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COVID-19 Learning Loss and Recovery in Brazil: Assessing Gaps Across Social Groups

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Abstract: Students in over 150 countries experienced school closures throughout the COVID-19 pandemic. In the years following, a growing body of literature seeks to estimate the impacts of these education disruptions on a diverse set of outcomes, including student learning. This article adds to this research by examining causal evidence through a difference-in-differences framework (DID). Results suggest that school closures led to learning losses in math for high school seniors in public schools in the Federal District (DF) in Brazil. And while all racial groups experienced learning loss, White and Asian students experienced the most significant losses in 2020. We find no evidence of learning recovery from 2020 to 2021 for any racial groups, suggesting that learning losses persisted into school reopening. We do find, however, possible signs of recovery for female senior students compared to male students. Nevertheless, male and female performance differences are still prominent when analyzing data from 2016 to 2021. The utilization of critical policy analysis and the effectively maintained inequality frameworks can offer insights into significant learning disparities experienced by students.

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La pérdida y recuperación del aprendizaje por COVID-19 en Brasil: Evaluación de las brechas entre grupos sociales

Resumen: Los estudiantes de más de 150 países experimentaron el cierre de escuelas durante la pandemia de COVID-19. En los años siguientes, ha ido creciendo un cuerpo de literatura que busca estimar los impactos de estas interrupciones educativas en un conjunto diverso de resultados, incluido el aprendizaje de los estudiantes. Este artículo añade a este cuerpo de investigación examinando la evidencia causal a través de un marco de diferencias-en-diferencias (DID). Los resultados sugieren que el cierre de escuelas provocó pérdidas de aprendizaje en matemáticas para los estudiantes de último año de secundaria en escuelas públicas del Distrito Federal en Brasil. Aunque todos los grupos raciales experimentaron pérdida de aprendizaje, los estudiantes blancos y asiáticos experimentaron pérdidas más significativas en 2020. No encontramos evidencia de recuperación del aprendizaje entre 2020 y 2021 para ningún grupo racial, lo que sugiere que las pérdidas de aprendizaje persistieron en la reapertura de las escuelas. Sin embargo, encontramos posibles signos de recuperación en estudiantes mujeres del último año en comparación con los estudiantes varones. No obstante, las diferencias del desempeño entre hombres y mujeres siguen siendo prominentes al analizar los datos de 2016 a 2021. La utilización de análisis críticos de políticas y de marcos de desigualdad mantenidos eficazmente puede ofrecer información sobre las importantes disparidades de aprendizaje experimentadas por los estudiantes.

Palabras-clave: pérdida de aprendizaje; COVID-19; diferencia-en-diferencias; recuperación

Perda e recuperação de aprendizagem devido à COVID-19 no Brasil: Avaliando lacunas entre grupos sociais

Resumo: Estudantes de mais de 150 países vivenciaram o fechamento das escolas durante a pandemia da COVID-19. Nos anos seguintes, foram publicados diversos estudos que procuraram estimar os impactos destas interrupções educacionais em um conjunto diversificado de resultados, incluindo a aprendizagem dos alunos. Este artigo contribui para este corpo de pesquisa examinando evidências causais ao aplicar a metodologia de diferenças-em-diferenças (DID). Os resultados sugerem que o fechamento de escolas levou a perdas de aprendizagem em matemática para alunos do último ano do ensino médio em escolas públicas do Distrito Federal no Brasil. E embora todos os grupos raciais tenham sofrido perdas de aprendizagem, os estudantes brancos e asiáticos sofreram as perdas mais significativas em 2020. Não encontramos provas de recuperação da aprendizagem em 2020 e 2021 para nenhum dos grupos raciais, sugerindo que as perdas de aprendizagem persistiram após a reabertura das escolas. Encontramos, no entanto, possíveis sinais de recuperação para estudantes do último ano do ensino médio do sexo feminino em comparação com estudantes do sexo masculino. No entanto, as diferenças de desempenho entre homens e mulheres ainda são proeminentes quando comparamos dados de 2016 a 2021. A utilização das teorias da análise crítica de políticas e da desigualdade efetivamente mantida podem oferecer esclarecimentos sobre as significativas disparidades de aprendizagem vivenciadas pelos alunos.

Palavras-chave: perda de aprendizagem; COVID-19; diferenças-em-diferenças; recuperação
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COVID-19 Learning Loss and Recovery in Brazil: Assessing Gaps Across Social Groups

In March of 2020, the novel coronavirus was declared a global pandemic by the World Health Organization (Cucinotta & Vanelli, 2020). This pandemic sparked what the United Nations Children's Fund (UNICEF, 2021a) would call "the largest disruption to schooling in the history of the world." One of the most common policy measures implemented by countries in response to the COVID-19 pandemic was to close the doors of their physical school buildings, thus cutting students off from in-person instruction. Data from the United Nations Educational, Scientific and Cultural Organization (UNESCO) shows that, on average, from February 2020, schools were either fully or partially closed for up to 35 weeks in a total of 151 countries UNESCO (2022). These closures affected over 81% of enrolled learners—a number representing almost 1.3 billion students worldwide. Globally, the typical student had 224 of his/her school days affected by either complete or partial school closures (UNICEF, 2021b), for a total average of 10 weeks of in-person instruction lost (Meinck et al., 2022).

In the years since these widespread COVID-19 school closures, a growing body of literature seeks to estimate the impacts of these education disruptions on a diverse set of outcomes, including student learning. Such shocks to the typical student experience have been linked to increases in student absence and dropout (Moscoviz & Evans, 2022; Southall et al., 2021), decreases in teacher retention (Carver-Thomas et al., 2021), and increases in stress and trauma for everyone within the education system (students, teachers, and staff; Storey & Zhang, 2021).

Other studies have shown some of the health-related impacts of the COVID-19 school closures. Rajmil et al. (2021) find associations between school closures and decreased physical activity in school-age children and an increase in symptoms of depression. In findings from Duraku and Hoxha (2021), students express an increase in sadness, anger, grief, sleep disorders, and a lack of motivation. Similar results around student emotional outcomes (hyperactivity, anxiety, frustration, loneliness, and sadness) as well as an increase in child BMI and obesity are found by Chaabane et al. (2021). Furthermore, closures increased absenteeism, especially in marginalized populations (Azevedo et al., 2021; Neidhöfer et al., 2021). Multiple authors have noted that disadvantaged students are disproportionately impacted by school closures for several reasons, including how their parents are unable to support online learning (Azevedo et al., 2021; Maldonado & De Witte, 2022; Neidhöfer et al., 2021).

Additionally, a number of studies have explored the potential economic effects of COVID-19 school closures, driven primarily by the loss of student learning (Azevedo et al., 2021; Engzell et al., 2021; Maldonado & De Witte, 2022; Souza et al., 2020; Yarrow et al., 2020). For instance, Dorn et al. (2020) estimate that COVID-driven learning losses could lead to a decrease of one year in lifetime earnings (between $61,000 to $82,000). Hanushek and Woessmann (2020) estimate the national-level impacts of losses in student learning on individual education rates of return as well as national economic growth.

The authors' estimates suggest that a loss of 0.3 years of learning are linked to a 3% decrease in lifetime earnings, which could potentially reduce national GDP by 1.5% over the course of those students' lives. A range of these economic costs range from $504 billion for South Africa to over $15.5 trillion for China. Azevedo et al. (2021) estimate that the learning loss associated with a school shutdown of five months could result in combined economic losses of $10 trillion for those students whose learning experience was disrupted by the pandemic. Prior research (i.e., studies conducted prior to the COVID-19 pandemic) on the links between student performance and economic outcomes also suggest that lower learning outcomes could be predictive of lower future

employability (Currie & Thomas, 2001). This paper contributes to the evolving global knowledge base by analyzing school closures, measuring their impact on student learning at the end of school lockdowns and one year after school reopening. This study also explores disparities by student gender and race. Understanding how worldwide school closures affected these populations can inform future policies, better preparing affected countries for future scenarios. Our findings suggest learning losses experienced by nearly all students following school lockdowns in 2020, with no sign of recovery despite schools reopening. However, we find possible signs of recovery among female students despite the documented historical difference concerning gender-based performance. In the following sections, we offer a brief overview of the literature on learning loss associated with COVID-19 throughout the world and in Brazil. We also present the data and methodology employed for this study. In the final section, we present our findings and discuss their implications.

Literature Review

The Global Experience with COVID-19 and Learning Loss

In the three-plus years since the COVID-19 pandemic first impacted schooling provision, there have been "dozens of studies" on the learning impacts of school closures across a range of country income levels (Moscoviz and Evans, 2022, p. 1). Overall, the body of research tends to show that the temporary disruptions to in-person schooling are related to significant reductions in student learning (Azevedo et al., 2020; Engzell et al., 2020; Maldonado & De Witte, 2020; Yarrow et al., 2020). Recently publicized research from the United States found that students in the average school district lost roughly 52% of a year's worth of learning in math and 23% in reading; moreover, 5% of students were in districts where achievement fell by more than one full grade level (Fahle et al, 2022).

Recently, a few systematic reviews of the global findings on COVID-related learning loss have been published. The first, by Donnelly and Patrinos (2021), offered a self-described "early systematic review" of the global evidence (of the studies published between March 2020 and March 2021). These authors found eight studies, all of which were focused on high-income countries.[1] Seven of the eight studies found significant evidence of learning loss, with the largest impact being roughly 0.3 SD or 2 months of learning. In total, this systematic review presents the results of 32 measures of students learning. Of these, eight were not statistically significant (i.e., showing no difference in learning after school closures), two were negatively significant (i.e., showing learning growth after school closures), and 22 were positively significant (i.e., showing learning loss after school closures). Overall, the results from this systematic review show a general trend of significant learning loss resulting from COVID-19 school closures.

A 2021 meta-analysis by Storey and Zhang (2021) identified 16 studies that use a 2019 cohort of students as a counterfactual to compare performance and thus estimate the impact of school closures on learning loss for 2020 students. The studies again come only from high-income contexts.[2] Results from the meta-analysis suggest that students lost, on average, 0.16 SDs of learning as a result of the pandemic-driven school closures. Moscoviz and Evans (2022) provide the most recent systematic review of the COVID-19 learning loss research. A notable characteristic of this study is that the results include findings from a set of low- and middle-income countries (MICS) (32% of the included studies) to complement the previous research from high-income contexts

[1] Australia, Belgium, Germany, Netherlands, Spain, Switzerland, and the United States (two studies).
[2] Belgium, Netherlands, Switzerland, United Kingdom, and United States.

(68% of the included studies).[3] This systematic review includes results from 29 studies of learning loss (in addition to 15 studies that assess the impacts on student dropout). The authors find that, on average, most estimates of student learning are negative (suggesting COVID-driven learning loss); although there are some exceptions to this, particularly in the low- and middle-income countries. In some contexts, the amount of learning loss was equivalent to the amount of learning that students would have experienced over the time length of the closure (e.g., 0.08 SD in the Netherlands over an 8-week closure; Engzell et al., 2021). A few highlights regarding learning in low and middle income countries (LMICs) include the following: in Bangladesh, students in Grades 7 and 8 experienced learning loss of 5% to 6% (Amin et al., 2021). For secondary students in Brazil, student learning in 2020 compared to 2019 was down 0.32 SDs (Lichand et al., 2021). In Mexico, learning loss was between 0.34 and 0.45 SDs in reading and between 0.62 and 0.82 SD in math (Hevia et al., 2022). Early grade primary students in South Africa only learned between one-half and one-quarter of what they normally would have learned (i.e., compared to students in the previous year's cohort; Ardington et al., 2021; Shepherd et al., 2021).

It is important to note that COVID-19-driven school closures have not been uniformly associated with student learning loss. In some cases, students have been found to experience no change in learning and, in a few, students have increased their learning levels. In the United States, 2.5% of COVID-impacted students were in school districts that experienced increases in math achievement and 14.8% of students were in districts where reading achievement increased (Fahle et al., 2022). In Spain, higher education students experienced learning growth following a school closure of 10 weeks (Gonzalez et al., 2020). In Belgium, students experienced learning losses in three out of four test subjects—an average test score reduction between 0.17 and 0.19 standard deviations Maldonado and De Witte (2022). In middle-income schools in Australia, Grade 3 students experienced improvements in math performance after an 8-10-week-long school closure (Gore et al., 2021). According to the systematic review results of Moscoviz and Evans (2022), students in Burkina Faso, Burundi, Côte d'Ivoire, Pakistan, Senegal, and Zambia showed no evidence of learning loss (UNESCO Institute for Statistics, 2022).

Inequality Exacerbates Learning Losses

One of the most consistent findings across studies of post-pandemic learning is that results are heterogenous across important socioeconomic characteristics, driven in part by the fact that households with fewer resources are less able to support remote learning opportunities (Azevedo et al., 2021; Dorn et al., 2020; Maldonado & De Witte, 2021). According to the United Nations International Children's Emergency Fund report (UNICEF, 2020), about 1 in 3 children were left out of remote learning opportunities, due to the lack of (i) policies supporting remote education and (ii) family access to remote instruction. Among students that did not receive instruction, almost 70% lived in rural areas, and 40% were underprivileged families without internet access (UNICEF, 2020). The same report showed that disadvantaged students faced difficulties attending online classes or using online content. The World Bank (2020) observed: "The crisis was not equally distributed—the most disadvantaged children and youth had the worst access to schooling, highest dropout rates, and the largest learning deficits" (p. 5).

According to Fahle et al. (2022), learning losses were significantly larger in higher poverty school districts (e.g., high-poverty districts lost 0.66 grade levels of learning compared to a loss of 0.45 grades of learning for low-poverty districts). According to Moscoviz and Evans (2022), a

[3] The full set of included countries includes the following: Australia, Bangladesh, Belgium (2), Brazil, Burkina Faso, Burundi, Côte d'Ivoire, Germany, Ghana, India, Italy, Kenya, Mexico, Netherlands (2), Pakistan (2), Senegal, South Africa (2), Switzerland, Uganda, United Kingdom (5), United States (4), and Zambia.

consistent finding across studies was an increase in learning inequality, with learning loss being "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" (p. i). In virtually every country, learning loss is "concentrated among the poorest children" (p. 2). Such results were found in the Netherlands, United States, Mexico, Bangladesh, Ghana, Uganda, Pakistan, and others, with learning loss differences as large as 200% for the poorest students (compared to the wealthiest).

Other authors also found minority groups to be more impacted. Dorn et al. (2020) estimated that while White students would earn $1,348 a year less over a 40-year working life, such earning losses would be $2,186 a year for Black students. According to Hanushek and Woessmann (2020), disadvantaged students are more impacted by school closures because their parents cannot support their online school learning.

In Honduras, Paz-Maldonado et al. (2021) illustrated how student dropout increased during COVID-19, arguing that the government should reduce disparity of access to the internet, increasing students' participation to promote learning. In a study of the most significant challenges Brazilian parents faced with pandemic-era online classes, Lunardi et al. (2021) found that parents reported issues with internet access, time management, student concentration, and conciliation between school demands and work. The authors suggested that such parents needed more support to deal with these pandemic-era educational scenarios. Many parents also reported lacking technological fluency, devices in the home sufficient for multiple children, or cell phone access to classes in the absence of computers. Other authors found that girls were especially vulnerable to these pandemic-related losses (Burzynska & Contreras, 2020). These authors identified two important concerns related to girls, challenging gender equality in educational access: sexual health and socioeconomic burdens. The authors found that teenage girls disproportionately dropped out of school, due to an increased risk of sexual exploitation, pregnancy, and forced marriage. During the 2014 Ebola outbreak in West Africa, school closures were associated with an increase in teenage pregnancies.

Education and Inequality in Brazil

Brazil has frequently faced challenges of inequality. The southern region of the country accounts for over 53% of Brazil's GDP, while the northeast contributes only 14% of GDP (IBGE, 2019). Such inequality manifests in its education system. Valente (2017) notes that Brazil suffers from high levels of socioeconomic inequality, impacting access to higher education. Brazil has a heterogeneous higher education system, with both private and public universities relying heavily, often exclusively, on a single standardized test—the Exame Nacional do Ensino Médio (ENEM)—as their sole mechanism for admitting students. In Brazil, public universities are highly ranked and tuition-free, enrolling over 1.7 million students, according to Schwartzman and Knobel (2016).

Recognizing this gap between supply and demand for public higher education in Brazil, several authors have noted public universities' tendency to select highly privileged students from wealthier households at an excessive rate. Valente (2017) assessed relationships between race and higher educational access from 2004 to 2008, finding that nonwhite students have lower scores on the ENEM, and that mother's education and parental income are highly correlated with student scores. Likewise, the odds of a student from a public school scoring high in the examination is 68.3% lower compared to a private school student.

Learning Before and During the Pandemic

In March of 2020, at the onset of the COVID-19 pandemic, Brazil closed its school doors and kept them closed through the end of 2020 (UNESCO, 2022). In January of 2021, schools partially reopened. Overall, Brazil endured 38 weeks of total school closure and about 40 weeks of partial closure. School closure onset and duration varied significantly throughout the country, as

each state had autonomy to reopen at its own discretion. During closure, over 95% of schools across Brazil implemented some form of online learning methodology. Brazil's Center for the Development of Informational Society (CETIC) studied the context of the country's entry into the pandemic: in 2019, about 39% of its public-school students lacked access to any computers or tablets at home. In private schools, that percentage was 9%. Likewise, 21% of public-school students accessed the internet via cell phone, compared to only 3% of private school students (CETIC, 2020). Lunardi et al. (2021) found that Brazilian students and parents reported problems with accessing the internet during the lockdown.

Catanante et al. (2020) noted that cultural differences, inadequate access to technology, and lack of family support resulted in low online educational participation. In their study, the authors found that only 36% of students in a senior high school class participated actively in online learning; 54% did not participate. The authors also observed that mere access to online classes is insufficient; students need family support and an adequate location to study. Unfortunately, many students lack this support at home.

In response to the lack of internet access for certain households, some schools implemented non-internet strategies. For example, some broadcasted their school content via television or printed materials. However, inequality in Brazil is not restricted to internet access. Costa & Sousa (2020) reported large portions of the population lacking access to television. Television, they found, is absent in many low-income households. For example, in 2019, in northeastern Brazil, 34% of households lacked access to TV, demonstrating that these educational programs were unavailable to many students in the region. Overall, the pandemic exacerbated many of Brazil's structural challenges in education.

Research Questions

This study attempts to estimate the causal impact of school closures on student learning in math and post-pandemic learning recovery one year following the pandemic. We aim to answer the following research questions:

1. What is the causal impact of school closures on student math achievement?
2. Is there evidence of post-closure recovery in learning loss?
3. Is there evidence of differential learning loss and recovery across student racial groups (White, Asian, Black, Brown)?

The authors hypothesize that school closures will be significantly linked to drops in student learning. We also expect, despite schools reopening, learning losses to persist into the school year following the pandemic. As is consistent with extant work, we expect inequality to play a role in learning losses in the context of school closures and learning loss recovery. As such, we anticipate school closures to impact students more deeply within disadvantaged social groups (i.e., females and Blacks).

Data

To answer these research questions, we utilize government data from the Exame Nacional do Ensino Médio (ENEM, or "The National High School Exam") from 2016 through 2021. The ENEM is a non-mandatory test that includes a written essay and roughly 180 questions divided into four subjects: language, mathematics, human sciences, and natural sciences. Participants answer these questions over the course of a two-day testing period. Public universities use ENEM scores as part of their admissions decisions, similar to SAT or ACT exams in the United States. Private universities also accept these scores, using them to grant tuition waivers or student loans.

Given that universities require the ENEM for university access and many public and private universities across the country require the exam scores as a requirement of admission, it is taken annually by a vast range of test-takers, including enrolled secondary students (sophomores, juniors, and seniors), graduates students, and even former high-school dropouts. To register for the ENEM, applicants provide their socioeconomic status, gender, race, age, parents' education, profession, and more. This data, in addition to students' scores, is accessible within the ENEM dataset.

This study analyzes data from Distrito Federal (DF), a Federal Brazilian district, similar to the District of Columbia in the United States. In this district are located Brazil's capital (Brasilia), the Brazilian president's office, the National Congress, and many federal governments agencies. The Federal District in Brazil is not part of any state, but it is a special political and administrative division. Many people from different states migrate to Distrito Federal, especially from the northwest and southwest. Data from this district was selected due to it meeting the requirements for the difference-in-differences methodology used by the authors (i.e., parallel trends between treated and comparison units before and up to the start of the pandemic). The data set includes information from 251,691 17-to-22-year-old test takers, 57% of whom were graduates and 43% of whom were high school seniors. We analyzed six years of data, from 2016 to 2021, including four years prior to the pandemic and two years following school reopening.

As of 2017, Brazil' 207 million residents identified across the following racial groups: 46.7% Brown or mixed-race, 44.2% White, 8.2% Black, and 0.9% Asian or Indigenous (Rubin et al., 2020). Within the ENEM dataset, we observe the following breakdown across these racial groups for the 251,691 test-takers: 49% Brown, 29% White, 15% Black, 3% Asian, and 0.4% Indigenous. The median per-capita income[4] of these populations was calculated based on the information provided by each test taker: R$ 1,177 for White students, R$ 679 for Asian students, R$ 674 for Brown students, R$ 596 for Black students, and R$ 523 for Indigenous students. These per-capita incomes suggest that roughly 32% of White, 46% of Asian, 46% of Brown, 50% of Black, and 56% of Indigenous students live below the international poverty line of $1.90 per day.

Methods

The key challenge in estimating the causal impact of school closures on student learning is accounting for selection bias. The COVID-19 pandemic disrupted the formal school experience of all students in the country; and thus, all students experienced a similar truncated educational experience. To account for potential temporal variations across year-to-year samples, we apply a counterfactual-based approach in the form of a difference-in-differences (DID) estimation.

The DID model compares group means in cases where one group is affected by an intervention (or event) and the other is not (Angrist & Krueger, 1999). In the context of this study, the intervention of interest is COVID-19-driven school closures that took place during the 2020 school year, and the subsequent reopening of schools. The treatment group consists of public-school students who were in their final year of education (i.e., high-school seniors) when they took the ENEM exam—the year that was shortened by the pandemic-driven school closures.

The counterfactual group is comprised of students who graduated prior to taking the ENEM exam (also prior to the COVID-19 pandemic), and thus whose schooling experience was not cut short. While we acknowledge that the pandemic had a widespread impact on everyone's life, it's important to note that those who graduated prior to the onset of COVID-19 did not experience the direct consequences of school closures. Any learning losses they may have incurred due to

[4] Family income divided by the number of people living in the household.

leaving school have likely remained consistent over the years as we compare those who took the ENEM as graduates versus those who took the exam as seniors since 2016.

The DID approach measures the difference in ENEM scores between treatment and counterfactual groups in the years leading up to the intervention year, and the year following the pandemic. The trend in these mean differences from year-to-year offers an expected difference in treatment-counterfactual means in the years after the intervention. Observed variation from this expected difference in the treatment year provides an estimate of the treatment effect. The 2020 ENEM exam occurred on January 17, 2021, almost 10 months after school closures (mid-March 2020). The 2021 ENEM version was administered on January 16, 2022. As such, the data comprises two years of analysis on the effects of school closure.

To employ DID, we must meet the primary assumption that both control and treatment groups demonstrate similar or parallel trends in the pre-intervention period. Trends for this study were analyzed using an event study approach (Borusyak & Jaravel, 2017; Clarke & Tapia-Schythe, 2021; Schmidheiny & Siegloch, 2019). Clarke & Tapia-Schythe (2021) noted that:

> By considering the variation in outcomes around the adoption of the event compared with a baseline reference period, both event lags and leads are estimated, allowing for a clear visual representation of the event's causal impact provided that key identifying assumptions are met. (p. 2)

The event study research design is helpful for treatment effects analysis and the effect of an event on a specific dependent variable (Woon, 2004). Researchers use this method for the intent of causal inference across many disciplines, including economics, education, other social sciences, and medicine (Sun & Abraham, 2021).

In our case, the event study captures the differences between treatment and control groups over the years, with the regression analysis in Table 1 demonstrating that no significant differences between those who took the test as graduates and those who took it as seniors, at a p-value of 0.05. Our baseline period is 2019, the year before COVID-19. We use OLS regression to calculate the interaction between the dummy variables of year and seniors, including fixed effects for year and senior status in these models (see Table 1).

Table 1

Regression Analysis Between the Dummy variables of Year and Seniors

	Estimate	Std. Error	Pr(>|t|)
Interaction Senior and Year 2016	0.68	1.21	0.58
Interaction Senior and Year 2017	-0.51	1.25	0.69
Interaction Senior and Year 2018	0.37	1.26	0.77
Interaction Senior and Year 2020	-19.34	2.02	0.00***
Interaction Senior and Year 2021	-18.27	1.56	0.00***

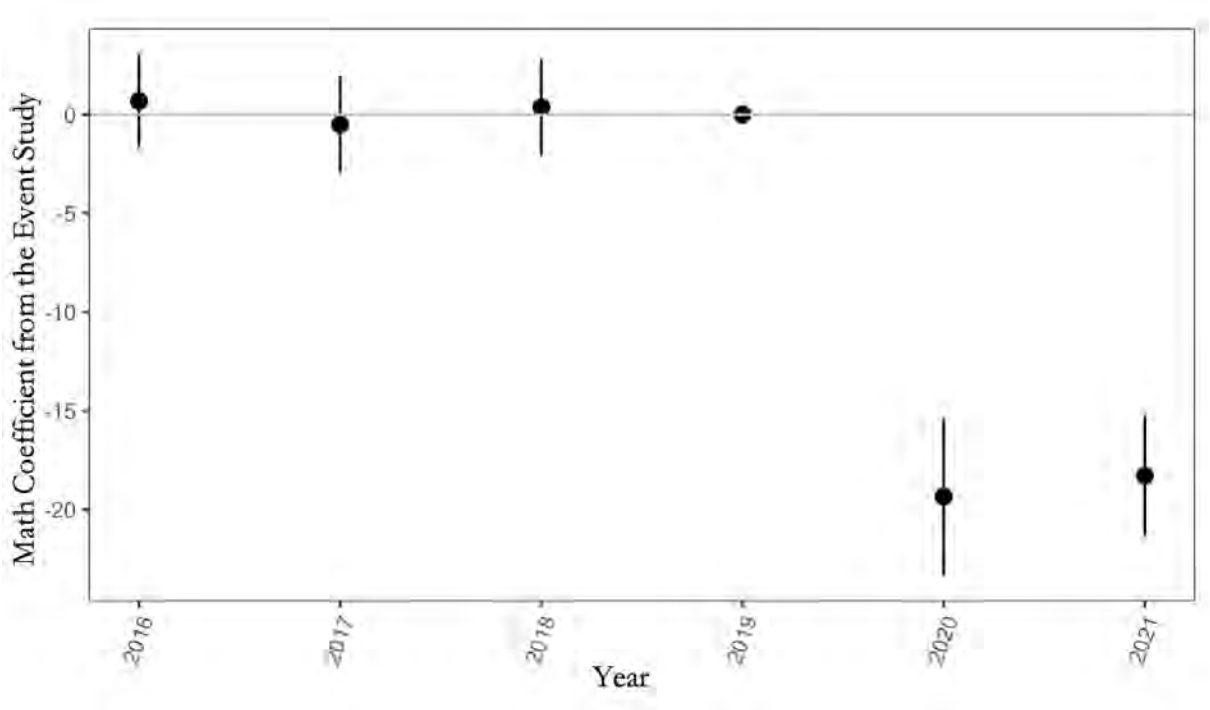
Note. This table presents results from the event study analysis to demonstrate that there are no statistical differences between those students who took the test as graduates and those who took it as seniors in the years before the pandemic, but that the difference in learning between these groups started to appear after 2020 (the pandemic year) when schools in Brazil were closed to avoid spreading the virus. We included years and status (seniors and graduates) as fixed effects in this model. The baseline year is 2019, which was the year before the pandemic.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

We plot the results as suggested by Borusyak and Jaravel (2017). Values close to 0 show that the differences among groups were constant over time (see Figure 1).

Figure 1

Event Study



Notes. The math event study shows that the difference between groups before school closure was close to zero. Following school closures (2020), the difference displayed on the graph illustrates the effect of school closures on learning.

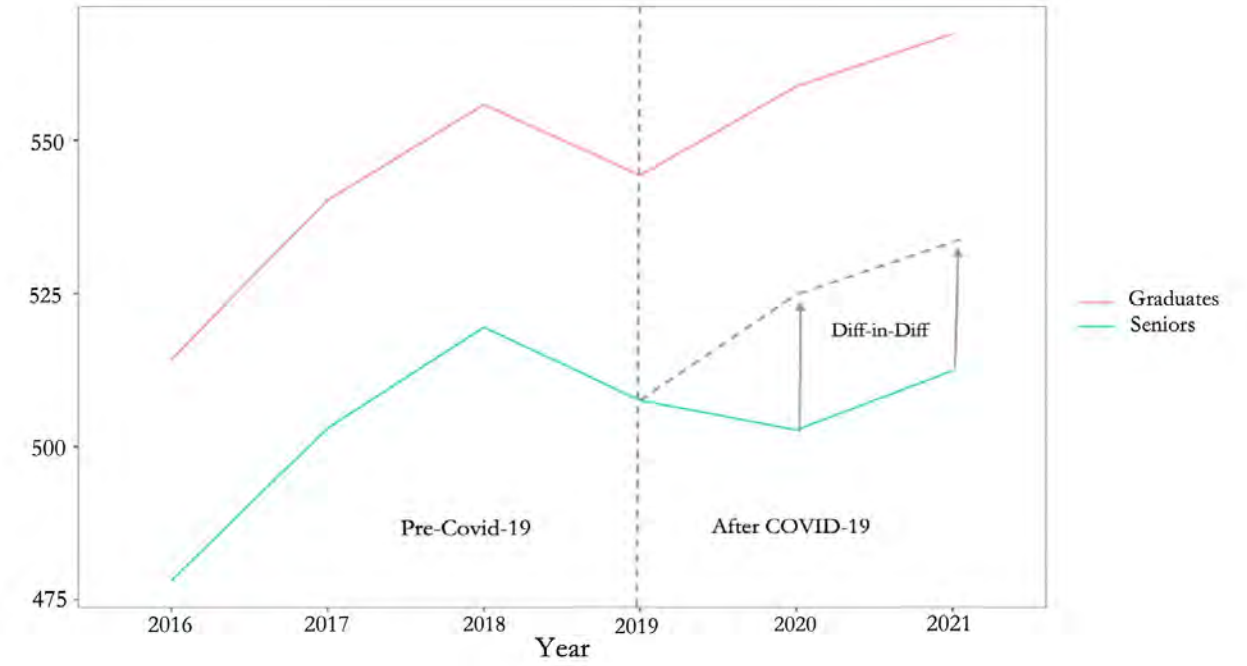
Additionally, we performed a complete analysis of group differences before and after COVID-19, making sure that test-takers' compositions did not change due to the pandemic (Cohen 1988, Ferguson, 2016). We present the results in standardized mean differences (SMD) in test takers' composition between 2019 and 2020, and 2019 and 2021. Those results are presented in Appendix A. We observe that none of the demographic characteristics[5] analyzed had SMD larger than 0.15—values that are considered small for both benchmarks suggested by Cohen (1988) and Ferguson (2016).

As seen in Figure 2, the trends in exam scores for math are perfectly parallel between seniors and those who took the test as graduates. Thus, the control group can be reasonably used as a counterfactual of what we would have expected to happen to the treatment group, the seniors, in the absence of school closures.

[5] We tested for senior status, gender, race, age group, family size, SES, and Below Poverty Line variables.

Figure 2

Math Trend Lines



Notes. The plot displays the trend lines between graduates and senior test takers in math. The vertical dash line separates the trends prior to school closures (2016 to 2019) and following school closures (2020 and 2021). The grey line represents possible trends without school closure.

Having confirmed the suitability of our data for the DID methodology, we apply a fixed effects model to estimate the DID. Formula 1 includes the main effect of senior and year. We calculate one model for 2019 and 2020, and one model for 2019 and 2021. To calculate the effect of the pandemic on gender and race, we regressed a three-way interaction with year, interest group, and senior, to study the differential effect that treatment has on these groups (Formula 2).

$$Math_i = \beta_0 + \beta_1 * Senior + \beta_2 * Year + \beta_3 * Senior * Year + e \quad (1)$$

$$Math_i = \beta_0 + \beta_1 * Seniors + \beta_2 * Race + \beta_3 * Gender + \beta_4 Seniors * Race * Year + \beta_5 Seniors * Gender * Year + e \quad (2)$$

Results

As presented in Table 2, senior high school students experienced losses of 19.34 points in math in 2020 (p <0.001, Cohens' d of 0.13 SD), and 18.27 points in 2021 (p < 0.001, Cohens' d of 0.16 SD). In Table 2, we note no discernible change in mean differences between seniors and graduates in the years that preceded the pandemic, specifically from 2016 to 2019 (the reference period). The 95% confidence intervals for learning loss in 2020 was between -23.1 to -15.6 points. The gap between treatment and counterfactual groups in 2021 was between -21.4 and -15.2 points, suggesting roughly no recovery in learning loss between 2020 and 2021.

Table 2

Difference in Differences Between the Pre- and Post-Pandemic Period

	Estimate	S.E.	*p*-value	
	2020			
(Intercept)	544.28	0.55	<2e-16	***
Senior	-36.71	0.81	<2e-16	***
Year 2020	14.51	1.33	<2e-16	***
Year 2020 x Senior	-19.34	1.92	<2e-16	***
	2021			
(Intercept)	544.28	0.54	<2e-16	***
Senior	-36.71	0.80	<2e-16	***
Year 2021	23.11	1.07	<2e-16	***
Year 2021 x Senior	-18.27	1.58	<2e-16	***

Note. The results presented in this table demonstrate that in 2020, senior students scored 19.34 points less than those students who graduated prior to taking the ENEM exam (also prior to the COVID-19 pandemic). In 2021, senior students scored 18.27 points less than graduate test takers. The results in this table confirm that learning loss occurred during the pandemic and persisted after school reopening.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 3 demonstrates the differences between 2020 and 2021 when comparing with the pre-pandemic period for race and gender. The estimated learning loss for senior test takers, Whites, Asians, Blacks, and Browns result from the interaction between senior * race * year. As observed, all races, except Indigenous, experienced learning losses, with White students experiencing the largest losses 36.35 points (p<0.001) and 95% CI [-41.9, -30.8]. The same pattern was observed in 2021, with all races, except Indigenous, maintaining their 2020 learning loss levels—suggesting no learning recovery from 2020 to 2021. White students experienced the largest maintained learning loss of 29.42 points (p<0.001) and 95% CI [-33.8, -25.1] in 2021. When analyzing gender, we observe that senior male test takers gained 14 points more than females test takers, in 2020 ($p < 0.001$, and 95% CI [8.8, 19.2]); however, the difference reduced to 4.4 points in 2021 ($p < 0.001$, and 95% CI [0.2, 8.6]), potentially suggesting that female students recovered from much of the learning loss they experienced in 2020.

Table 3

Group Learning Loss Differences

	2020				2021			
	Estimate	S.E.	*p*		Estimate	S.E.	*p*	
(Intercept)	562.02	0.82	0.00		561.35	0.79	0.00	***
Senior	-36.06	0.78	0.00	***	-36.09	0.77	0.00	***
Asian	-38.87	2.36	0.00	***	-37.37	2.27	0.00	***
Black	-58.55	1.16	0.00	***	-58.07	1.11	0.00	***
Brown	-44.92	0.86	0.00	***	-43.46	0.81	0.00	***

	2020				2021			
	Estimate	S.E.	*p*		Estimate	S.E.	*p*	
Indigenous	-80.31	5.73	0.00	***	-80.87	5.61	0.00	***
Unknown	-12.96	2.61	0.00	***	-10.95	2.50	0.00	***
Males	37.13	0.76	0.00	***	36.67	0.73	0.00	***
Year	14.34	1.29	0.00	***	19.14	1.04	0.00	***
Senior x White x Year	-36.35	2.81	0.00	***	-29.42	2.23	0.00	***
Senior x Asian x Year	-22.17	7.43	0.00	**	-23.08	7.23	0.00	**
Senior x Black x Year	-11.24	3.65	0.00	**	-8.29	3.06	0.01	**
Senior x Brown x Year	-16.29	2.41	0.00	***	-11.74	2.05	0.00	***
Senior x Indigenous x Year	1.87	18.11	0.92		15.11	18.29	0.41	
Senior x Unknown x Year	-35.15	9.03	0.00	***	-26.69	7.18	0.00	***
Senior x Male x Year	14.00	2.65	0.00	***	4.40	2.12	0.04	*

Note. This table demonstrates the differences between the 2020 and 2021 regression analysis when comparing race, gender, and senior students' results from 2020 and 2021. The first part of the table demonstrates the results for 2020 (compared to 2019), and the second part the 2021 results (compared to 2019). The reference group for the model is those who took the ENEM exam as graduates.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Following our initial analysis of learning loss across groups, we delve deeper into the distinctions among senior students in their math performance over the years, using Cohen's *d*. The effect sizes (Cohen's *d)* presented in Table 4 and Figure 4 represent zero-order differences between males and females, between White students and all other racial groups. Note that the group means look slightly different from the DID results in Table 3, as there are no included covariates or control groups as we have in the DID analysis. While effect size is valuable for describing the group differences, it falls short in establishing causation due to the lack of control for confounding factors. Therefore, the results presented in Table 4 are not used to quantify learning loss but to compare math achievement over the period analyzed in this paper. The results shed light on the historical disparity across different social groups. Our analysis reveals a consistent trend since 2016, where male students have consistently outperformed their female counterparts in math achievement. The effect size, categorically moderate, ranged from 0.33 SD in 2017 to 0.52 SD in 2020, notably during the pandemic year. In 2020, there was a significant increase in the difference between male and female scores, which, however, started to reduce in 2021.

Table 4

Seniors Students Differences in Effect Size

	Females	Males	Cohens' *d*	Cohens' *d* CI
2016	462.80	498.25	-0.40	[-0.43, -0.38]
2017	490.62	520.00	-0.33	[-0.36, -0.30]
2018	504.99	540.37	-0.41	[-0.44, -0.38]
2019	492.55	528.77	-0.40	[-0.45, -0.38]
2020	485.39	537.02	-0.52	[-0.57, -0.47] *
2021	496.63	538.53	-0.45	[-0.49, -0.42]

	Black	Whites	Cohens' *d*	Cohens' *d* CI
2016	473.58	490.75	-0.42	[-0.46, -0.37]
2017	494.31	517.13	-0.31	[-0.35, -0.26]
2018	512.07	533.34	-0.40	[-0.45, -0.36]
2019	495.36	525.33	-0.39	[-0.43, -0.36]
2020	488.79	522.20	-0.43	[-0.50, -0.36]
2021	493.07	531.24	-0.42	[-0.47, -0.36]
	Browns	Whites	Cohens' *d*	Cohens' *d* CI
2016	474.17	490.75	-0.43	[-0.46, -0.39]
2017	499.34	517.13	-0.34	[-0.37, -0.31]
2018	515.38	533.34	-0.42	[-0.45, -0.38]
2019	502.05	525.33	-0.40	[-0.42, -0.37]
2020	495.76	522.2	-0.55	[-0.60, -0.49] *
2021	504.5	531.24	-0.47	[-0.51, -0.43]
	Indigenous	Whites	Cohens' *d*	Cohens' *d* CI
2016	459.25	490.75	-0.47	[-0.53, -0.41]
2017	499.27	517.13	-0.30	[-0.35, -0.24]
2018	497.8	533.34	-0.43	[-0.49, -0.37]
2019	488.27	525.33	-0.39	[-0.43, -0.35]
2020	478.89	522.2	-0.45	[-0.53, -0.37]
2021	494.17	531.24	-0.44	[-0.57, -0.38]

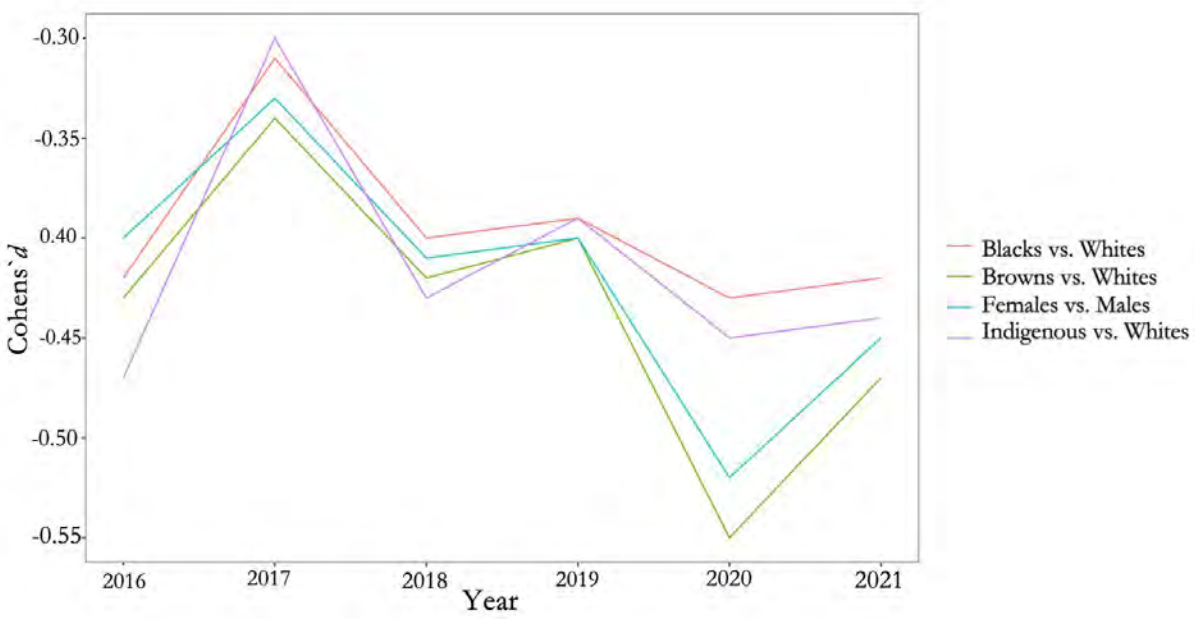
Note. The table shows differences in average ENEM math scores for the last 6 years between females and males, Blacks and Whites, Browns and Whites, and Indigenous and Whites high school seniors. It does not include data on test takers who have already graduated from high school. The (*) highlights the largest differences between groups based on SD distance.

The results indicate potential improvements in learning outcomes for female students, though the medium effect size disparity between male and female senior students in math persisted at 0.45 SD, with a 95% confidence interval of [-0.49, -0.42]. Similarly, this pattern extends to Brown students, who exhibited a substantial gap compared to White senior students in 2020, equivalent to 0.55 SD and a 95% CI of [-0.60, -0.49], but started to exhibit some reduction in math achievements' effect size by 2021 with an effect size of 0.47 SD and a 95% CI of [-0.51, -0.43].

Table 4 also underscores that the gap between White students and all other racial groups remains historically wide. The moderate effect size between Black and White senior students ranges from 0.31 SD in 2017 to 0.43 SD in 2020. The differences in math scores between White and Brown senior students have ranged from 0.34 SD in 2017 to 0.55 SD in 2020. For Indigenous students, the difference ranges from 0.30 SD to 0.47 SD.

Figure 4

Effect Size Comparison Between Groups



Note. The plot compares Blacks and Whites, Browns and Whites, females and males, and Indigenous and White senior students' differences in SD. The graph suggests possible improvements for females and Brown students. On the other hand, there are no improvements for Blacks compared to the pre-pandemic period (2019 and before).

Finally, the analysis from our DID results (Table 3) shows that from 2020 to 2021, White, Black, Asian, and Brown public-school students' learning losses remained consistent with the pandemic period, suggesting no improvement. Thus, our results did not find evidence that any racial groups are recovering differently than others, but that all racial groups are still subject to the effect of school closures (with the one exception of Indigenous students, who did not experience post-pandemic learning loss). Conversely, we observe that in 2021, the difference in learning between male and female test-takers decreased from 14 to 4.4 points. The confidence intervals show no overlap, implying that senior female students may be on the path to recovering from their learning setbacks.

Limitations

Some limitations of this paper include the use of only one Brazilian location. As such, we cannot apply our results on a national level. In addition, the outcomes we observe from ENEM 2020 derive from when students took the test in January 2021, almost ten months after COVID-19 began, during a pandemic peak. When we analyzed the composition of test-takers in both years, we found a similar demographic composition, as observed in Appendix A. As observed, none of the values are superior to 0.15 SD when comparing gender, race, age group, family size, and socioeconomic status. However, we cannot rule out the possibility that the pandemic affected people's willingness or ability to take the test.

Finally, our learning loss analysis conducted in the present study includes high school seniors who are motivated to use ENEM scores to apply to higher educational institutions in Brazil. The

results of this study cannot be applied to freshmen, sophomores, or juniors, who do not have the same motivation as senior students.

Policy Implications

The results of this study offer contrary evidence to the overwhelming majority of learning loss studies globally, which find disadvantaged students to be most deeply impacted by COVID-related school closures. Indeed, these findings suggest that the most economically privileged racial group in Brazil's Federal District—White students, who have an average household income nearly double that of the next closest group—experienced the greatest levels of learning loss. At first blush, this conclusion may seem to suggest that Brazil implemented a more equitable response to school closures than many other countries. However, closer examination of the school context in Brazil and its Federal District indicate that the learning losses experienced across racial groups may actually be indicative of deeper social inequalities within the education system. In fact, we suggest that the learning losses experienced by White students are evidence of differential access to quality learning opportunities within the formal school system in Brazil.

Overall, we know that Brazil has demonstrated low learning levels by secondary-age students. On the 2018 PISA exam, Brazil scored 71st out of 79 countries in secondary mathematics. The country's score of 384 was one full standard deviation below the international mean of 489. According to estimates by the World Bank, Brazilian 15-year-olds won't reach the current OECD average math score for 75 years (World Bank, 2018). Furthermore, data from the ENEM exam suggest that the learning taking place in the Brazilian education system is not spread evenly among schools. Specifically, White students, on average, attend significantly higher performing schools than students from any other demographic group. The school-level ENEM score for schools attended by White students in 2019 in DF was 547.9, compared to 525.7 for schools attended by Black students, 528.8 for Brown students, 527.8 for Asian students, and 500.4 for Indigenous students. Put differently, there is a gap of 0.37 standard deviations in performance between the schools attended by White and Black students. There is a performance gap of 0.79 standard deviations in the schools attended by White and Indigenous students.

Combining evidence of low overall school quality in the Brazilian education system and systematic advantages for White students in accessing the highest quality schools, it is perhaps not surprising to observe a greater loss of learning for White students after their time in these schools was cut short. The school closures in Brazil's Federal District removed a structural advantage for one of the more privileged social groups, thus reducing that group's higher learning achievement. Further evidence of this conclusion is highlighted by the fact that the racial group that historically has access to the lowest performing schools in DF—Indigenous students—experienced no learning loss after school closures.

On the whole, these findings serve to highlight the deep socially based achievement gaps across racial groups in Brazil's Federal District. They also align with prior research from other countries that finds disparities in the quality of education available across social classes—as explained by Lucas' (2001) effectively maintained inequality (EMI) hypothesis (Guetto & Vergolini, 2017; Marks, 2013). The EMI framework explains how the socioeconomic privileged in any society leverage their social and economic advantages to obtain education that is quantitatively equivalent (i.e., equal in number of years) but qualitatively superior (i.e., of a higher quality) compared to their peers. From this perspective, disparities in access to quality schools and teachers, as well as stratified educational curricula, result in differential levels of achievement, higher education access, and post-schooling economic opportunities (Lucas, 2001; Marks, 2013). In the Brazilian context, high ENEM test scores allow examinees to access higher education learning opportunities, including scholarships.

In addition to the results around systemic inequities in Brazil's formal school system, our findings provide evidence of learning loss for most students impacted by the COVID-19 school closures, with little-to-no recovery in the following year. While differences between male and female test-takers were reduced compared to 2020 and 2021 results, we note that in all models, females scored lower than male test-takers, demonstrating achievement differences between these groups. This reinforces the findings of Burzynska and Cotreras (2020), who report that COVID-19 school closures may have widened the gender gap and compromised female empowerment.

In conventional policy analysis approaches, there is an expectation that policymakers will follow a logical progression, which includes steps like problem identification, agenda setting, implementation, and evaluation (Sabatier, 2019). However, these traditional methods primarily emphasize a rational decision-making process and often disregard the social context in which policies are formulated and put into action. Unfortunately, this approach tends to overlook the social and cultural nuances of the issues at hand, as well as the intricate nature of policy decision-making and execution (Chase et al., 2014; Sabatier & Jenkins-Smith, 1988). Chase et al. (2014) observed that many policy frameworks fail to account for the needs and concerns of marginalized populations.

In response to this critical gap, the theories of critical policy analysis (CPA) have provided a valuable tool for addressing the challenges underrepresented communities face. CPA empowers policymakers to examine policies in a manner that challenges established power structures and social hierarchies. As Shaw (2004) pointed out, it is essential to recognize that "policy analysis is never value-neutral" (p. 56), and often, it remains silent on issues related to marginalized groups.

The utilization of CPA and EMI framework can offer insights into the significant learning disparities experienced by White students. As explained in this paper, one possible explanation lies in the substantial economic inequalities that grant White students' better access to educational institutions, whereas Black and other demographic groups may encounter restricted access. It is crucial to acknowledge that "our institutions, social structures, and even our very identities are closely intertwined with the inequities that shape our society" (Apple, 2019, p. 277). Hence, we cannot disregard the possibility that distinct educational experiences may yield disparities in learning losses.

An important question raised by Diem and Brooks (2022), which is highly relevant to the issue of educational inequality in Brazil presented in this paper, is "How much longer should children, families, and educators wait before legislators and administrators craft, implement, and enforce policies that provide equal opportunity for a quality school experience?" The unequivocal answer is that they should not wait any longer. However, the reality is that the wait has been far too extended, as evidenced by this paper's findings highlight significant disparities among minority groups over the past years.

In responding to the learning loss experienced by students during the COVID-19 pandemic, as well as addressing more systemic inequities in the formal schooling system in Brazil, we suggest that public policy makers pay considerable attention to social, economic, and educational disparities. In line with Zhang and Storey (2022), we argue that solutions for pandemic learning losses should provide support to historically marginalized groups and that recovery plans should prioritize vulnerable children and youth.

References

Amin, S., Hossain, M., & Ainul, S. (2021). *Learning loss among adolescent girls during the COVID-19 pandemic in rural Bangladesh.* Population Council.

Angrist, J. D., & Krueger, A. B. (1999). Empirical strategies in labor economics. In *Handbook of labor economics* (Vol. 3, pp. 1277-1366). Elsevier.

Apple, M. W. (2019). On doing critical policy analysis. *Educational Policy*, *33*(1), 276-287. https://doi.org/10.1177/0895904818807307

Ardington, C., Wills, G., & Kotze, J. (2021). COVID-19 learning losses: Early grade reading in South Africa. *International Journal of Educational Development*, *86*, 102480. https://doi.org/10.1016/j.ijedudev.2021.102480

Azevedo, J. P., Hasan, A., Goldemberg, D., Geven, K., & Iqbal, S. A. (2021). Simulating the potential impacts of COVID-19 school closures on schooling and learning outcomes: A set of global estimates. *The World Bank Research Observer*, *36*(1), 1-40. https://doi.org/10.1093/wbro/lkab003

Borusyak, K., & Jaravel, X. (2017). *Revisiting event study designs*. https://scholar.harvard.edu/files/borusyak/files/borusyak_jaravel_event_studies.pdf

Burzynska, K., & Contreras, G. (2020). Gendered effects of school closures during the COVID-19 pandemic. *The Lancet*, *395*(10242), 1968. https://doi.org/10.1016/S0140-6736(20)31377-5

Carver-Thomas, D., Leung, M., & Burns, D. (2021*). California teachers and COVID-19: How the pandemic is impacting the teacher workforce*. Learning Policy Institute. Retrieved from ERIC: https://files.eric.ed.gov/fulltext/ED614374.pdf

Catanante, F., de Campos, R. C., & Loiola, I. (2020). Aulas online durante a pandemia: Condições de acesso asseguram a participação do aluno?. *Revista Científica Educcação*, *4*(8), 977-988. https://doi.org/10.46616/rce.v4i8.122

Centro Regional de Estudos para o Desenvolvimento da Sociedade da Informação. (2020). *TIC Educação 2020 Edição COVID-19, metodologia adaptada.* https://cetic.br/media/analises/tic_educacao_2020_coletiva_imprensa.pdf

Chaabane, S., Doraiswamy, S., Chaabna, K., Mamtani, R., & Cheema, S. (2021). The impact of COVID-19 school closure on child and adolescent health: A rapid systematic review. *Children, 8*(5), 415. https://doi.org/10.3390/children8050415

Chase, M. M., Dowd, A. C., Pazich, L. B., & Bensimon, E. M. (2014). Transfer equity for "minoritized" students: A critical policy analysis of seven states. *Educational Policy*, *28*(5), 669-717. https://doi.org/10.1177/0895904812468

Clarke, D., & Tapia-Schythe, K. (2021). Implementing the panel event study. *The Stata Journal*, *21*(4), 853-884. https://doi.org/10.1177/1536867X211063144

Cohen, J. (1988). *The effect size. Statistical power analysis for the behavioral sciences.* Taylor & Francis.

Costa, M. R. M., & Sousa, J. C. (2020). *Desafios da educação e das tecnologias de informação e comunicação durante a pandemia de COVID-19: Problematizando a transmissão de aulas assíncronas nos canais de televisão aberta e o uso da internet para fins didático-pedagógicos.* UNB. https://repositorio.unb.br/handle/10482/40012

Cucinotta, D., & Vanelli, M. (2020). WHO declares COVID-19 a pandemic. *Acta Bio Medica: Atenei Parmensi*s, *91*(1), 157. https://doi.org/10.23750/abm.v91i1.9397

Currie, J., & Thomas, D. (2001). Early test scores, school quality and SES: Long run effects on wage and employment outcomes. In *Worker wellbeing in a changing labor market* (pp. 103-132). Emerald Group. https://doi.org/10.1016/S0147-9121(01)20039-9

Diem, S., & Brooks, J. S. (2022). Critical policy analysis in education: Exploring and interrogating (in) equity across contexts: Special issue introduction. *Education Policy Analysis Archives, 30*(10). https://doi.org/10.14507/epaa.30.7340

Donnelly, R., & Patrinos, H. A. (2021). Learning loss during COVID-19: An early systematic review. *Prospects*, 1-9. https://doi.org/10.1007/s11125-021-09582-6

Dorn, E., Hancock, B., Sarakatsannis, J., & Viruleg, E. (2020). *COVID-19 and student learning in the United States: The hurt could last a lifetime.* McKinsey & Company. https://www.childrensinstitute.net/sites/default/files/documents/COVID-19-and-student-learning-in-the-United-States_FINAL.pdf

Duraku, Z. H., & Hoxha, L. (2021). The impact of COVID-19 on education and on the well-being of teachers, parents, and students: Challenges related to remote (online) learning and opportunities for advancing the quality of education. In Z. Hyseni Duraku (Ed.), *The impact of COVID-19 on education and well-being: Implications for practice and lessons for the future* (pp. 17-45). University of Prishtina.

Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning loss due to school closures during the COVID-19 pandemic. *Proceedings of the National Academy of Sciences*, *118*(17). https://doi.org/10.1073/pnas.2022376118

Fahle, E., Kane, T. J., Patterson, T., Reardon, S. F., & Staiger, D. O. (2022). *Local achievement impacts of the pandemic.* Education Recovery Scorecard. https://educationrecoveryscorecard.org/wp-content/uploads/2022/10/Education-Recovery-Scorecard_Key-Findings_102822.pdf

Ferguson, C. J. (2016). An effect size primer: A guide for clinicians and researchers. In A. E. Kazdin (Ed.), *Methodological issues and strategies in clinical research* (pp. 301–310). American Psychological Association. https://doi.org/10.1037/14805-020

Gonzalez, T., De La Rubia, M. A., Hincz, K. P., Comas-Lopez, M., Subirats, L., Fort, S., & Sacha, G. M. (2020). Influence of COVID-19 confinement on students' performance in higher education. *PloS one*, *15*(10), e0239490. https://doi.org/10.1371/journal.pone.0239490

Gore, J., Fray, L., Miller, A., Harris, J., & Taggart, W. (2021). The impact of COVID-19 on student learning in New South Wales primary schools: An empirical study. *The Australian Educational Researcher*, *48*(4), 605-637. https://doi.org/10.1007/s13384-021-00436-w

Guetto, R., & Vergolini, L. (2017). Educational expansion without equalization: A reappraisal of the 'Effectively Maintained Inequality' hypothesis in children's choice of the upper secondary track. *European Societies*, *19*(1), 1-27. https://doi.org/10.1080/14616696.2016.1236283.

Hanushek, E. A., & Woessmann, L. (2020). *The economic impacts of learning losses.* OECD Education Working Papers, No. 225. OECD Publishing. https://dx.doi.org/10.1787/21908d74-en

Hevia, F. J., Vergara-Lope, S., Velásquez-Durán, A., & Calderón, D. (2022). Estimation of the fundamental learning loss and learning poverty related to COVID-19 pandemic in Mexico. *International Journal of Educational Development*, *88*, 102515. https://doi.org/10.1016/j.ijedudev.2021.102515

Instituto Brasileiro de Geografia e Estatística (2019). *Acesso à internet e à televisão e posse de telefone móvel celular para uso pessoal. PNAD contínua 2018*. https://ftp.ibge.gov.br/Trabalho_e_Rendimento/Pesquisa_Nacional_por_Amostra_de_Domicilios_continua/Anual/Acesso_Internet_Televisao_e_Posse_Telefone_Movel_2018/Analise_dos_resultados_TIC_2018.pdf

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira. (2020). *Microdados do Enem* https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados/enem

Lichand, G., Dória, C. A., Neto, O. L., & Cossi, J. (2021). *The impacts of remote learning in secondary education: Evidence from Brazil during the pandemic.* Europe PMC. https://doi.org/10.21203/rs.3.rs-568605/v1

Lucas, S. R. (2001). Effectively maintained inequality: Education transitions, track mobility, and social background effects. *American Journal of Sociology*, *106*(6), 1642-1690. https://doi.org/10.1086/321300

Lunardi, N. M. S. S., Nascimento, A., Sousa, J. B. D., Silva, N. R. M. D., Pereira, T. G. N., & Fernandes, J. D. S. G. (2021). Remote classes during the pandemic: Difficulties and strategies used by parents. *Educação & Realidade*, *46*. https://doi.org/10.1590/2175-6236106662

Maldonado, J. E., & De Witte, K. (2022). The effect of school closures on standardized student test outcomes. *British Educational Research Journal*, *48*(1), 49-94. https://doi.org/10.1002/berj.3754

Marks, G. N. (2013). Evaluating effectively maintained inequality: School and post-school transitions, socioeconomic background, academic ability and curricular placement. *Social Science Research*, *42*(6), 1635-1649. https://doi.org/10.1016/j.ssresearch.2013.07.004

Meinck, S., Fraillon, J., & Strietholt, R. (2022). *The impact of the COVID-19 pandemic on education: International evidence from the Responses to Educational Disruption Survey (REDS).* International Association for the Evaluation of Educational Achievement. https://www.iea.nl/publications/international-evidence-responses-to-educational-disruption-survey

Moscoviz, L., & 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.* https://www.ungei.org/sites/default/files/2022-04/learning-loss-and-student-dropouts-during-covid-19-pandemic-review-evidence-two-years.pdf

Neidhöfer, G., Lustig, N., & Tommasi, M. (2021). Intergenerational transmission of lockdown consequences: prognosis of the longer-run persistence of COVID-19 in Latin America. *The Journal of Economic Inequality*, *19*(3), 571-598. https://doi.org/10.1007/s10888-021-09501-x

Paz-Maldonado, E., Flores-Girón, H., & Silva-Peña, I. (2021). Educación y desigualdad social: El impacto de la pandemia COVID-19 en el sistema educativo público de Honduras. *Education Policy Analysis Archives*, *29*. https://doi.org/10.14507/epaa.29.6290

Rajmil, L., Hjern, A., Boran, P., Gunnlaugsson, G., de Camargo, O. K., & Raman, S. (2021). Impact of lockdown and school closure on children's health and well-being during the first wave of COVID-19: A narrative review. *BMJ Pediatrics Open*, 5(1). https://doi.org/10.1136/bmjpo-2021-001043

Sabatier, P. A. (2019). Fostering the development of policy theory. In *Theories of the policy process* (2nd ed., pp. 321-336). Routledge.

Sabatier, P. A., & Jenkins-Smith, H. (1988). Special issue: Policy change and policy-oriented learning: Exploring an advocacy coalition framework. *Policy Sciences*, *21*, 123-272.

Schmidheiny, K., & Siegloch, S. (2019). *On event study designs and distributed-lag models: Equivalence, generalization and practical implications.* SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3338836

Schult, J., Mahler, N., Fauth, B., & Lindner, M. (2021). Did students learn less during the COVID-19 pandemic? Reading and math competencies before and after the first pandemic wave. *PsyArXiv*, *11*. https://doi.org/10.31234/osf.io/pqtgf

Schwartzman, S., & Knobel, M. (2016). High-stakes entrance examinations: A view from Brazil. *International Higher Education*, (85), 19-20.

Shaw, K. M. (2004). Using feminist critical policy analysis in the realm of higher education: The case of welfare reform as gendered educational policy. *The Journal of Higher Education*, *75*(1), 56-79. https://doi.org/10.1080/00221546.2004.11778896

Shepherd, D., Mohohlwane, N., Taylor, S., & Kotzé, J. (2021). *Changes in education: A reflection on COVID-19 effects over a year.* NIDS-CRAM.

Souza, A. P., Lima, L.., Soares, C.., Marcondes, G.., & Davi, P. (2020). *Perda de aprendizado no Brasil durante a pandemia de COVID-19 e o avanço da desigualdade educacional.* Centro de Aprendizagem em Avaliação e Resultados para o Brasil e a África Lusófona (FGV EESP Clear), da

Fundaçao Getulio Vargas (FGV). https://fundacaolemann.org.br/storage/materials/e828oun5zDAh6bqCMcplmqKz1VsD5Tr3jTgecYXd.pdf

Southall, E., Holmes, A., Hill, E. M., Atkins, B. D., Leng, T., Thompson, R. N., Dyson, L., Keeling, M. J., & Tildesley, M. J. (2021). An analysis of school absences in England during the COVID-19 pandemic. *BMC Medicine*, *19*, 1-14. https://doi.org/10.1186/s12916-021-01990-x

Storey, N., & Zhang, Q. (2021). *A meta-analysis of the impact of COVID-19 on student achievement.* [Preprint]. EdArXiv. https://doi.org/10.35542/osf.io/qekw2

Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, *225*(2), 175-199.

United Nation Children's Fund. (2020). *COVID-19: Are children able to continue learning during school closures?* https://data.unicef.org/resources/remote-learning-reachability-factsheet/

United Nation Children's Fund. (2021a). *Largest disruption to schooling in history due to COVID-19 measures must not rob children of their education and development*. http://tinyurl.com/58j8dszn

United Nation Children's Fund. (2021b). *The state of the global education crisis: A path to recovery. A joint UNESCO, UNICEF and WORLD BANK report.* https://redined.educacion.gob.es/xmlui/bitstream/handle/11162/236447/STATE.pdf?sequence=1

United Nations Educational, Scientific and Cultural Organization. (2022). *COVID-19 impact on education: International evidence from the Responses to Educational Disruption Survey (REDS).* https://en.unesco.org/covid19/educationresponse#durationschoolclosures

United Nations Educational, Scientific and Cultural Organization Institute for Statistics. (2022). *COVID-19 in Sub-Saharan Africa: Monitoring impacts on learning outcomes.* https://milo.uis.unesco.org/wp-content/uploads/sites/17/2022/01/MILO-Summary-Full-Report.pdf

Valente, R. R. (2017). The vicious circle: Effects of race and class on university entrance in Brazil. *Race Ethnicity and Education*, *20*(6), 851-864. https://doi.org/10.1080/13613324.2016.1150824

Woon, W. S. (2004). Introduction to the event study methodology. *Singapore Management University*, *4*(7). http://tinyurl.com/y87wdm8b

World Bank. (2020). *The COVID-19 pandemic: Shocks to education and policy responses.* https://inee.org/sites/default/files/resources/148198.pdf

World Bank. (2018). *World development report 2018: Learning to realize education's promise.* https://www.worldbank.org/en/publication/wdr2018

Yarrow, N, Masood, E., & Afkar, R. (2020). *Estimates of COVID-19 impacts on learning and earning in Indonesia: How to turn the tide.* https://openknowledge.worldbank.org/handle/10986/34378

Zhang, Q., & Storey, N. (2022). Controversies behind COVID learning loss: Historical issues, current measurements, and future strategies. *Theory Into Practice*, *61*(3), 300-311. https://doi.org/10.1080/00405841.2022.2096380

Appendix A

Standardized Mean Differences from Test Takers in 2019 and 2020

	Means Treated	Means Control	Std. Mean Diff.	Var. Ratio	eCDF Mean	eCDF Max
Senior	0.49	0.45	0.07	.	0.04	0.04
Gender Female	0.67	0.60	0.15	.	0.07	0.07
Gender Male	0.33	0.40	-0.15	.	0.07	0.07
Race: White	0.33	0.30	0.07	.	0.03	0.03
Race: Asian	0.03	0.03	0.00	.	0.00	0.00
Race: Black	0.15	0.15	-0.02	.	0.01	0.01
Race: Brown	0.47	0.50	-0.05	.	0.03	0.03
Race: Indigenous	0.00	0.00	-0.01	.	0.00	0.00
Race: No Answer	0.02	0.02	0.00	.	0.00	0.00
Age Group	2.61	2.70	-0.13	0.94	0.03	0.06
Family Size	4.03	4.09	-0.04	0.92	0.00	0.03
SES	2998.88	3072.71	-0.02	1.11	0.02	0.10
Below Poverty Line	0.46	0.42	0.09	.	0.04	0.04

Standardized Mean Differences from Test Takers in 2019 and 2021

	Means Treated	Means Control	Std. Mean Diff.	Var. Ratio	eCDF Mean	eCDF Max
Senior	0.46	0.45	0.02	.	0.01	0.01
Gender Female	0.63	0.60	0.07	.	0.03	0.03
Gender Male	0.37	0.40	-0.07	.	0.03	0.03
Race: White	0.39	0.30	0.19	.	0.09	0.09
Race: Asian	0.02	0.03	-0.04	.	0.01	0.01
Race: Black	0.13	0.15	-0.06	.	0.02	0.02
Race: Brown	0.43	0.50	-0.13	.	0.06	0.06
Race: Indigenous	0.00	0.00	-0.04	.	0.00	0.00
Race: No Answer	0.02	0.02	0.00	.	0.00	0.00
Age Group	2.59	2.70	-0.15	0.92	0.04	0.07
Family Size	3.97	4.09	-0.09	0.84	0.01	0.04
SES	3512.73	3072.71	0.10	1.31	0.03	0.07
Below Poverty Line	0.39	0.42	-0.05	.	0.03	0.03

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