RISE Working Paper 22/120
December 2022

COVID-19 Learning Losses, Parental Investments, and Recovery: Evidence from Low-Cost Private Schools in Nigeria

Adedeji Adeniran, Dozie Okoye, Mahounan P. Yedomiffi, Leonard Wantchekon

Abstract

About 2 billion children were affected by school closures globally at the peak of the COVID-19 pandemic. This has led to documented learning losses while children were out of school, and an especially precarious future academic path for pupils in developing countries where learning and continued enrolment remain important issues. There is an urgent need to understand the extent of these learning and enrolment losses, and possible policy options to get children back on track. This paper studies the extent of learning losses and recovery in Africa's most populous country, Nigeria, and provides some evidence that a full recovery is possible. Using data from a random sample of schools, we find significant learning losses of about .6 standard deviations in English and Math. However, a program designed to slow down the curriculum and cover what was missed during school closures led to a rebound within 2 months, and a recovery of all learning losses. Students who were a part of the program do not lag behind one year later and remain in school.

COVID-19 Learning Losses, Parental Investments, and Recovery: Evidence from Low-Cost Private Schools in Nigeria

Adedeji Adeniran
CSEA

Dozie Okoye
Dalhousie University and CSEA

Mahounan P. Yedomiffi
University of Illinois Urbana-Champaign

Leonard Wantchekon
Princeton University and ASE

Acknowledgements:

Project was supported by funding from the Research for Improving Systems of Education COVID-19 grants. We are grateful to Moses Ogenyi for outstanding project management. We thank Obinna Obiwulu and Faiza Mutaka for assistance with research and data collection. Special thanks to participants at the RISE Conference (2021) and Pan-African Scientific Research Council Conference (2022) and for useful comments on the earlier draft of this manuscript. All errors are our own.

This is one of a series of working papers from "RISE"—the large-scale education systems research programme supported by funding from the United Kingdom's Foreign, Commonwealth and Development Office (FCDO), the Australian Government's Department of Foreign Affairs and Trade (DFAT), and the Bill and Melinda Gates Foundation. The Programme is managed and implemented through a partnership between Oxford Policy Management and the Blavatnik School of Government at the University of Oxford.

Please cite this paper as:
Adeniran, A., Okoye, D., Yedomiffi, M.P. and Wantchekon, L. 2022. COVID-19 Learning Losses, Parental Investments, and Recovery: Evidence from Low-Cost Private Schools in Nigeria. RISE Working Paper Series. 22/120. https://doi.org/10.35489/BSG-RISEWP_2022/120

Introduction

The spread of and containment measures against COVID-19 such as school closures have severely affected education systems globally. UNESCO (2021) estimates that more than 1.6 billion students were affected by school closures at the peak of the pandemic. Empirical evidence largely from developed countries reveal huge learning losses from school closures despite the transition to remote learning (Elisa and De Witte, 2020). Simulation analysis also predicts between 0.3 and 1.5 years of learning losses globally (Azevedo et al., 2020; Kaffenberger, 2020). There is a growing concern regarding potential learning losses for children in developing countries who are already facing chronic learning deficits. Psachropoulos et al. (2020) estimate that COVID-19 induced school shutdowns might result in future earnings losses equivalent to 15% of future national income, thereby derailing decades of economic progress in many developing countries. To avert this bleak outcome requires a speedy recovery and net learning gains going forward to compensate for the loss. Policymakers in developing countries need information on the costs of school closure and policy options to expedite recovery.

This paper estimates the level of learning loss due to Covid-19 among low-cost private primary schools in Nigeria that have been especially hard-hit by COVID-19 related school closures. Nigeria exemplifies the educational challenges among developing countries, with the highest number of out-of-school children in the world and high learning deficits among those in schools. Low-cost private schools are ideal for investigating learning losses due to school closures because they are less likely to have received government support and face challenges providing remote learning support (Lennox et al, 2021). These schools also cover an increasing share of the Nigerian population, as they have grown tremendously over the years to fill gaps in the public education system (Nigerian Education Data Survey, 2015). Students attending low-cost private schools are also more likely to be on the margins of either remaining in school or dropping out completely.

Working with 76 low cost schools located in low-income areas, the study evaluates the level of learning losses due to covid-19 using pre- and post-pandemic test scores in Mathematics and English We also implemented a two-month supplemental learning program covering all students in low-cost private schools in a semi-urban part of Nigeria, starting in September, when schools were permitted to partially open once again. The aim of the program was to enable students to regain learning after being away from school for approximately 6 months. The program focused on exposure to the curriculum that would have been covered before and during school closures. The program also helped participating low-cost private schools to remain open by sustaining their expected enrollment levels, as many parents were unable to pay the fees needed for their children to return to school or enroll in these supplemental lessons after the economic troubles induced by pandemic.

We collected four assessments over the course of the study. The first assessment covers the pre-pandemic period and we collect this from school records. We administered the same test over the baseline (September), midline (October) and endline (November) of the intervention. We measure learning losses as the difference in scores between the pre-pandemic and baseline assessments. The difference between the baseline, midline and endline assessments are our indicators of learning recovery. We also collected data on student test scores, school and teacher plans and attitudes, parental background, plans, and living conditions. This allows us to evaluate home and parental effects on learning loss and recovery. The literature has noted significant heterogeneities in COVID-19 effects, with children from socially and economically disadvantaged backgrounds disproportionately affected (Dorn et al, 2020; Tomasik et al, 2020).

Tracking the performance of the same student over time, we find that the magnitude of learning losses caused by school closures could be equivalent to losses from being out of school for 5-6 months of class time. Specifically, our data reveal that student performance decreased by about .65 and .6 standard deviations in Math and English respectively, relative to their performance prior to school closures. Furthermore, we find that the effects and magnitude of losses observed were different for children who had access to some learning at home such as completing assignments sent by school teachers, TV/radio education programmes, home-tutoring etc, compared to children who did not have access to at-home learning. Students from households with educated mothers also experienced less learning losses. Therefore, the pandemic negatively impacted learning outcomes, but engaging in educational activities at home during school closure mitigated these negative impacts.

Further, we track students through the supplemental lessons and find that they recover quickly from these learning losses. Within one month of the program, students are already performing at or higher than pre-pandemic levels, and perform at about .45 s.d. deviations above pre-pandemic means after two months of supplemental lessons. Students with educated mothers, access to at-home learning during the pandemic, and from households whose incomes remained stable, benefitted even more relative to pre-pandemic performance. We find this to be a positive result, because it demonstrates that COVID-19 learning losses do not need to be permanent, students can recover. However, it is important to emphasize that the supplemental lessons studied here have not been widely adopted, especially in public schools and low-cost private schools. The evidence, nevertheless, demonstrates that they will be helpful to avert long-term learning losses and ensure that students' progress with the skills they require.

The remainder of the paper proceeds as follows: Section 2 provides background and context into education policy responses to the COVID-19 shock in Nigeria. Section 3 describes the approach to data collection and design of the impact evaluation. Section 4 describes our results. Section 5 concludes with a discussion of the results and implications for policymakers as efforts shift towards recovery.

Background, Context, and Literature Review

Pandemic Policy on Education in Nigeria

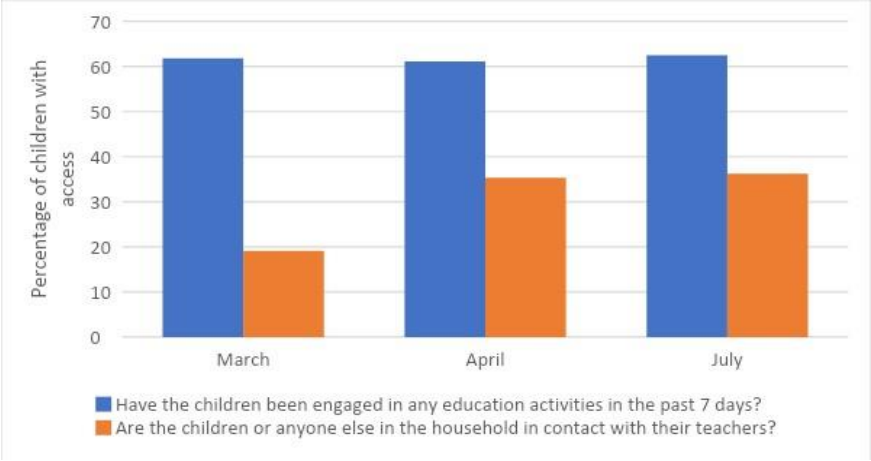
In March 2020, with the first case of COVID-19, Nigerian authorities implemented extended school closures across the country. Schools remained closed over a period of 6 months for at least 22.4 million public elementary school students, 6.8 million lower secondary school students, and 1.7 million undergraduate students (Simona, 2020). Beginning in September 2020, the government started reopening of schools in phases. To reduce class size and ensure effective social distancing, school periods were shortened from 7 hours to 4 hours. Schools were fully reopened in January 2021, which implies between 8-9 months of forced school closures or limited schooling. Full closures lasted for roughly 5-6 months according to the regular academic schedule shown in Table A8.

The government and private school owners introduced a number of initiatives during this period to ensure learning continuity. Free e-learning tools were available for adoption for those with necessary hardware, while mass media (TV, radio) also provided alternative learning platforms. The effectiveness of these measures was limited as seen in the low adoption rate based on a rapid telephone survey from Nigeria's National Bureau of Statistics (Figure A). During the initial phase of the school closure in March, about 38% of students were not involved in any education activities and only 19% had contact with their teachers. While there were some improvements over time as contact with teachers reached 36.1% by July 2020, most learners are still disconnected from the school system and the share of children not engaged in any education activities remains around 38%.

Among those that were learning, the NBS survey shows self-education and household support were the main means of education for most children. Learning apps were among the least popular forms of engagement over the period, reflecting low rates of technology adoption in Nigeria. The extent to which these alternative learning platforms mitigate learning loss is not known, but it is doubtful they can sufficiently close the gap. Firstly, a significant number of children are not reached, meaning prolonged exclusion from learning activities is unaddressed. Secondly, most of those reach are through unconventional means and with limited school or

teacher's guidance. Alternative learning platforms' capacity to effectively teach and replicate classroom experience is limited (Jenna 2017), so learning losses are also expected among those with access. Evidence from developed countries with better e-learning infrastructure indicates digital platforms are not perfect substitutes for typical children-teacher interactions (Engzella et al, 2021; Tomasik et al., 2020). Thirdly, after school reopened, school terms were either eliminated or curriculums fast tracked, suggesting an absence of effective learning recovery activities. Given these trends, an exercise to probe into the scope of learning loss and efforts at recovery is crucial to learn from the crisis, especially in Nigeria, which is already experiencing a flat learning curve.

Figure A: Learning activities during school closure: COVID-19 Monthly Phone Survey



Source: National Bureau of Statistics (NBS, 2020)

Table A: Medium of learning during school closure in Nigeria

	March	April	May	June	July
Completed assignments provided by the teacher	17.09	33.64	37.3	47.79	46
Used mobile learning apps	6.2	17.89	20.46	23.73	15.99
Watched educational TV programs	15.5	30.69	39.02	46.68	35.72
Listened to educational programs on radio	20.48	45.18	44.86	51.09	46.16
Studying/reading on their own	67.4	80.07	77.26	77.2	77.69
Taught by parent or other household member	56.06	75.35	73.25	72.83	72.2
Session/meeting with Lesson Teacher (tutor)	15.94	32.92	45.76	60	54.17
Other activity	3.08	2.22	2.07	4.44	1.16

Source: National Bureau of Statistics (NBS, 2020)

Context and Justification

The Learning Loss Debate

It is well accepted that long school closures result in learning loss (Cooper et al., 1996; Tom & Shanthi). Many education experts and parents are familiar with "Summer Learning Loss" or "Summer Slide", a phenomenon in which achievement levels drop as a result of summer breaks. While summer learning loss is mostly associated with education systems that have long breaks such as in the USA and Canada, similar effects have also been observed from prolonged school absenteeism or a "family decision to remove" a student from school (Aycejo & Romano, 2016; Goodman, 2014). The prolonged school closure due to the COVID-19 pandemic has raised concerns about huge learning losses. According to Manos Antoninis[1], director of UNESCO's "Global Education Monitoring Report", on average, "two-thirds of an academic year has been lost worldwide due to COVID-19 school closures". At the peak of the pandemic, 1.6 billion students were forced out of school as a result of government containment measures.

However, the implications of evidence from summer learning loss for COVID-19 school closures are less clear. First, there is no country or region that experienced a complete absence of learning as governments and multilateral institutions rolled out various distance learning tools. In most settings, especially developed countries, digital platforms allowed for some learning continuity and sustained teacher-pupil interactions. In settings without ICT facilities, mass media like TV, radio and SMS were deployed to engage learners. Second, parents were also affected by movement restrictions, implying children could receive elements of support from parents at home. Third, COVID-19 comes with other changes that could either support or restrict learning, such as income changes and stress at home. Countries with capacities to provide social protection could help families and communities cope better with the disruption and therefore might experience less learning losses.

---

[1] https://en.unesco.org/news/one-year-covid-19-education-disruption-where-do-we-stand
[3] The ridiculousness of Learning Loss

There is also an argument that learning losses are a mirage. In an article entitled "The Ridiculousness of Learning Loss", John Ewing, President of Math for America, argued that learning loss is a "shallow, naïve, ridiculous concept"[3]. He pointed out that in fact, "stepping away from a topic for a while requires time to recollect the bits and pieces when you return. Those bits and pieces aren't lost—they only require reassembling, and often the reassembling leads to greater understanding". Ewing further argued that learning is a complicated process, and the mind is not a vessel to be filled but a fire to kindle. Like a fire, a mind does not leak but just needs to be rekindled.

Several studies from developed countries have investigated the scope of COVID-19 induced learning losses. In the USA, a nationwide study by (Dorn et al, 2020) revealed that on average, "students lost the equivalent of three months of learning in Mathematics and one-and-a-half months of learning in reading". In the Netherlands, (Engzella et al, 2021) showed that school closure due to COVID-19 resulted in a learning loss equivalent to one-fifth of a school year in Math, spelling, and reading for 350,000 Dutch students aged 8 to 11. In a survey undertaken by the National Institute for Early Education Research (NIEER) at the Rutgers Graduate School of Education, by the fall of 2021, in-person attendance of three-year-old preschoolers had dropped to 32% and that of four-year-old preschoolers decreased to 40% compared to 2020.

Another strand of literature examines strategies to minimize learning loss during school closure and ensure learning recovery. Angrist et al. (2020) design low technology interventions in the form of SMS text messages and direct phone calls to support parents to educate their children in Botswana and found this as effective in mitigating learning loss. Similarly, Clark et al. (2020) found in the case of China that online education improves students' academic achievement by 0.22 of a standard deviation relative to those who stopped receiving learning support from their school during the COVID-19 lockdown. The authors also found that low achievers benefit the most from online learning while there is no significant impact for top students. The achievement level attained is higher for those using computers for online education than those using smartphones. Tomasik et al. (2020) also concluded based on evidence from Switzerland that distance learning is an

effective substitute for in-person learning, at least in an emergency situation, but not all pupils benefit to the same degree.

Singh, Romero and Muralidharan (2022) also test for the effectiveness of non-technological interventions to ensure learning recovery in India after 18 months of school closure. Specifically, they examined a government led remedial program in which community volunteers provide between 60-90 minutes of daily complementary lessons after normal school hours. They found that the state intervention contributed 28% to the population-level catch-up in language and 20.7% in mathematics. This is the closest in literature to the learning recovery intervention that was designed and tested in this study, and the result indicated the potential and scalability of remedial programmes targeted at foundational literacy and numeracy as well as content missed due to school closure.

This evidence suggests that learning loss is a reality for those who are excluded from the school system during school closures and are without access to alternative learning mediums. It also suggests that online learning and low-cost technology could mitigate learning loss if appropriately deployed. However, in a setting with weak access to technological gadgets like computers and electricity, remote learning could be less effective. The study is in low-income areas where the majority of households lack access to even feature phones and electricity access is erratic, hence we test the effectiveness of conventional classroom contexts that increase teaching time through supplemental teaching. We discuss more below on the evidence of learning loss among disadvantaged groups.

The Case of Disadvantaged Students: Acute Loss

A second concern is that learning losses will be uneven across populations. The difference in access to online tools suggests that children from disadvantaged socioeconomic backgrounds will be more significantly affected. Dorn et al. (2020) find that the COVID-19 pandemic has taken an especially heavy toll on Black, Hispanic, and Indigenous communities. According to their findings, in Mathematics, students of color experienced six to 12 months of learning loss, compared to four to eight months of learning loss for white students. In the Netherlands, Per Engzella et al. (2021) found that learning loss was up to 60% larger among primary students from less educated or

disadvantaged homes. Tomasik et al. (2020) similarly found that secondary school pupils in Switzerland were largely unaffected, but learning slowed down among primary school pupils and interindividual variance in learning gains also increased.

Lim (2022) also found in the case of Indonesia that low-ability students suffer the least learning losses in numeracy. However, this result is relative as other studies that reported a more disproportionate effect for the low-ability student. Patrinos, Vegas and Carter-Rau (2022) in their systematic review of literature on COVID-19 induced learning losses observed that the majority of studies (11 studies) found greater learning losses for students at lower levels of academic achievement as against 3 studies that documented greater learning losses for students with greater past academic achievement.

Another area that COVID-19 disproportionately affects the disadvantaged groups is through lower enrolment. Most studies do not account for enrolment effect of COVID-19, hence underestimate the learning loss which is computed based on only in-school students. Moscoviz and Evans (2022) in their cross-country survey of the effect of COVID-19 on drop out rates found that Nigeria is among the few countries experiencing significant decline in enrolment after the reopening of schools. Dessy et al., (2021) found school attendance in Nigeria declined by 8 percentage points between 2019 and 2020 (after schools reopened) with the older cohort mostly affected. Similarly, the authors found that adolescent girls' enrollment was much more affected than those of boys, especially in the regions where child marriage is more prevalent. If these school dropouts stay permanently out of school, this will create further challenges in access and long term learning loss.

There are two emerging trends in the literature on COVID-19 impact on the school system. The empirical evidence confirms the hypothesis of significant learning losses. Among developed countries with the structure and infrastructure for distance learning, as well as social protection interventions to minimize the psychological effect of the pandemic, learning loss is still present. Further, learning losses vary according to the student's socioeconomic background and other characteristics (minority groups, rural dwellers, low-income households). This implies that COVID-19 amplified existing fault lines and inequalities, suggesting pre-pandemic structural issues are being amplified by the shocks. The literature on resilience to shocks has similarly

observed disproportional effects on poor households. Another explanation for the trend is the capacity for households to effectively utilize different types of support. For example, children with educated parents can benefit from distant learning support more than others.

While there are few studies on learning loss among developing countries, this evidence suggests a deeper and more disproportionate impact on disadvantaged groups, with higher learning disruption. High-frequency phone survey in Nigeria and Senegal, about two-third children are not engaging in any learning activity during the lockdown (Nestour & Moscoviz, 2020)..However, evidence on the extent of learning losses in developing countries, which frequently lack the infrastructure to deliver effective distance learning, and steps that can be taken to mitigate these losses is lacking.

Data

The data is built around 73 low-cost private schools that have been especially hard-hit by COVID-19 related school closures. Low-cost private schools are ideal for investigating learning losses due to school closures because they are less likely to have received any government support and face challenges providing support for remote learning (Lennox et al, 2021).[2] The schools also cover a large and increasing share of the Nigerian population, as they have grown tremendously over the years to fill gaps left by a weak public education system (NEDS, 2016). Students attending low-cost private schools are also more likely to be on the margins of either remaining in school or dropping out completely. We collected data on student test scores, school and teacher plans and attitudes, parental background, plans, and living conditions for students who participated in a supplemental learning program prior to the reopening of schools that have been closed for about 6 months (March to September). The program built on plans by schools to supplement incomes by offering classes to pupils who have been out of school. Specifically, all students on the school's

[2] None of the schools in our data received any form of support from the government, and none were able to implement any form of remote learning.

roster and at the appropriate grade who still lived in the area were allowed to participate in the program, although some parents were willing to pay independent of the program.[3]

Student Data

Data collection focused on students in primary schools, specifically grades 2 to 4. We focused on these age groups because students in grade 1 were too young to participate, and some students above grade 4 were already preparing for entrance exams to secondary schools. For each student, we collected data on test scores prior to school closures in March (pre-COVID, period 0). Each student was also tested on the *same* material at the beginning of the supplemental classes in order to assess how much of the material they retained in the intervening period (period 1). Students were then tested once again after 1 month (period 2) and 2 months (period 3) of the supplemental classes. These tests were monitored by independent supervisors to ensure that they were held to the same standards. We also kept track of student attendance and continued enrollment over this time period.[4] In total, we have data on 2055 students across the 73 low-cost private schools, of which 48% were female. Not all students continued with the supplemental lessons, so the actual number of students for whom we have data on test scores is lower. The appendix contains details of schools and the number of students at each school.

Table 1a below provides a preliminary overview of the data, showing test scores pre-COVID and at the start of the supplemental program. Test score data were collected for Math and English, with "0" signifying the period before the lockdowns and "1" signifying the beginning of the supplementary lessons. Note that pre-closure test results were not available for all students. The results show that mean scores dropped from 62 to 51 for Mathematics, and from 64 to 54 for

[3] The cost of the program is less than $30 per student for 2 months of remedial classes, excluding the provision of personal protective equipment. It allowed schools to offer these programs to more students than would have been possible without the subsidy. Students whose parents paid directly tend to come from relatively better off families (see Table A6). We do not find any significant differences in learning losses and recovery between both groups.

[4] We plan to return to the field after one year to assess the impact of the supplemental lessons on continued enrollment and school continuity, relative to schools and students that did not participate in the program. This is an important dimension to school closures that could not be studied over 2 months, although the data indicates a significant share of parents plan to withdraw their children from school.

English, indicating substantial decreases in test scores between school closures in March and resumption of the supplemental lessons 6 months later. This loss is seen across the distribution of test scores, with declines observed for the 25th, 50th, and 75th percentiles.

Table 1a.: Test Scores Before and Immediately After School Closures.

	MATHS 0	**ENGLISH 0**	**MATHS 1**	**ENGLISH 1**
count	1765	1761	1868	1873
mean	62	64	51	54
std	22	21	26	27
min	0	0	0	0
25%	48	50	33.33	33.33
50%	64.28	65.71	50	54
75%	80	81	70	75
max	100	100	100	100

Note: This table displays summary statistics of test scores before and immediately after school closure.

Table 1b contains the full summary of test scores across all test rounds, with time 0 representing the period before school closures due to COVID-19. We see a decline in performance post-school closures but prior to the start of supplemental lessons. Performance recovers after 1 month of supplemental lessons and is well above pre-COVID levels after 2 months, showing that students recover and advance. We further investigate the robustness of this finding in the next section, specifically by following the same student over time instead of looking at overall means.

Table 1b: Summary of Test Scores Across RoundsAll Rounds

	Mean	Standard Deviation	Minimum	Maximum	Observations
Math percentage grade	62.31	24.78	0	100	3074
English percentage grade	63.67	24.45	0	100	3071

Math z-score within school mean at time 0	-0.05	1.16	-3	2	3074
English z-score within school mean at time 0	-0.03	1.16	-3	2	3071

Panel B: Round 1 (Time 0)

	Mean	Standard Deviation	Minimum	Maximum	Observations
Math percentage grade	62.78	21.33	0	100	770
English percentage grade	64.30	20.96	0	100	769
Math z-score within school mean at time 0	0.00	1.00	-3	2	770
English z-score within school mean at time 0	0.00	1.00	-3	2	769

Panel C: Round 2 (Post-Closure, before supplemental lessons)

	Mean	Standard Deviation	Minimum	Maximum	Observations
Math percentage grade	47.70	24.91	0	100	769
English percentage grade	50.85	25.84	0	100	768
Math z-score within school mean at time 0	-0.73	1.16	-3	2	769
English z-score within school mean at time 0	-0.64	1.23	-3	2	768

Panel D: Round 3 (1 Month After Supplemental Lessons)

	Mean	Standard Deviation	Minimum	Maximum	Observations
Math percentage grade	67.12	22.66	7	100	767
English percentage grade	68.12	22.79	5	100	766
Math z-score within school mean at time 0	0.18	1.06	-3	2	767
English z-score within school mean at time 0	0.18	1.08	-3	2	766

Panel E: Round 4 (2 Months After Supplemental Lessons)

	Mean	Standard Deviation	Minimum	Maximum	Observations
Math percentage grade	71.65	23.36	0	100	768
English percentage grade	71.41	22.83	0	100	768
Math z-score within school mean at time 0	0.39	1.09	-3	2	768
English z-score within school mean at time 0	0.34	1.09	-3	2	768

Parental and Household Data

We supplement data on student test scores with information on parental and household characteristics. These include data on parents' education (father and mother), occupations of parents, income loss due to COVID-19, investments in learning for children during the lockdowns, and intentions for their children's further education. These are intended to help us understand the roles of parental investments and intentions for learning losses and recovery. Data from the survey of parents is summarized in Table A7.

School and Teacher Data

The schools in our data are generally low cost private schools, with tuition fees of less than $50 over a 3-month term, and there is very little variation between them. In order to further understand how COVID-19 might impact the education system going forward we asked school owners and teachers about their experiences, plans, and future intentions. In general, the schools in our data have the following characteristics;

1. Tuition fee is about NGN 15,000 ($50) per term.
2. Average student-teacher ratio is 20 to 1.
3. Average of four teachers per school

In addition to the above, we also collected information on school activities during the closures, specifically educational activities and modes of delivery. Data was also collected on teacher retention and payment of salaries, plans for teachers to return to the classroom, and teacher contact with students during the lockdowns.

Overview of Data

We briefly summarize results from surveys of school owners, teachers, and parents below, with associated tables and figures in the Appendix.

Impacts on Schools

We administered questionnaires to 59 school owners covering school characteristics, impact of the pandemic on school owners and impact of the pandemic on teacher retention. The results indicate that while schools were closed, a majority of school owners (46/59) conducted face-to-face tutoring with a few students. This implies that learning did not cease while schools were shut down, although the effectiveness of these learning activities will be investigated in the next section. The primary motivation for undertaking these learning activities was to generate some income, because the vast majority of school owners (54/59) did not pay their teachers from March to September. In the survey, 73% of schools had at least one teacher resign as a result, and most school owners

believe that these teachers are unlikely to return. The exit of teachers from the growing low-cost private school sector is one aspect of COVID-19's impact on school systems that is relatively understudied and it is a challenge not faced by teachers in the public school system.

Results from Teacher Surveys

The above notwithstanding, teachers (92%) continued to indicate strong interest in continuing with teaching and supplemented incomes by tutoring privately (not necessarily with students at the same schools). Teachers also planned to help students "catch up" with missed content, although this is conditional on students potentially paying for the extra time. Responses from teachers painted a more positive view of the continuity of the low-cost private school system, though their actions ultimately depend on the ability of school owners to keep their schools running with pupils in the classroom. Hence, we turn to parents and their plans.

What Do Parents Think?

We surveyed 1,010 parents whose children attend the 73 schools in our study, and data was collected on their educational backgrounds, effects of COVID-19 on their incomes and engagement with their children's learning, and on their future plans. About 35% of the parents in our data have no formal education, and a majority only have some primary education, underlying the vulnerability of the pupils in this study to leaving education completely. About 23% of parents did not engage their children in any learning activities during school closures while the rest attempted to teach their children themselves or hired private tutors to assist. Roughly 80% of parents interviewed said that their incomes were significantly reduced due to the pandemic, and about 60% of parents said that their children might not be able to return to school due to changes in household incomes. The vast majority of parents who do not plan for their children to return are hoping to place them in income-generating activities to help with the household. While this study focuses on the impacts of school closures on learning, the long-term impacts on enrolment in Nigeria, a country already struggling with over 10 million out of school children, might be even more important and is left for future research.

Next, we formally investigate the impacts of the lockdown on learning and the potential for recovery when schools reopen.

Empirical Approach

Econometric Framework

Now, we focus on the primary goal of this paper which is to assess how much learning was lost due to the COVID-19 pandemic, whether this can be recovered, and the roles of parental investments in the process. A primary challenge to answering this question is to find comparable students and tests before and after the pandemic. Our data addresses this challenge by collecting test scores for the same tests before the pandemic, at the start of a supplemental lessons program ("the program"), and 2 months after the start of the program.

Our approach is to compare student performance prior to school closures to performance on the same test at the beginning of the program (measuring losses), and performances one and two months after supplemental lessons (measuring recovery). The basic econometric model we estimate is below:

$$Score_{ist} = \alpha_i + \gamma_s + \sum_{t=1}^{3} \beta_t D_{ist} + \mu_{ist} \qquad \text{Equation (1)}$$

Equation (1) estimates a fixed effects model of test scores of pupil *i*, in school *s*, at time *t,* on individual fixed effects, α_i, school fixed effects, γ_s, and dummies (*D*) for the start of the program

(period 1), one month after the program (period 2), and 2 months after the program (period 3). The period prior to school closures is excluded and serves as the reference time period.

We estimate learning losses by tracking student performance over time. Therefore, we are able to interpret the coefficients, β_t, in the equation as the impacts of school closures and the supplemental programs for the students in our data under the assumption that the only changes over time are

related to school closures and the program. For example, test scores cannot have declined over time regardless of school closures, nor can they have recovered independently over 2 months regardless of the supplemental lessons.[5] This concern is more important in terms of measuring learning losses, as some loss of learned material could occur over time. This is unlikely in this context, however, given that the tests cover the basics expected from students in grades 2, 3, and 4, and knowledge they are expected to know upon advancement to a higher grade for the next academic year. One way to assess the importance of natural learning losses versus losses due to being out of school is to compare losses for students who had some learning activities at home to those who did not have any learning activities. We find losses for both groups, suggesting that being out of school was important. Further, we compare the learning losses that we estimate with estimates in the literature on learning losses associated with "summer breaks," and demonstrate that the losses we estimate were due to school closures and are much more than would be expected over a summer break.

A second concern with the approach above has to do with external validity, i.e how generalizable are the findings to students who did not return to school? Our data allows us to address this concern because it includes students whose parents voluntarily paid for access to the supplemental program and those who only returned to school because their fees were covered under the program. We

[5] It is possible, for example, that students' performance would have declined significantly over time even if schools were kept open.

compare learning losses and recovery for these groups and find that they are quantitatively and statistically indistinguishable.

For the econometric analysis, we primarily use two datasets, the students' and parents' dataset as school characteristics are captured by school fixed effects. The student dataset contains information regarding students' test scores in Mathematics and English for the four rounds (pre-covid, post-closure but start of supplemental lessons, a month after start of supplemental lessons, and two months after start of supplemental lessons), students' grade and gender. Test scores were normalized into percentages for easy comparison. We also transform the raw percentage test scores into z-scores (standardized scores) in some analyses, so that changes can be interpreted as standard deviations.

Further, we estimate variants of Equation (1) that split the sample according to key parental and household characteristics, and variants that focus on only two periods. These includes measures of parent's education, a dummy for whether the mother has some education, a dummy for whether the father has some education or not, a dummy for whether the students had access to some types of learning or not, a dummy for whether the family's income was affected by covid-19 or not, and a dummy for whether the family income is below NGN 25,000 (the mean in the data). Parents' education equals zero if both parents have no education, one if only one parent has some education and two if both parents have some education. These variables are intended to capture the pupil's household characteristics and to help us understand whether these matter for mitigating any learning losses during school closures. Lastly, we also disaggregate results for male and female pupils. The results are described in the next section.

Results

General Results on Learning Losses and Recovery

Our main results from the estimation of Equation (1) are in Table 2, which shows scores in Math and English, using percentage and standardized test scores for all students. Results in the first row demonstrate that, relative to the period right before schools were closed due to the pandemic, students performed significantly worse on both Math and English post-COVID but before the start

of supplemental lessons (post-closure in the Tables). They score about 14.15 percentage points lower in Math, and 12.43 percentage points lower in English, on the same test, relative to the period prior to school closures. This is equivalent to a .65 standard deviation (s.d.) decline in Math scores and a .6 s.d. decline in English scores. Figure 1 and Table 3 show that this loss is similar for both males and females, with males losing slightly less in Math and females losing slightly less in English. These differences are quantitatively small, however, relative to the general loss.

How much of this loss is due to school closures related to COVID-19 as opposed to general learning losses associated with breaks in the school year? In order to assess this question, first we consider the schedule in Table A8 which shows that schools are only closed for long-holidays in Nigeria for about 30 days under a normal schedule, compared to well over 90 days of school days lost due to pandemic-related school closures in Nigeria (Lagos State Government, 2020).

Long summer breaks are not found in Nigeria, however we can assess the extent of learning losses one can expect based on estimates from countries where summer breaks are longer. A review of the literature found that summer learning losses only amount to about one month worth of school-year learning or .1 standard deviations, the losses are higher for Math, and are larger at higher grades (Cooper et al, 1996). Therefore, the learning losses we find are about 6 times as large as estimated learning losses due to summer closures. The estimated learning loss is also roughly equal to about 5-6 months of class time, which is equivalent to the length of time the students in our data were out of school and cannot be accounted for by the regular 30 days of class time lost to long-holidays.

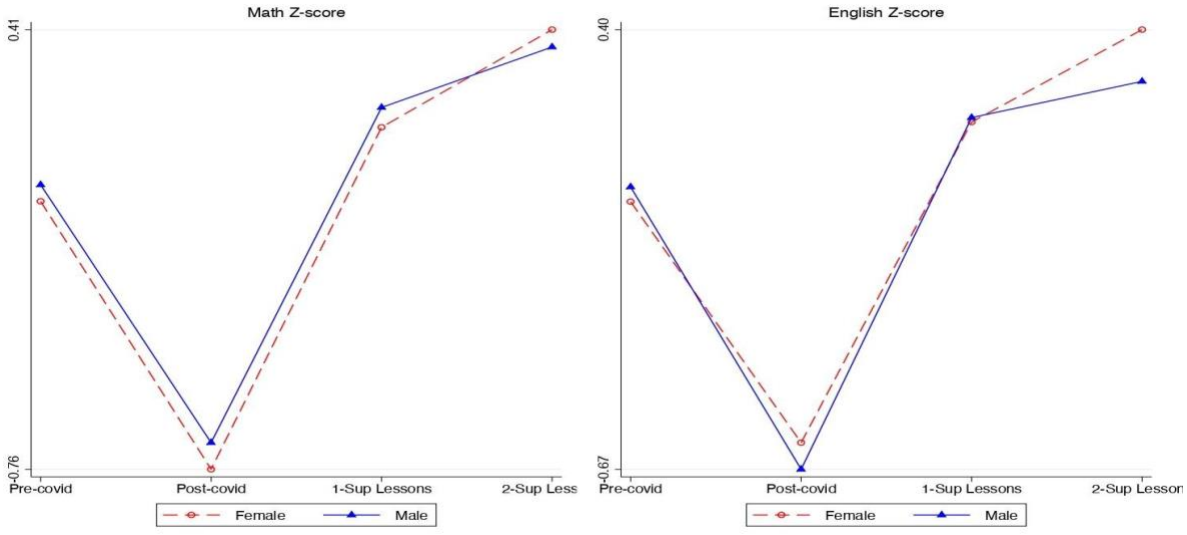
Further, when we compare students who had access to some learning at home to those who did not, the results demonstrate that access to learning at home did not eliminate learning losses for Math and English (see Figure 6). At-home learning is thought to mitigate losses from long-holiday breaks, and the fact that we do not find any difference between students with and without access to at-home learning vis-a-vis estimated learning losses indicates that the losses are related to school closures indeed.

Table 2a: Evolution of Test Scores after Closures and Supplemental Classes

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Pooled with Individual and School Fixed Effects				
Post-Closure	-15.045*** (3.099)	-13.443*** (2.759)	-0.705*** (0.145)	-0.641*** (0.132)
A Month after Sup Lessons	4.435 (3.262)	3.864 (3.038)	0.208 (0.153)	0.184 (0.145)
Two Months after Sup Lessons	8.947*** (3.072)	7.159** (3.002)	0.419*** (0.144)	0.342** (0.143)
Observations	3,074	3,071	3,074	3,071
Mean	62.782	64.296	0.000	0.000
SD	21.329	20.961	1.000	1.000

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program.

Figure 1: Evolution of Test Scores by Gender



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons) for males and females.

Table 3: Focusing on Learning Losses by Gender before Supplemental Lessons

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Panel A: Learning Loss with Individual/School Fixed effects				
Post-Closure Before Sup Lessons	-15.045*** (3.795)	-13.442*** (3.381)	-0.702*** (0.177)	-0.640*** (0.161)
Observations	1,539	1,537	1,539	1,537
Mean	62.782	64.296	-0.024	0.001
SD	21.329	20.961	0.996	0.997
Panel B: Female Only				
Post-Closure Before Sup Lessons	-15.376*** (4.193)	-12.376*** (4.030)	-0.718*** (0.196)	-0.589*** (0.192)
Observations	764	764	764	764
Mean	62.306	63.915	-0.046	-0.018
SD	21.851	21.905	1.020	1.042
Panel C: Male Only				
Post-Closure Before Sup Lessons	-14.718*** (3.950)	-14.496*** (3.516)	-0.687*** (0.184)	-0.690*** (0.167)
Observations	775	773	775	773
Mean	63.250	64.673	-0.002	0.018
SD	20.821	20.006	0.972	0.952

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program. Estimated effect is relative to the last test prior to school closures.

Table 4: Focusing on Learning Losses by Performance Tertile Before School Closures

	(1)	(2)	(3)	(4)		
	Percentage grade	Z-score calculated using	Percentage grade	Z-score calculated using	Percentage grade	Z-score calculated using

		precovid mean		precovid mean		precovid mean
Panel A: Math						
Group	**Below 33rd Percentile**		**33rd to 66th Percentile**		**Above 66th Percentile**	
Post-Closure Before Sup Lessons	-3.971 (4.088)	-0.186 (0.192)	-16.450*** (4.982)	-0.771*** (0.234)	-25.273*** (3.918)	-1.185*** (0.184)
Observations	538	538	484	484	516	516
Mean	45.900	-0.792	63.351	0.027	79.738	0.795
SD	17.620	0.826	14.893	0.698	15.460	0.725
Panel B: English						
Group	**Below 33rd Percentile**		**33rd to 66th Percentile**		**Above 66th Percentile**	
Post-Closure Before Sup Lessons	1.851 (3.654)	0.088 (0.174)	-15.020*** (4.412)	-0.717*** (0.210)	-27.912*** (3.727)	-1.332*** (0.178)
Observations	538	538	483	483	516	516
Mean	41.474	-1.089	65.335	0.050	87.118	1.089
SD	11.971	0.571	5.105	0.244	8.365	0.399

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program. Estimated effect is relative to the last test prior to school closures, and students are divided into tertiles based on initial (before school closures) performance in Math.

Recovery

The estimated learning losses are large and roughly equivalent to what would be expected from 5-6 months of school closures. Next, we ask whether the situation is hopeless, at least for students who are able to return to school? Results in the next two rows of Table 2 demonstrate that all hope is not lost. Learning recovers after one month of the supplemental lessons, and is in fact above the pre-closure means by about 5-percentage points for Math and English, or .25 s.d. Students fully recover after 2 months and continue to be above pre-closure scores, although the *rate* of recovery slows down. Figure 2 shows that recovery is similar for both males and females in Mathematics,

although males lag slightly in English after 2 months (see Table 4). Hence, we may conclude that while there are significant learning losses associated with school closures, students do recover, conditional on teachers devoting time to help students catch-up with lost time. We cannot, however, assume that every school will devote time to helping students catch up, especially in overcrowded and understaffed public schools. The contribution of our findings is to demonstrate that students can and do get on the right track with purposeful effort on the part of teachers, and more effort needs to be devoted across Nigeria, and the developing world, to helping students recover from COVID-19 associated learning losses.

Tables 3 and 4 re-estimate Equation (1) but focus on learning losses relative to the pre-closure time period, and recovery relative to the start of supplemental lessons, respectively. The findings are consistent with Table 2. We find substantial learning losses but students are able to recover after 2 months of supplemental lessons. Next, we investigate the importance of household and parental characteristics in mitigating learning losses and helping learning to recover following school closures.

Table 5: Learning Recovery by Gender After Supplemental Lessons

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Panel A: All				
A month after Sup Lessons	19.479***	17.352***	0.909***	0.826***
	(2.740)	(2.983)	(0.128)	(0.142)
Two months after Sup Lessons	23.994***	20.625***	1.120***	0.981***
	(3.166)	(2.847)	(0.148)	(0.135)
Observations	2,304	2,302	2,304	2,302
Mean	47.700	50.852	-0.728	-0.639
SD	24.909	25.841	1.163	1.230

Panel B: Female Only				
A month after Sup Lessons	19.683*** (3.385)	16.468*** (3.211)	0.919*** (0.158)	0.784*** (0.153)
Two months after Sup Lessons	25.221*** (3.537)	21.211*** (3.169)	1.177*** (0.165)	1.009*** (0.151)
Observations	1,145	1,146	1,145	1,146
Mean	46.930	51.540	-0.763	-0.606
SD	25.099	25.331	1.171	1.205
Panel C: Male Only				
A month after Sup Lessons	19.278*** (2.524)	18.234*** (3.255)	0.900*** (0.118)	0.868*** (0.155)
Two months after Sup Lessons	22.781*** (3.254)	20.047*** (3.111)	1.063*** (0.152)	0.954*** (0.148)
Observations	1,159	1,156	1,159	1,156
Mean	48.459	50.171	-0.692	-0.672
SD	24.730	26.352	1.154	1.254

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program. Estimated effect is relative to the start of supplemental classes.

Table 6: Learning Recovery by Performance Tertile Before School Closures

	(1)	(2)	(3)	(4)		
	Percentage grade	Z-score calculated using precovid mean	Percentage grade	Z-score calculated using precovid mean	Percentage grade	Z-score calculated using precovid mean
Panel A: Math						
Group	**Below 33rd Percentile**		**33rd to 66th Percentile**		**Above 66th Percentile**	
A month after Sup Lessons	21.424*** (3.464)	1.004*** (0.162)	20.038*** (3.439)	0.939*** (0.161)	16.873*** (3.014)	0.791*** (0.141)
Two months after Sup Lessons	25.117*** (4.217)	1.178*** (0.198)	22.886*** (4.350)	1.073*** (0.204)	23.958*** (3.537)	1.123*** (0.166)
Observations	786	786	767	767	751	751
Mean	42.829	-0.935	47.380	-0.722	53.109	-0.453

SD	24.728	1.159	24.674	1.157	24.339	1.141
Panel B: English						
Group	**Below 33rd Percentile**		**33rd to 66th Percentile**		**Above 66th Percentile**	
A month after Sup Lessons	21.714*** (4.076)	1.036*** (0.194)	17.491*** (4.394)	0.834*** (0.210)	12.668*** (3.070)	0.604*** (0.146)
Two months after Sup Lessons	23.912*** (4.287)	1.141*** (0.205)	19.688*** (4.035)	0.939*** (0.193)	18.066*** (2.945)	0.862*** (0.140)
Observations	806	806	724	724	772	772
Mean	43.325	-1.001	50.309	-0.667	59.206	-0.243
SD	24.092	1.149	25.659	1.224	25.361	1.210

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program. Estimated effect is relative to the start of supplemental lessons, and students are divided into tertiles based on initial (before school closures) performance in Math.

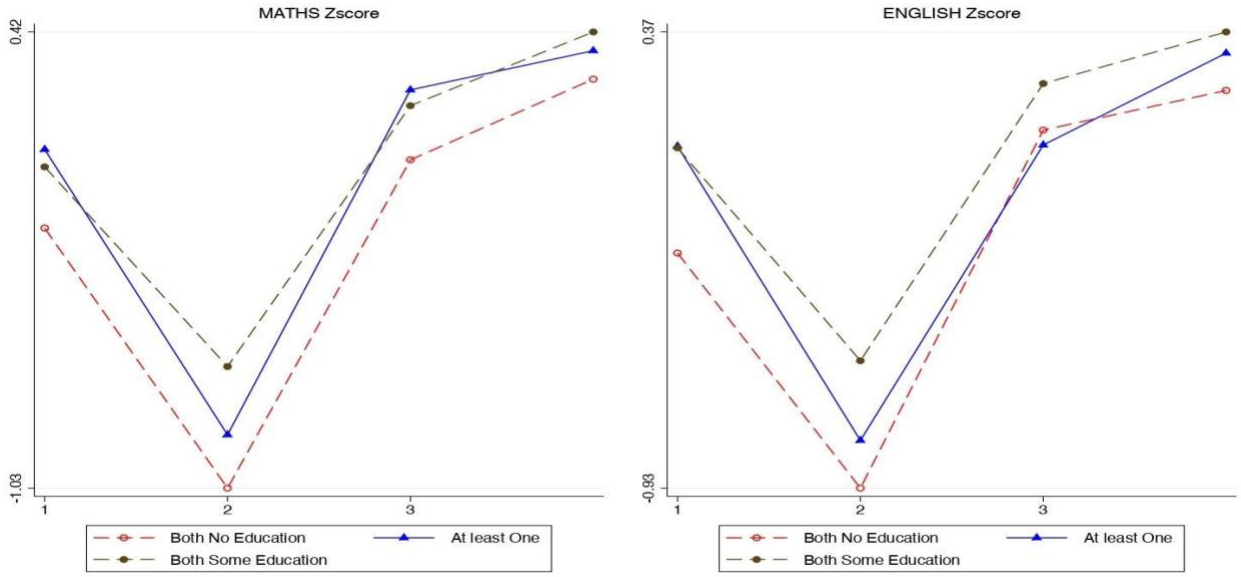
Importance of Household Characteristics

Here, we investigate the role of household characteristics and parental investments in mitigating learning losses and recovery during the supplemental lessons. Our analyses will be centered around parental education, pre-pandemic household incomes (below and above the mean), access to learning at home, and impacts of changes in income due to the pandemic. We provide the results in graphs for ease of exposition, and associated tables are contained in the Appendix.

Parental Education, Learning Losses, and Recovery

We begin by examining the role of parental education in mitigating learning losses. As almost all students in our data come from two-parent households, we aggregate education levels into 3 groups: no education for both parents, some education for at least one parent, and both parents educated. The working hypothesis is that having a parent who is educated can help to mitigate learning losses and aid recovery when school reopens. Results are in Figures 2-4, for both parents, the mother, and the father, respectively.

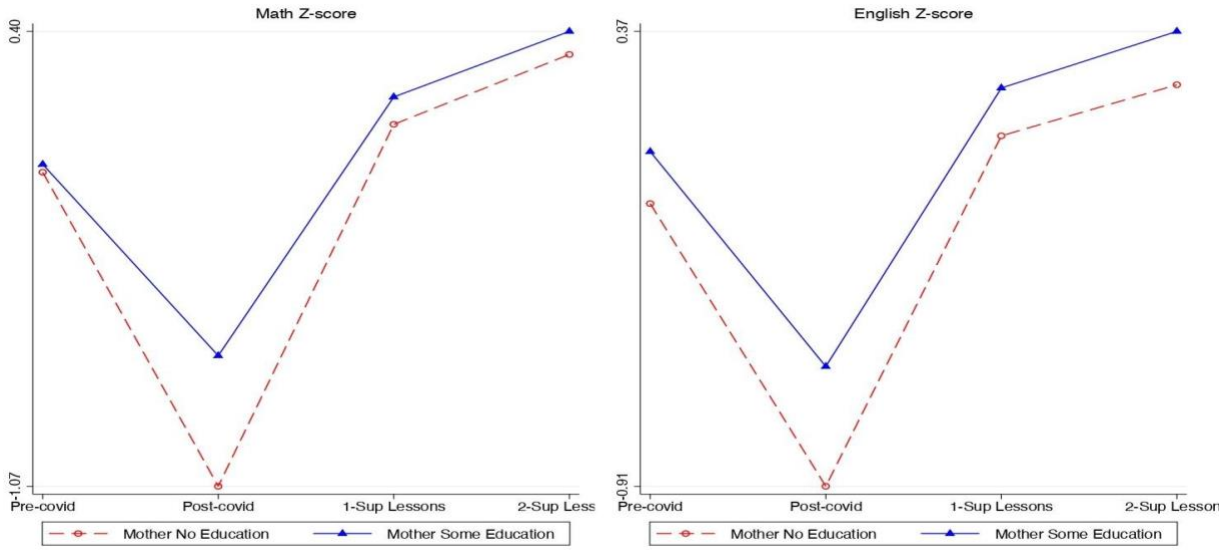
Figure 2: Parental Education, Learning Loss, and Recovery



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons) depending on parental education.

The results indicate that while students from a household where at least one parent has an education tend to perform better, learning losses are found for all groups. However, there appears to be some benefit to having two educated parents, because students in this group tend to experience smaller learning losses, by about .2 s.d. in Math and .06 s.d in English (see Table A1) compared to the group with no educated parent. This implies that parental education, and how it might assist learning at home, might have played a role in mitigating learning losses especially when both parents have had some education. All groups of students recover well, but students with both parents educated recover less (because they lost less due to the closure).

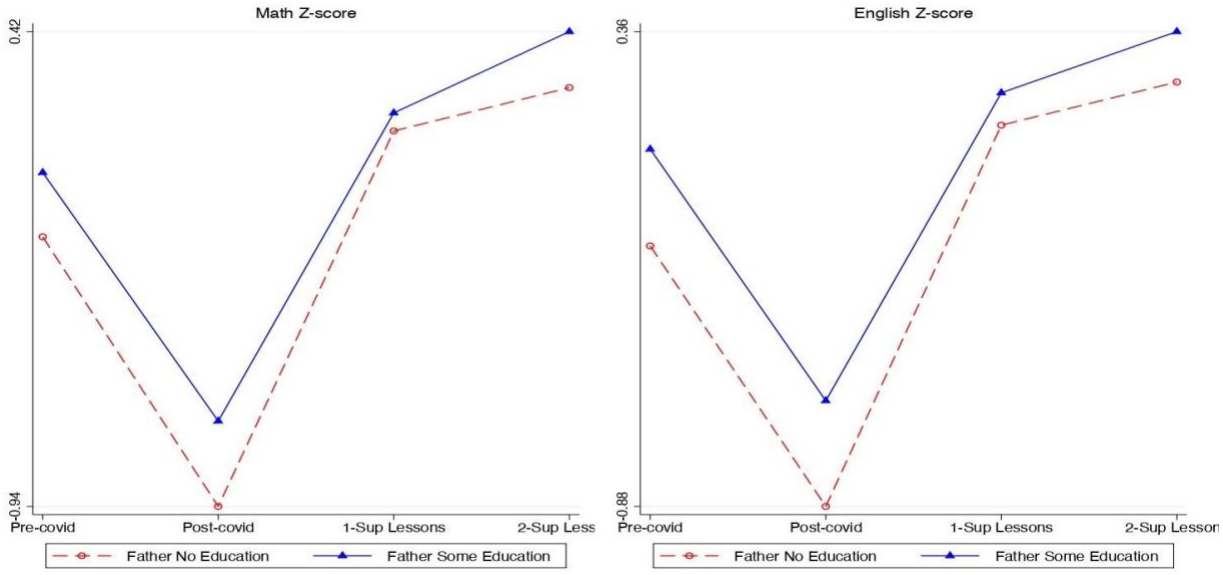
Figure 3: Mother's Education, Learning Loss, and Recovery



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons) depending on the mother's education.

Figures 3 and 4 break down parental education into the education of the mother and the father. The big picture finding is that the mother's education seems to matter more than that of the father. Students with mothers who have some education experience substantially less learning losses, about .35 s.d. less in Math and .18 s.d. less learning lost in english, compared to students with uneducated mothers (see Table A2). In comparison, students whose fathers have had some education do lose less, about .08 s.d. in Math and .14 sd in english compared to students with uneducated fathers. The advantage in Mathematics is sustained even after 2 months of supplemental lessons for students with educated mothers. Hence, we may conclude that having an educated mother helped to mitigate learning losses due to school closures.

Figure 4: Father's Education, Learning Loss, and Recovery



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons) depending on the mother's education.

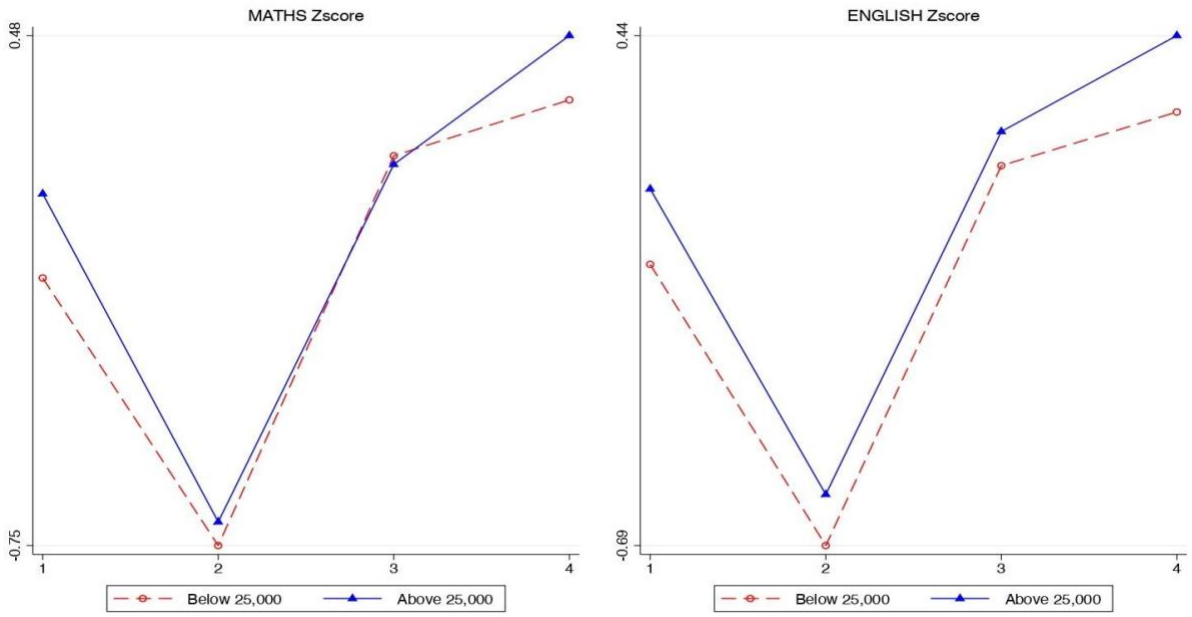
Household Incomes, Learning Losses, and Recovery

Household income might have been important in mitigating learning losses during the lockdowns for a number of reasons. Incomes would have enabled households to engage in at-home learning through any of the means highlighted in the survey, such as hiring tutors, learning through radio broadcasts, or internet connectivity. Therefore, we ask whether students in households with above-average incomes (25,000 Naira or about $60/month in the data) experienced less learning losses and/or recovered faster.

The results in Figure 5 do not provide evidence that higher household incomes were important. In fact, students in households with higher incomes actually lost more in Maths and english, .14 s.d and .054 s.d. respectively. However, 2 months after the start of supplemental lessons, students from higher incomes households had recovered and jumped above other students as was the case before school closures. Unfortunately, our data does not provide more insights into why higher household incomes did not cushion learning losses in this context. One hypothesis might be that incomes are generally low for students in this study (lower than the average national income), so that "higher-income" households possibly have both parents engaged in the workforce leaving less

time for at-home learning. This is only a hypothesis, but will be worth investigating in future studies. Next, we examine the importance of access to at-home learning.

Figure 5: Parental Income, Learning Loss, and Recovery

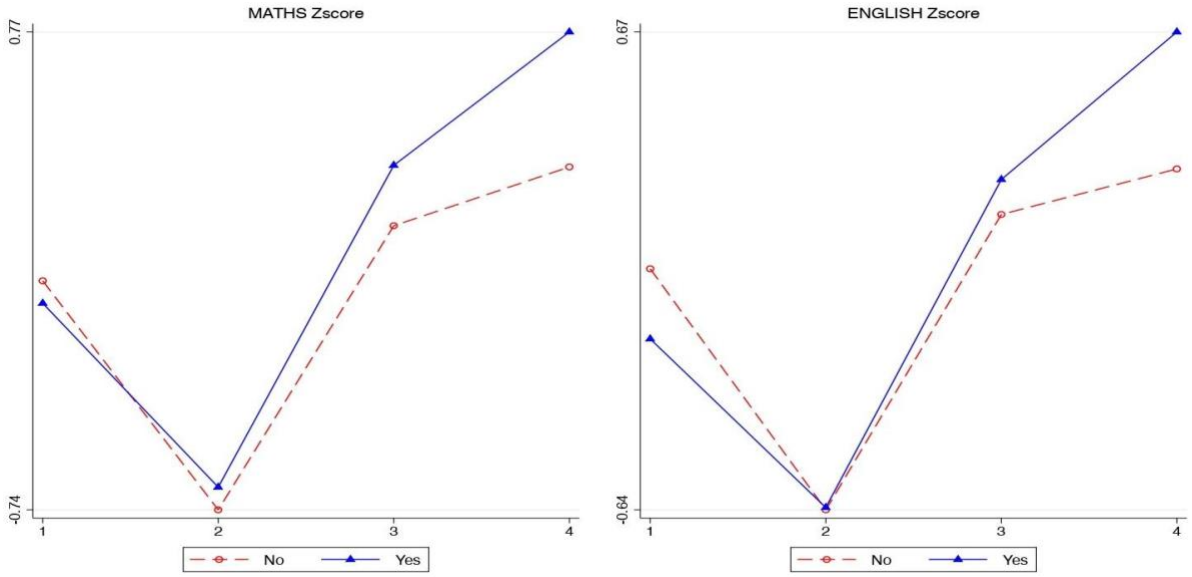


Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons) depending on parental income.

At-Home Learning, Learning Losses, and Recovery

At-home learning was widely adopted at the onset of the pandemic as the primary alternative to in-school learning. In Nigeria, this largely took the form of learning delivered through the radio, and the internet for wealthier households. Parents in our data also took it upon themselves to pay tutors and teach their children. Did at-home learning reduce learning losses? The evidence in Figure 6 and Table A4 shows that at-home learning helped mitigate learning losses---students with access to at-home learning experienced smaller losses in Math and much smaller losses in english. Students with access to at-home learning lost .14 s.d less in Math and .2 s.d. less in english. One explanation for this is that English was probably easier to teach over the radio and by parents at home.

Figure 6: At-Home Learning, Learning Loss, and Recovery



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons)

Access to at-home learning was especially important in the recovery phase. Students with access to either tutors or parental instruction at home benefited substantially more from the supplemental lessons, in addition to having lost less due to school closures. The point estimates in Table A4 show quantitatively larger recovery, greater than .35 s.d. in Math and English for students with access to at-home learning. Hence, we may conclude that at-home learning offered some succour during school closures and also helped students perform better during the following supplemental lessons.

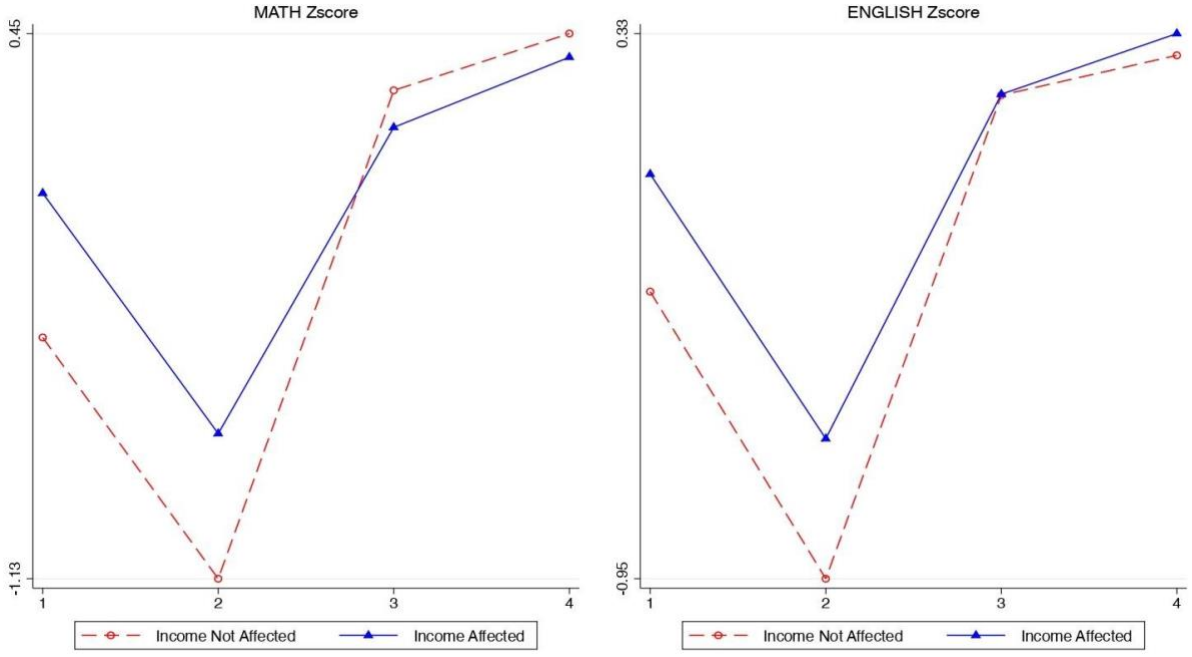
Income Losses, Learning Losses, and Recovery

The COVID-19 pandemic not only affected schools, but also restricted the ability of parents to earn incomes.[6] This has some confounding effects on learning. On the one hand, out-of-work parents might spend more time at home and with their children learning. However, income losses could have significant negative effects on children. The stress associated with income losses might mean that children would have to contribute in some capacity to the household. Another possible

[6] Most parents in our data report that they did not receive any financial aid from the government.

negative effect of income loss is that it constrains the ability of parents to recruit external tutors for their children and purchase equipment required for at-home learning.[7] Results on the role of income loss are in Figure 7 and Table A5.

Figure 7: Income Loss, Learning Loss and Recovery



Note: Figure shows evolution of test scores across time, from time 1 (pre-COVID) to time 4 (2 months after supplemental lessons.

The estimates indicate that income losses associated with the pandemic did not have a differential effect on learning losses, perhaps due to the confounding effects identified above. However, students from households for which incomes were not affected by the pandemic benefited a lot more from the supplemental lessons. The estimates in Table A5 show that students from households where incomes changed recovered .49 s.d. less in Math scores and .27

[7] Our analysis of job losses also ignores the possibility that children from households with decreased incomes are substantially less likely to return to school. As reported earlier, many parents report that their children will not be returning to school as they will prefer to place them in vocational trades where they can begin to contribute to the household's incomes (see Figures A11 and A12). The supplemental lessons waived fees for students who could not attend in order to ensure these students returned to school.

s.d. less in English scores relative to households with more stable incomes.

Follow-up Results

After one year, we followed up with students who have remained in school in order to understand whether the recovery has been sustained. The sample we focus on here consists of students still at school, but we also collect information on those who have advanced to higher grades, left the area of the original school, or dropped out of school completely. In order to assess the extent of learning recovery, we compare students in their current grade to the average of students in that grade prior to the lockdowns. For example, for students currently in primary 4 we ask whether they are doing as well as students in primary 4 prior to school closures. This assumes that performance prior to school closures is an appropriate baseline to assess how school closures have affected student learning and performance. Results are in Table 5 below.

The results reveal that the students are performing at the same level as would have been expected without school closures on Math and English. Specifically, while the students perform better, on average, this difference is not statistically significant at conventional levels. This result holds for the female and male samples, as we see in Panels B and C. Hence, we may conclude that for students still at school (not graduated, left the area, or dropped out), school closures during COVID-19 have not had a sustained negative effect on performance and that the recovery driven by the supplemental lessons have been sustained.[8]

Table 7: School Performance One Year After Supplemental Lessons

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z score within school precovid mean	English z-score within school precovid mean

[8] Of course, we can immediately conclude that the sustained recovery is only due to the supplemental lessons as our research design is not set up to address that question. Further, our results do not generalize to students who have permanently dropped out of school as a result of school closures.

Panel A: All				
One-Year after Sup Lessons	1.007 (6.014)	4.302 (3.731)	0.063 (0.377)	0.319 (0.277)
Observations	575	580	575	580
Mean	63.320	64.643	0.000	-0.000
SD	15.964	13.479	1.000	1.000
Panel B: Female Only				
One-Year after Sup Lessons	-0.437 (6.537)	6.015 (4.245)	-0.027 (0.409)	0.446 (0.315)
Observations	312	313	312	313
Mean	64.583	64.780	0.079	0.010
SD	15.233	13.129	0.954	0.974
Panel C: Male Only				
One-Year after Sup Lessons	2.872 (6.324)	2.116 (4.671)	0.180 (0.396)	0.157 (0.347)
Observations	263	267	263	267
Mean	61.670	64.467	-0.103	-0.013
SD	16.804	13.980	1.053	1.037

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and includes all students in the supplemental lessons program still in school. Estimated effect is relative to same-grade performance prior to school closures.

Conclusions

Prior to the pandemic, the Nigerian education system was faced with multiple challenges which COVID-19 has exacerbated. Previous estimates of learning profiles in Nigeria indicate that the majority of those in school are not learning, and the country currently has millions of out of school children. The pandemic threatens to worsen the situation with school closures and associated economic crises having a disproportionate impact on students and families at the margins. More evidence is needed in these contexts on the extent of learning losses and what steps, if any, could be taken to salvage the situation. This study contributes substantial evidence towards understanding the extent of COVID-19 related learning losses and how students can recover.

Our analysis tracks students in grades 2-4 of low-cost private schools from the pre-pandemic period to the immediate period after schools were permitted to partially resume, and for two months as they participated in a supplemental lessons program. The evidence demonstrates that students lost about .65 s.d. in Math and .6 s.d. in English, equivalent to about 6 months of schooling, due to school closures during the pandemic. These losses vary by parental characteristics and household investments in at-home learning. This is the sobering news. However, we further find that a basic supplemental lesson can help students recover quite rapidly. Students are able to perform about .45 s.d. above pre-pandemic levels in Math and English after 2 months in the program. The students in our sample who remain at the same school continue to perform at expected levels one year later. This indicates that these learning losses do not have to be permanent, and provides evidence that could support similar programs more broadly. This is very hopeful news.

These findings have implications for policymakers in three significant respects. First, there is a need for a learning recovery plan to mitigate loss from prolonged school closures. It must be noted that simply reopening or canceling/shortening the school calendar is not a recovery plan but rather an ephemeral strategy that will compound learning loss going forward. Second, frequent assessments are needed to track learning loss, design better interventions and effectively reduce learning loss. Third, our findings underscore the need for sustained support and social protection for households and schools as part of the broader macroeconomic recovery process.

The combination of economic crisis, a discouraged education workforce and learning loss can devastate the education system in Nigeria, especially without an adequate support structure for disadvantaged groups.

Our study can be extended in a number of dimensions. We still do not know the extent to which students will remain in school given the economic challenges posed by the pandemic, because the supplemental lessons were subsidized. Many parents in our data indicate a strong preference to placing their children in vocations, as opposed to schools. A follow-up study will provide evidence on how much enrollment has been sustained from pre-pandemic levels. Secondly, we do not provide evidence on how students have progressed through grades, because the tests in our study continue to measure performance for those still at the same school. The fact that students are able

to substantially exceed pre-pandemic levels of performance after 2 months indicates they should be able to proceed effectively to higher grades, but more evidence is needed and this is an avenue for future research. Third, we examine students at lower grades where foundational skills are still being taught. While this provides evidence on students at early and vulnerable ages, it might not apply to students at higher levels, who might have missed substantial milestones such as entrance exams. More evidence will be needed here as well.

References

Angrist, N., Bergman, P., & Matsheng, M., (2021). School's Out: Experimental Evidence on Limiting Learning Loss Using "Low-Tech" In a Pandemic. *Working Paper 28205*. *https://www.nber.org/system/files/working_papers/w28205/w28205.pdf*

Aucejo, E. M., & Romano, T. F. (2016). Assessing the effect of school days and absences on test score performance. *Economics of Education Review*, **55**, 70– 87.

Cachón-Zagalaz, J., Sánchez-Zafra, M., Sanabrias-Moreno, D., González-Valero, G., Lara-Sánchez, A. J., & Zagalaz-Sánchez, M. L. (2020). Systematic Review of the Literature About the Effects of the COVID-19 Pandemic on the Lives of School Children. *Frontiers in Psychology*, *11*. https://doi.org/10.3389/fpsyg.2020.569348

Clark, A. E., Rong, Z., Nong, H., & Zhu, H. (2021). Compensating for academic loss: Online learning and student performance during the COVID-19 pandemic. *China Economic Review*, *68*, 101629. https://doi.org/10.1016/j.chieco.2021.101629

Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research*, *66*(3), 227-268.

Dessy, S., Gninafon, H., Tiberti, L., & Tiberti, M. (2021). COVID-19 and Children's School Resilience: Evidence from Nigeria (No. 952). GLO Discussion Paper. https://www.econstor.eu/handle/10419/243100

Dorn, E., Hancock, B., Sarakatsannis, J., & Viruleg, E. (2020). *COVID-19 and student learning in the United States: The hurt could last a lifetime*. 9.

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), e2022376118. https://doi.org/10.1073/pnas.2022376118

Gillett-Swan, J. (2017). Supporting and Engaging the Isolated Learner. *Journal of Learning Design*, *10*(1), 11.

Goodman, J. (2014). *Flaking out: Student absences and snow days as disruptions of instructional time (NBER working paper no. 20221)*. National Bureau of Economic Research.

https://plus.google.com/+UNESCO. (2021, March 19). *One year into COVID-19 education disruption: Where do we stand?* UNESCO. https://en.unesco.org/news/one-year-covid-19-education-disruption-where-do-we-stand

LASG (Lagos State Government. (2020). Lagos State Schools Calendar 2020/2021 [Official Version]. LASU-INFO.COM. https://www.lasu-info.com/2018/09/lagos-state-schools-academic-calendar.html

Lennox, J., Reuge, N., & Benavides, F. (2021). UNICEF's lessons learned from the education response to the COVID-19 crisis and reflections on the implications for education policy. *International Journal of Educational Development*, 102429.

Maldonado, J., & De Witte, K. (2020). *The effect of school closures on standardised student test—KU Leuven*. https://limo.libis.be/primo-explore/fulldisplay/LIRIAS3189074/Lirias

Martin J. Tomasik, Laura A. Helbling, & Urs Moser. (2020). *Educational gains of in‐person vs. distance learning in primary and secondary schools: A natural experiment during the COVID‐19 pandemic school closures in Switzerland*. https://doi.org/10.1002/ijop.12728

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. *Center for Global Development, Working Paper*, *609*.

National Education Survey 2015 complete_.pdf. Retrieved August 7, 2021, from https://nigerianstat.gov.ng/pdfuploads/National%20Education%20Survey%202015%20complete_.pdf

National Institute for Early Education Research (NIEER). (2021). *Preschoolers Continue to Lose Learning Opportunities from Pandemic—National Institute for Early Education Research*. https://nieer.org/press-release/preschoolers-continue-to-lose-learning-opportunities-from-pandemic

National Population Commission (Nigeria) and RTI International. (2016) [NEDS]. 2015 Nigeria Education Data Survey (NEDS).

Ogunode, N. J. (2020). *Effects of COVID-19 Schools Close Down on Academic Programme of Senior Secondary Schools in Abaji Area Council of Federal Capital Territory Abuja, Nigeria*. https://doi.org/10.2139/ssrn.3576048

Patrinos, H. A., Vegas, E., & Carter-Rau, R. (2022). An Analysis of COVID-19 Student Learning Loss. Policy Research Working Paper 10033

Simona, V. (2020). cycles, T. text provides general information S. assumes no liability for the information given being complete or correct D. to varying update, & Text, S. C. D. M. up-to-D. D. T. R. in the. (n.d.). *Topic: Education in Nigeria*. Statista. Retrieved August 7, 2021, from https://www.statista.com/topics/6658/education-in-nigeria/

Singh, Romero and Muralidharan (2022): COVID-19 Learning Loss and Recovery: Panel Data Evidence from India; RISE Working Paper 22/112

The Department of Education United States of America (2021). I*mpacts-of-covid19.pdf*. Retrieved August 7, 2021, from https://www2.ed.gov/about/offices/list/ocr/docs/20210608-impacts-of-covid19.pdf

Tom N. & Shanthi T. (2019). *Preventing a summer slide in reading – the effects of a summer school: Australian Journal of Learning Difficulties: Vol 24, No 2*. https://www.tandfonline.com/doi/full/10.1080/19404158.2019.1635499?src=recsys&__cf_chl_captcha_tk__=pmd_febb3460b2fdaf2ec8cdb2e9121bf992b5dde08b-1628327665-0-gqNtZGzNAvijcnBszQti

Tomasik, M. J., Helbling, L. A., & Moser, U. (2020). Educational gains of in‐person vs. distance learning in primary and secondary schools: A natural experiment during the COVID‐19 pandemic school closures in Switzerland. *International Journal of Psychology*. https://doi.org/10.1002/ijop.12728

UNESCO. (2021, March 19). *One year into COVID-19 education disruption: Where do we stand?* UNESCO. https://en.unesco.org/news/one-year-covid-19-education-disruption-where-do-we-stand

United Nation. (2020). *UNSDG | Policy Brief: Education during COVID-19 and beyond*. https://unsdg.un.org/resources/policy-brief-education-during-covid-19-and-beyond, https://unsdg.un.org/resources/policy-brief-education-during-covid-19-and-beyond

Appendix

Supplemental Tables

Table A1.1: Learning Loss and Parental Education

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0

Panel A: Both have no Education				
Post-Closure Before Sup Lessons	-17.790** (6.524)	-13.694*** (4.472)	-0.834** (0.306)	-0.653*** (0.213)
Observations	188	188	188	188
Mean	58.757	58.904	-0.189	-0.257
SD	18.772	17.922	0.880	0.855
Panel B: One has some Education				
Post-Closure Before Sup Lessons	-23.353*** (6.779)	-20.071*** (5.417)	-1.095*** (0.318)	-0.958*** (0.258)
Observations	218	218	218	218
Mean	64.291	64.530	0.071	0.011
SD	22.496	20.752	1.055	0.990
Panel C: Both have some Education				
Post-Closure Before Sup Lessons	-13.552*** (3.956)	-12.773*** (3.636)	-0.635*** (0.185)	-0.609*** (0.173)
Observations	1,051	1,049	1,051	1,049
Mean	63.133	65.206	0.016	0.043
SD	21.392	21.361	1.003	1.019

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated effect is relative to the period just before schools were closed.

Table A1.2: Learning Loss and Mother's Education

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0
Panel A: Mother has some Education				
Post-Closure Before Sup Lessons	-13.248*** (3.824)	-12.790*** (3.541)	-0.621*** (0.179)	-0.610*** (0.169)
Observations	1,173	1,171	1,173	1,171
Mean	62.747	64.992	-0.002	0.033
SD	21.526	21.264	1.009	1.014

Panel B: Mother has no Education				
Post-Closure Before Sup Lessons	-21.813*** (6.256)	-16.490*** (4.797)	-1.023*** (0.293)	-0.787*** (0.229)
Observations	330	330	330	330
Mean	62.085	61.878	-0.033	-0.115
SD	20.950	19.517	0.982	0.931

Table A1.3: Learning Loss and Father's Education

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0
Panel A: Father has some Education				
Post-Closure Before Sup Lessons	-15.214*** (4.067)	-13.869*** (3.668)	-0.713*** (0.191)	-0.662*** (0.175)
Observations	1,191	1,189	1,191	1,189
Mean	63.759	65.445	0.046	0.055
SD	21.528	21.360	1.009	1.019
Panel B: Father has no Education				
Post-Closure Before Sup Lessons	-16.820*** (5.825)	-14.293*** (3.742)	-0.789*** (0.273)	-0.682*** (0.179)
Observations	282	282	282	282
Mean	59.635	60.173	-0.148	-0.197
SD	20.107	18.725	0.943	0.893

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated effect is relative to the period just before schools were closed.

Table A2.1: Learning Recovery and Parental Education

	(1)	(2)	(3)	(4)

	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0
Panel A: Both have no Education				
Two Months after Sup Lessons	27.958*** (6.513)	23.152*** (6.129)	1.311*** (0.305)	1.105*** (0.292)
Observations	188	188	188	188
Mean	40.967	45.210	-1.023	-0.911
SD	19.533	21.769	0.916	1.039
Panel B: One of them has some Education				
Two Months after Sup Lessons	29.899*** (6.585)	24.723*** (5.235)	1.402*** (0.309)	1.180*** (0.250)
Observations	218	218	218	218
Mean	40.938	44.459	-1.024	-0.946
SD	25.149	26.263	1.179	1.253
Panel C: Both have some Education				
Two Months after Sup Lessons	22.969*** (3.939)	19.742*** (3.428)	1.077*** (0.185)	0.942*** (0.164)
Observations	1,049	1,048	1,049	1,048
Mean	49.526	52.430	-0.621	-0.566
SD	25.165	25.973	1.180	1.239

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated effect is relative to the start of supplemental classes.

Table A2.2: Learning Recovery and Mother's Education

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0
Panel A: Mother has some Education				

Two Months after Sup Lessons	22.702*** (3.755)	19.883*** (3.539)	1.064*** (0.176)	0.949*** (0.169)
Observations	1,171	1,170	1,171	1,170
Mean	49.450	52.198	-0.625	-0.577
SD	25.325	26.112	1.187	1.246
Panel B: Mother has no Education				
Two Months after Sup Lessons	29.969*** (5.616)	23.344*** (4.792)	1.405*** (0.263)	1.114*** (0.229)
Observations	330	330	330	330
Mean	40.272	45.388	-1.055	-0.902
SD	22.247	23.947	1.043	1.142

Table A2.3: Learning Recovery and Father's Education

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math zscore within school mean at time 0	English zscore within school mean at time 0
Panel A: Father has some Education				
Two Months after Sup Lessons	24.045*** (3.911)	20.353*** (3.280)	1.127*** (0.183)	0.971*** (0.156)
Observations	1,189	1,188	1,189	1,188
Mean	48.498	51.574	-0.670	-0.607
SD	25.357	26.159	1.189	1.248
Panel B: Father has no Education				
Two Months after Sup Lessons	26.166*** (5.831)	22.926*** (5.794)	1.227*** (0.273)	1.094*** (0.276)
Observations	282	282	282	282
Mean	42.815	45.880	-0.936	-0.879
SD	21.854	23.539	1.025	1.123

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated effect is relative to the start of supplemental classes.

Table A3: Learning Loss, Recovery, and Pre-COVID Incomes

	(1)	(2)	(3)	(4)

	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Panel A: Learning Loss with Individual/School Fixed effects				
Income Below NGN 25,000				
Post-Closure Before Sup Lessons	-13.777*** (4.246)	-13.149*** (3.934)	-0.646*** (0.199)	-0.627*** (0.188)
Observations	835	833	835	833
Mean	61.041	62.953	-0.082	-0.064
SD	20.902	20.663	0.980	0.986
Panel B: Income Above NGN 25,000				
Post-Closure Before Sup Lessons	-16.969*** (4.706)	-14.092*** (4.074)	-0.796*** (0.221)	-0.672*** (0.194)
Observations	664	664	664	664
Mean	65.495	66.406	0.127	0.101
SD	21.627	21.411	1.014	1.022
Panel B: Recovery with Individual/School Fixed effects				
Income Below NGN 25,000				
Two Months after Sup Lessons	23.292*** (4.035)	20.173*** (4.043)	1.092*** (0.189)	0.962*** (0.193)
Observations	833	832	833	832
Mean	47.190	49.796	-0.731	-0.692
SD	24.607	25.631	1.154	1.223
Income Above NGN 25,000				
Two Months after Sup Lessons	25.134*** (4.983)	21.159*** (3.590)	1.178*** (0.234)	1.009*** (0.171)
Observations	664	664	664	664
Mean	48.526	52.314	-0.668	-0.572
SD	25.489	26.056	1.195	1.243

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated learning loss is relative to the last test just before school closures. Estimated recovery is relative to the start of supplemental classes. Mean household income in our dataset is 25,000 Naira per month, which is roughly equivalent to $65 per month at the prevailing exchange rate.

Table A4: Learning Loss, Recovery, and At-Home Learning

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Panel A: Learning Loss with Individual/School Fixed effects				
No Access to Learning				
Post-Closure Before Sup Lessons	-12.512* (6.775)	-9.380 (5.973)	-0.587* (0.318)	-0.447 (0.285)
Observations	172	172	172	172
Mean	61.474	60.596	-0.061	-0.177
SD	19.970	21.145	0.936	1.009
Access to Learning				
Post-Closure Before Sup Lessons	-15.433*** (4.207)	-14.041*** (3.655)	-0.724*** (0.197)	-0.670*** (0.174)
Observations	1,349	1,347	1,349	1,347
Mean	62.984	64.863	0.009	0.027
SD	21.598	20.972	1.013	1.001
Panel B: Recovery with Individual/School Fixed effects				
No Access to Learning				
Two Months after Sup Lessons	30.709*** (9.463)	27.121*** (8.526)	1.440*** (0.444)	1.294*** (0.407)
Observations	172	172	172	172
Mean	48.962	51.217	-0.648	-0.624
SD	24.290	24.558	1.139	1.172
Access to Learning				
Two Months after Sup Lessons	23.320*** (3.711)	19.776*** (3.356)	1.093*** (0.174)	0.943*** (0.160)
Observations	1,347	1,346	1,347	1,346
Mean	47.509	50.819	-0.716	-0.643
SD	25.076	25.992	1.176	1.240

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated learning loss is relative to the last test just before school closures. Estimated recovery is relative to the start of supplemental classes. At-Home learning includes all forms of access to learning at home, including parental tutoring (see Figure A13).

Table A5: Learning Loss, Recovery, and Income Changes due to COVID

	(1)	(2)	(3)	(4)
	Math percentage grade	English percentage grade	Math z-score within school mean at time 0	English z-score within school mean at time 0
Panel A: Learning Loss with Individual/School Fixed effects				
Income Affected				
Post-Closure Before Sup Lessons	-14.960*** (3.696)	-13.108*** (3.194)	-0.701*** (0.173)	-0.625*** (0.152)
Observations	1,411	1,409	1,411	1,409
Mean	63.082	64.432	0.014	0.006
SD	21.568	21.164	1.011	1.010
Income Not Affected				
Post-Closure Before Sup Lessons	-15.002 (11.321)	-14.160 (9.972)	-0.703 (0.531)	-0.676 (0.476)
Observations	56	56	56	56
Mean	54.114	58.578	-0.406	-0.273
SD	19.716	21.226	0.924	1.013
Panel B: Recovery with Individual/School Fixed effects				
Income Affected				
Two Months after Sup Lessons	23.589*** (3.785)	20.005*** (3.171)	1.106*** (0.177)	0.954*** (0.151)
Observations	1,409	1,408	1,409	1,408
Mean	48.082	51.321	-0.689	-0.619
SD	24.805	25.751	1.163	1.229
Income Not Affected				
Two Months after Sup Lessons	33.903*** (7.781)	25.815** (9.320)	1.590*** (0.365)	1.232** (0.445)
Observations	56	56	56	56

Mean	39.112	44.418	-1.110	-0.948
SD	26.095	29.240	1.223	1.395

Note: ***.001, **.01, *.05. Standard errors clustered at the school level in brackets. Regressions include individual and school fixed effects, and include all students in the supplemental lessons program. Estimated learning loss is relative to the last test just before school closures. Estimated recovery is relative to the start of supplemental classes. Income changes refer to income declines due to COVID-19 restrictions.

Table A6: Comparison of Regular vs Subsidized Students at Baseline and Endline

	(1)	(2)	(3)	(4)
	Already Attending Sup Lessons	Attended because of the intervention	P-value from test of equality	Observations
Income Affected by Pandemic	0.953	0.965	0.127	1318
Family Income above Mean	0.506	0.404	0.000	1350
Parental Education	1.669	1.557	0.000	1316
Mother is Educated	0.827	0.766	0.000	1358
Father is Educated	0.846	0.788	0.000	1328
No Learning At Home*	0.120	0.099	0.371	761
Dropped Out*	0.092	0.055	0.083	733

Note: Each row represents a regression where we regress the variable in the first column on two dummy variables of column two and three. Living in a rented house is a dummy variable taking one if the family is living in a rented house pre-covid. Income Affected by Pandemic is a dummy variable taking one if the family income was affected by covid. Family Income above mean is equal to one if the family income is above NGN 25,000. Parental Education takes zero if both parents have no education, one if one of them has some education and two if both have some education. Mother is Educated is a dummy taking one if mother is educated and Father is Educated is also a dummy taking one if Father is educated. *Sample comes from students still at the selected school at the endline.

Table A7: Summary of Household and Parental Data

	(1)	(2)	(3)
	Yes	No	Number of Parents
Income Affected by Pandemic	96.23	3.77	742
Family Income above Mean	44.14	55.86	759

Parental Education (Both)	72.22	27.78	738
Parental Education (One Only)	14.91	85.09	738
Parental Education (None)	12.87	87.13	738
Mother is Educated	78.19	21.81	761
Father is Educated	80.83	19.17	746

Note: See Notes to Table A6 for a definition of variables.

TABLE A8: Calendar and Timeline for Primary Schools in Nigeria

Term	**Normal School Calender**	**Week**	**Covid-19 period**	**week**
Second Term	January (2nd Week) to April (1st Week)	Approximately 13 weeks	January (2nd Week) to March (3rd Week)	Approximately 10 weeks
Second Term Holiday	*April (2nd Week-3rd week)*	*Approximately 2 weeks*	*Holiday*	*6 months of school closure: no learning/remote learning/holidays*
Third Term	*April (4rd Week) to July (3rd Week)*	*Approximately 13 weeks*	*Distance learning (e-learning and mass media)*	
End of Third Term Holiday	*July (4th week) to August (4th week)*	*5 weeks*	*Holiday*	
First Term	September (1st Week) to December (3rd Week)	Approximately 16 weeks	October (2nd Week) to December (3rd Week)	Approximately 9 weeks
End of First Term Holiday	December (4th week) to January (1st Week)	Approximately 2 weeks	December (4th week) to January (3rd Week)	Approximately 2 weeks

Note: The period of full closures is shown in italics.

Table A9: Attrition at Endline by Parental Characteristics

	(1)	(2)	(3)	(4)

	Attrited	Non-Attrited	P-value, Test of Equality	Observations
Male	0.522	0.477	0.218	758
Parents Education	1.594	1.591	0.953	729
Mother's Education	0.791	0.768	0.46	752
Father's Education	0.804	0.814	0.748	737
Parents Income	0.45	0.434	0.651	750
No Learning At Home	0.149	0.07	0.001	761
Income Affected by Pandemic	0.993	0.985	0.684	754
Student dropped out	0.149	0	0	733

Note: Table shows how parental and household characteristics differ between observations that were present throughout the study (baseline sample) and those who were no longer in the sample after 1 year (attrited). Variable definitions are in the text.

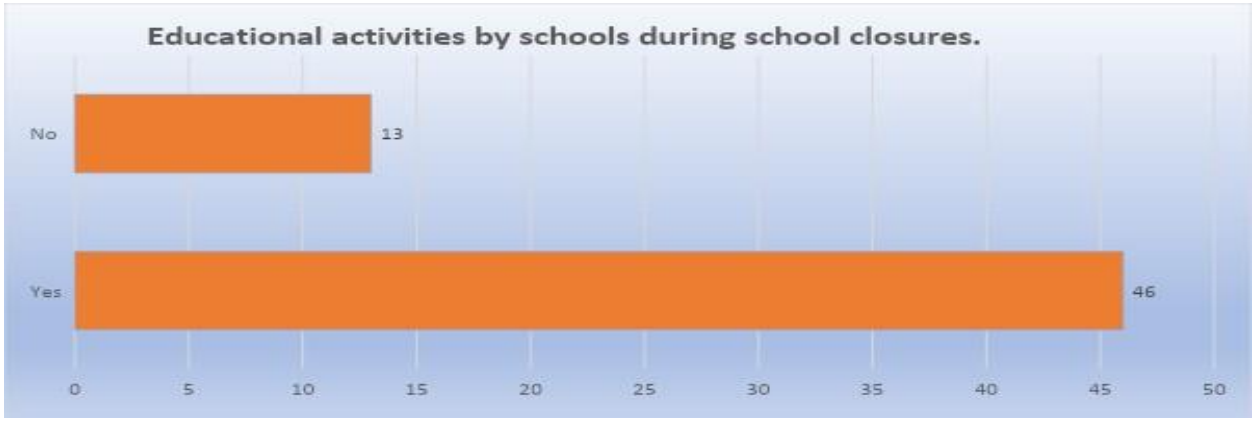
Table A10: Dropout at Endline by Parental Characteristics

	(1)	(2)	(3)	(4)
	Dropped Out	In School	P-value, Test of Equality	Observations
Male	0.534	0.496	0.570	730
Parents Education	1.483	1.602	0.219	704
Mother Educated	0.724	0.785	0.281	724
Father Educated	0.759	0.815	0.295	712
Above Average Income	0.404	0.451	0.488	722
No Learning At Home	0.052	0.114	0.144	733
Income Affected by Pandemic	1.034	0.984	0.143	726

Note: Table shows how parental and household characteristics differ between students who have dropped out of school one year later. The sample is restricted to observations that were present throughout the study (baseline sample). Variable definitions are in the text.

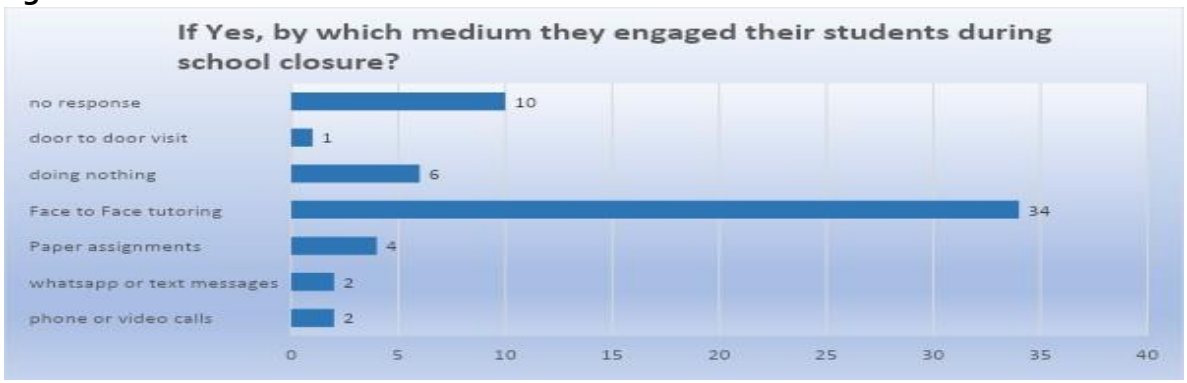
Figures for Data Overview

Figure A1



Source: Nigerian CRT- Covid-19 supplemental study.

Figure A2



Source: Nigerian CRT- Covid-19 supplemental study.

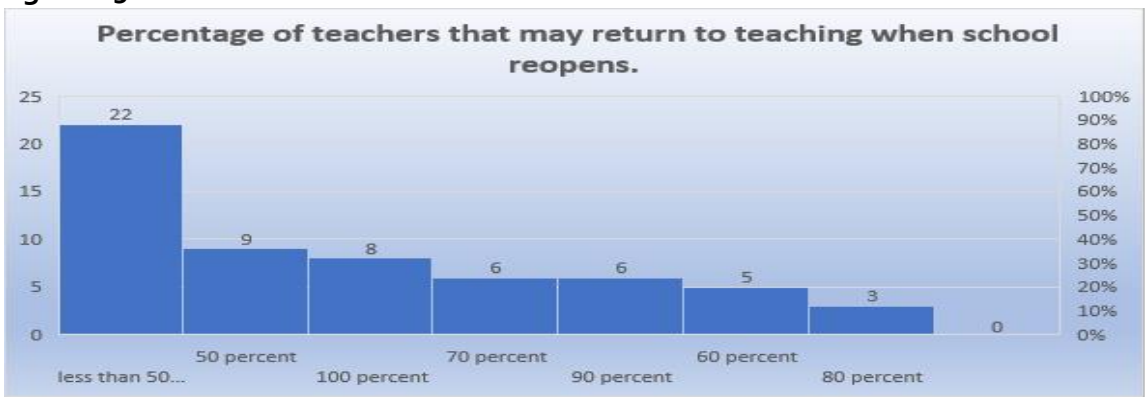
Figure A3

Source: Nigerian CRT- Covid-19 supplemental study.

Figure A4

Source: Nigerian CRT- Covid-19 supplemental study.

Figure A5

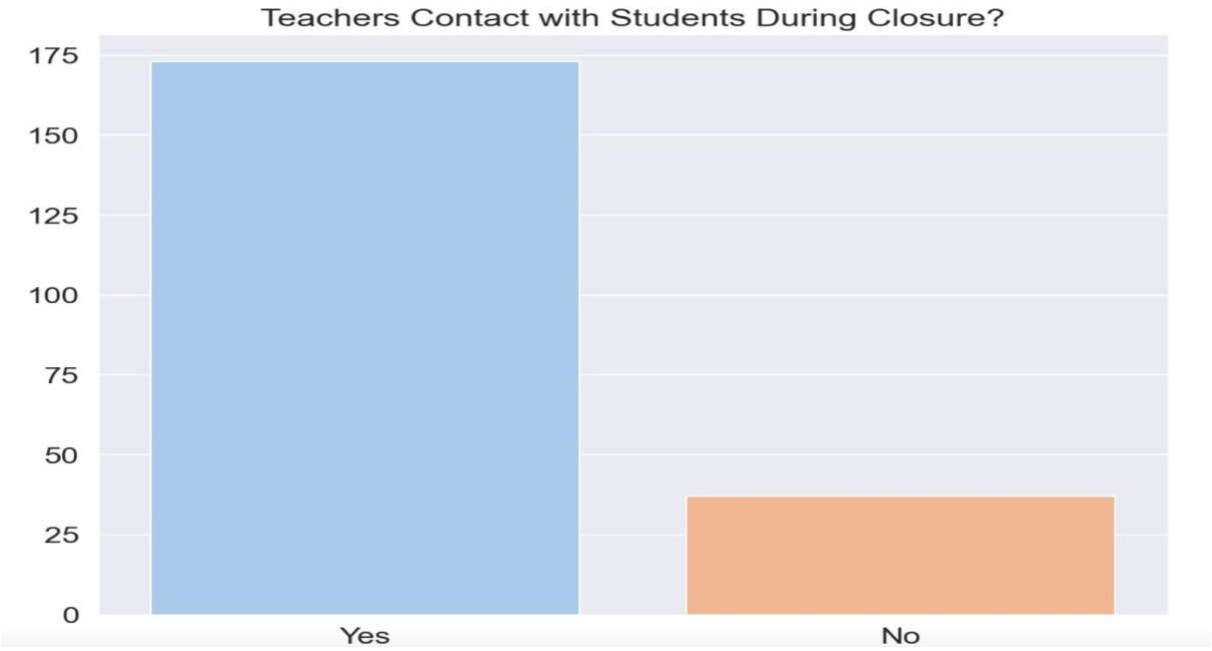


Source: Nigerian CRT- Covid-19 supplemental study.

Figure A6

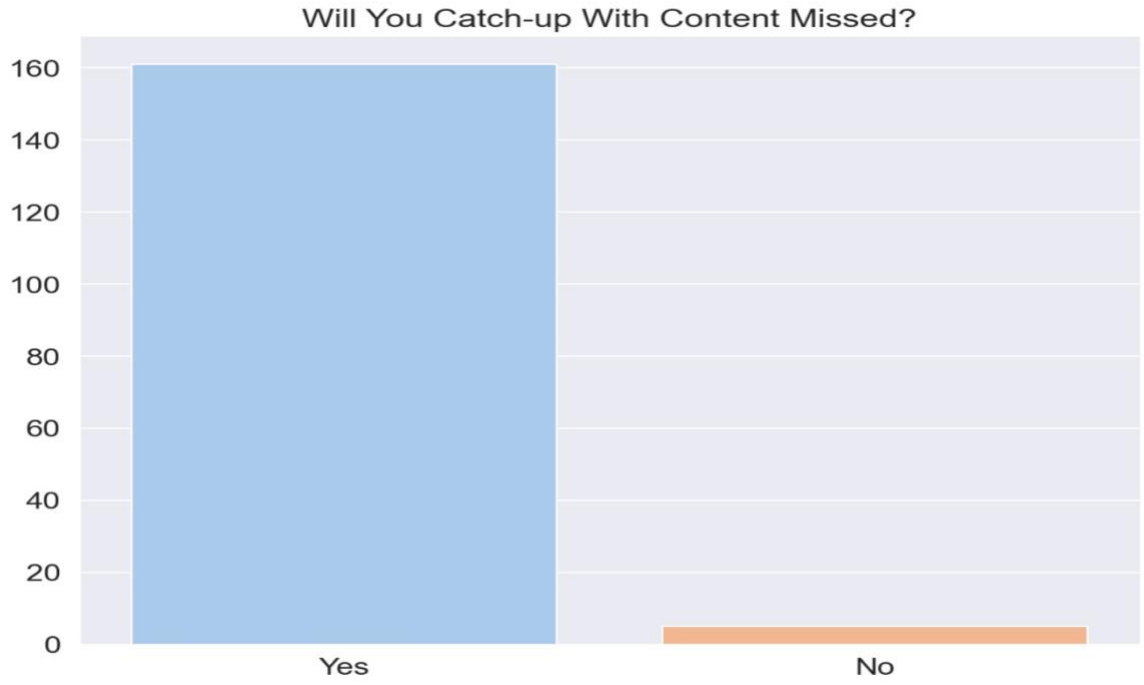
Source: Nigerian CRT- Covid-19 supplemental study.

Figure A7



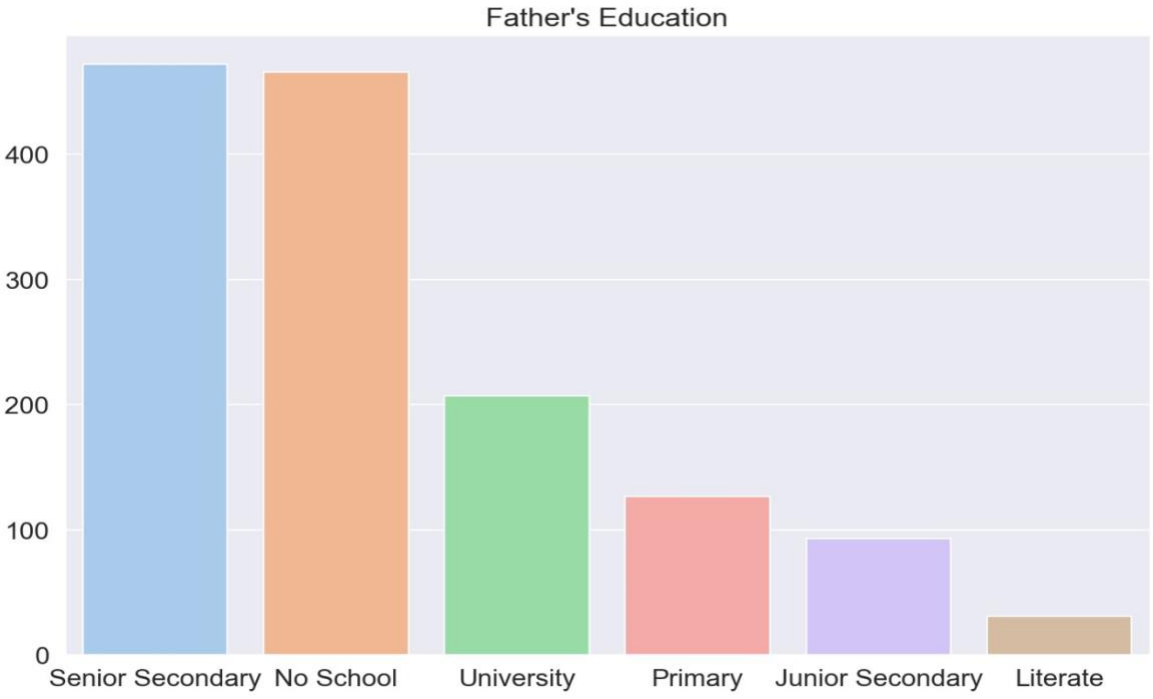
Source: Nigerian CRT- Covid-19 supplemental study.

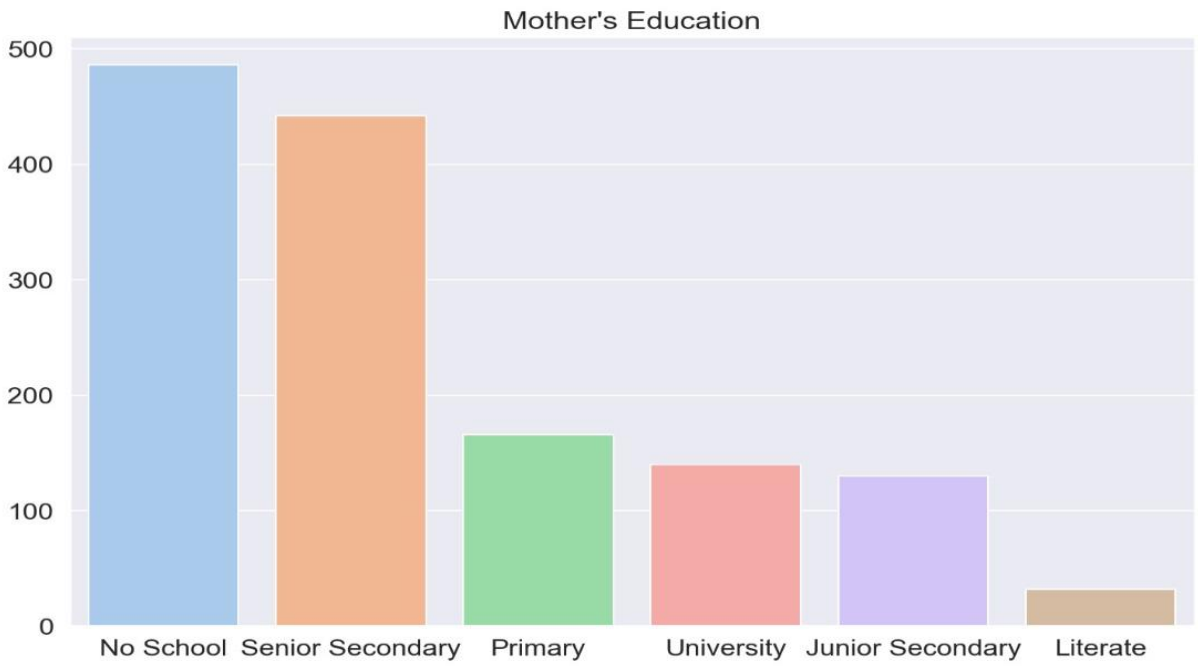
Figure A8



Source: Nigerian CRT- Covid-19 supplemental study.

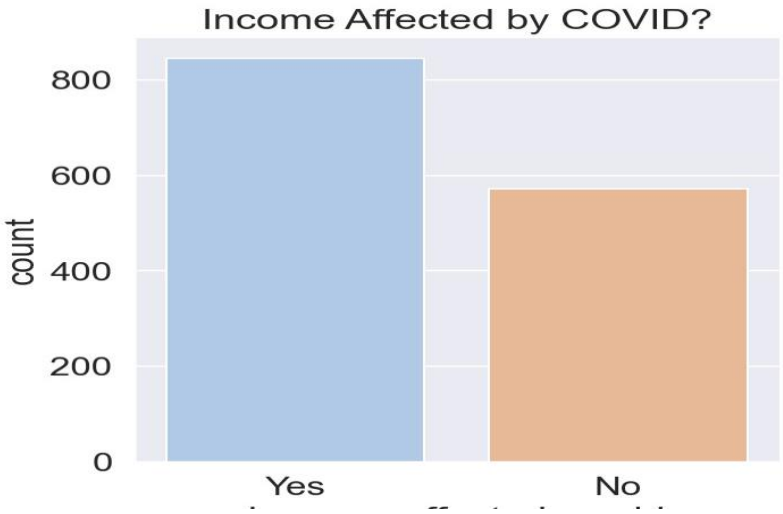
Figure A9





Source: Nigerian CRT- Covid-19 supplemental study.

Figure A10

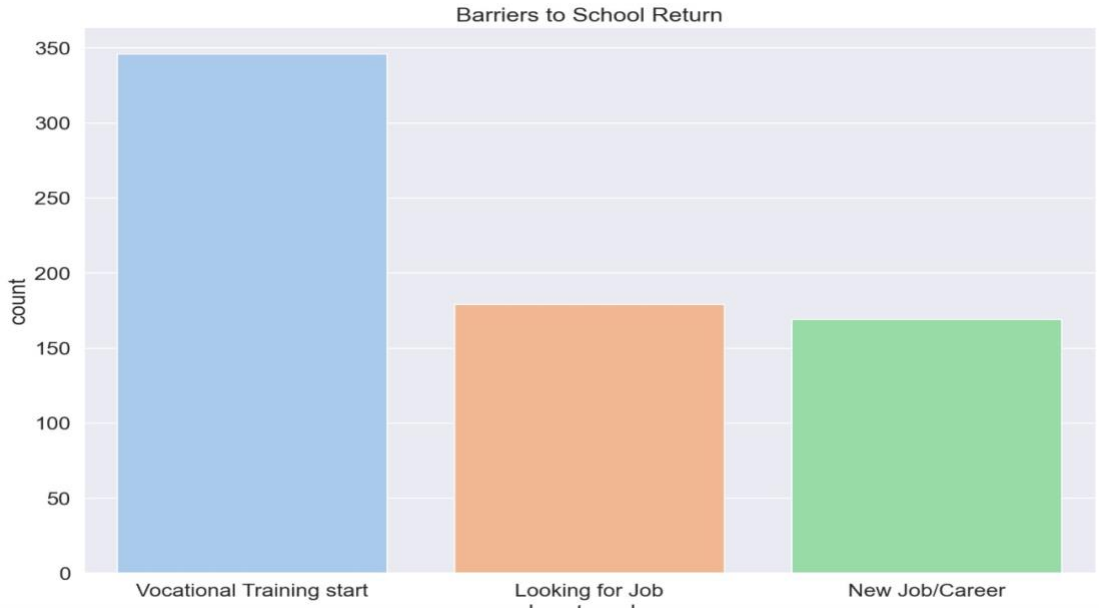


Source: Nigerian CRT- Covid-19 supplemental study.

Figure A11

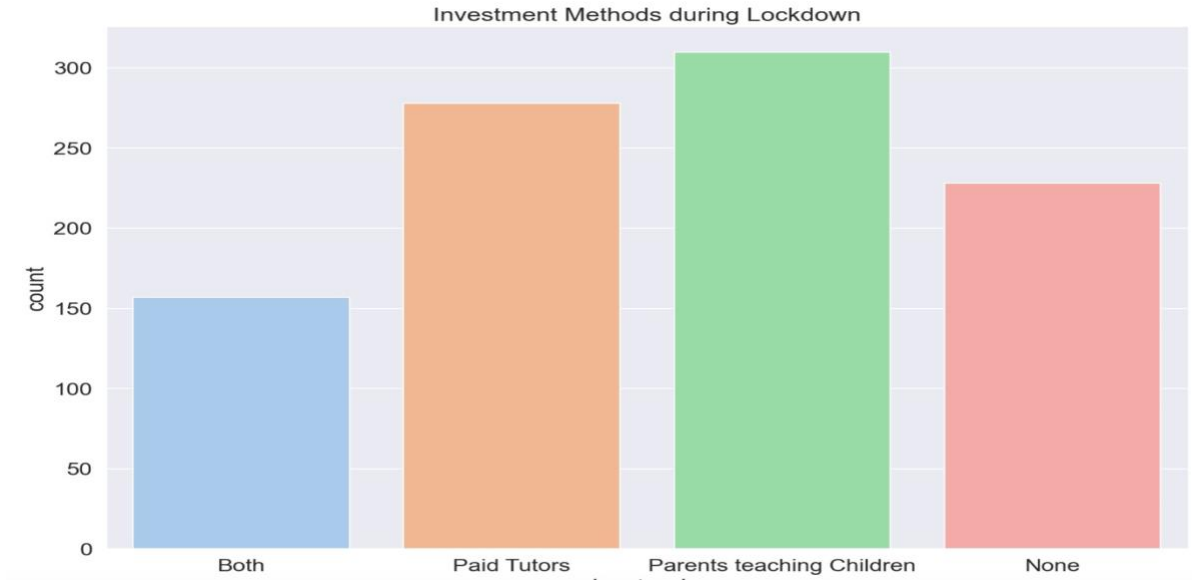
Source: Nigerian CRT- Covid-19 supplemental study.

Figure A12



Source: Nigerian CRT- Covid-19 supplemental study.

Figure A13



Source: Nigerian CRT- Covid-19 supplemental study.