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Munich Papers in Political Economy
Working Paper No. 04/2021

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9 August 2021

Abstract

Using a randomized controlled experiment in 200 Bangladeshi villages, we evaluate the impact of over-the-phone mentoring and homeschooling support delivered by volunteers on the learning outcomes of primary school children during school closures caused by the coronavirus pandemic. The telementoring program improved the learning outcomes of treated children by 0.75 SD and increased homeschooling involvement of treated mothers by 0.64 SD. The impacts on learning are driven primarily by the direct mentoring of children and to some extent also by the increased homeschooling involvement of mothers. Academically weaker children and households from lower socioeconomic backgrounds benefitted the most from telementoring.

JEL: C93, I21, I24, P46

Keywords: Telementoring, homeschooling, school closure, primary education, randomized experiment, rural areas.

We thank the volunteer mentors who participated in the training and mentoring the children over the phone. We are grateful to Global Development Research Initiative (GDRI), a research focused NGO, for providing excellent research support in the field. This trial is registered in the AEA RCT registry at: AEARCTR-0006395 and ethical clearance was received from Monash University, Australia (project no. 25039). This project has received funding from the Centre for Development Economics and Sustainability (CDES), Monash University, Australia.

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1 Introduction

Educational disruptions in low- and middle-income countries are prevalent. Natural and human-induced events that damage educational infrastructure and limit school operations often create significant barriers to the learning of children worldwide. For instance, the 2010 floods in Pakistan affected one-fifth of the country's population, damaging and shutting down schools for months (Fleet and Winthrop, 2010). In Syria, about 2.5 million children have been out of schools since the conflict began in 2011 and 40% of schools have been severely damaged due to war (UNICEF, 2021). In West Africa, the Ebola outbreak disrupted the schooling of about 5 million children for nine consecutive months (World Bank, 2015). Also, frequent political unrests and protests, such as *hartals*, in India forces schools to operate for about 190 days in a year, 30 school days short of the minimum requirement to cover the yearly syllabus (ENS, 2019). Bangladesh also faces frequent political strikes and school shutdowns due to disasters, such as floods or cyclones. Deteriorating income, living conditions, and health due to frequent shocks in developing countries also affect school attendance, performance, and eventual dropouts (Andrabi et al., 2021), threatening the educational attainment of millions of children worldwide.

One of the largest education crises in recent times occurred during the coronavirus disease (COVID-19) pandemic when 1.5 billion students worldwide were affected by partial or full school closures (UNESCO, 2021a). As of March 2021, nearly half of the students worldwide continued to be affected by school closures and about 65% of low-income countries have announced cutting their education budgets (UNESCO, 2021b). Because of prolonged school closures during the pandemic, many countries adopted online education and homeschooling measures to help address their educational challenges. However, children, particularly those coming from a low socioeconomic background and those living in developing countries, might find learning difficult in such circumstances due to the lack of Information and Communication Technologies (ICTs) and effective educational guidance and support at home (Bacher-Hicks et al., 2021, Larsen et al., 2021, Parolin and Lee, 2021). As many children in developing countries are first-generation learners, their parents usually do not have the ability, confidence, or skills to support their learning at home (Banerjee and Duflo, 2006, Hanushek and Woessmann, 2015, Glewwe and Muralidharan, 2016, Agostinelli et al., 2020). Thus, the pandemic has disproportionately worsened the learning of these children and led to calls for better leverages on low-cost and widely accessible ICTs, such as basic feature phones, to improve educators' engagement with these children and their parents (Muralidharan and Singh, 2021).

In this study, we evaluate one such intervention – telementoring – that relies on volunteer mentors to provide primary school children and their mothers in rural Bangladesh with mentoring services via basic feature mobile phones to help with the learning of children at

home.[1] During school closures, we provided telementoring, that was not otherwise available to children in low-resource settings, with voluntary support from current university students who worked remotely as mentors.[2] We implement a randomized controlled trial (RCT) in 200 villages to evaluate its impact. The intervention ran for 13 weeks in late-2020 when all schools were closed due to the COVID-19 pandemic. Children in the treatment group were given weekly support on mathematics and English that lasted roughly 30 minutes per session, while children in the control group were not given any support. In addition, mentors also provided structured guidance and support every week to treated mothers over the phone and via text messages to facilitate and improve homeschooling. One month after the intervention ended, we conducted standardized learning assessments among children and parental surveys to evaluate the impact.

We find several major results. First, treated children scored 0.66 standard deviations (SD) higher in English literacy and 0.56 SD higher in numeracy relative to children in the control group. We also find positive spillovers on school subjects not directly targeted by mentors. Specifically, treated children scored 0.62 SD higher in Bangla literacy and 0.50 SD higher in general knowledge relative to untreated children. Second, we find significant improvement in parental involvement as measured by the daily time spent on children: 0.64 SD more involvement in homeschooling (roughly 22 minutes per day) and 0.16 SD more involvement in leisure activities, such as playing, (roughly 12 minutes per day) than in the control arm. Importantly, increased homeschooling neither crowded out mothers' involvement in income-generating activities nor had any negative implications on their mental well-being. Third, negative parenting, such as frequent punishments and coercive interaction, decreased by 0.26 SD, self-reported parenting abilities increased by 0.19 SD, and parental aspiration about the child's educational attainment increased by 0.21 SD following the intervention.

Our causal mediation analysis suggests that the total effects of the intervention on children's test scores are primarily due to the direct effects of engaging with and being taught by the mentors. Nevertheless, roughly 12.6 to 14.1 percent of the total effects on test scores can be explained by the indirect effects of the mentors mediated through the parental channel. The indirect effects may seem small in relative terms, but the effect sizes ranging between 0.07 and 0.10 SD are considered sizable in the education literature. Finally, using a machine learning approach, we find that the intervention benefitted children that are older, academically weaker, and from a low socioeconomic background. In addition, the effect on homeschooling was larger

[1] Single and Muller (1999) define telementoring as electronic communications (primarily over the phone) between a "mentor" and a "protégé/mentee" with a goal to develop and grow the skills and knowledge of the mentee. Although children received "tutoring" and mothers received "mentoring" from the volunteer mentors, for simplicity, we use the term "mentoring" to define both services throughout this paper.

[2] See Appendix A for a description of the context and background, and a conceptual framework to understand how telementoring could be beneficial in our context.

among children that have less access to private tuition or supplementary learning opportunities. Thus, the intervention is most beneficial for vulnerable children.

This study contributes to the recent evidence on the effectiveness of various distant learning and mentoring programs on children's learning outcomes during the COVID-19 pandemic. Our paper is most closely related to Angrist et al. (2020) that shows weekly tutoring services and text messages delivered to parents of primary school-aged children in Botswana over five weeks can improve children's learning outcomes by 0.12 SD during school closures. Other related papers are in the context of developed countries. For instance, Carlana and La Ferrara (2021) show that the use of video-conferencing tutoring sessions that lasted 3 to 6 hours per week over five weeks in Italy led to a 0.21 SD improvement in middle school children's learning outcomes. Similarly, Hardt et al. (2020) find that the use of remote peer mentoring had positive impacts on students' motivation, studying behavior, and exam registration in a university in Germany when teaching was switched to online during the COVID-19 pandemic. By utilizing volunteer mentors to provide telementoring to both children and their parents via basic mobile phones in a low-income, low-resource setting, our findings demonstrate that low-cost ICT instruction programs can help address learning crises. More broadly, our findings indicate that telementoring can be a potential solution to the learning disruptions caused by natural disasters, wars, political unrest, teacher strikes, and teacher absenteeism, that many developing countries regularly face (Islam, 2019).

This study is also closely related to the broader literature on after-school tutoring, remedying education, and targeted instruction. In-person tutoring, with or without fee, is highly effective for improving learning outcomes (Nickow et al., 2020, Islam and Ruthbah, 2020, Carr and Wang, 2018). Specifically, one-on-one or small group tutoring is particularly beneficial for students that struggle (Ander et al., 2016). The reason being that it allows the educator to target instruction and teach at the "right level" (Banerjee et al., 2016). Other studies have shown that delivering targeted instructions through adaptive computer software can also be highly effective for learning (Banerjee et al., 2007, Muralidharan et al., 2019). However, in-person tutoring or distant tutoring that requires computing facilities and internet access is often not available for children in low-income, low-resource settings. Our findings, thus, demonstrate that phone-based distant mentoring can mitigate such instruction delivery challenges that are prevalent in most remote communities.

2 Experimental Design

2.1 The intervention

Telementoring. We partnered with the Global Development and Research Initiative (GDRI), a research-focused NGO operating in the Southwestern part of Bangladesh (see Figure C1 in Appendix C), to implement a telephone mentoring (or telementoring) program in rural

Bangladesh using a randomized controlled trial.[3] We recruited student volunteers from various local universities as mentors to provide learning support to primary school-age children and home-schooling advice to their mothers every week for 13 consecutive weeks. During the intervention period, each mentor called the mother at least once a week at a pre-determined time and day to provide support to the child on home-schooling over the phone. During sessions, children were provided with textbook solutions "on-demand", guiding the mother in setting weekly goals (such as weekly time involvement and curriculum target), and homeschooling assistance for both the child and the mother (such as learning plans, solution keys, and answering any questions they have).[4] The mentors only provided tuition on two core subjects: mathematics and English. Each mentoring session lasted approximately 30 minutes. The mentors' mobile phones were topped up with 100+ minutes of phone credit every week to allow them to initiate weekly calls.

In addition, there were 10 weekly session themes. Each session theme provided mentors with guidance regarding the discussions to have with their mentees in a particular week. These themes began in week 3 and ended in week 12. In addition, mothers were sent text messages (in *Bangla*) every week with tips, advice, and ideas related to the weekly themes. The objective was to encourage mothers to also advise their children on the weekly themes. Table C1 lists the themes and provides a brief overview of the text messages.

At the beginning of the intervention, GDRI mobilized its field staff to deliver weekly academic plans to the mothers. The field staffs were from the same subdistricts as the participating households. Each visit lasted for 5-10 minutes, and health guidelines were strictly followed.

Recruitment of volunteer mentors. In July 2020, we announced a call for volunteer mentors on social media (e.g., Facebook) and posted the announcement on various universities' official social media pages to encourage existing university students to participate (see Figure B1 for the project timeline). 267 university students signed up as prospective mentors. We conducted a half-day training session via videoconferencing to discuss the telementoring program and its objectives with these prospective mentors. After the initial training session, three training seminars on education and development in Bangladesh and three Q&A sessions were arranged on three separate days for them. Two of the co-authors of this study, Hashibul Hassan and Asad Islam, conducted these training and seminars. Mentors were given mentoring

[3] Tables, figures, and sections numbered A#-E# hereinafter correspond to tables/figures/sections in Appendix A-E.

[4] We provided a weekly academic plan to the mentors, where study target of a particular week was given. In addition, we also provided a detailed mentoring guideline where the following items were discussed: child development stages, general advice for the parents, materials, and ideas for better interactive telephone sessions, 10 principles of our mentoring program, general rules, the "dos and don'ts" during mentoring session, and weekly mock mentoring sessions. We also provided all academic books and teachers' manual to the mentors in digital version.

guidelines, which were adapted from the guidelines of the Government Teacher's Training College – the main public college in teacher training in Bangladesh.

We kept the training sessions short because most of the prospective mentors had prior tutoring experience. It is common in Bangladesh for university students to have private tutoring experience. In August 2020, we invited all prospective mentors to sign a consent form and participate in an online survey. 219 volunteers, of which 111 were female students, provided consent, completed the online survey and were recruited as mentors.

Recruitment of primary school children and their mothers. Our local partner, GDRI, has up-to-date contact information and survey data on 6,503 households across 223 villages in Khulna and Satkhira districts. Their contact information was recorded during a large-scale survey on early childhood development conducted in 2019. For our telementoring intervention, at the beginning of 2020, each household needed to have at least one child in the 7-9 years of age. Children were eligible for the telementoring program if they were enrolled in grades 1-3 at any public primary school. We leveraged GDRI's directory to recruit primary school children and their mothers for the intervention and existing data (that we use as our baseline in addition to a new round of rapid-survey in 2020) to check the balance of individual- and household-level characteristics across treatment arms. We recruited 838 mother-child dyads (one from each household), where half of them were assigned randomly to receive the telementoring treatment. Section 2.2 details the sampling and randomization procedures.

Assigning mentors to mentees. Each mentor was randomly assigned to two primary school children in the same grade level. We allocated 419 children to 210 mentors. The remaining nine mentors were kept as a reserve but also engaged in other tutoring-related activities, such as substituting for mentors who could not help due to illnesses or other emergencies. At the start of the intervention, 22 children in the treatment arm dropped out for various reasons, such as problems with mobile phone availability, family issues, etc. Moreover, 13 mentors left during the first two weeks of the intervention, leaving us with 397 mentees and 206 mentors (199 for mentoring and seven as reserves).[5] As a result, we re-organized the mentors-mentees matches after the second week by randomly re-assigning mentees whose mentor left to mentors whose mentee(s) left. After the second week, none of the remaining mentees or mentors dropped out. Section 2.4 further explains the attrition and demonstrates no attrition bias.

Timeline. Mentor recruitment and training started in July and ended in August 2020. A baseline survey on the mentors was administered in August 2020. The telementoring intervention began in early September and ended in early December 2020, where sessions took

[5] Note that tutoring was only given to children in the treatment arm while children in the control arm received no tutoring during the intervention; thus, dropping out of children and mentors only occurred in the treatment arm as no mentor was required in the control arm.

place every week for 13 consecutive weeks. The endline survey started in January 2021 (one month after the intervention ended) and lasted for about a month (see Figure B1).

2.2 Sampling and Data

From the list of 6,503 contacts from the GDRI directory, we randomly selected 1,500 phone numbers for the intervention. However, we could only reach out and communicate directly with the guardians in 1,047 households (across 207 villages) over the phone to invite them and their primary-school-age children to partake in the telementoring program. At the end of the invitation call, we also conducted a rapid survey to find out in which grade the children were enrolled (to check the eligibility criteria) and their existing homeschooling situations. 968 mother-child dyads across 206 villages agreed to participate, but only 838 of them met the eligibility criteria (i.e., the child is in grade 1, 2, or 3, and the household has permanent and reliable access to a phone).[6] Among the 838 mother-child dyads, we randomly assigned half (419) to the treatment arm – those who received weekly telementoring – and the remaining half to the control arm, where no telementoring was provided. Among the 838 recruited mother-child dyads (or households), we were able to conduct 817 children's assessments and 818 surveys on the mothers at endline. A total of 814 households completed both the assessment and survey at endline. See Figure B2 for the flowchart of participants' progress through the phases of the trial. We describe the baseline data, short phone surveys before the intervention started and the endline data collection in Appendix B.

2.3 Outcomes

We focus on three types of outcomes for the empirical analysis.

Children's cognitive ability. Children's cognitive ability is measured using the standard one-on-one assessment test. This variable takes the value from 0 to 100, where higher points correspond to higher cognitive ability. There were four segments in the test, i.e., English literacy, numeracy, Bangla literacy, and general knowledge. The exact questions asked are presented in Table D1.

Parental involvement. Parental investments in children's educational and non-educational activities are measured using two survey questions answered by the mother. The first is the total daily time spent (in minutes) in helping the child with various academic activities. The second is the total daily time spent (in minutes) with the child on various non-academic activities, such as storytelling, playing, etc.

Parenting perceptions. We have four measures for this type of outcome. First, the prevalence of "negative parenting", which is the sum of five dummy variables, such as support

[6] In the registered pre-analysis plan, we mention 840 households. However, two households' phone numbers were added twice to the list, counting these two households twice by mistake.

the child if sad, use of abusive words, beating, etc. Second, "parenting ability", which is the sum of 11 items, each answered on a 5-point Likert scale to assess the perception of the mother in her parenting role. Third, the "future expectation" of the mother regarding the child's education, which is a categorical variable where a higher value corresponds to a higher level of educational achievement by their child. Finally, the "mother's confidence" about her involvement in the child's learning, which is the sum of three 10-point scales regarding her involvement in the child's education.

2.4 Sample characteristics, balance, and attrition

Table C2 reports sample baseline characteristics by treatment and control and confirms that these characteristics are balanced across treatment arms. Importantly, cognitive assessments of the participating children are similar across treatment arms.

Table C6 provides the descriptive of the mentors. Mentors were on average 22 years old. Most mentors were female (52%), from an urban background (62%), had prior tutoring experience (76%), and had prior volunteering experience (75%). Almost all of them (96%) are studying at a public university, and most of them are now at the undergraduate level (84%).

Out of the 838 participating households that were randomly assigned to treatment and control arms, 24 did not complete both the assessment and parental survey in the endline. We check for differential attrition by treatment in Table C4 and find no such evidence.

2.5 Empirical strategy

To investigate the impact of telementoring, we estimate the following OLS regression:

$$Y_{ijk} = \alpha + \beta T_{ijk} + \mathbf{\Gamma}' \boldsymbol{X}_{ijk} + g_j + c_k + \varepsilon_{ijk} \qquad (1)$$

where Y_{ijk} is an outcome of child i or an input type of mother i with the child being in grade j, living in union council k, measured at the endline; T is an indicator for the telementoring treatment; X is a vector of controls that includes the child's gender, age, birth order, baseline literacy, baseline numeracy, and access to private tuition, as well as the number of children under 15 in the household, parental educational attainment, family income, and religion. g and c are grade and union council fixed effects respectively.[7]

Since we consider a range of outcomes for children and mothers, we correct for multiple hypotheses testing using Westfall and Young (1993) adjustments. The adjustment accounts for correlations across outcomes using sample bootstrapping with 5,000 repetitions. Moreover, we

[7] With 814 respondents across 200 villages at endline, not all villages include both treatment and control households. As a result, we include union council fixed effects – the smallest rural administrative unit in Bangladesh, where each union council consists of 9 villages. However, as a robustness check, we use village fixed effects and our conclusions remain largely robust (see Table C8).

also compute randomization inference (RI) p-values by reshuffling the treatment status 1,000 times following Young (2019). Our results are largely robust to both adjustments.

3 Results

We investigate the impact of the telementoring program on three groups of outcomes: (i) learning outcomes of children, (ii) parental involvement, and (iii) parental perceptions.

3.1 Learning outcomes of children

To assess the impact on aggregate test score across all subject matters (where the total score is between 0 and 100), we standardize each student's total score by subtracting the control group's mean and then dividing it by the control group's standard deviation (SD). Thus, this standardized total score has a mean zero and SD one for the control group, and the estimated $\hat{\beta}$ from equation (1) indicates where the mean of the treatment group lies in the distribution of the control group in SD units. We also follow this procedure to standardize the subject-level test scores. We plot the estimated coefficients in Figure 1 (Panel A), with 99% and 95% confidence intervals, and also report the estimates, standard errors, and randomization inference p-values in Table C7. We find significant improvements in both aggregate test scores and subject-level test scores, where all effect sizes are above 0.5 SD (all $p < 0.01$). Specifically, we find that the intervention led to an improvement in total score by 0.75 SD. The largest and smallest effect sizes are for English literacy (0.66 SD) and general knowledge (0.50 SD), respectively. These estimated effects are similar with or without covariate adjustments. For comparison, Angrist et al. (2020) find an effect of 0.12 SD from a phone-based tutoring intervention in Botswana over five weeks during the COVID-19 pandemic. Carlana and La Ferrara (2021) found a 0.21 SD improvement in learning outcomes following five weeks of video-conferencing tutoring sessions that lasted 3 to 6 hours per week among middle school students in Italy. We believe our relatively large effects can be explained by the length of the intervention, which is 13 consecutive weeks.[8]

We also report the estimated treatment effects for unstandardized test scores (Panel A of Table 1). We find that the treatment improved the overall test score of treated students by 17.7 points (test score between 0 and 100) or 35% improvement, with students in the control group scoring 50.1 points. We plot the distribution of overall test scores from endline assessments in Panel A of Figure 2, separately for treatment and control groups. We also present the comparison as a percentile-to-percentile mapping of the two distributions in Panel B of Figure 2. The 30th percentile of the treatment group distribution corresponds approximately to the 60th

[8] Our students are also coming from poor socioeconomic backgrounds in rural area, where other means of remote learning are not available. Parents in these settings are also generally not able to help their children with study or are not used to teaching their own children. During our baseline rapid survey, we observe 38.54% of our sample children do not study at home regularly during the school closures. Our results also indicate that the gap due to school closures are going to be much larger for students without access to online or remote learning.

percentile of the control group distribution. This implies that the effect of telementoring intervention would be equivalent to moving a child at the 30th percentile of the control group to the 60th percentile. In Figure C2, we show mean test scores of children in treatment and control groups for each subject separately. It shows, both groups perform the least in the English literacy component of the test. While the treated children show the largest improvement in English literacy (also shown in Figure 1), the control children performed very poorly in English literacy which is consistent with the observed level of English literacy skills of the students in rural areas. At the subject level, we find that Bangla literacy improved by 3.9 points (37%), English literacy improved by 5.6 points (52%), numeracy improved by 5.4 points (33%), and general knowledge improved by 2.8 points (22%) in the treatment group relative to the control group. Since mentors only assisted children in English and mathematics, the treatment effects on Bangla literacy and general knowledge suggest two indirect channels: spillovers from improved learning and parental involvement.

3.2 Parental involvement

Besides helping students with English literacy and mathematics, the mentors also supported mothers by giving parenting advice and helping them set up weekly goals for homeschooling. Measures of parental involvement allow us to test: (1) the direct impact of our intervention on parental engagement in homeschooling and (2) whether parental involvement is an important channel through which the intervention improved the children's learning outcomes. Treatment effects on parental involvement are reported in Panel B of Figure 1, Table 1, and Table C7.

We find significant improvements in parental involvement in both homeschooling their children (0.64 SD) and spending leisure time with them (0.16 SD), both shown in Figure 1 (Panel B). The impact on time spent on homeschooling is more than twice the impact on time spent on doing leisure activities together, and this difference is statistically significant ($p < 0.01$). In terms of minutes spent per day, mothers in the treatment group spent 22 minutes (26%) more on homeschooling and 12 minutes (16%) more on doing leisure activities with their children than mothers in the control group, who spent an average of 84 minutes on homeschooling and 79 minutes on leisure activities with their children daily.

A potential concern regarding increased parental involvement is the crowding out of their leisure and employment time, which could have detrimental effects on their own mental and emotional well-being and income. Since parental involvement increased by only 34 minutes per day on average, we do not believe it can have a substantial negative impact on income-generating activities. Only 7.62% of mothers in our sample engage in income-generating activities (while the remaining 92.38% are homemakers) and our treatment had no negative impact on their household income (see columns 1-2 in Table C9). In terms of mental health, we measure depression symptoms of mothers at the endline using the 20-items CES-D scale

(Radloff, 1977). Columns 3-5 in Table C9 show that our intervention did not deteriorate mothers' mental well-being. Although statistically insignificant, negative coefficients on the treatment dummy suggest that mothers were somewhat better off mentally following the intervention.

3.3 Parental perceptions

The use of strong punishment or coercive interaction is negatively associated with children's academic achievements (Domina, 2005). Parental advice given to the mothers in the intervention includes avoiding the use of strong punishments on their children (or 'negative parenting'). Our results show that the prevalence of negative parenting decreased by 0.26 SD among the treated mothers (Panel C, Figure 1), which translates to a 22% decrease relative to mothers in the control group (Panel C, Table 1).

We also test whether our intervention increased mothers' aspirations about their children's academic future. We find that our intervention led to a 0.18 SD improvement in the mothers' aspirations, which translates to a 5% improvement relative to the control group. Although the mothers' confidence in tutoring their children also increased slightly, the increase is not statistically significant (FWER-adjusted $p > 0.10$).

Finally, another important aspect of effective homeschooling is parenting skills. In our sample, we find that 87% of the treated mothers regularly sought information and suggestions regarding parenting from the mentors at some point during the intervention. Besides, mothers were sent text messages throughout the intervention encouraging positive parenting practices. We find that self-reported parenting skills improved by 0.22 SD. Thus, support from the mentors provided valuable parenting skills to the participating mothers. In all, these sets of results indicate that the intervention had positive effects on parenting perceptions, practices, and skills. In the next subsection, we examine how much the mothers' involvement in their children's learning at home may have contributed to the improvements in their children's learning outcomes.

3.4 Causal mediation analysis

To investigate the direct effect of the telementoring intervention and the indirect effects of it that mediate through parental involvement, we use a formal mediation analysis approach proposed by Imai et al. (2010; IKY). To test whether the effect of telementoring also mediates through parental involvement, the following two sets of equations are estimated using IKY:

$$M_{ijk} = \alpha + \beta T_{ijk} + \boldsymbol{\Gamma}' \boldsymbol{X}_{ijk} + g_j + c_k + \varepsilon_{ijk} \qquad (2)$$

$$Y_{ijk} = \rho + \pi T_{ijk} + \delta M_{ijk} + \boldsymbol{\Gamma}' \boldsymbol{X}_{ijk} + g_j + c_k + \omega_{ijk} \qquad (3)$$

where M_{ijk} is a mediator that captures parental involvement. If parental involvement is an important channel through which the intervention leads to an improvement in the child's learning, then $\beta\delta \neq 0$.[9]

We use factor analysis to construct a parental involvement index that captures both the quantitative and qualitative aspects of parental involvement. The quantitative aspect of parental involvement is the time the mother spent on homeschooling the child, whereas the qualitative aspect includes the parenting style, ability, aspirations, and confidence of the mother in homeschooling the child that makes their time spent on homeschooling more effective.

Table 2 reports the results of the mediation analysis. We find that the mediator accounts for between 12.6% to 14.1% of the total treatment effect. The estimates suggest that the total effects of the intervention are primarily driven by the direct effects of telementoring on the children. Although the mediation effects of parental involvement may seem small in relative terms, they are fairly large in absolute terms. That is, in absolute terms, the effect sizes are between 0.07 and 0.10 SD. The mediation effects are slightly larger for Bangla and English and the smallest for numeracy and general knowledge. Since the indirect effects of parental involvement on children's test scores are sizable, these results corroborate findings in earlier work that suggests training and guiding parents can lead to significant improvements in children's academic achievement (Tam and Chan, 2009). For scaling up and policy implications, this analysis suggests that both children (for direct mentoring) and mothers (for homeschooling support) should be targeted.

We also conduct an alternative mediation analysis to understand the relative roles of parental involvement and perception in affecting the learning outcome of children. We re-estimate equation (1) adding different indicators of parental involvement and perception as additional controls.[10] Table C10 reports the results of this analysis. We find that the treatment effect in each model remains large and significant after controlling these additional variables. Adding just homeschooling reduces the coefficient of the treatment effect significantly ($p < 0.01$) by 0.1 SD (column 2) or 13% of the treatment effect. Adding other variables successively (columns 3-7) does not further change the treatment effect. Among all indicators of parental involvement and perception, estimates suggest that more time in homeschooling, avoidance of negative parenting, and higher aspiration about children's educational attainment contribute to learning outcomes.

[9] IKY is carried out under the assumption of sequential ignorability, i.e., error terms from equations (2) and (3) are independent. We carry out a sensitivity analysis to test this assumption and find that the dependence (or correlation between the errors) needs to reach between 0.10-0.25 for the ACME to be statistically insignificant (Figure C3 in Appendix C). Importantly, under complete independence (correlation equals 0), the ACME remains positive and statistically significant.

[10] While parental knowledge and perceptions are likely to be impacted by our intervention, the aim of this exercise is to assess to what extent addition of these variables absorbs any of the treatment effects that we reported in Table C7.

4 Heterogeneous treatment effects using machine learning

To examine heterogeneity in treatment effects, we follow a machine learning algorithm developed by Athey and Imbens (2016) and Wager and Athey (2018), and the procedure laid out in Davis and Heller (2017) to explore who benefitted the most from our intervention. Section E1. in Appendix E details the steps.

We begin by estimating the Conditional Average Treatment Effect (CATE) or $E[Y_1 - Y_0|X = x]$ (where Y_1 and Y_0 are treatment group's and control group's learning outcomes, and $X = x$ are the values of each covariate as listed in Table 3) using a causal forest algorithm. Then, using predictions on the CATE, we investigate treatment heterogeneity by creating four quartiles. We then compare the average baseline characteristics between those at the top quartile (most affected) and those at the bottom quartile (least affected) to identify which subgroups benefitted the most and least from our intervention.

Overall, we find that the groups most benefitted in terms of learning outcomes ("25% most" in column 1 of Table 3) are children that were academically weaker at baseline (i.e., scored relatively lower in literacy and numeracy tests), children with less-educated parents, children coming from a low-income family, and children with fewer siblings. We also find that children that are older, more likely to be first-born, and from Muslim families were also affected the most. However, we do not observe any heterogeneity by children's gender and grade. Moreover, treatment effects on learning outcomes also do not vary by children's access to private or supplementary tuition. Importantly, these results do not change when learning outcomes are disaggregated by subjects (columns 1-2, Table C11).

We also examine heterogeneity in treatment effects on parental involvement (columns 2-3 in Table 3), where we find that academically weaker children at baseline received more homeschooling (column 2) and leisure (column 3) time from their mothers. Also, mothers in households with more educated parents and with higher incomes invested more time in their children. Moreover, children that are less likely to have private tutors received more homeschooling time from their mothers. We also find gender bias in homeschooling and leisure time investments, where boys received more attention from mothers than girls.[11] One reasonable explanation for the observed bias is the widespread 'preferences for sons' among parents in Bangladesh, particularly in rural areas (Kabeer et al., 2014). For the remaining characteristics, there is no heterogeneity. We also examine heterogeneity on the remaining outcomes (negative parenting, parenting ability, etc.) and find similar patterns throughout (see Table C11 and Table C12). Overall, the intervention helped children that are academically

[11] Section E2 of Appendix E provides heterogeneity results using interactions with child gender, birth order, treatment intensity and quality of mobile phone network.

weaker, from a low socioeconomic background, and have less access to private tuition. Thus, the intervention is most effective and helpful for vulnerable children.

5 Conclusion

This study shows in a randomized controlled experiment that telementoring delivered by volunteer mentors to primary graders and their mothers in a low-resource setting can significantly improve the learning outcomes of children and increase their mothers' involvement in their education. The intervention increased the treated children's learning outcomes by as much as 0.75 SD and also increased the homeschooling support provided by the mothers, while also improving their parenting style, perceived parenting ability, and aspirations about their children's education. Our causal mediation analysis shows that the effects of the intervention on the learning outcomes of the children are primarily driven by the direct effects of the mentors on the children. The indirect effects channel through parental involvement are around 12.6 to 14.1 percent, which are large in absolute terms (effect sizes of 0.07 to 0.10 SD). We also find that non-coercive interaction with children and parental aspirations about the academic attainment of children is as important as time involvements in homeschooling for improving learning outcomes of children.

Although widespread school closures and learning disruptions are unique to the COVID-19 pandemic, school closures and learning disruptions due to political unrests, teacher strikes, and natural disasters have always been a major source of learning deficits and losses, especially for children living in developing countries. The telementoring intervention provides a low-cost solution to the learning deficits and losses that children experience. The total monetary cost of this intervention was USD 8,094. Given that 419 children received the treatment, the cost per child was less than USD 20. In other words, each dollar on over-the-phone mentoring led to an average 0.038 SD improvement in learning outcomes among treated children in rural areas. One key reason for the low cost is that the intervention relied solely on volunteer university students to provide mentoring.

Our study has both immediate and long-term policy implications. Globally, a significant portion of children is kept out of school due to the COVID-19 pandemic. Given the high penetration of mobile phones, our low-tech, low-cost intervention that utilizes educated volunteers as mentors can potentially provide a scalable and effective solution. This type of intervention can also be utilized in non-pandemic contexts to address learning deficits experienced by children in developing countries.

References

AGOSTINELLI, F., DOEPKE, M., SORRENTI, G. & ZILIBOTTI, F. 2020. When the Great Equalizer Shuts Down: Schools, Peers, and Parents in Pandemic Times. National Bureau of Economic Research.

ANDER, R., GURYAN, J. & LUDWIG, J. 2016. Improving Academic Outcomes for Disadvantaged Students: Scaling up Individualized Tutorials. Policy Proposal 2016-02. *Hamilton Project*.

ANDRABI, T., DANIELS, B. & DAS, J. 2021. Human capital accumulation and disasters: Evidence from the Pakistan earthquake of 2005. *Journal of Human Resources*, 0520-10887R1.

ANGRIST, N., BERGMAN, P. & MATSHENG, M. 2020. School's Out: Experimental Evidence on Limiting Learning Loss Using "Low-Tech" in a Pandemic. National Bureau of Economic Research.

ATHEY, S. & IMBENS, G. 2016. Recursive partitioning for heterogeneous causal effects. *Proceedings of the National Academy of Sciences,* 113, 7353-7360.

BACHER-HICKS, A., GOODMAN, J. & MULHERN, C. 2021. Inequality in household adaptation to schooling shocks: Covid-induced online learning engagement in real time. *Journal of Public Economics,* 193, 104345.

BANERJEE, A. & DUFLO, E. 2006. Addressing absence. *Journal of Economic perspectives,* 20, 117-132.

BANERJEE, A. V., COLE, S., DUFLO, E. & LINDEN, L. 2007. Remedying education: Evidence from two randomized experiments in India. *The Quarterly Journal of Economics,* 122, 1235-1264.

BANK, W. 2015. *Back to School After the Ebola Outbreak* [Online]. The World Bank Group. Available: https://www.worldbank.org/en/news/feature/2015/05/01/back-to-school-after-ebola-outbreak [Accessed 01 July 2021].

CARLANA, M. & LA FERRARA, E. 2021. Apart but Connected: Online Tutoring and Student Outcomes during the COVID-19 Pandemic.

CARR, D. & WANG, L. C. 2018. The Effect of After-School Classes on Private Tuition, Mental Health and Academic Outcomes: Evidence from Korea. *Sociology,* 52, 877-897.

DAVIS, J. & HELLER, S. B. 2017. Using causal forests to predict treatment heterogeneity: An application to summer jobs. *American Economic Review,* 107, 546-50.

DOMINA, T. 2005. Leveling the Home Advantage: Assessing the Effectiveness of Parental Involvement in Elementary School. *Sociology of Education,* 78, 233-249.

ENS. 2019. Hartals affecting schools' quality across Kerala. *The New Indian Express*.

FLEET, J. V. & WINTHROP, R. 2010. *An Estimated 20 Million Pakistanis in Desperate Need: Why So Little Media Attention?* [Online]. The Brookings Institution. Available: https://www.brookings.edu/opinions/an-estimated-20-million-pakistanis-in-desperate-need-why-so-little-media-attention/ [Accessed 01 July 2021].

GLEWWE, P. & MURALIDHARAN, K. 2016. Improving education outcomes in developing countries: Evidence, knowledge gaps, and policy implications. *Handbook of the Economics of Education.* Elsevier.

HANUSHEK, E. A. & WOESSMANN, L. 2015. *The knowledge capital of nations: Education and the economics of growth*, MIT press.

HARDT, D., NAGLER, M. & RINCKE, J. 2020. Can Peer Mentoring Improve Online Teaching Effectiveness? An RCT During the COVID-19 Pandemic. CESifo.

IMAI, K., KEELE, L. & YAMAMOTO, T. 2010. Identification, inference and sensitivity analysis for causal mediation effects. *Statistical science*, 51-71.

ISLAM, A. 2019. Parent–teacher meetings and student outcomes: Evidence from a developing country. *European Economic Review,* 111, 273-304.

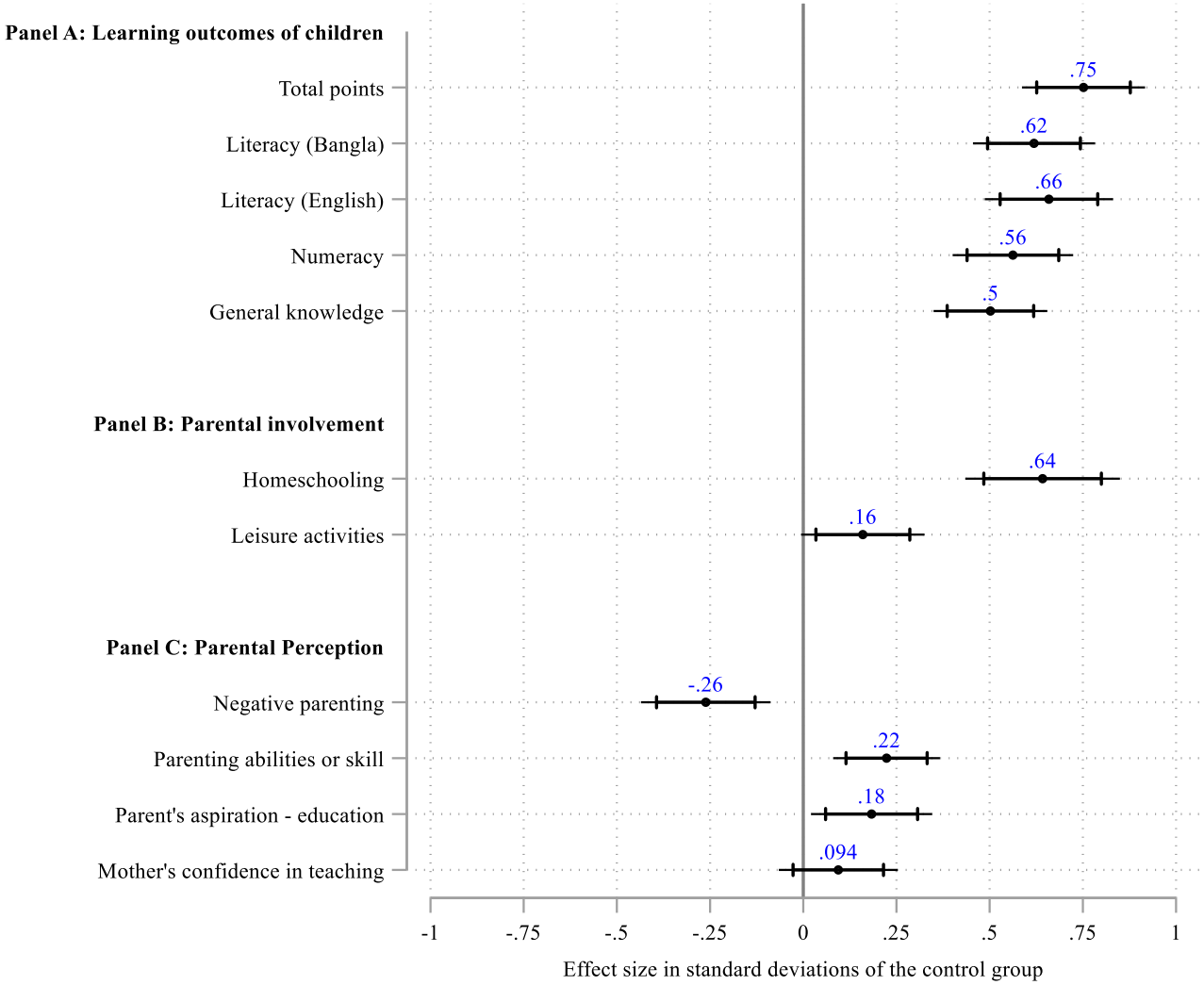
ISLAM, A. & RUTHBAH, U. 2020. After-school tutoring in developing countries: Evidence from a large Scale RCTs.

KABEER, N., HUQ, L. & MAHMUD, S. 2014. Diverging stories of "missing women" in South Asia: Is son preference weakening in Bangladesh? *Feminist Economics,* 20, 138-163.

LARSEN, L., HELLAND, M. S. & HOLT, T. 2021. The impact of school closure and social isolation on children in vulnerable families during COVID-19: a focus on children's reactions. *European Child & Adolescent Psychiatry*.

MURALIDHARAN, K. & SINGH, A. 2021. India's new National Education Policy: Evidence and challenges. *Science,* 372**,** 36-38.
MURALIDHARAN, K., SINGH, A. & GANIMIAN, A. J. 2019. Disrupting Education? Experimental Evidence on Technology-Aided Instruction in India. *American Economic Review,* 109**,** 1426-60.
NICKOW, A., OREOPOULOS, P. & QUAN, V. 2020. The Impressive Effects of Tutoring on Prek-12 Learning: A Systematic Review and Meta-Analysis of the Experimental Evidence. *NBER Working Paper*.
PAROLIN, Z. & LEE, E. K. 2021. Large socio-economic, geographic and demographic disparities exist in exposure to school closures. *Nature Human Behaviour*.
RADLOFF, L. S. 1977. The CES-D scale: A self-report depression scale for research in the general population. *Applied psychological measurement,* 1**,** 385-401.
SINGLE, P. B. & MULLER, C. B. Electronic mentoring: Issues to advance research and practice. International Mentoring Association Annual Meeting, 1999.
TAM, V. C. & CHAN, R. M. 2009. Parental Involvement in Primary Children's Homework in Hong Kong. *School Community Journal,* 19**,** 81-100.
UNESCO. 2021a. *Education: From disruption to recovery* [Online]. Paris, France: UNESCO. Available: https://en.unesco.org/covid19/educationresponse [Accessed 05 July 2021].
UNESCO. One year into COVID: Prioritizing education recovery to avoid a generational catastrophe. The Global Education 2030 Agenda, 2021b.
UNICEF. 2021. *Crisis in Syria: What you need to know* [Online]. UNICEF. Available: https://www.unicef.org/emergencies/syrian-crisis [Accessed 01 July 2021].
WAGER, S. & ATHEY, S. 2018. Estimation and inference of heterogeneous treatment effects using random forests. *Journal of the American Statistical Association,* 113**,** 1228-1242.
WESTFALL, P. H. & YOUNG, S. S. 1993. *Resampling-based multiple testing: Examples and methods for p-value adjustment*, John Wiley & Sons.
YOUNG, A. 2019. Channeling fisher: Randomization tests and the statistical insignificance of seemingly significant experimental results. *The Quarterly Journal of Economics,* 134**,** 557-598.

Figure 1: Treatment effects on standardized outcomes

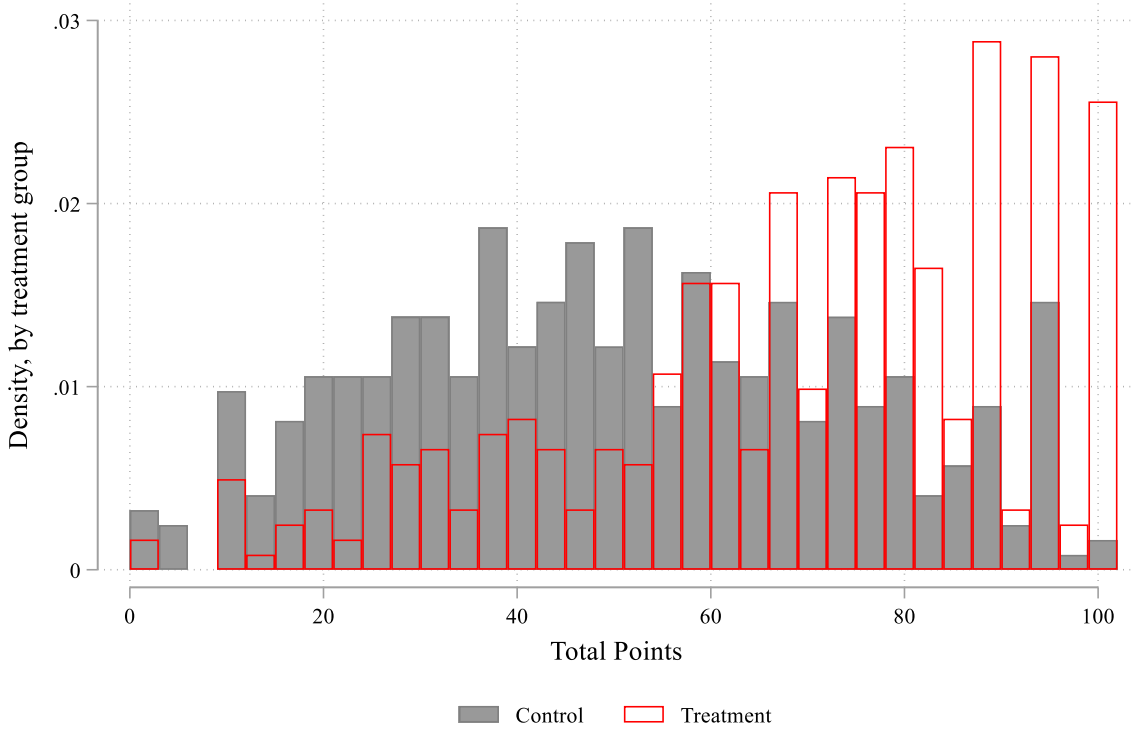


Notes:

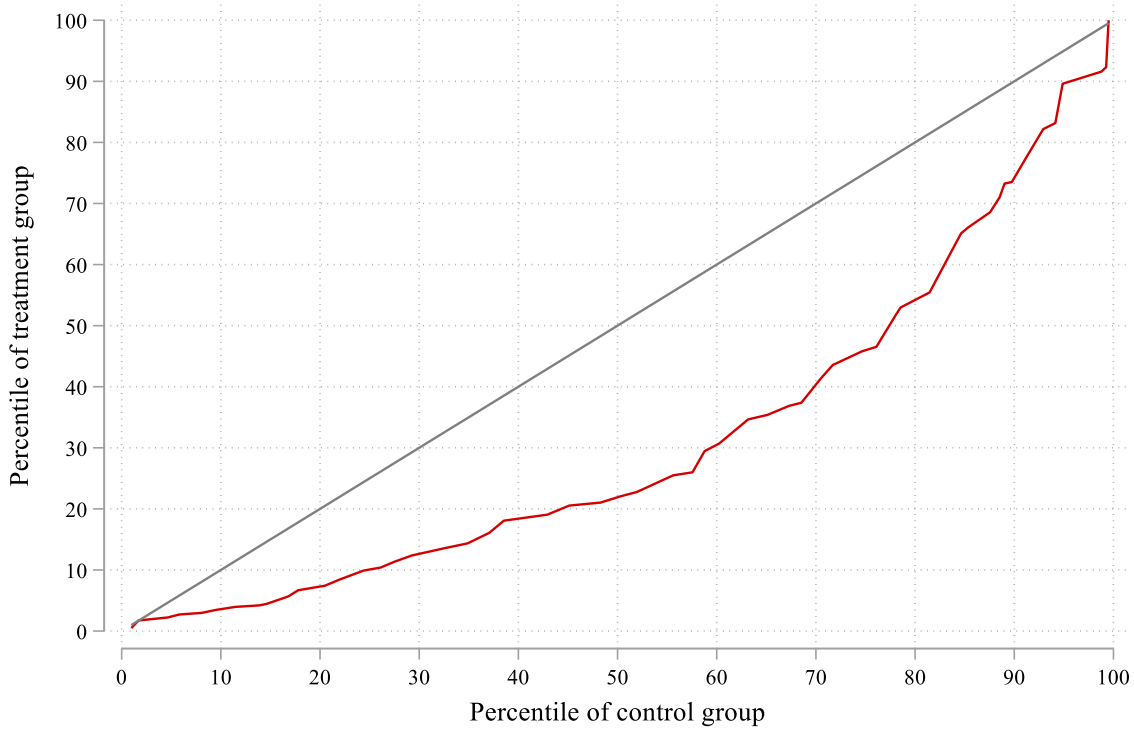
a. This figure exhibits the mean effects of the telementoring intervention on the outcome variables. All outcome variables are standardized [(y_i – mean of the control group)/standard deviation of control group]. Coefficients estimated with OLS. Baseline controls included: gender, age, birth order, baseline literacy score, baseline numeracy score, access to private tuition, parents' education in years, family income, religion, and the number of children in the household.
b. Grade and union fixed effects are included in all regression.
c. The standard error bar indicates 95 and 99 confidence intervals.

Figure 2: Distribution of total points and difference in distribution by treatment group

Panel A: Distribution of total points by treatment group



Panel B: Difference in point distribution by treatment group



Notes:

a. Panel A exhibits the distribution of total points for the telementoring treatment and control groups, separately, for all children who completed the endline assessment test. Panel B shows percentile-to-percentile plot of the total points of endline test.

Table 1. Treatment effect on unstandardized outcomes

Outcome Variables	(1) Treatment[a] n=404	(2) Control[a] n=410	(3) Difference[b] n=814	(5) FWER P-value	(6) RI P-value
Panel A: Learning outcomes of children					
Total points [100 marks test]	68.349	50.110	17.702***	0.000	0.001
Literacy (Bangla) [20 marks]	14.592	10.524	3.867***	0.000	0.001
Literacy (English) [30 marks]	16.619	10.756	5.590***	0.000	0.001
Numeracy [30 marks]	21.520	16.244	5.424***	0.000	0.001
General Knowledge [20 marks]	15.619	12.585	2.821***	0.000	0.001
Panel B: Parental involvement					
In Homeschooling (in minutes/ day)	106.757	84.407	21.813***	0.000	0.001
In Homeschooling – dummy (Probit est.)	0.332	0.144	0.691***	0.000	0.001
In leisure activities (in minutes/day)	91.978	79.127	12.032***	0.026	0.013
In leisure activities – dummy (Probit est.)	0.151	0.093	0.336***	0.019	0.009
Panel C: Parenting perception					
Negative parenting (beating, use of abusive words, etc.) [0 to 5 scale]	1.027	1.310	-0.284***	0.001	0.001
Parenting abilities or skill [11 to 55 scale]	50.042	48.698	1.469***	0.001	0.000
Parent's aspiration about child's future edu.	5.173	4.868	0.246***	0.013	0.003
Mother's confidence in educational involvement	22.411	21.415	0.650	0.128	0.144

Notes:

a. Mean values of the respective outcome variables.
b. This column exhibits the coefficients estimated with OLS unless indicated otherwise. Baseline controls included in all regression: gender, age, birth order, baseline literacy score, baseline numeracy score, access to private tuition, parents' education in years, family income, religion, and the number of children in the household.
c. Grade and union fixed effects are used in all regressions.
d. *** p<0.01, ** p<0.05, * p<0.1
e. Westfall-Young FWER adjusted p-values are calculated based on 5,000 replications.
f. P-values from Randomized Inference (RI) are calculated based on 1,000 replications.

Table 2. Average causal mediation effect on standardized outcomes following IKY

	(1) Total points	(2) Literacy (Bangla)	(3) Literacy (English)	(4) Numeracy	(5) General Knowledge
Direct effect	0.649***	0.533***	0.572***	0.486***	0.430***
	(0.064)	(0.063)	(0.066)	(0.063)	(0.061)
Indirect effect (ACME)	0.101***	0.086***	0.092***	0.070***	0.070***
	(0.020)	(0.019)	(0.019)	(0.016)	(0.017)
Total effect	0.750***	0.619***	0.664***	0.556***	0.501***
	(0.063)	(0.062)	(0.065)	(0.061)	(0.060)
Percentage of total effect	13.50%***	13.84%***	13.84%***	12.56%***	14.11%***
mediated via parental index	(0.012)	(0.014)	(0.014)	(0.014)	(0.018)
Corr$(\omega, \varepsilon \mid T)$ for ACME = 0	0.240	0.206	0.211	0.170	0.178

Notes:

a. Total effects are the same as in Figure 1 and Table C7 in Appendix C.
b. Direct effect is the π from equation (2) and ACME is the average causal mediation effect.
c. All variables are standardized, such that the control group has a mean 0 and standard deviation of 1.
d. Robust standard errors are in the parentheses.
e. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Heterogeneous treatment effect on learning outcomes: a machine learning approach

Covariates	(1) Total test score			(2) Homeschooling			(3) Leisure activities		
Estimated ATE (CF) →	18.093*** [1.532]			22.675*** [2.695]			9.599*** [3.606]		
Median dummy →	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)
Girl	0.49	0.46	0.03	0.40	0.52	-0.12**	0.44	0.58	-0.14***
	(0.43, 0.56)	(0.39, 0.53)	(-0.06, 0.13)	(0.33, 0.47)	(0.45, 0.59)	(-0.21, -0.02)	(0.38, 0.51)	(0.51, 0.65)	(-0.23, -0.04)
Age	7.41	7.21	0.20***	7.28	7.44	-0.16***	7.31	7.31	-0.01
	(7.35, 7.47)	(7.17, 7.26)	(0.12, 0.27)	(7.23, 7.33)	(7.36, 7.52)	(-0.25, -0.07)	(7.24, 7.37)	(7.25, 7.38)	(-0.09, 0.09)
Birth order	0.77	1.10	-0.34***	0.90	0.99	-0.08	1.05	0.89	0.16*
	(0.64, 0.89)	(0.96, 1.25)	(-0.52, -0.15)	(0.77, 1.04)	(0.86, 1.11)	(-0.26, 0.10)	(0.91, 1.19)	(0.76, 1.02)	(-0.03, 0.35)
Grade of Study	1.49	1.52	-0.03	1.49	1.54	-0.05	1.47	1.56	-0.01
	(1.39, 1.59)	(1.42, 1.61)	(-0.16, 0.11)	(1.40, 1.58)	(1.44, 1.63)	(-0.18, 0.08)	(1.37, 1.57)	(1.48, 1.65)	(-0.22, 0.03)
Baseline literacy	13.20	18.58	-5.38***	13.09	19.03	-5.95***	15.02	17.91	-2.90***
	(12.62, 13.79)	(18.12, 19.05)	(-6.13, -4.64)	(12.62, 13.55)	(18.62, 19.44)	(-6.56, -5.33)	(14.39, 15.64)	(17.46, 18.36)	(-3.66, -2.13)
Baseline numeracy	12.50	16.31	-3.81***	14.01	15.72	-1.62***	14.15	15.60	-1.45***
	(11.98, 13.02)	(16.12, 16.50)	(-4.37, -3.26)	(13.66, 14.53)	(15.41, 16.02)	(-2.14, -1.09)	(13.70, 14.60)	(15.26, 15.93)	(-2.00, -0.89)
Access to private tutor	0.59	0.62	-0.03	0.47	0.66	-0.19***	0.50	0.70	-0.20***
	(0.53, 0.66)	(0.56, 0.69)	(-0.13, 0.07)	(0.40, 0.54)	(0.60, 0.73)	(-0.28, -0.01)	(0.43, 0.57)	(0.64, 0.76)	(-0.29, -0.11)
Father's education	4.48	7.40	-2.92***	8.27	4.90	3.37***	8.83	5.20	3.64***
	(3.96, 4.50)	(6.76, 8.03)	(-3.74, -2.10)	(7.60, 8.94)	(4.46, 5.34)	(2.57, 4.17)	(8.16, 9.51)	(4.73, 5.67)	(2.82, 4.46)
Mother's education	5.42	7.73	-2.31***	7.75	6.57	1.18***	8.21	7.03	1.18***
	(4.98, 5.86)	(7.27, 8.18)	(-2.94, -1.68)	(7.24, 8.26)	(6.18, 6.95)	(0.54, 1.83)	(7.70, 8.72)	(6.66, 7.40)	(0.55, 1.81)
Total family income	10,347	12,890	-2,543***	13,485	9,232	4,252***	15,036	9,953	5,085***
	(9,831, 10,862)	(12,093, 13,687)	(-3,492, -1,5935)	(12,566, 14,403)	(8,864, 9,599)	(3,263, 5,242)	(13,991, 16,082)	(9,509, 10,395)	(3,948, 6,220)
No of children	1.48	1.75	-0.27***	1.58	1.70	-0.11*	1.70	1.59	0.11*
	(1.40, 1.56)	(1.65, 1.85)	(-0.40, -0.14)	(1.49, 1.67)	(1.61, 1.78)	(-0.23, 0.01)	(1.60, 1.81)	(1.51, 1.68)	(-0.02, 0.24)
Religion (1=Islam)	0.85	0.74	0.11***	0.81	0.82	-0.01	0.84	0.76	0.08**
	(0.80, 0.90)	(0.68, 0.80)	(0.04, 0.19)	(0.76, 0.87)	(0.76, 0.87)	(-0.08, 0.07)	(0.79, 0.89)	(0.701, 0.82)	(0.01, 0.16)

Notes:

a. This table exhibits the mean values of various observable characteristics of children and parents of most and least affected groups and the difference between these values. Most and least affected groups are estimated using conditional treatment effects on the outcome variables measured using causal forest analysis (see Section E1 in Appendix E of online appendix for more details).

b. Robust Standard Error in square brackets

c. Robust CI in parentheses

d. *** p<0.01, ** p<0.05, * p<0.1

Online Appendix
Telementoring and homeschooling during school closures: A randomized experiment in rural Bangladesh

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Contents

This document is supplementary to the main paper and not for publication.

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Appendix A: Context and Conceptual Framework

A1. The context

Primary education in Bangladesh. Around 7 million children and adolescents, primarily in rural areas, were estimated to be out-of-school in 2016 (BBS, 2017). A large-scale assessment shows that 44% of students were unable to read simple words after completing grade 1 (USAID, 2021). Also, more than half of the fifth-graders failed to meet grade-level proficiency in subjects, such as Bangla and mathematics (NSA, 2017). Learning deficits are also not uniform across different population subgroups, with students from lower socioeconomic backgrounds and rural areas experience it the most (Nath, 2012). The poor learning outcomes of primary-school-age children are potentially due to the shortfall in educational investments by the government (BANBEIS, 2018). Bangladesh also spends considerably less on education than its neighboring countries.

Coronavirus pandemic in Bangladesh. Educational institutions were closed on March 18, 2020, to help curb the spread of COVID-19. The reopening roadmap remains unclear as of August 2021 due to the persistently high COVID-19 infection rates and deaths throughout the country. Given prolonged school closure, the COVID-19 pandemic has potentially exacerbated the learning deficits and inequality in Bangladesh.

Unlike developed countries, shifting from in-person classes to online synchronous classes were not feasible, due to the weak information technology ecosystem and lack of resources. The government attempted to address the problem by using public broadcasting (e.g., television and radio) of asynchronous lessons to school-age students (UNICEF, 2020). This program, however, is not accessible to the majority of rural Bangladeshi children because over 56% of rural households do not own a television and only 3% of rural households listen to the radio regularly (UNICEF, 2019). Besides accessibility, the television-run educational program is only available during the daytime, when mothers are often busy with household chores and fathers are out for work. This implies that children may neither receive proper guidance from their parents nor feel the urge to participate in these learning programs (Biswas et al., 2020). In all, a significant portion of children is kept out of all forms of education, raising the possibility of increased dropouts especially among girls and those from disadvantaged backgrounds (Rahman and Sharma, 2021).

An over-the-phone intervention in Bangladesh is feasible because 94% of rural households have access to at least one basic phone, while only 33% have internet access (UNICEF, 2019). In Khulna and Satkhira districts where our intervention took place, more than 95% of rural households own at least one basic mobile phone (UNICEF, 2019). This allows us to implement and evaluate the effectiveness of a telementoring intervention to promote home-based learning in rural households. Given the existing digital divide, basic feature phones can

play an important role in addressing the learning crisis in Bangladesh even after the schools reopen.

A2. Conceptual framework

We present a simple educational production framework to highlight how the telementoring intervention may, directly and indirectly, influence a primary grader's cognitive test performance. The framework helps guide the empirical specifications that we use to test for the reduced-form effects of the intervention as well as the indirect effects of mediators. Given that schools are closed during the COVID-19 pandemic, we express a student's cognitive performance, y, as a function of two non-school inputs – the telementoring intervention provided by the mentor, T, and the parents, p:

$$y = F(T, p(T))$$

The parental input is also a function of the intervention because each mentor not only provides direct tutoring help to the student, but also tips, advice, and ideas to the student's mother, which enable the mother to better engage and involve in the student's learning activities. We view the intervention as augmenting both the amount and quality of time that the mother involves with the student's learning activities. Given the education production function, the total effect of the telementoring intervention can be decomposed into the direct and indirect effects by total differentiation:

$$\frac{dy}{dT} = \frac{\partial y}{\partial T} + \frac{\partial y}{\partial p}\frac{\partial p}{\partial T}$$

The total effect of the telementoring program on a child's cognitive performance, $\frac{dy}{dT}$, is the sum of the direct effect of telementoring on the child's performance, $\frac{\partial y}{\partial T}$, and the indirect effect of telementoring on the child's performance which mediates through the effect of telementoring on the mother's input into the child, $\frac{\partial y}{\partial p}\frac{\partial p}{\partial T}$. The indirect effect is not zero when the telementoring intervention is effective in augmenting the mother's input and the mother's input plays a role in the child's learning outcomes.

We expect the indirect effect to be non-zero. Parents may misperceive their children's effort and learning, which can subsequently discourage them to support their children's education (Banerjee et al., 2010, Dizon-Ross, 2019, Bergman, 2021). Increased parental engagement in children's education may change this misperception, leading to improvements in the parents' confidence and aspirations about their children's academic attainment. Previous work shows that parents' educational expectations and aspirations, often used interchangeably in the literature, have a positive relationship with the academic achievement of their elementary school children (see Boonk et al., 2018 for a review). Sanders et al. (2008) show that combining

self-help approaches, technology, and media could lead to better parenting practices. Parents' beliefs about their role, self-efficacy, and invitations for involvement in their children's education can play a major role in their children's learning outcomes (Walker et al., 2005).

We focus on estimating $\frac{dy}{dT}$ and $\frac{\partial p}{\partial T}$ using reduced-form specifications while also quantifying the direct and indirect effects using the mediation analysis approach by (Imai et al., 2010). Our intervention most closely resembles Angrist et al. (2020) as we also rely on basic phone calls and text messages, but we expect much stronger effects for several reasons. In Angrist et al. (2020) study, a weekly 5 to 20-minute basic phone call that provides tutoring help in addition to a weekly text message that contains practice math problems are delivered to children in grades 3 to 5 in Botswana over a five-week period. In contrast, the duration of our intervention is 13 weeks and the duration of a typical phone call in our intervention is approximately 30 minutes. Furthermore, the parents in Angrist et al. (2020) study primarily accompanied the children when the children were receiving the intervention, while the parents in our intervention also receive direct guidance and tips on how to better involve and engage in their child's learning activities. Since our intervention also directly targets the mothers and the intensity of our intervention is at least several times greater than Angrist et al. (2020), we expect the total effect of telementoring on a child's cognitive performance to be much greater than the 0.12 standard deviations reported in theirs.

Appendix B: Data Collection and Trial Phases

B1. Data collection

Baseline. All households in the experiment were surveyed in 2019 by GDRI. Detailed information on demographics, income, employment status, household asset composition, livelihood, parenting involvement, etc. of the households was collected in that survey. Moreover, children's skills were also assessed. Skills assessments of children consisted of various domains, such as language, literacy, numeracy, fine- and gross-motor skills, problem-solving, personal-social domain, working memory, self-regulation, etc.

Rapid surveys before the intervention. We conducted an over-the-phone rapid survey (during recruitment of mother-child dyads) to collect a range of information on children's current homeschooling situation, household's investment in private education, and household's access to information technology immediately before the intervention began. This information allowed us to perform additional tests to check the balance between treatment and control arms. We also conducted an online survey on the mentors to record their personality traits, academic results, socioeconomic status, and any previous mentoring or tutoring experiences as of August 2020 (Section D2 lists these survey items).

Endline. The endline survey of the parents and assessment of the children were conducted one month after the intervention ended. A group of two from GDRI visited each household, one enumerator and one assessor, during the endline. The enumerator administered a survey with the mothers while the assessor conducted one-on-one assessments (cognitive tests) with the children.[††]

Through the survey on parents, we collected information on the household's socioeconomic condition, child's existing educational situation, parental involvement in child's educational and other activities, the parent's perception regarding their engagement in the child's education, and other outcomes. Section D4 of Appendix D lists the information collected during endline.

Children's assessment tests were grade specific. There were different sets of questions for students in the three grade levels (see Table D1). Each set of questions consisted of 19 sub-questions (with a maximum of 100 points): (i) 4 questions on Bangla literacy (20 points), (ii) 4 questions on general knowledge (20 points), (iii) 6 questions on English literacy (30 points), and (iv) 5 questions on numeracy/mathematics (30 points). All test questions were inspired by the national curriculum of the respective grades. Answers to the questions were intentionally

[††] The team carried face masks and hand sanitizer to provide to the interviewees. Both interviews and assessments were carried in open spaces (often in backyards), while always maintain 1.5 meters distance (see Section D3 for some photos from the surveys and assessments). Most importantly, these visits were carried out after the government lifted the movement and home visit restrictions in Bangladesh.

kept dichotomous to reduce assessment biases. The assessor asked the children questions and then recorded their answers in an answer sheet on a tablet computer. For example, if the assessor asked, “What is the sum of 6 and 0?”, then they recorded the answer as correct if the answer was given was 6 and incorrect if otherwise.

Finally, mentors also completed an exit survey (online) immediately after the intervention ended. See Section D2 for the survey questions.

Figure B1. Timeline of intervention and evaluation

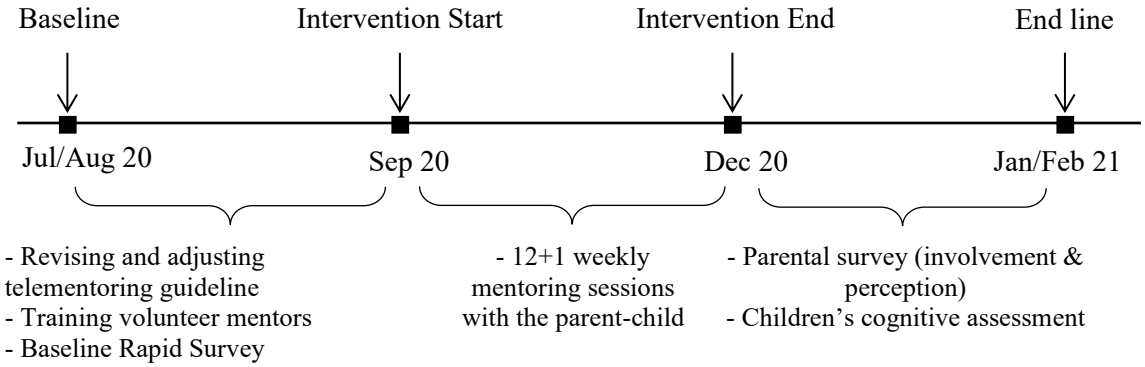
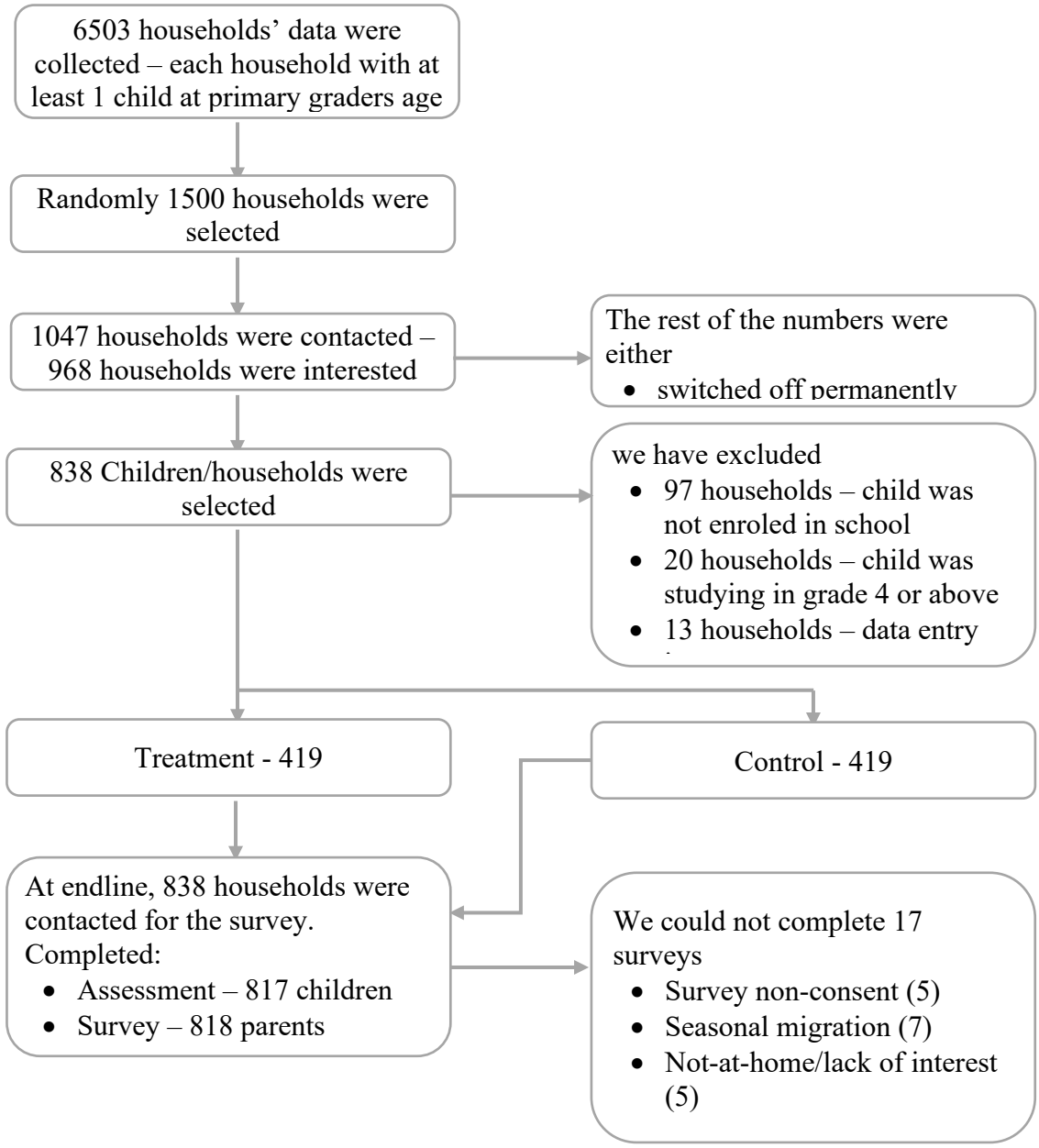


Figure B2. Flowchart of participants' progress through the phases of the trial



Appendix C: Additional Figures and Tables

Figure C1. Maps of households participating in the telementoring program

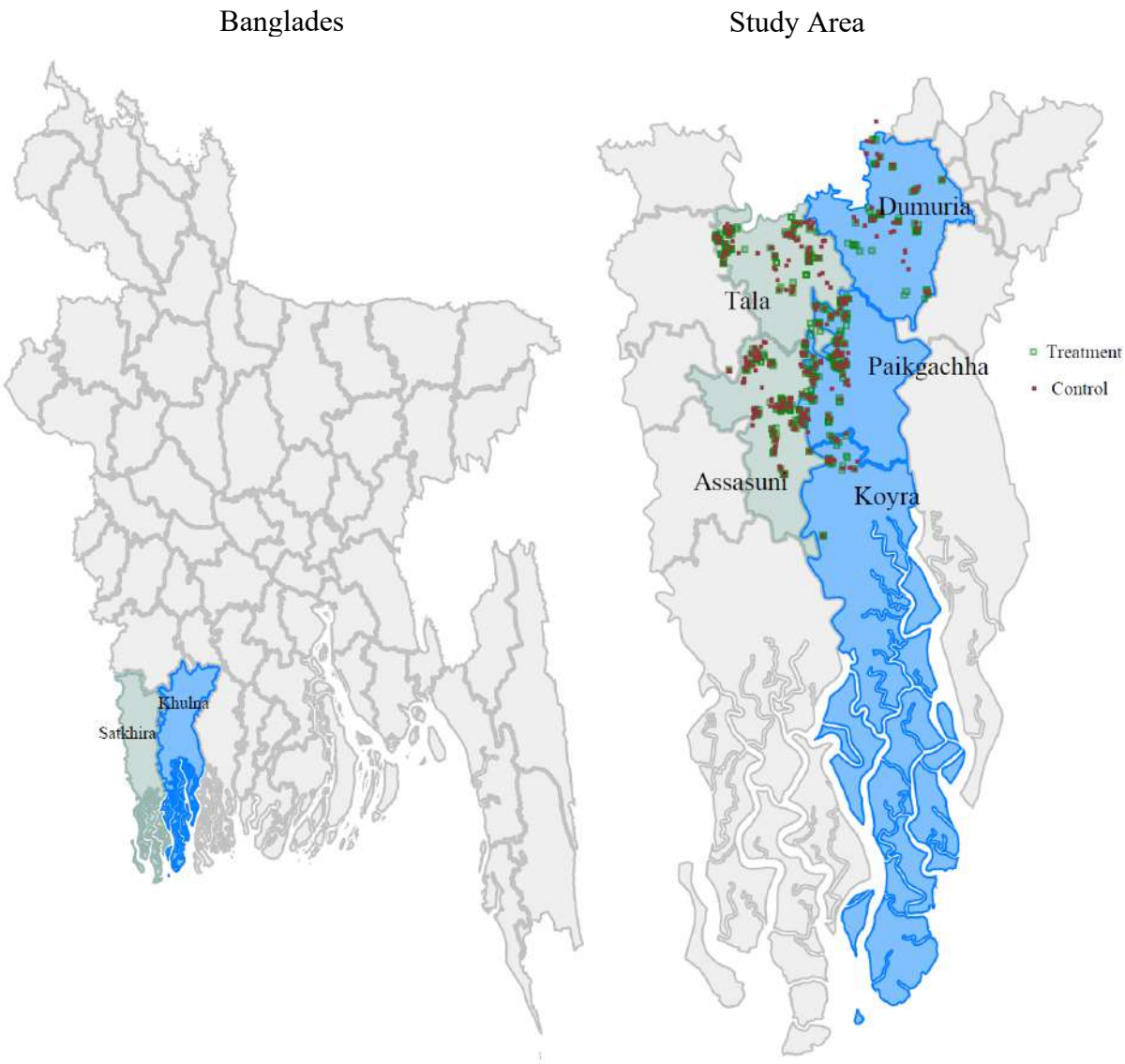
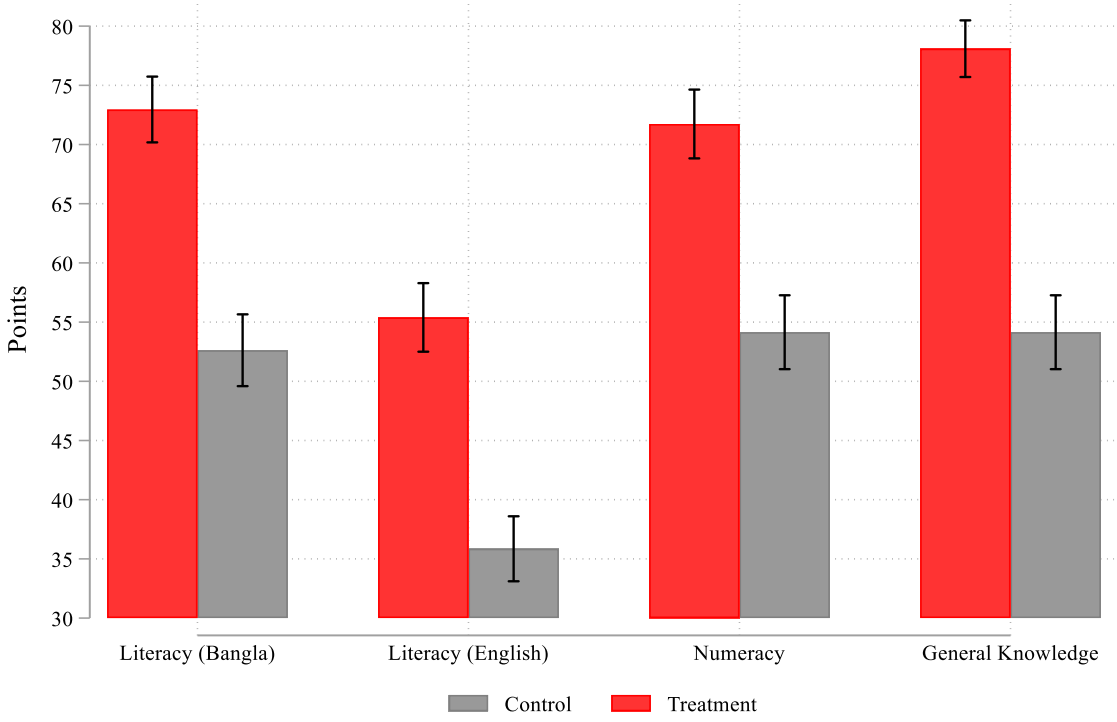


Figure C2. Assessment test performance by subject



Notes:

a. This figure exhibits test performance by telementoring treatment and control groups for all children who completed the endline assessment test. All subject marks are converted to 100 points for comparison. 95% confidence interval is represented by the line.

Figure C3. Sensitivity analysis of average mediation effect of homeschooling

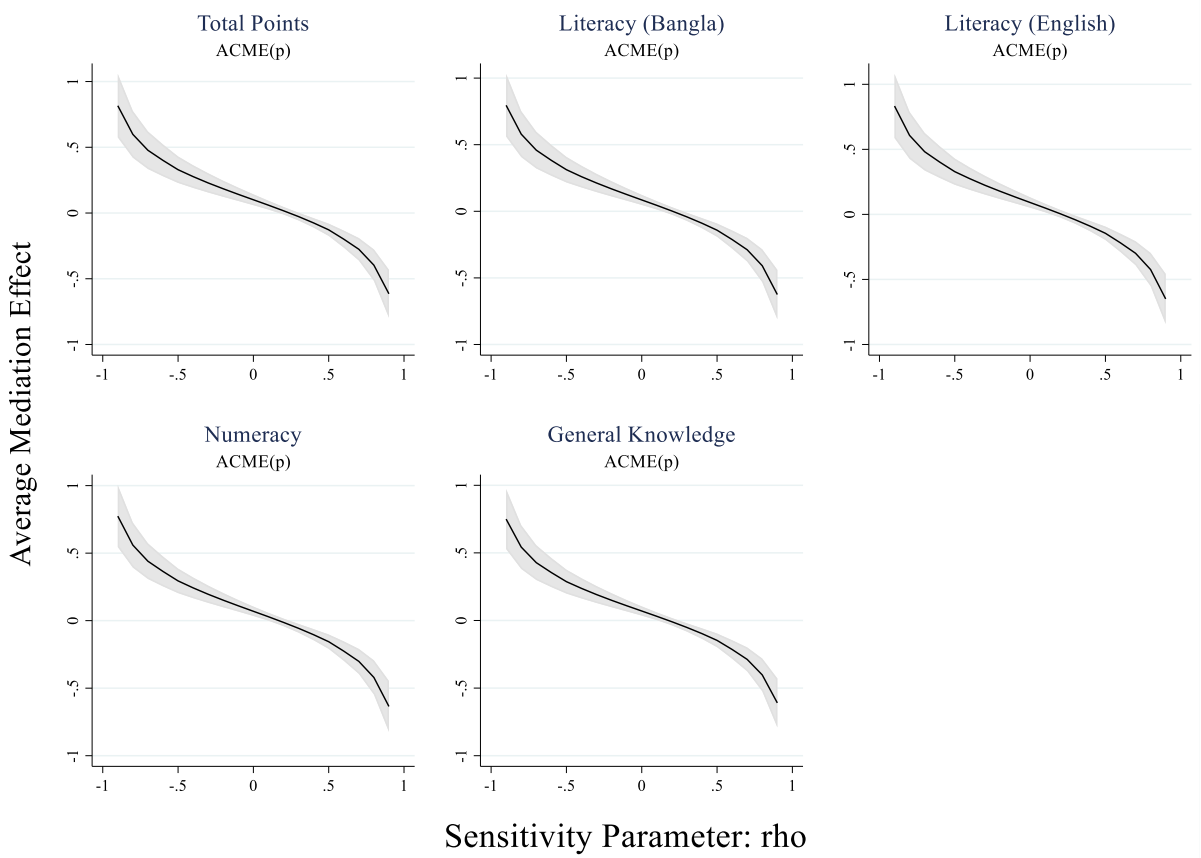


Table C1. Weekly themes of the telementoring program

Week no	Theme no	Weekly Theme	SMS Campaign
1	-	None	02/09/2020: Notification of selection 08/09/2020: Second notification
2	-	None	No SMS
3	1	Promoting Social Responsibility	21/09/2020: Notifying the social responsibility of the mentors
4	2	Maintaining daily routine	25/09/2020: Importance of routine 29/09/2020: Repeat
5	3	Restraining abusive parenting	02/10/2020: Request to stop beating and scolding with abusive language
6	4	Encouraging gender equality in home schooling	09/10/2020: Explaining why both boys and girls need basic education
7	5	Teach your child to share	16/10/2020: Tips to teach sharing behavior to the child
8	6	Encourage to read books (story)	23/10/2020: Information and advice about reading practice
9	7	Promoting parents' aspiration about offspring's education	30/10/2020: Motivate parents to remain positive about child's performance
10	8	Stimulating parents' confidence in providing educational support to the kids	06/11/2020: Explaining the Role of parents as a teacher
11	9	Believing in the kids and letting them know	13/11/2020: Tips about how to let children know that parents' have faith in them 16/11/2020: Advice on positive competition
12	10	Broadening the educational planning horizon of the parents i.e., shifting their concentration from a role model	20/11/2020: Explaining return on education
13	-	None	27/11/2020: Concluding message

Note:

a. All themes and messages were in Bangla (The main language of Bangladesh). Here we present only the main idea of them.

Table C2. Sample characteristics and tests of balance (using Endline Sample)

Variable	(1) Treatment n=404	(2) Control n=410	(3) Difference n=814	(4) p-value (F-test)
Panel A: Demography				
Child age (as of 1/9/2020)	7.381	7.390	-0.009	0.775
	(0.023)	(0.022)	(0.032)	
Child gender (Boy = 1)	0.500	0.495	0.005	0.889
	(0.025)	(0.025)	(0.035)	
Father's education in years	6.002	5.985	0.017	0.955
	(0.214)	(0.213)	(0.302)	
Mother's education in years	6.980	6.732	0.248	0.287
	(0.161)	(0.169)	(0.233)	
Family's monthly income	11,429	11,348	81.16	0.825
	(287.4)	(229.6)	(367.8)	
Number of sibling(s) under 15 years	0.631	0.641	-0.010	0.820
	(0.033)	(0.031)	(0.045)	
Religion (Islam = 1)	0.790	0.795	-0.006	0.846
	(0.020)	(0.020)	(0.028)	
Homestead land size in decimal	8.168	9.080	-0.912	0.202
	(0.455)	(0.552)	(0.715)	
Value of total asset	820,338	684,271	136,067	0.437
	(157,356)	(76,501)	(174,966)	
Panel B: Children's Assessments [2019]				
ASQ score	261.856	258.268	3.588	0.240
	(2.003)	(2.303)	(3.052)	
Literacy score	16.035	16.227	-0.192	0.499
	(0.195)	(0.206)	(0.284)	
Numeracy score	14.748	14.751	-0.004	0.986
	(0.148)	(0.147)	(0.209)	
Panel C: Parental Involvement & perception [2019]				
Parenting – negative actions	0.384	0.388	-0.004	0.922
	(0.030)	(0.030)	(0.042)	
Parenting time – education	2.307	2.254	0.053	0.454
	(0.052)	(0.049)	(0.071)	
Parenting abilities or skill (15-item scale)	4.328	4.309	0.019	0.557
	(0.023)	(0.023)	(0.032)	
Panel D: COVID-19				
Extent of economic loss	1.911	1.911	-0.006	0.923
	(0.047)	(0.047)	(0.064)	
Television in the household	0.526	0.524	0.002	0.961
	(0.031)	(0.030)	(0.043)	
Child's home education frequency	1.488	1.490	-0.003	0.958
	(0.034)	(0.036)	(0.050)	
Hours given to the child in English	2.582	2.581	0.001	0.988
	(0.062)	(0.062)	(0.087)	
Hours given to the child in Mathematics	2.534	2.481	0.053	0.569
	(0.069)	(0.061)	(0.092)	
Private tutor - at present	0.621	0.590	0.031	0.365
	(0.024)	(0.024)	(0.034)	

Notes:

a. Standard errors in parentheses
b. *** p<0.01, ** p<0.05, * p<0.1
c. This table reports the background characteristics of children in the final sample used for the analysis of the performance of the program. The p-value reported in the last column is from the F-test.
d. In Table C3, we present this table for the entire baseline sample of 838 mother-child dyads.
e. In Table C5, all variables are defined.

Table C3. Sample characteristics and tests of balance (using Baseline Sample)

Variables	(1) Treatment n=419	(2) Control n=419	(3) Total n=838	(4) P-Value (F-test)
Panel A: Demography				
Child age (1/1/2020)	7.387	7.396	-0.009	0.769
	(0.0226)	(0.0218)	(0.031)	
Child gender (Boy=1)	0.494	0.494	-0.000	1
	(0.024)	(0.024)	(0.035)	
Father's education in years	6.010	6.007	0.002	0.994
	(0.208)	(0.210)	(0.295)	
Mother's education in years	6.983	6.726	0.258	0.261
	(0.157)	(0.166)	(0.229)	
Family's monthly income	11,409.3	11,342.0	67.3	0.851
	(278.7)	(226.5)	(359.1)	
Number of sibling(s) under 15 years	0.640	0.635	0.005	0.915
	(0.033)	(0.030)	(0.045)	
Religion (Islam = 1)	0.771	0.778	-0.007	0.804
	(0.021)	(0.020)	(0.029)	
Homestead land size in decimal	8.401	9.033	-0.632	0.383
	(0.483)	(0.541)	(0.725)	
Value of total asset	822,675	723,045	99,630	0.571
	(152,098)	(88,489)	(175,966)	
Panel B: Children's Assessments [2019]				
ASQ Score	261.95	258.52	3.437	0.251
	(1.960)	(2.264)	(2.995)	
Literacy Score	16.122	16.243	-0.122	0.663
	(0.192)	(0.202)	(0.279)	
Numeracy Score	14.778	14.747	0.031	0.880
	(0.144)	(0.145)	(0.205)	
Panel C: Parental Involvement & perception [2019]				
Parenting - negative actions	0.372	0.394	-0.021	0.606
	(0.029)	(0.030)	(0.042)	
Parenting time - education	2.310	2.267	0.043	0.542
	(0.051)	(0.049)	(0.070)	
Parenting abilities or skill (15-item scale)	4.334	4.306	0.028	0.380
	(0.022)	(0.023)	(0.032)	
Panel D: COVID-19				
Extent of economic loss	1.909	1.919	-0.010	0.879
	(0.045)	(0.043)	(0.063)	
Television in the household	0.525	0.518	0.007	0.868
	(0.030)	(0.030)	(0.043)	
Child's regularity in home education	1.496	1.496	-0.000	1
	(0.034)	(0.036)	(0.049)	
Hours given to the child in studying English	2.587	2.583	0.005	0.956
	(0.061)	(0.061)	(0.086)	
Hours given to the child in studying Mathematics	2.546	2.486	0.061	0.507
	(0.068)	(0.061)	(0.092)	
Private tutor - at present	0.623	0.585	0.038	0.259
	(0.024)	(0.024)	(0.034)	

Notes:

a. Standard errors in parentheses
b. *** p<0.01, ** p<0.05, * p<0.1
c. This Table exhibits the background characteristics of the treatment and control group's children in the baseline sample. The p-value reported in the last column is from the F-test.
d. In Table C2, we present this table for the entire endline sample of 814 mother-child dyads.
e. In Table C5, all variables are defined.

Table C4. Attrition between baseline and endline

Variables	(1) Surveyed at endline	(2) Surveyed at endline
Treatment	0.014	-0.040
	(0.012)	(0.255)
Gender (1=Boy)		-0.004
		(0.013)
Child age as of 1/9/20		0.036
		(0.026)
Birth order		-0.034**
		(0.014)
Grade of study		-0.019**
		(0.009)
Baseline literacy score		0.001
		(0.002)
Baseline numeracy score		-0.003
		(0.003)
Access to private tuition		-0.027*
		(0.015)
Father's years of education		0.002
		(0.001)
Mother's years of education		-0.004*
		(0.002)
Monthly income		-0.000
		(0.000)
Number of children		0.024
		(0.021)
Religion (1 =Islam)		-0.103***
		(0.032)
Constant	0.021***	-0.074
	(0.007)	(0.185)
Interactions of variables and treatment dummy	No	Yes
Observations	838	838
R-squared	0.002	0.105
Joint *p*-value on individual/household variables	-	0.541
Joint *p*-value on interactions	-	0.567

Notes:

a. This table exhibits the coefficients from OLS regressions. The dependent variable is a dummy variable if a mother-child duo has not completed the endline survey and assessment i.e., attrited households. In column 1, attrition is regressed on the treatment dummy only. In column 2, attrition is regressed on the treatment dummy, various characteristics, and interactions between characteristics and treatment dummy (not reported). The *p*-values check the overall joint test of balance.

b. Robust standard errors in parentheses

c. *** p<0.01, ** p<0.05, * p<0.1

Table C5. Variable definition

	Variable Name	Definition
Variables – Baseline	Child age	Age as of 1 September 2020 – beginning of the intervention.
	ASQ Score	Ages & Stages Questionnaires® - for details - https://agesandstages.com/
	Literacy Score	Woodcock-Johnson Tests III
	Numeracy Score	Woodcock-Johnson Tests III
	Operational Span Score	Blair and Willoughby – Working Memory
	Something Same Score	Blair and Willoughby – Attention Shifting
	Parenting - negative actions	Using bad words to teach discipline, beating with or without a cane, etc. [sum of five dummy variables]
	Parenting time - education	Time spent in a day 1 = 30 Minutes or less 2 = Around an hour 3 = 1-2 hours 4 = 2-3 hours 5 = 3-4 hours
	Parenting time - storybook reading	
	Parenting time - Play	
	Parenting time - drawing	
	Parenting abilities or skill (15-item scale)	Mean value of 5-point Likert scale of 15 parental perception related questions.
	Parents' expectations about child's level of education	1 to 8, the higher value represents a higher level of educational attainments.
	The extent of economic loss	5-point Likert scale from not at all to a great deal
	Child's regularity in home education	4-point scale from no to high
	Hours gave to the child in studying English	Hours in a week
	Hours gave to the child in studying Mathematics	
Variables – Endline	Bangla literacy	Questions from Bangla textbook of the national curriculum
	English literacy	Questions from the English textbook of the national curriculum
	Numeracy	Questions from elementary mathematics textbook of the national curriculum
	General Knowledge	Questions from Bangla textbook of the national curriculum
	Total points	Sum of all 4 components of assessment test
	Negative parenting (0 to 5)	5 dichotomous questions indicating negative parenting and coercive interaction
	Parenting abilities or skill (11 items 5-point scale)	11 general questions indicative parenting skill
	Confidence about child's educational achievement	Self-reported questions about confidence.
	Mother's confidence in helping the child	Summation of three 10-point questions

Table C6. Descriptive statistics of mentors

Variable	Mean	Min.	Max.
Age	21.798	18.292	27.685
Gender (Male=1)	0.477	0	1
Short 15-item Big Five Inventory (BFI-S)[a]			
Openness	5.684	3	7
Conscientiousness	5.316	1.5	7
Extraversion	4.698	1	7
Agreeableness	5.907	1	7
Neuroticism (emotional instability)	3.588	1	7
Cognitive Flexibility Scale (CFS)[b]	55.353	37	72
General Anxiety Disorder[c]	6.783	0	23
As the percentage of mentors who responds			
From urban background	61.81%		
From public universities or colleges	95.47%		
Business and social sciences discipline	85.90%		
Post-graduate level or graduated	15.58%		
Dissatisfied with the academic result	20.60%		
Earn money from a part-time job	61.83%		
Dissatisfied with monthly expenditure	27.42%		
Prior mentoring experience	76.02%		
Paid tutoring experience with the primary graders	59.65%		
Past volunteering	74.85%		

Notes

a. Averages for the self-administered condition of BFI-S are Openness- 4.54; Conscientiousness- 5.70; Extroversion- 4.92; Agreeableness- 5.30; Neuroticism- 3.98. These averages have been calculated based on Table 2 of Lang et al. (2011).

b. The Cognitive Flexibility Scale is a self-reported questionnaire to measure the ability of the respondent to switch between different thoughts and actions. As our mentors are coming from different educational institutions with inter-institutional grading and assessment differences, we use this scale to generalize their cognitive ability. This scale is designed by Martin and Rubin (1995). The average score among students is (around) 55 points.

c. Depression Severity: 0-4 none, 5-9 mild, 10-14 moderate, 15-19 moderately severe, 20-27 severe. General Anxiety Disorder is measured by the Bangla version of the 9-item Patient Health Questionnaire. This scale is adapted from PRIMEMDTODAY, developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke, and colleagues, with an educational grant from Pfizer Inc. (Kroenke et al., 2001). Click here for more details.

Table C7. Standardized treatment effect on the outcome variables

Outcome Variables	(1) Standardized Coefficient on Treat	(2) Standard Error	(3) FWER P-value	(4) RI P-value
Panel A: Learning outcomes of children				
Total points [100 marks test]	0.752***	0.064	0.000	0.001
Literacy (Bangla) [20 marks]	0.619***	0.063	0.000	0.001
Literacy (English) [30 marks]	0.659***	0.067	0.000	0.001
Numeracy [30 marks]	0.562***	0.063	0.000	0.001
General Knowledge [20 marks]	0.502***	0.059	0.000	0.001
Panel B: Parental involvement				
In Homeschooling (in minutes/day)	0.642***	0.080	0.000	0.001
In Leisure time (in minutes/day)	0.160**	0.064	0.026	0.013
Panel C: Parenting perception				
Negative parenting (beating, use of abusive words etc.) [0 to 5 scale]	-0.261***	0.067	0.001	0.001
Parenting abilities or skill [11 to 55 scale]	0.223***	0.055	0.001	0.001
Parent's aspiration about child's future edu.	0.183***	0.063	0.013	0.004
Mother's confidence in educational involvement	0.094	0.062	0.128	0.143

Notes:

a. This Table exhibits the effect of the telementoring program participation on the standardized outcome variables. All outcome variables are standardized [(y_i – mean of the control group)/standard deviation of control group]. Coefficients estimated with OLS. Baseline controls included in all regression: gender, age, birth order, baseline literacy score, baseline numeracy score, access to private tuition, parents' education in years, family income, religion, and the number of children in the household.

b. Grade and union fixed effects are used in all regression.

c. Robust standard errors

d. Westfall-Young FWER adjusted p-values are calculated based on 5,000 replications.

e. RI – Randomized Inference

Table C8. Treatment effect on unstandardized outcomes (with Village fixed effect)

Outcome Variables	(1) Treatment[a] n=404	(2) Control[a] n=410	(3) Difference[b] n=814
Panel A: Learning outcomes of children			
Total points [100 marks test]	68.349	50.110	15.921***
Literacy (Bangla) [20 marks]	14.592	10.524	3.395***
Literacy (English) [30 marks]	16.619	10.756	5.182***
Numeracy [30 marks]	21.520	16.244	4.771***
General Knowledge [20 marks]	15.619	12.585	2.573***
Panel B: Parental involvement			
In Homeschooling (in minutes/ day)	106.757	84.407	21.214***
In Homeschooling – dummy (Probit est.)	0.332	0.144	0.788***
In leisure activities (in minutes/day)	91.978	79.127	6.214
In leisure activities – dummy (Probit est.)	0.151	0.093	0.328*
Panel C: Parenting perception			
Negative parenting (beating, use of abusive words, etc.) [0 to 5 scale]	1.027	1.310	-0.254***
Parenting abilities or skill [11 to 55 scale]	50.042	48.698	1.559***
Parent's aspiration about child's future edu.	5.173	4.868	0.145
Mother's confidence in educational involvement	22.411	21.415	0.438

Notes:

a. Mean values of the respective outcome variables.
b. This column exhibits the coefficients estimated with OLS unless indicated otherwise. Baseline controls included in all regression: gender, age, birth order, baseline literacy score, baseline numeracy score, access to private tuition, parents' education in years, family income, religion, and the number of children in the household.
c. Grade and Village fixed effects are used in all regressions.
d. *** p<0.01, ** p<0.05, * p<0.1

Table C9. Effects on income and mental health of mothers

Variables	(1) Income	(2) Income – log	(3) Depression Score[b]	(4) Standardized depression score[c]	(5) Depression – dummy
Treatment	431.692	0.042	-0.462	-0.037	-0.008
	(383.724)	(0.049)	(0.846)	(0.068)	(0.025)
Gender (1=Girl)	50.019	-0.029	-0.316	-0.025	-0.017
	(388.300)	(0.051)	(0.856)	(0.068)	(0.025)
Child age as of 1/9/20	-992.566**	-0.166***	-0.761	-0.061	-0.008
	(459.771)	(0.060)	(0.886)	(0.071)	(0.027)
Birth order	403.165	0.062	-0.612	-0.049	-0.013
	(482.917)	(0.052)	(1.015)	(0.081)	(0.029)
Grade of study – 2	182.588	-0.032	-0.810	-0.065	-0.025
	(647.546)	(0.061)	(0.971)	(0.078)	(0.028)
Grade of study – 3	529.465	0.103	-0.293	-0.023	0.014
	(657.866)	(0.064)	(1.364)	(0.109)	(0.046)
Baseline literacy score	55.033	0.008	-0.030	-0.002	-0.003
	(54.592)	(0.006)	(0.132)	(0.011)	(0.004)
Baseline numeracy score	-129.789*	-0.019*	0.137	0.011	0.003
	(73.497)	(0.010)	(0.179)	(0.014)	(0.005)
Access to private tuition	124.283	-0.029	-0.370	-0.030	0.013
	(452.587)	(0.058)	(0.849)	(0.068)	(0.025)
Father's education in years	155.582**	0.015**	-0.051	-0.004	-0.001
	(75.685)	(0.006)	(0.113)	(0.009)	(0.003)
Mother's education in years	202.386**	0.003	-0.045	-0.004	0.001
	(82.374)	(0.009)	(0.161)	(0.013)	(0.004)
Monthly income	0.358***	0.000***	-0.000***	-0.000***	-0.000**
	(0.102)	(0.000)	(0.000)	(0.000)	(0.000)
Number of children	-213.059	-0.054	1.415	0.113	0.024
	(637.634)	(0.083)	(1.536)	(0.123)	(0.043)
Religion (1=Islam)	1,717.664***	0.065	2.610***	0.209***	0.094***
	(458.739)	(0.082)	(0.965)	(0.077)	(0.030)
Constant	8,511.463**	9.876***	8.927	-0.000	0.121
	(3,726.091)	(0.571)	(7.348)	(0.588)	(0.225)
Observations	814	814	814	814	814
R-squared	0.226	0.124	0.139	0.139	0.114

Notes:

a. The dependent variable for each regression is listed in the column heading.
b. Depression score is estimated using Center for Epidemiologic Studies Depression Scale-Revised (CESD-R) scale (Radloff, 1977).
c. Outcome variable is standardized by using the following formula - [(y_i – mean of the control group)/standard deviation of control group].
d. Union fixed effect is used in all regression but not reported.
e. Robust standard errors in parentheses
f. *** p<0.01, ** p<0.05, * p<0.1

Table C10. Mediation analysis of parental involvement and perception

Variables	(1) Total points	(2) Total points	(3) Total points	(4) Total points	(5) Total points	(6) Total points	(7) Total points
Telementoring	0.752***	0.654***	0.656***	0.633***	0.628***	0.617***	0.614***
	(0.064)	(0.066)	(0.066)	(0.066)	(0.066)	(0.065)	(0.065)
Homeschooling	-	0.152***	0.139***	0.135***	0.129***	0.106***	0.110***
		(0.030)	(0.031)	(0.032)	(0.032)	(0.032)	(0.032)
Leisure activities	-	-	0.042	0.037	0.037	0.038	0.039
			(0.030)	(0.029)	(0.030)	(0.028)	(0.028)
Negative parenting	-	-	-	-0.099***	-0.091***	-0.070**	-0.070**
				(0.032)	(0.033)	(0.033)	(0.033)
Parenting abilities or skill	-	-	-	-	0.051	0.020	0.027
					(0.038)	(0.038)	(0.040)
Parent's aspiration - education	-	-	-	-	-	0.207***	0.210***
						(0.037)	(0.037)
Mother's confidence in teaching	-	-	-	-	-	-	-0.022
							(0.038)
Constant	-1.128**	-0.934*	-0.952*	-0.992*	-1.003*	-0.990**	-0.978*
	(0.524)	(0.516)	(0.517)	(0.512)	(0.511)	(0.504)	(0.504)
Observations	814	814	814	814	814	814	814
R-squared	0.363	0.385	0.386	0.394	0.395	0.419	0.419

Notes:

a. This column exhibits the coefficients estimated with OLS regression. Baseline controls included in all regression: gender, age, birth order, baseline literacy score, baseline numeracy score, access to private tuition, parents' education in years, family income, religion, and the number of children in the household.
b. Grade and union fixed effects are used in all regressions.
c. Robust standard errors in the parentheses.
d. *** p<0.01, ** p<0.05, * p<0.1

Table C11. Heterogeneous treatment effect on outcome variables: a machine learning approach *(Part 1)*

Covariates	(1) Literacy (English)			(2) Numeracy			(3) Negative Parenting		
Estimated ATE (CF) →	5.793*** [0.567]			5.476*** [0.597]			-0.287** [0.073]		
Median dummy →	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)
Girl	0.448	0.564	-0.115**	0.473	0.515	-0.042	0.586	0.468	0.118**
	(0.379, 0.517)	(0.495, 0.632)	(-0.21, -0.018)	(0.404, 0.542)	(0.446, 0.584)	(-0.13, 0.056)	(0.518, 0.654)	(0.399, 0.537)	(0.021, 0.215)
Age	7.491	7.269	0.222***	7.345	7.289	0.055	7.221	7.558	-0.337***
	(7.428, 7.554)	(7.210, 7.328)	(0.135, 0.309)	(7.276, 7.413)	(7.255, 7.323)	(-0.02, 0.132)	(7.163, 7.279)	(7.505, 7.611)	(-0.41, -0.259)
Birth order	0.517	1.245	-0.728***	1.025	0.819	0.206**	1.305	0.409	0.897***
	(0.401, 0.633)	(1.110, 1.380)	(-0.90, -0.550)	(0.883, 1.166)	(0.697, 0.940)	(0.019, 0.393)	(1.185, 1.426)	(0.295, 0.523)	(0.731, 1.062)
Grade of Study	1.601	1.461	0.140**	1.335	1.603	-0.268***	1.517	1.631	-0.113
	(1.506, 1.696)	(1.376, 1.545)	(0.013, 0.268)	(1.251, 1.419)	(1.510, 1.696)	(-0.39, -0.142)	(1.426, 1.609)	(1.526, 1.735)	(-0.25, 0.025)
Baseline literacy	15.039	18.618	-3.578***	13.498	17.358	-3.860***	17.079	15.310	1.768***
	(14.53, 15.543)	(18.07, 19.161)	(-4.31, -2.837)	(12.85, 14.142)	(16.92, 17.787)	(-4.63, -3.086)	(16.58, 17.578)	(14.69, 15.924)	(0.978, 2.559)
Baseline numeracy	14.468	15.608	-1.140***	11.980	16.461	-4.480***	15.369	14.172	1.197***
	(14.03, 14.905)	(15.29, 15.919)	(-1.67, -0.604)	(11.46, 12.492)	(16.32, 16.595)	(-5.00, -3.952)	(15.05, 15.688)	(13.67, 14.667)	(0.609, 1.785)
Access to private tutor	0.640	0.569	0.072	0.591	0.618	-0.027	0.734	0.473	0.261***
	(0.574, 0.707)	(0.500, 0.637)	(-0.02, 0.167)	(0.523, 0.659)	(0.551, 0.685)	(-0.12, 0.069)	(0.673, 0.795)	(0.404, 0.542)	(0.169, 0.353)
Father's education	5.202	6.201	-0.999**	4.759	7.142	-2.384***	8.616	5.276	3.340***
	(4.668, 5.736)	(5.517, 6.885)	(-1.86, -0.132)	(4.179, 5.338)	(6.564, 7.721)	(-3.20, -1.565)	(8.093, 9.138)	(4.646, 5.905)	(2.522, 4.158)
Mother's education	5.389	7.618	-2.228***	5.478	7.892	-2.414***	8.616	5.719	2.897***
	(4.938, 5.840)	(7.163, 8.073)	(-2.86, -1.588)	(4.979, 5.976)	(7.484, 8.301)	(-3.05, -1.770)	(8.262, 8.970)	(5.189, 6.250)	(2.259, 3.534)
Total family income	10,334	12,226	-1,893***	10,801	11,685	-884*	12,989	11,728	1,262**
	(9,831, 10,835)	(11,454, 12,997)	(-2,812, -972)	(10,253, 11,348)	(10,927, 12,442)	(-1,818, 51)	(12,235, 13,742)	(11,003, 12,451)	(216, 2,307)
No of children	1.355	1.804	-0.449***	1.675	1.544	0.131**	1.862	1.281	0.581***
	(1.273, 1.436)	(1.714, 1.894)	(-0.57, -0.328)	(1.576, 1.774)	(1.468, 1.621)	(0.005, 0.256)	(1.782, 1.942)	(1.203, 1.359)	(0.469, 0.693)
Religion (1=Islam)	0.842	0.745	0.097**	0.867	0.755	0.112***	0.734	0.833	-0.099**
	(0.792, 0.893)	(0.685, 0.805)	(0.019, 0.176)	(0.820, 0.914)	(0.696, 0.814)	(0.036, 0.188)	(0.673, 0.795)	(0.781, 0.884)	(-0.17, -0.019)

Notes:

a. This table exhibits the mean values of various observable characteristics of children and parents of most and least affected groups and the difference between these values. Most and least affected groups are estimated using conditional treatment effects on the outcome variables measured using causal forest analysis (see Section E1. in Appendix E of online appendix for more details).

b. Robust Standard Error in square brackets

c. Robust CI in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table C12. Heterogeneous treatment effect on outcome variables: a machine learning approach *(Part 2)*

Covariates	(4) Parenting abilities			(5) Mother's Aspiration education			(6) Mother's Confidence in teaching		
Estimated ATE (CF) →	1.343*** [0.390]			0.299*** [0.084]			0.804** [0.437]		
Median dummy →	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)	25% most (δ_4)	25% least (δ_1)	Diff. ($\delta_4 - \delta_1$)
Girl	0.471	0.593	-0.123**	0.502	0.517	-0.015	0.544	0.539	0.005
	(0.402, 0.539)	(0.525, 0.661)	(-0.21, -0.026)	(0.433, 0.572)	(0.448, 0.586)	(-0.11, 0.083)	(0.475, 0.613)	(0.470, 0.608)	(-0.09, 0.102)
Age	7.285	7.277	0.009	7.365	7.318	0.047	7.405	7.273	0.132***
	(7.237, 7.334)	(7.210, 7.343)	(-0.07, 0.091)	(7.320, 7.411)	(7.253, 7.384)	(-0.03, 0.127)	(7.357, 7.452)	(7.206, 7.339)	(0.051, 0.213)
Birth order	1.206	0.828	0.377***	1.143	0.857	0.286***	1.088	0.951	0.137
	(1.067, 1.345)	(0.702, 0.955)	(0.190, 0.565)	(1.012, 1.274)	(0.716, 0.998)	(0.093, 0.478)	(0.958, 1.218)	(0.817, 1.085)	(-0.04, 0.324)
Grade of Study	1.348	1.583	-0.235***	1.562	1.468	0.094	1.559	1.554	0.005
	(1.266, 1.430)	(1.491, 1.676)	(-0.35, -0.112)	(1.479, 1.644)	(1.377, 1.559)	(-0.02, 0.217)	(1.465, 1.653)	(1.463, 1.645)	(-0.12, 0.135)
Baseline literacy	13.843	18.000	-4.157***	16.172	14.493	1.680***	13.735	18.554	-4.819***
	(13.24, 14.437)	(17.59, 18.405)	(-4.87, -3.438)	(15.67, 16.675)	(13.91, 15.072)	(0.913, 2.446)	(13.23, 14.235)	(18.12, 18.983)	(-5.47, -4.160)
Baseline numeracy	13.828	15.569	-1.740***	14.778	14.084	0.695**	13.451	16.309	-2.858***
	(13.33, 14.327)	(15.25, 15.885)	(-2.33, -1.150)	(14.30, 15.247)	(13.65, 14.508)	(0.062, 1.327)	(13.02, 13.881)	(16.07, 16.540)	(-3.34, -2.370)
Access to private tutor	0.505	0.657	-0.152***	0.512	0.675	-0.163***	0.652	0.574	0.078
	(0.436, 0.574)	(0.591, 0.722)	(-0.24, -0.057)	(0.443, 0.581)	(0.610, 0.740)	(-0.25, -0.068)	(0.586, 0.718)	(0.505, 0.642)	(-0.01, 0.173)
Father's education	4.789	8.230	-3.441***	5.567	7.852	-2.286***	7.103	5.402	1.701***
	(4.315, 5.263)	(7.564, 8.897)	(-4.25, -2.623)	(5.055, 6.078)	(7.229, 8.475)	(-3.09, -1.479)	(6.576, 7.630)	(4.787, 6.017)	(0.892, 2.510)
Mother's education	4.304	9.270	-4.966***	6.483	7.975	-1.493***	7.569	5.961	1.608***
	(3.879, 4.729)	(8.916, 9.623)	(-5.51, -4.413)	(6.087, 6.878)	(7.510, 8.440)	(-2.10, -0.882)	(7.187, 7.950)	(5.441, 6.481)	(0.963, 2.253)
Total family income	10,823	13,763	-2,940***	8,451	15,764	-7,313***	12,451	10,629	1,821***
	(10,100, 11,545)	(12,892, 14,632)	(-4,070, -1,808)	(8,117., 8,783)	(14,843, 16,683)	(-8,291, -6,334)	(11,644, 13,256)	(9,906, 11,352)	(737, 2,904)
No of children	1.750	1.593	0.157**	1.685	1.611	0.074	1.721	1.627	0.093
	(1.657, 1.843)	(1.505, 1.681)	(0.029, 0.285)	(1.607, 1.762)	(1.508, 1.714)	(-0.05, 0.203)	(1.631, 1.810)	(1.539, 1.716)	(-0.03, 0.219)
Religion (1=Islam)	0.951	0.613	0.338***	0.768	0.788	-0.020	0.765	0.765	0.000
	(0.921, 0.981)	(0.546, 0.680)	(0.265, 0.412)	(0.710, 0.827)	(0.732, 0.845)	(-0.10, 0.062)	(0.706, 0.823)	(0.706, 0.823)	(-0.08, 0.083)

Notes:

a. This table exhibits the mean values of various observable characteristics of children and parents of most and least affected groups and difference between these values. Most and least affected groups are estimated using conditional treatment effects on the outcome variables measured using causal forest analysis (see Section E1. in Appendix E of online appendix for more details).

b. Robust Standard Error in square brackets

c. Robust CI in parentheses

d. *** p<0.01, ** p<0.05, * p<0.1

Appendix D: Assessment Test and Questionnaires

Table D1. Children's assessment

Subject	No	Grade 1	Grade 2	Grade 3	Marks
Bangla Literacy	1.	Give an example of one Bangla vowel letter.	Make two words using the Bangla letter ----.	Make one word and a sentence from that word using the Bangla letter (----).	5
	2.	Which two letters come after letters ---- & ----.	Give an example of a word written with joint letters.	What is the antonym of the Bangla word (freedom)?	5
	3.	Make a word with Bangla letter -----.	What is the spelling of the word (Sundarbans)?	What is the spelling of the word (freedom fighter)?	5
	4.	What is the English of ------ (common flower name)?	What is the antonym of the Bangla word (high)?	What is the meaning of the Bangla word (----)?	5
General Knowledge	5.	How many days there are in a week?	Give an example of five flowers.	On which date of 1952, there was a march for the Bangla language?	5
	6.	What are the days come after Saturday?	What is the first month of Bangla year?	What is victory day in Bangladesh?	5
	7.	Give an example of three flowers.	Which season is best for homemade cakes?	Mostafa Kamal is an ----.	5
	8.	What is the national animal of Bangladesh?	What was the pet's name of the national poet of Bangladesh?	How many days there are in the month 'March'?	5
English Literacy	9.	Make a word with 'C'.	Make a word with 'M'.	Make two words with 'C'.	6
	10.	Answer this English question: What is your name?	Answer this English question: How old are you?	Answer this English question: What month is it now?	6
	11.	Tell the English of Bangla word – (Hand).	Tell the English of Bangla word – (Window).	Tell the English of Bangla word – (Farmer).	4
	12.	Tell the English of Bangla word – (Book).	Tell the English of Bangla word – (Rose).	Tell the English of Bangla word – (Umbrella).	4
	13.	Tell the English of Bangla word – (Dog).	Tell the English of Bangla word – (Breakfast).	Tell the English of Bangla word – (Flag).	4
	14.	Spell your name in English.	Spell the English word 'Mother'.	Spell 'English Teacher' in English.	6
Mathematics	15.	Which number comes after 6? Does it even or odd?	Name the even numbers in between 1 and 10.	Which number is bigger in 525 and 495?	6
	16.	What is the sum of 3 and 4?	Whether the sum of 3 and 4 is an even or odd number?	There are 6 notes of 20 taka. How much money is there?	6
	17.	If we deduct 3 from 8, what remains?	In a class, there were 16 students. The teacher sends 5 of them for gardening. How many students are left in the classroom?	Whether the sum of 13 and 11 is an even or odd number?	6
	18.	How many minutes in 60 seconds?	How many sides a triangle has?	How many sides a rectangle has?	6
	19.	6+0 equals to what?	There are three fruits on a plate. How many fruits there are in 4 plates?	The price of 5 eggs is BDT 30. How much does it cost to buy 2 eggs?	6

D2. Parents' survey

The following items were included in the endline survey:

1. Household identification,
2. Socio-economic status,
3. Child's educational activities at present,
4. Parental involvement in child's education,
5. Parental involvement in child's Leisure activities,
6. Perception about own ability in helping the child to learn,
7. Expectation about child's educational achievement,
8. Prevalence of negative parenting,
9. Parenting style survey (Robinson et al., 1995),
10. Strength and Difficulties Questionnaire (SDQ) – parents' perception about their child (Goodman, 1997),
11. Child-parent relationship scale (Driscoll and Pianta, 2011),
12. Short 15-item Big-Five questionnaire (Lang et al., 2011),
13. Center for Epidemiologic Studies Depression Scale-Revised (CESD-R) (Radloff, 1977)
14. Perception about the telementoring program, and
15. Assessment of the assigned mentor.

D3. Photographs of survey and assessment session

(a) A mother is answering the survey

(b) A child is answering the assessment questions

(c) A child is taking lesson with the help of a basic phone (and in the presence of mother) while mentor was in the call. *Photo credit: Parents*

(b) A mentor sends some goody to the mentee.

D4. Mentor's survey

The following items were included in the surveys during the intervention and endline:

1. Mentoring related problems (qualitative)
2. Parents' cooperation
3. Mentee's responsiveness
4. How difficult do you find it to communicate with these parents? (1 to 10 scale)
5. Do the mentee's parents understand the weekly theme?
6. Do you think parents comply with our weekly themes?
7. Parents' motivation towards a child's education. (1 to 10 scale)
8. What is the main challenge you are facing in mentoring this child?
9. In your opinion, do the parents of this mentee have a lack of aspiration about his/her education?
10. How do you rate the level of parental aspiration? (1 to 10 scale)
11. Do you think, the parents of this mentee have a high aspiration gap?
12. How do you rate the chance that this kid will meet the parent's aspiration? (1 to 10 scale)
13. In your opinion, do the parents of this mentee is capable to teach their child?
14. How do you rate their level of teaching ability? (1 to 10 scale)
15. In your opinion, do the parents of this mentee is confident in teaching or helping their child in the study?
16. How do you rate the confidence of the parents in helping kids in the study? (1 to 10 scale)
17. In your opinion, do the parents of this mentee have good faith in their child?
18. How do you rate their level of believing in the child? (1 to 10 scale)
19. In your opinion, do the parents of this mentee promote competition in the study?
20. How do you rate the level of competition in parents about a child's study? (1 to 10 scale)
21. How many times you have called and talked with this mentee and/or its parents?
22. On average, how many times you had to call every week to this mentee to finish mentoring?
23. If we assume our desired level of mentoring input is 10, how much you will give to this mentee based on the input you could have provided to him/her?
24. How many points do you give to the parents of this mentee in cooperating with you and the mentorship program?

D5. Mentor's certificate

Mentorship During Pandemic

A telementoring program for primary graders of rural Bangladesh

Project Partners

CDES, Monash University, Australia

Global Development & Research Initiatives (GDRI), Bangladesh

Presented to

Dummy Mentor

Dummy University

To certify participation in the volunteer mentoring program as **"Mentor"** to guide primary school children from the South-West region of Bangladesh. As part of this program, volunteers successfully complete the following -

- Seminar 1: Education Inequality and Parental Involvement in Rural Bangladesh
- Seminar 2: How to change the rural lives?
- Seminar 3: Improving Education of the Children in Rural Bangladesh
- Training on Mentoring Methods and Techniques
- 13-week mentoring via telephone from September 04 to December 03, 2020

We wish every success of his/her life.

Professor Asad Islam
Director, Centre for Development Economics and Sustainability (CDES)
Monash University, Melbourne, Australia

Ref: GDRI/telementoring/2020/Dummy University/99

Appendix E: Heterogeneous Treatment Effects

E1. Details on heterogeneity analysis using causal forest

It is extremely important to underpin the heterogeneity of treatment effect as it may vary largely across various sub-sample. The traditional approach of estimating heterogeneous effects with the interaction between treatment and different variables of interest has some limitations. Too many variables may bring computational challenges and increase the risk of overfitting. On the contrary, restricting to a particular subset of variables to estimate heterogeneous effects may lead to arbitrary decision making and the loss of information about potential heterogeneity (Carlana and La Ferrara, 2021). To overcome these challenges, we estimate the heterogeneous treatment effect using an honest casual forest algorithm (Wager and Athey, 2018).

In particular, we follow the estimation procedure of Davis and Heller (2017). According to this approach, we split the sample into two subsamples. One sub-sample, the training sample, is used to implement the causal forest algorithm. The other subsample, the test sample, is used to compute average treatment effects. We follow the following step-by-step procedure for each of the outcome variables:

1. From our final sample, 814 households, we draw a random subsample – without replacement – approximately 50% of the total observations. This subsample is the training sample. The remaining observations constitute the test sample.
2. We use the training sample to estimate the causal forest (using Stata command causal_forest to run grf of R and return the result. The parameters we choose are the number of trees in the forest 10000; to build each tree, we divide the training sample in half (default); this subsample is further split by 70% and 30%, the latter is used to estimate the conditional treatment effects.
3. By using both conditional treatment effects from step 2 and the test sample, we estimate average treatment effects.
4. Repeat steps 1 to 3 for 100 times.
5. The final estimates are the average of the results from all simulations.
6. Based on the final predicted CATE, we create 4 dummy variables based on the quartiles and report the mean of various observable characteristics of bottom and top quartiles. The bottom quartile represents the least affected group and the top quartile represent the most affected group.

E2. Heterogeneity analysis using an interaction model

In this section, we explore treatment heterogeneity in respect to several dimensions, to better understand how the program had an impact on the outcomes. We start with the gender-based heterogeneous treatment effect as the perceived value of education for girls are different from

the boys (Blunch and Das, 2015). Then, we discuss the heterogeneous effect of childbirth order, treatment intensity and mobile network issues.

E2.1. Gender of child

An important dimension of heterogeneity is related to participants, demographic, and socioeconomic characteristics, which is explored in Section 4 in detail. Here, we are discussing one of such important dimensions, gender. At baseline, we have a hypothesis on how the program affects outcomes of girls versus boys. We were expecting that the boys will do better compared to the girls as the traditional norm in the locale of the study is to invest more time and resources in boys. So, parents may show more seriousness if the participant is a boy that may lead to better compliance with the mentor's instructions and extended follow-up of the homework provided by the mentor.

However, we find that boys and girls benefited to the same extent from the telementoring intervention. These results are exhibited in Panel A of Table E1. In the third row of the table, coefficients of the interaction terms are presented that give us the difference-in-difference estimates. The positive (negative) coefficient on the interaction term of a particular outcome variable suggests that girls did better than boys in treatment groups relative to the control group. As none of the coefficients is statistically significant, we cannot reject the null hypothesis. But signs of the estimates are very interesting and help to underpin some community norms. Girls get fewer marks in the cognitive test and provide more time in non-academic activities due to the more burden of domestic works. Participation in telementoring helps girls to improve in academic tests and lowers the non-academic works loads. It is also revealed that parents of the girl child use reduced punishment, feel less able to help the child and expect less about the educational attainment of the child. The findings of no gender-based heterogeneity support the previous findings reported by Begum et al. (2018).

E2.2. Birth order

Following the resource dilution theory by Blake (1981) we assume that each additional child would dilute parental resources as those are shared among more offspring, especially in the resource-constrained households. It means that a first-born child can enjoy all parental resources until a sibling arrives and a later-born child must share from their birth. Therefore, later-born children get less support in their intellectual development. Moreover, we also follow the confluence model by Zajonc and Markus (1975), which argues that earlier-born children grow up mostly in adult supervision i.e. more stimulating intellectual environment. To understand the treatment heterogeneity, we construct a birth-order variable where '0' means single child, '1' means first-born child, '2' means second-born child and so on.

Like gender heterogeneity, we use interaction terms between treatment and birth order that give us the difference-in-difference estimates. These results are presented in Panel B of Table E1. Note that we do not report the estimates for fourth- and fifth-born as there is only 3

sample in these groups. We find that later-born children have under-performed in the assessment test compared to their counterparts from single-child families. Moreover, more children reduce parental time and increase the prevalence of negative parenting action. This heterogeneous treatment effect supports the negative birth order effect on education reported by Booth and Kee (2009).

E2.3. Treatment intensity

We measure treatment intensity by the mentoring duration over the intervention period. Students received a different number of mentoring hours due to several issues such as lack of interest, family issues, technical problems etc. This variation in mentoring duration can be used to understand how the treatment effect varies with the mentoring intensity.

In Table E2, we present the regression results where outcome variables are regressed on the treatment dummy and on an indicator for whether the student got above-median mentoring hours. Column 1 shows that the impact of less than median duration of mentoring is a 14.08 increase in academic performance, as measured by our 100-mark assessment test, while another 7.37 points increase in the academic performance due to the above-median mentoring duration i.e., intense mentoring. This is a significant effect of additional hours, but not surprising. Carlana and La Ferrara (2021) find a linear effect of additional hours in academic performance, 0.2 sd increase in the 3-hours program and another 0.22 sd in the 6-hours program. In a meta-analysis, Nickow et al. (2020) also show that the average effect of tutoring on learning doubles if the duration doubles i.e. 1-2 days from 4-5 days. Though our measures of intensity do not indicate doubling the mentoring hours, the high degree of statistically significant increase supports the existing literature.

Besides the academic performance of the children, column 5 of Table E2 indicates intense mentoring has a significant positive impact on the amount of parental time provided in Homeschooling. That means parents who receive intense mentoring provide higher time to the children in studying their curriculum. Intense mentoring also raises parents' educational expectations from the children. We do not find any other significant effect due to the intensity of the telementoring program.

E2.4. Network issues

Our locale of the study is the South-Western part of Bangladesh, mostly from remote areas (see Figure C1 in the appendix C). Though we use a basic feature phone to deliver our intervention, network quality (i.e., call drops, low signal etc.) was an important issue. Therefore, we asked our mentors to report their experience related to these issues and we convert their answers to a dummy variable, '1' if the mentor faced technical difficulties during the program.

We find that 55.2% of the children had some sort of technical issues during the 13-weeks mentoring period. In Panel B of Table E2, we regress the outcome variables on the treatment

and technical difficulties dummy after controlling the baseline characteristics. It is evident that the presence of technical difficulties negatively affects the academic performance of the children. The impact of treatment is a 20.17 increase in the assessment test score whereas technical difficulties decrease the score by 4.48, as measured in our assessment test. We do not find any significant effect of technical difficulties on the other outcome variables. One encouraging aspect of this finding is that even after controlling the technical difficulties effect of mentoring is large and significant.

Table E1. Heterogeneous treatment effect by gender and birth order of the children

	Cognitive Outcome			Parental Time		Parent's Parenting Perception			
	(1) Total points	(2) Literacy (English)	(3) Numeracy	(4) Home schooling	(5) Leisure activities	(6) Negative parenting	(7) Parenting ability	(8) Aspiration about education	(9) Mother's confidence in teaching
Panel A: Heterogeneous effects on children by gender									
Treatment	16.660***	5.963***	5.149***	21.511***	10.654***	-0.257**	1.799***	0.330***	0.654
	(2.114)	(0.784)	(0.856)	(3.760)	(3.806)	(0.106)	(0.527)	(0.110)	(0.625)
Girl	-2.490	0.390	-1.374	3.744	12.314**	-0.180*	-0.248	-0.599***	0.854
	(2.061)	(0.759)	(0.850)	(3.422)	(5.422)	(0.105)	(0.540)	(0.118)	(0.621)
Treatment × Girl	2.037	-0.730	0.539	0.591	-3.371	-0.054	-0.647	-0.165	-0.008
	(2.957)	(1.111)	(1.177)	(5.225)	(7.162)	(0.144)	(0.724)	(0.165)	(0.863)
Observations	814	814	814	814	812	814	814	814	814
R-squared	0.363	0.319	0.315	0.209	0.111	0.114	0.286	0.293	0.262
Panel B: Heterogeneous effects on children by their birth order									
Treatment	19.031***	6.444***	5.404***	25.460***	8.080	-0.488***	1.342**	0.296**	0.560
	(2.280)	(0.865)	(0.907)	(4.423)	(5.190)	(0.113)	(0.538)	(0.123)	(0.668)
First child	3.277	2.132	-0.216	15.724**	13.663	-0.080	-0.302	-0.125	0.813
	(4.671)	(1.810)	(1.847)	(7.177)	(10.436)	(0.251)	(1.272)	(0.322)	(1.268)
Second child	0.406	0.440	-0.518	13.228*	16.255	-0.168	-0.783	-0.464	0.672
	(4.732)	(1.838)	(1.816)	(6.947)	(11.695)	(0.240)	(1.318)	(0.331)	(1.367)
Third child	6.850	3.708	0.266	24.982*	26.909	0.167	0.507	-0.485	3.228
	(9.783)	(3.979)	(4.043)	(14.370)	(21.091)	(0.501)	(2.692)	(0.724)	(2.475)
Treatment × First child	-2.987	-2.015	-0.709	-15.386**	1.695	0.445**	0.600	-0.332	0.643
	(4.007)	(1.502)	(1.584)	(6.904)	(8.362)	(0.197)	(0.950)	(0.218)	(1.112)
Treatment × Second child	-0.777	-0.820	0.740	-1.504	2.357	0.393**	0.009	0.075	-0.255
	(3.375)	(1.268)	(1.366)	(6.268)	(8.706)	(0.172)	(0.896)	(0.190)	(1.047)
Treatment × Third child	-15.362*	-6.011*	-2.547	-0.296	-6.252	-0.333	-0.352	-0.114	0.321
	(9.318)	(3.248)	(3.706)	(16.055)	(17.061)	(0.418)	(2.047)	(0.547)	(2.773)
Observations	814	814	814	814	812	814	814	814	814
R-squared	0.367	0.324	0.318	0.215	0.113	0.127	0.288	0.298	0.266

Notes:

a. The dependent variable for each regression is listed in the column heading. The same control variables are used as before. Grade and Union fixed effects are used in all regression.

b. Robust standard errors in parentheses

c. *** p<0.01, ** p<0.05, * p<0.1.

Table E2. Heterogeneous treatment effect by mentoring duration and technical difficulties during the mentoring program

	Cognitive Outcome			Parental Time		Parent's Parenting Perception			
	(1) Total points	(2) Literacy (English)	(3) Numeracy	(4) Home schooling	(5) Leisure activities	(6) Negative parenting	(7) Parenting ability	(8) Aspiration about education	(9) Mother's confidence in teaching
Panel A: Heterogeneous effects by mentoring duration									
Treatment	13.994***	4.064***	4.596***	13.928***	8.339***	-0.272***	1.209***	0.118	-0.173
	(1.904)	(0.704)	(0.782)	(3.307)	(3.137)	(0.087)	(0.436)	(0.106)	(0.557)
Mentoring duration dummy (1=above median)	7.415***	3.052***	1.657**	15.772***	7.383*	-0.024	0.520	0.256**	1.646***
	(2.126)	(0.810)	(0.835)	(3.967)	(4.353)	(0.100)	(0.510)	(0.115)	(0.621)
Treat + intensity = 0	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.003
Observations	814	814	814	814	812	814	814	814	814
R-squared	0.373	0.331	0.318	0.227	0.166	0.114	0.286	0.296	0.269
Panel B: Heterogeneous effects by technical difficulty report by mentors									
Treatment	20.408***	6.501***	6.207***	26.142***	12.809***	-0.314***	1.835***	0.308***	0.587
	(1.892)	(0.735)	(0.737)	(3.683)	(4.053)	(0.092)	(0.449)	(0.102)	(0.562)
technical difficulties dummy[b] (1=Yes)	-4.997**	-1.682**	-1.446*	-7.992*	-1.436	0.055	-0.677	-0.114	0.116
	(2.144)	(0.823)	(0.826)	(4.090)	(4.434)	(0.101)	(0.502)	(0.116)	(0.632)
Treat + technical difficulties=0	0.000	0.000	0.000	0.000	0.000	0.003	0.008	0.059	0.163
Observations	814	814	814	814	812	814	814	814	814
R-squared	0.367	0.322	0.317	0.214	0.162	0.115	0.287	0.293	0.262

Notes:

a. The dependent variable for each regression is listed in the column heading. The same control variables are used as before. Grade and Union fixed effects are used in all regression.

b. We asked our mentors to report their experience related to network issues, such as call drops, unreachable due to low signal etc. and we convert their answers to a dummy variable, '1' if the mentor faced technical difficulties during the program.

c. Robust standard errors in parentheses

d. *** p<0.01, ** p<0.05, * p<0.1.

References

ANGRIST, N., BERGMAN, P. & MATSHENG, M. 2020. School's Out: Experimental Evidence on Limiting Learning Loss Using "Low-Tech" in a Pandemic. National Bureau of Economic Research.

BANBEIS 2018. Pocket Book on Bangladesh Education Statistics 2017. Dhaka, Bangladesh: Bangladesh Bureau of Educational Information and Statistics.

BANERJEE, A. V., BANERJI, R., DUFLO, E., GLENNERSTER, R. & KHEMANI, S. 2010. Pitfalls of participatory programs: Evidence from a randomized evaluation in education in India. American Economic Journal: Economic Policy, 2, 1-30.

BBS 2017. Household Income and Expenditure Survey 2016. Dhaka, Bangladesh: Bangladesh Bureau of Statistics (BBS).

BEGUM, L., GROSSMAN, P. J. & ISLAM, A. 2018. Gender bias in parental attitude: An experimental approach. Demography, 55, 1641-1662.

BERGMAN, P. 2021. Parent-child information frictions and human capital investment: Evidence from a field experiment. Journal of Political Economy, 129, 000-000.

BISWAS, K., ASADUZZAMAN, T., EVANS, D. K., FEHRLER, S., RAMACHANDRAN, D. & SABARWAL, S. 2020. TV-Based Learning in Bangladesh: Is it Reaching Students?

BLAKE, J. 1981. Family size and the quality of children. Demography, 18, 421-442.

BLUNCH, N.-H. & DAS, M. B. 2015. Changing norms about gender inequality in education: Evidence from Bangladesh. Demographic Research, 32, 183-218.

BOONK, L., GIJSELAERS, H. J. M., RITZEN, H. & BRAND-GRUWEL, S. 2018. A review of the relationship between parental involvement indicators and academic achievement. Educational research review, 24, 10-30.

BOOTH, A. L. & KEE, H. J. 2009. Birth order matters: the effect of family size and birth order on educational attainment. Journal of Population Economics, 22, 367-397.

CARLANA, M. & LA FERRARA, E. 2021. Apart but Connected: Online Tutoring and Student Outcomes during the COVID-19 Pandemic.

DAVIS, J. & HELLER, S. B. 2017. Using causal forests to predict treatment heterogeneity: An application to summer jobs. American Economic Review, 107, 546-50.

DIZON-ROSS, R. 2019. Parents' beliefs about their children's academic ability: Implications for educational investments. American Economic Review, 109, 2728-65.

DRISCOLL, K. & PIANTA, R. C. 2011. Mothers' and Fathers' Perceptions of Conflict and Closeness in Parent-Child Relationships during Early Childhood. Journal of Early Childhood & Infant Psychology.

GOODMAN, R. 1997. The Strengths and Difficulties Questionnaire: a research note. Journal of child psychology and psychiatry, 38, 581-586.

IMAI, K., KEELE, L. & YAMAMOTO, T. 2010. Identification, inference and sensitivity analysis for causal mediation effects. Statistical science, 51-71.

KROENKE, K., SPITZER, R. L. & WILLIAMS, J. B. 2001. The PHQ-9: validity of a brief depression severity measure. Journal of general internal medicine, 16, 606-613.

LANG, F. R., JOHN, D., LÜDTKE, O., SCHUPP, J. & WAGNER, G. G. 2011. Short assessment of the Big Five: Robust across survey methods except telephone interviewing. Behavior research methods, 43, 548-567.

MARTIN, M. M. & RUBIN, R. B. 1995. A new measure of cognitive flexibility. Psychological reports, 76, 623-626.

NATH, S. R. 2012. Factors Influencing Primary Students' Learning Achievement in Bangladesh. Research in Education, 88, 50-63.

NICKOW, A., OREOPOULOS, P. & QUAN, V. 2020. The Impressive Effects of Tutoring on Prek-12 Learning: A Systematic Review and Meta-Analysis of the Experimental Evidence. NBER Working Paper.
NSA 2017. The National Student Assessment 2017 (Grades 3 and 5). Dhaka, Bangladesh: Ministry of Primary and Mass Education.
RADLOFF, L. S. 1977. The CES-D scale: A self-report depression scale for research in the general population. Applied psychological measurement, 1, 385-401.
RADLOFF, L. S. 1977. The CES-D scale: A self-report depression scale for research in the general population. Applied psychological measurement, 1, 385-401.
RAHMAN, T. & SHARMA, U. 2021. A Simulation of COVID-19 School Closure Impact on Student Learning in Bangladesh. Washington, DC: World Bank.
ROBINSON, C. C., MANDLECO, B., OLSEN, S. F. & HART, C. H. 1995. Authoritative, Authoritarian, and Permissive Parenting Practices: Development of a New Measure. Psychological Reports, 77, 819-830.
SANDERS, M., CALAM, R., DURAND, M., LIVERSIDGE, T. & CARMONT, S. A. 2008. Does self-directed and web-based support for parents enhance the effects of viewing a reality television series based on the Triple P – Positive Parenting Programme? Journal of Child Psychology and Psychiatry, 49, 924-932.
UNICEF 2019. Progotir Pathey, Bangladesh Multiple Indicator Cluster Survey 2019, Survey Findings Report. Dhaka, Bangladesh: Bangladesh Bureau of Statistics (BBS).
UNICEF 2020. Students in Bangladesh adjust to remote learning via national TV during COVID-19 lockdown. UNICEF.
USAID. 2021. Education [Online]. Dhaka, Bangladesh: USAID. Available: https://www.usaid.gov/bangladesh/education [Accessed 30/05/2021 2021].
WAGER, S. & ATHEY, S. 2018. Estimation and inference of heterogeneous treatment effects using random forests. Journal of the American Statistical Association, 113, 1228-1242.
WALKER, J. M., WILKINS, A. S., DALLAIRE, J. R., SANDLER, H. M. & HOOVER-DEMPSEY, K. V. 2005. Parental involvement: Model revision through scale development. The elementary school journal, 106, 85-104.
ZAJONC, R. B. & MARKUS, G. B. 1975. Birth order and intellectual development. Psychological review, 82, 74.

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Impressum:

ISSN: **2701-3456**
Editors: Tim Büthe, Hanna Hottenrott
Associate Editors: Timm Betz, Sebastian Goerg, Michael Kurschilgen, Amy Pond, Sebastian Schwenen, Janina Steinert, Matthias Uhl
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