observe a more mixed pattern in low- and middle-income countries (Appendix Table A1), with more studies showing no learning loss. There is some evidence of stronger effects in secondary school than we see in high-income countries, consistent with what we might expect in contexts with reduced access to education technology. A study among lower secondary girls (grades 7 and 8) in rural Bangladesh found learning loss of 5 to 6 percent, although students were assessed on third grade content, so that could lead to underestimates relative to measures of more recently acquired content (Amin et al., 2021).[4] In contrast to the more muted learning losses at the secondary level in high-income countries, a study in Brazil comparing secondary students' learning in 2020 relative to 2019 found a drop in test scores of 0.32 SDs, as if students had learned roughly one quarter of what they normally learned in face-to-face schooling (Lichand et al., 2021). A comparison of household surveys in 2019 and 2021 in Mexico showed that children aged 10 to 15 years old experienced learning loss of between 0.34 and 0.45 SDs in reading and between 0.62 and 0.82 SDs in math (Hevia et al., 2022).

Among younger students, a volunteer-implemented survey in Pakistan found little impact of learning loss in reading but some in math for Grade 3 (but not so much Grade 5) students.[5] In South Africa, after a ten-week full school closure in 2020 (but more than double that in the early grades of primary school) and a delayed school re-opening in 2021, a survey of early grade primary students' reading ability suggests that as of early 2021, those students had only learned a quarter of what they normally would have learned in home tongue language

[4] Alternatively, classrooms in many low- and middle-income countries have students with content mastery far below grade level and so third grade content may not be too low for some students.
[5] Two rounds of phone surveys in Pakistan—both conducted during the pandemic—indicate no significant differences in learning loss (Crawfurd et al., 2021a).

and half of what they learned in English (Shepherd et al., 2021).[6] In complement to these findings, longitudinal assessments in three provinces of South Africa that were poorly performing at the outset of the pandemic found that grade 2 and grade 4 students learned less than half of what their pre-pandemic peers were learning (Ardington et al., 2021). And in Uganda, the results are bimodal, with both more students achieving full competence in reading ability but also more students in the non-reader stage (i.e., they could not read or sound out letters of the alphabet). The latter group roughly doubled between 2018 and 2021 (Uwezo Uganda 2021; Sandefur 2022). In a series of surveys with fifth- or sixth-grade students, depending on the country—Burkina Faso, Burundi, Côte d'Ivoire, Senegal, and Zambia–there was generally no evidence of learning loss (UNESCO Institute for Statistics, 2022).[7]

A non-representative survey of students in grades 4 through 8 in Kenya observed learning loss in math skills for just over 50 percent of students, with the highest concentrations in the younger grades (Whizz Education, 2021). A study in India finds lower literacy rates than ten years ago, but the window is so broad that attributing the change to COVID-related school shutdowns is difficult (SCHOOL, 2021).

Because studies report learning losses in a wide variety of units, comparing across studies is a challenge. Appendix Table A1 lists how long schools had been closed at the time of the assessments reported. There is no obvious pattern beyond the fact that most studies report learning loss, suggesting that other factors may drive differences across settings, such as the relative productivity of education that students receive when schools are open, the quality of alternative learning options that students had access to while schools were closed, and even the quality of assessments.

3.1.2 Heterogeneous effects

Consistently, across high-, low-, and middle-income countries, learning loss was concentrated among poorer students. In the Netherlands, losses were as much as 60 percent higher for students whose parents had less education (Engzell et al., 2021), with parallel results in Italy (Piazzalunga, 2021); other work from the same country suggests the same is true for other indicators of vulnerability, such as poverty (Haelermans et al., 2022). In Belgium, inequality within schools rose by between 17 and 20 percent (depending on the subject), with larger learning losses in schools with more disadvantaged students (Maldonado and De Witte, 2020). In the United Kingdom, disadvantaged children benefiting from pupil premium or free school meals were more likely to experience a larger decline in learning (Rose et al., 2021; Renaissance Learning & Education Policy Institute, 2021; Blainey & Hannay, 2021). In the United States, achievement gaps between low and high poverty schools widened by at least 0.10 SD (Kuhfeld et al., 2022). Even in Australia, where researchers observed no average learning loss among primary school students between 2019 and 2020,

[6] Even once schools reopened in South Africa, students attended on a rotating basis in most schools.
[7] The same study measured learning levels in Kenya but did not compare those to pre-pandemic levels.

student achievement growth was 2 months shorter among the least advantaged schools (Gore et al., 2021).

In Mexico, low socioeconomic status students lost more than twice as much reading ability as high socioeconomic status students (Hevia et al., 2022). In Bangladesh, learning loss was more than double among girls in the poorest 40 percent of the sample, relative to better off girls (Amin et al., 2021). In Ghana, the learning gap for primary school students widened for the poorest students in both literacy and math, according to phone-based assessments (Wolf et al., 2021). In Uganda, poorer children were much more likely to have no reading ability (Sandefur, 2022). In Pakistan, the poorest children appeared to be falling behind in subtraction skills, whereas the richest children were not (Crawfurd et al., 2021b).

Most studies find little difference between boys and girls. Learning loss was similar for boys and girls in the Netherlands (Engzell et al., 2021; Haelermans et al., 2022), for math scores among kindergartners in Ghana (Wolf et al., 2021); and for most students studied in Mexico (Hevia et al., 2022). Likewise, there was no gender differential in learning loss in Uganda (Sandefur, 2022). Early evidence from a simple, two-item assessment in Pakistan suggested that boys may actually be losing more learning than girls (Crawfurd et al., 2021b).

3.2 Dropout rates

We observe high variation in dropout rates across low- and middle-income countries (Figure 3). (The full list of studies and estimates are included in Appendix Table A2.) But we consistently observe higher dropout rates among older children, and there is some evidence that girls tend to drop out more than boys. Some studies report simple dropout rates, without a counterfactual (e.g., the dropout rate previous to COVID), but others provide at least some evidence of how much the rate has changed over time. Figure 3A reports dropout rates; Figure 3B reports changes in dropout rates. 8 of the 14 studies in our sample report dropout rates of under 5 percent: in order of rising dropout rates, that includes South Africa (0.4 percent for primary aged children between 8 and 12 years old—Gustafsson, 2021), Uganda (0.7 percent across school ages, with higher rates of 3–4 percent for 15- and 16-year olds—Uwezo, 2021), Senegal (1.6 percent among students across primary and secondary—Mbaye et al., 2021), Ghana (2 percent on average across grades, but with much higher rates in terminal grades of education cycles, e.g., more than 5 percent for the last year of primary and more than 8 percent for the last year of lower secondary—Abreh et al., 2021), Liberia (2.3 percent across school ages—Caballero et al., 2021), Sierra Leone (3 percent among primary school students—Crawfurd et al., 2021a; 3.1 percent across school ages—Caballero et al., 2021), Ghana (3.7 percent across school ages—Caballero et al., 2021), Malawi (4.3 percent across school ages, with the highest rates for secondary school children—Kadzamira et al., 2021), and India (4.6 percent across school ages—ASER India, 2021). For the Ghana 2 percent estimate and for Senegal, these rates were very similar to the rates in the year previous to the pandemic (Figure 3B). In Malawi, the 4.3 percent rate represented an increase, from around 1.2 percent before the pandemic. Beyond these already relatively low numbers, three-quarters of the students who had dropped out in the survey in Ghana (3.7 percent estimate), Liberia, and Sierra Leone reported plans to re-enroll

(Caballero et al., 2021).[8] In South Africa, Gustafsson (2021) also reports a decline of 2.3 percent in first-time enrollment among first graders in 2021.

Studies in three countries report rates between 5 and 10 percent, including two reporting large changes. In rural Kenya, researchers observed a tripled risk of dropout among secondary school aged girls, rising from 3.2 percent in pre-pandemic years to 9.4 percent. The risk of getting pregnant prior to completing secondary school also doubled. Girls experienced more than a tripling of school transfers, which may further affect learning (Zulaika et al., 2022). Among students across school ages in South Africa, we also observe a tripling of risk, with the highest dropout rates among the poorest households (Spaull et al., 2021). A study in Pakistan found 6 percent of students aged 6 to 16 had dropped out in 2021, but the total number of out-of-school students was very similar to that in 2019 (16 percent in 2021 versus 14 percent in 2019), suggesting that the impact of COVID-19 may not have been substantial (ASER Pakistan, 2021).

The two studies that report the highest dropout rates in our study are from Nigeria and Brazil. In Nigeria, school enrollment dropped from 90 percent in 2019 to 82 percent in 2020 (after schools reopened). But these results are highest among adolescents, with a roughly 5 percent drop for children aged 5 to 11 versus an effect double that size for youth aged 15 to 18 (Dessy et al., 2021).

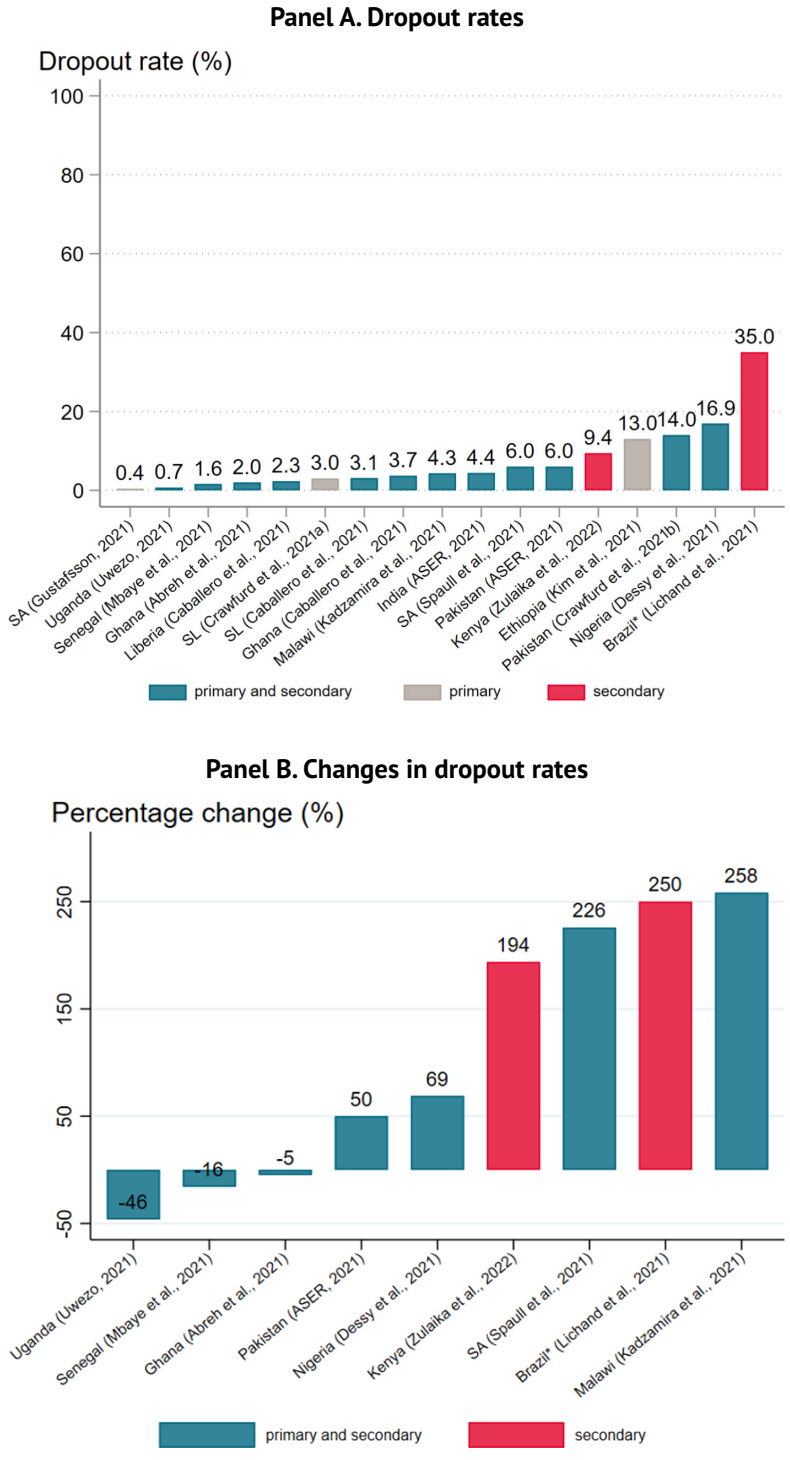
In São Paulo state, Brazil, the proportion of secondary school students at high dropout risk more than tripled, rising from under 2 percent to more than 6 percent, with the highest impacts on students in seventh and eighth grade (Lichand et al., 2021). Their proxy on dropout risk is highly correlated to actual dropouts (with a Spearman correlation coefficient, or ρ, equal to 0.7). Accounting for this relationship and the fact that dropouts in São Paulo state secondary schools before the pandemic were 10 percent yields an estimated potential dropout rate of 35 percent among lower and upper secondary students.

The data suggest that girls in Sub-Saharan Africa may be particularly vulnerable during school disruptions. In Kenya, where children remained out of school for six months, Zulaika et al. (2022) find the risk of pregnancy doubled among adolescent girls. Adolescent girls were also more likely to report undesired sexual encounters. In the regions of Nigeria where child marriage is more prevalent (the northwest of the country), adolescent girls' enrollment was much more affected than that of boys (Dessy et al., 2021). In Malawi, while girls and boys did not have statistically significantly different dropout rates, the reasons were different: marriage and pregnancy were cited as the main reasons for girls to drop out, whereas boys did not re-enrol because of financial constraints (Kadzamira et al., 2021). These results align with previous evidence from Sub-Saharan Africa that adolescent pregnancies increase after

[8] In high income countries, the closest we identify to evidence on dropout is from the state of Washington, where we observe reduced primary school enrollment by 3 percent compared to 2019 (Tuchman & Heyward, 2021). Researchers cite anecdotal evidence that this may be attributed to a mix of parents delaying kindergarten enrollment during the pandemic and parents switching students to virtual or home schooling.

emergency crises and that this is associated with school dropout (Bandiera et al., 2019; Elston et al., 2017; Grant & Hallman, 2008; Stoner et al., 2019).

Figure 3. Dropout rates and changes in dropout rates in the COVID-19 era



Notes: This figure reports dropout rates and percentage change in dropout rate when available. The full list of studies and rates are included in Appendix Table A2. *Dropout rate for Sao Paulo State only.

4. Discussion

4.1 How do these estimates stand up against the predictions?

The vast majority of studies in our sample document that learning loss has taken place, but average learning loss may have fallen short of predictions. Rather, the observed learning loss is concentrated among the most vulnerable children. Comparing the predictions to the observed experience can be complicated due to differing samples, but as an example, in Bangladesh, where schools closed for more than a year, Rahman & Sharma (2021) predicted that students could lose between 0.5 and 0.9 years of learning adjusted schooling (with optimistic, intermediate, and pessimistic models based on school closure length) while empirical results from Amin et al. (2021) show that girls' test scores in rural Bangladesh declined by just 5–6 percent compared to previous years. In Uganda, Angrist et al. (2021a) modeled a scenario where children would lose between 12 and 13 correct words per minute in reading because of school closures. Similarly, Cummiskey (2021) predicted that Ugandan students' learning levels would likely remain at the same level as students in the middle or close to the end of the previous grade. These predictions contrast with empirical results from Uwezo Uganda (2021) that find no learning loss on average in 2021 but rather a concentration of learning loss among the lower performing students compared to pre-pandemic. While we do not observe specific projections for other countries that did not report learning loss (e.g., Burkina Faso, Burundi, Côte d'Ivoire, and Senegal), the lack of observed impacts certainly runs contrary to expectations from global projection models (e.g., Azevedo 2020 or Kaffenberger 2021).

However, while most projections did not focus on losses for the poorest students, this is where studies consistently show adverse, often large impacts. In one case, Wolf et al. (2021) find in Ghana that the learning gap between primary school students from rich and poor backgrounds has widened. These results align with predictions from Sabates et al. (2021), estimating larger learning loss for Ghanaian children who are less likely to receive parental support and home learning resources.

4.2 How effective were interventions to curb learning loss or dropouts?

The estimates we have synthesized above suggest that there has been extensive learning loss, particularly among the most vulnerable students. Most countries in the world implemented some sort of distance learning intervention to curb learning loss or otherwise keep students connected with the education system (Muñoz-Najar et al., 2021), and many teams of researchers remain in the process of evaluating how effective those efforts have been (World Bank, 2021; GDN Channel 2021).

While the systematic search underlying this review focused on learning loss, some studies on interventions to curb the loss have come out, which we briefly discuss here. This list is focused on low- and middle-income countries and is likely not comprehensive. Most studies to date are of supplementary interventions, beyond the standard government offer

of internet, radio, or television lessons.[9] For example, in Brazil (Goiás state), text messages to secondary school students or their parents encouraging students to engage in remote learning activities and to stay enrolled in school reduced learning loss on average, but also increased learning inequality. Dropout rates did not change at conventional levels of statistical significance (Lichand et al., 2022b). Several other studies examined the impact of phone-based tutoring. In Botswana, sending text messages to households with simple math problems and then following those up with phone calls with live instructors boosted learning by 0.12 standard deviations (Angrist et al., 2021b). In Sierra Leone, text messages reminding students to listen to the government radio broadcasts coupled with phone calls from teachers to go over the content had no impact on learning, albeit some impact on children's and parents' engagement in learning activities (Crawfurd et al., 2021a). In Kenya, text messages with practice math problems to students in primary school, coupled with brief calls from teachers to see if students had done the problems, had no impact on learning, and adding longer phone calls with more instruction actually led to lower student test scores (Schueler & Rodriguez-Segura, 2021). Phone calls to provide tutoring in language and math to primary school students in Bangladesh reported positive impacts on learning outcomes (Hassan et al., 2021). These widely mixed results from somewhat similar interventions (all involving telephone tutoring) mean that it will take time to unpack why some interventions worked better than others, beyond the fact that contexts—including baseline student performance—will vary. One candidate explanation is how well phone-based instruction was targeted to actual student learning levels (as opposed to simply following the radio or TV curriculum). Samples may also differ across studies.

5. Conclusion

In this review, we identify 40 studies that document learning loss, dropout, or both. We find largely consistent evidence of average learning loss across countries, with poorer students performing worse. Dropout rates vary dramatically across settings but are highest among older children. With the largest learning loss concentrated among the poorest students, even in lower income settings, interventions to remediate should likely focus on those students who have fallen behind, drawing on previous successful experiences remediating students (e.g., Banerjee et al., 2017; Duflo et al., 2021), rather than broad-brush interventions like having an entire cohort repeat a school year or extending the school year for all students.

There is much left to learn. While school closures were implemented around the world, we identified measures of learning loss or dropout from only 14 percent of countries. Large swaths of Latin America, Africa, and Asia lack systematically reported data on

[9] One study in China compared three middle schools, one that offered no online educational support, a second that offered a locally managed online platform, and a third that offered online recordings of "the highest quality" teachers (i.e., not from the local school). Researchers find 0.22 standard deviations higher learning in the two schools that offered online learning, with the highest results for the "highest quality" teachers intervention (Clark et al., 2021).

either outcome. We identified very little data at the pre-primary level. The vast majority of our estimates are from middle-income and high-income countries, such that we know less about outcomes in low-income countries. Moving forward, evidence on the trajectory of recovery across a wide range of countries will be important, together with the impact of interventions and policies to ensure that children and youth continue both to learn and to benefit from other aspects of schooling.

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Appendix Tables and Figures

Table A1. Estimates of learning loss

Country	Income Level	Short Reference	Months Closed Before Assessment	Date of Assessment	Average Effect	National Sample	Heterogeneity Analysis
Australia	HIC	Gore et al. (2021)	4.25	2020	Math: 1.65 adjusted mean difference (not significant) Reading: 1.15 adjusted mean difference (not significant)	No	Yes
Bangladesh	LMIC	Amin et al. (2021)	15.5	July 2021	6 percent learning loss for girls (significant)	No	Yes
Belgium	HIC	Maldonado & De Witte (2020)	4	June 2020	Math: −0.19 SD (significant) Dutch: −0.29 SD (significant)	No	Yes
Belgium	HIC	Gambi & De Witte (2021)	6.75	May–June 2021	Math: −0.11 SD (significant) Dutch: −0.24 SD (significant)	No	Yes
Brazil	LMIC	Lichand et al. (2021)	5.75	2020	Math and Portuguese: −0.32 SD (significant)	No	NA
Burkina Faso	LMIC	UNESCO Institute For Statistics (2022)	3.25	Mid 2021	Reading: +3.2pp (not significant) Math: +5.8pp (significant)	Yes	Yes
Burundi	LMIC	UNESCO Institute For Statistics (2022)	0	Mid 2021	Reading: −0.2 (not significant) Math: −3.5 (not significant)	Yes	Yes
Côte d'Ivoire	LMIC	UNESCO Institute For Statistics (2022)	3.25	Mid 2021	Reading: +0.4 (not significant) Math: +1.4 (not significant)	Yes	Yes
Germany	HIC	Schult et al. (2022)	3.75	2020	Reading: –0.07 SD (significant) Operations: –0.09 SD (significant) Numbers: –0.03 SD (significant)	No	Yes
Ghana	LMIC	Wolf et al. (2021)	5	2020	Reading and Math: 0.2–0.3 SD gap between disadvantaged children and others (significant)	Yes	Yes
India	LMIC	SCHOOL (2021)	17	August 2021	Literacy rate was 66–74 percent in 2020 vs 88–98 percent in 2011	No	NA
Italy	HIC	Piazzalunga (2021)	3.75	October 2020	Math: –0.19 SD (significant)	No	Yes
Kenya	LMIC	Whizz Education (2021)	9.25	between October 2020 and March 2021	Math: −3.5 months lost	No	NA

Country	Income Level	Short Reference	Months Closed Before Assessment	Date of Assessment	Average Effect	National Sample	Heterogeneity Analysis
Mexico	LMIC	Hevia et al. (2022)	14.5	May 2021	Reading: 0.34–0.45 SD (significant) Math: 0.62–0.82 SD (significant)	Yes	Yes
Netherlands	HIC	Engzell et al. (2021)	2.5	2020	−0.08 SD (significant)	Yes	Yes
Netherlands	HIC	Haelermans et al. (2022)	2.5	end of 2019/2020 compared to beginning of 2020/2021	Reading: −0.14 SD (significant) Spelling: −0.15 SD (significant) Math: −0.21 SD (significant)	Yes	Yes
Pakistan	LMIC	Crawfurd et al. (2021b)	13.75	February 2021	No significant change over time	No	Yes
Pakistan	LMIC	ASER Pakistan (2021)	13.75	March–April 2021	Change in class [X] students able to do [Y] in 2019–2021 • Class 3, read local language: −1 percentage point (pp) • Class 5, read: −2 • Class 3, do 2-digit division: −10 • Class 5, do 2-digit division: −3	Yes	NA
Senegal	LMIC	UNESCO Institute For Statistics (2022)	5.25	Mid 2021	Reading: −1.4 (not significant) Math: −0.6 (not significant)		
South Africa	LMIC	Shepherd et al. (2021)	12	February–March 2021	Home Language: 76 percent loss English as a First Additional Language: 48 percent loss	No	Yes
South Africa	LMIC	Ardington et al. (2021)	4.75	2020	In grade 2, 70 percent of a year of learning was lost (significant). in grade 4, 62–81 percent of a year of learning lost (significant).	No	Yes
Switzerland	HIC	Tomasik et al. (2020)	1.5	January–May 2020	Significant for primary school pupils (mean learning slope = 0.018 during school closure vs 0.42 during in-person learning)	No	NA
Uganda	LMIC	Uwezo Uganda (2021)	18.25	August–September 2021	Literacy and numeracy: +6.1 percentage points (2021 vs 2018)	Yes	Yes

Country	Income Level	Short Reference	Months Closed Before Assessment	Date of Assessment	Average Effect	National Sample	Heterogeneity Analysis
United Kingdom	HIC	Rose et al. (2021)	4.5	November 2020	Reading: −0.17 SD (significant) Math: −0.14 SD (significant)	Yes	Yes
United Kingdom	HIC	Renaissance Learning & Education Policy Institute (2021)	4.5	October 2020	Reading: 1.6–2 months lost Math: 3 months lost	Yes	Yes
United Kingdom	HIC	Blainey & Hannay (2021)	4.5	November–December 2020	Math: between −0.09SD and −0.02SD Reading: between −0.17 SD and −0.05SD	Yes	Yes
United Kingdom	HIC	GL Assessment (2021)	4.5	September–October 2020	Math (primary): −6.6 pts (significant) Math (secondary): −4.0 pts (significant) Reading (primary): −3.4 pts (significant) Reading (secondary): −2.9 pts (not significant)	Yes	Yes
United Kingdom	HIC	Juniper (2021)	4.5	September 2020	Math: −21.4 pp Writing: −18.1 pp	Yes	Yes
United States	HIC	Pier et al. (2021)	14.5	Winter 2021	"There has been significant learning loss in both English Language Arts and Math, with students in earlier grades most affected."	No	Yes
United States	HIC	Domingue et al. (2021)	4.75	2020	Grade 2: −7.3 Words Per Minute (WPM) (significant)	No	Yes
United States	HIC	Kuhfeld et al. (2020)	4.75	Fall 2020	Math: −5 to −10 percentile points	Yes	NA
United States	HIC	Kuhfeld et al. (2022)	17.75	Fall 2021	Math: −0.20–0.27 SD Reading: −0.09–0.18 SD	Yes	Yes
Zambia	LMIC	UNESCO Institute For Statistics (2022)	6.75	Mid 2021	Reading: 0.5 (not significant) Math: −1.4 (significant)	Yes	Yes

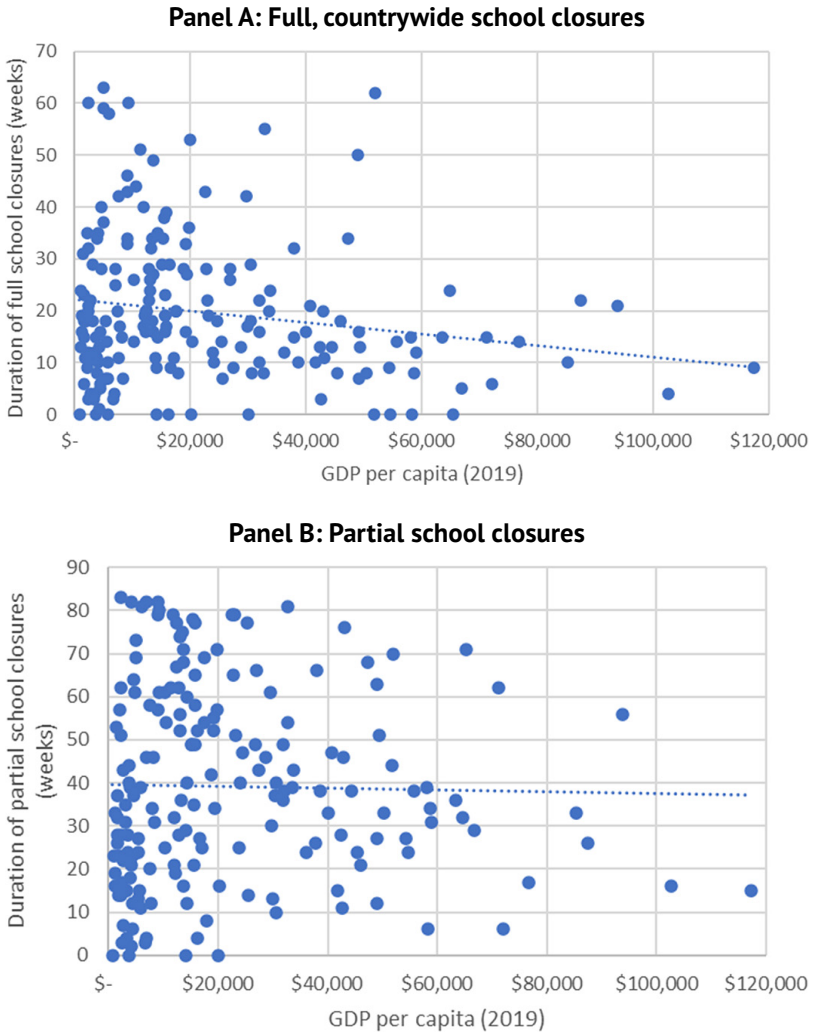
Notes: Some studies did not report statistical significance; in those cases, we do not indicate significant or a lack thereof. School closure duration data estimated by combining data from UNESCO (2021) and the evaluation studies. The UNESCO database reports school closures by time period and closure type (full and partial). We report partial and full closures for time periods that best cover the beginning of school closure until the assessment date.

Table A2. Estimates of dropout rates

Country	Income Level	Short Reference	Dropout Rate (Benchmark Rate)	National Sample
Brazil	LMIC	Lichand et al. (2021)	35 percent (10)	No
Ethiopia	LMIC	Kim et al. (2021)	13 percent (Not available – NA)	No
Ghana	LMIC	Abreh et al. (2021)	2 percent (2.1)	Yes
Ghana, Liberia, Sierra Leone	LMIC	Caballero et al. (2021)	Ghana: 3.7 percent (NA)	Yes
India	LMIC	ASER India (2021)	4.4 percent (NA)	No
Kenya	LMIC	Zulaika et al. (2022)	9.4 percent (3.2)	No
Liberia	LMIC	Caballero et al. (2021)	2.3 percent (NA)	Yes
Malawi	LMIC	Kadzamira et al. (2021)	4.3 percent (1.2)	Yes
Nigeria	LMIC	Dessy et al. (2021)	16.9 percent (10)	Yes
Pakistan	LMIC	Crawfurd et al. (2021b)	14 percent (NA)	No
Pakistan	LMIC	ASER Pakistan (2021)	6 percent (4)	Yes
Senegal	LMIC	Mbaye et al. (2021)	1.6 percent (1.9)	Yes
Sierra Leone	LMIC	Caballero et al. (2021)	3.1 percent (NA)	Yes
Sierra Leone	LMIC	Crawfurd et al. (2021a)	3 percent (NA)	No
South Africa	LMIC	Spaull et al. (2021)	6 percent (2*)	Yes
South Africa	LMIC	Gustafsson (2021)	0.4 percent (NA)	Yes
Uganda	LMIC	Uwezo Uganda (2021)	0.7 percent (1.3**)	Yes

Notes: *Spaull et al. (2021) also reports the actual number of dropouts, from which we calculate the percentage change between 2018 and 2021. **The benchmark rate is from a different source (Uwezo Uganda 2019).

Figure A1. Relationship between GDP per capita and duration of school closures



Notes: Duration of full and partial school closures (UNESCO 2021). These represent the full duration of school closures as of late 2021. GDP per capita are from the World Bank's World Development Indicators (purchasing power parity, in current international dollars). This is based on the 186 countries nationwide for which both school closure and national income data were available. For Panel A, the correlation is −0.17 (p = 0.02). For Panel B, the correlation is −0.02 (p = 0.79).