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Emma Näslund-Hadley
Juan Manuel Hernández-Agramonte
Carolina Mendez
Fernando Fernandez

Inter-American Development Bank
Social Sector Department

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Remote Parent Coaching in Preschool Mathematics: Evidence from Peru*

Emma Näslund-Hadley†
Juan Manuel Hernández-Agramonte‡
Carolina Mendez§
Fernando Fernandez¶

Abstract

We evaluate the effects of a 10-week intervention that randomly provided access to remote coaching to parents of preschool children over the summer break in Peru. In response to learning losses during school closures induced by COVID-19, education coaches offered guidance and encouragement to parents in activities designed to accelerate the development of core mathematical skills. We find that the intervention improved cognitive outcomes in mathematics by 0.12 standard deviations. Moreover, we show that remote coaches increase the likelihood and frequency of parental engagement in mathematics-related activities, suggesting that learning gains are driven by greater parental involvement in child skill development.

JEL Codes: I20, I24

Keywords: Preschool learning, education technologies, interactive radio instruction, parent engagement

† Inter-American Development Bank. Email: emman@iadb.org
‡ Innovations for Poverty Action. Email: jmhernandez@poverty-action.org
§ Inter-American Development Bank. Email: caroliname@iadb.org
¶ Universidad de Piura. Email: fernando.fernandez@udep.edu.pe

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1 Introduction

School closures induced by the COVID-19 pandemic pose a grave risk to long-run development and economic recovery, especially in developing countries. Recent evidence from a range of settings demonstrates that school closures have caused important learning losses worldwide (Grätz and Lipps, 2020; Lichand et al., 2021; Grewening et al., 2020; Maldonado and De Witte, 2020). These negative effects on learning are likely to widen the achievement gap between students from rich and poor households (Agostinelli et al., 2022; Bacher-Hicks et al., 2021; Andrew et al., 2020; Dietrich et al., 2020; Malkus, 2020). A search is under way for effective and affordable policy options to mitigate the learning losses provoked by school shutdowns.

In this paper, we study an intervention designed to attenuate learning losses by providing parents with educational materials on math-related activities, along with remote access to a trained coach to guide and support parents in the use of those materials. In particular, the program seeks to accelerate the development of foundational skills for mathematical learning among preschoolers in Peru.

In mid-March 2020, soon after the World Health Organization declared the COVID-19 pandemic, the Peruvian government announced stringent measures to contain the spread of the virus in the country. Following the declaration of a countrywide state of emergency, restrictions were applied. These included a lockdown combined with curfews, an increased military and police presence, the closure of international borders, and the institution of remote education for the 2020 academic year. Under the policy, all primary and secondary schools were closed effective March 2020. (Peru's academic year runs from mid-March to mid-December.)

The remote education program of the Ministry of Education (MINEDU) was named Aprendo en Casa ("I learn at home"). To maximize access to the program, educational content was transmitted online and on television and radio. Official figures indicate that 95 percent of the student population used to the program in 2020, though only 65 percent were satisfied with it (MINEDU, 2021). A survey at the preschool level reveals that 77 percent of households gained access to Aprendo en Casa via television and radio. Owing to the lack of internet connectivity, only 10 percent accessed lessons online. The remaining 13 percent used either paper-based resources provided by the teacher or did not use Aprendo en Casa (Näslund-Hadley et al., 2022).

In late 2020, as the second wave of COVID-19 was peaking, the feasibility of reopening schools for the 2021 academic year was in doubt. Because MINEDU had no plan to safely return teachers and children to schools, the remote education program was extended through December 2021. As a result, Peru had one of the world's longest periods of school closures. Nevertheless, initiatives were undertaken to mitigate the learning losses caused by the closures.

MateWasi is one such initiative. Designed by MINEDU, Innovations for Poverty Action, and the Inter-American Development Bank (IDB), the MateWasi program was conceived to improve mathematics learning among preschoolers in Peru's San Martin region over the 2021 summer break (January to March). Preschools in San Martin follow the national Peruvian curriculum, which in mathematics covers concepts taught internationally at this level. These include observation, one-to-one correspondence (i.e., the ability to count objects), number sense, spatial sense, classification and seriation, patterns, comparisons, measurement, parts and wholes, numbers and symbols, graphing, mathematical language, mathematical reasoning and problem solving (MINEDU, 2016).

The program consisted of forty 15-minute lessons broadcast on public radio over a period of 10 weeks during the summer break between preschool and first grade. The program did not cover the entire preschool mathematics content but focused on key concepts to prepare students for the mastery of upcoming first-grade content and skill development.

The MateWasi program was broadcast publicly and free of charge, so all parents and children could benefit from the lessons. For that reason, we did not randomize access to the radio lessons of the program. Instead, our research design involved random variation in remote access to coaches who guided parents through the program activities and in the provision of educational materials to facilitate math-related activities. Parents in the treatment group received calls and text messages three times per week from a coach who offered guidance on parenting and suggested pedagogical activities using the materials provided. The 14 coaches, who worked under the supervision of two field coordinators, were either child psychologists or educators by training. They received a 10-hour course of training in use of the materials conducted by a specialist in interactive radio education. Phone calls with parents lasted an average of 10 minutes. Coaches reminded parents to have their child participate in each lesson and asked about progress since the last audio lesson. Parents in the control group did not receive any type of support, access to remote coaching, educational materials, or encouragement to engage in program activities.

MINEDU's San Martin regional office provided telephone numbers of households in two provinces, Lamas and San Martin. Between December 2020 and January 2021, we collected baseline information through phone surveys, including 1,065 households with children aged between 4 and 6 years old. We gathered detailed child-level and parent-level information on a wide range of outcomes and characteristics. To remotely measure child learning, we adapted the Early Grade Mathematical Assessment and the Measuring Early Learning Quality and Outcomes tests, which have proven psychometric properties (Hernández-Agramonte et al., 2022). We also obtained measures of parental involvement and family care to see if these mechanisms could explain potential learning gains. The program activities ended in late March 2021. We administered an endline survey to children and parents in April 2021.

Our results indicate that the 10-week intervention was successful in boosting learning outcomes. In particular, we find that treated children scored 0.12 standard deviations higher than children in the control group. Our evidence suggests that this improvement in preschool learning was driven by greater parental involvement in educational activities promoted by the program, such as counting objects, playing mathematics games, and tutoring. The evidence also suggests that the benefits of the program were greater for boys than for girls, resonating with previous results from Paraguay (Näslund-Hadley et al., 2014).

Our study is related to several strands of literature. We add to the extensive literature showing that reaching parents through text messages or phone calls can increase parental investments in their children's education. For instance, Barrera et al. (2020) analyzed an intervention conducted in Nicaragua in 2015 in which parents received daily text messages containing information on parenting practices. The program was effective in improving parenting investments, but the investigators did not find evidence of better child development. Berlinski et al. (2021) evaluated the impacts of sending text messages to parents, including information on attendance, grades, and classroom behavior. The program, conducted in Chile between 2014 and 2015, increased student achievement through better parental information. York et al. (2018) showed that text messages containing parenting guidelines increased parental involvement and led to learning gains among preschoolers in San Francisco, California.

Our work also relates to a body of empirical evidence on the effects of summer programs on student achievement. Guryan et al. (2014) estimated the impacts of READS, a randomized intervention in North Carolina with students in second and third grade. The program consisted of sending one book per week over 10 weeks to students in the treatment group. Students were encouraged to read each book and asked to produce a tri-fold based on their reading. The results show that the program increased the number of books read, but this did not translate into better reading skills (as measured by postintervention tests) for average students. The investigators did find that the program improved comprehension among girls in third grade. Kraft (2017) evaluated a program in which parents of children in primary schools randomly received text messages encouraging them to promote literacy skills at home during the summer break. They found that the program increased reading comprehension by 0.21–0.29 standard deviations and also showed that parental participation in teacher-parent meetings rose after the program. Lynch et al. (2022) conducted a meta-analysis of 27 experimental and quasi-experimental studies on the effectiveness of summer programs as a means of improving mathematical skills in school-age children. They found that students participating in summer programs achieved better outcomes in mathematics. The weighted average impact was 0.10 standard deviations—close to our estimated effect.

Our study also adds to the growing recent literature on remote programs to mitigate learning losses resulting from school closures during the COVID-19 pandemic. Carlana and La Ferrara (2021) analyzed the effects of an online tutoring program targeted at teenage students in Milan, Italy.

They found positive and large effects on test scores in three subjects (mathematics, Italian, and English). They also documented positive impacts on socio-emotional skills, educational aspirations, and psychological well-being. Lee et al. (2021) examined the impacts of live phone tutorials on engagement with radio lessons and student learning in Sierra Leone. They showed that tutorials led to higher parental and student engagement but found no improvements in learning.

The study closest to ours is Angrist et al. (2021). The authors examined a low- tech intervention in Botswana, the objective of which was to limit learning losses from school closure. The program sent parents text messages with several “problems of the week” and live phone calls to guide parents and children through mathematics problems. The evidence showed that text messages and phone calls increased test scores by 0.12 standard deviations. They also found increases in parental engagement and self-efficacy, as well as improvements in the accuracy of their perceptions on their child’s development. Hernandez-Agramonte et al. (2022) analyzed a similar intervention in Costa Rica, during the pandemic-related lockdown. Parents of preschool students received text messages to engage them in their children’s learning at home. After 15 weeks, the intervention had produced an improvement of 0.11–0.12 standard deviations in cognitive skills.

Our study makes four contributions to the understanding of policies that work to improve child learning in times of prolonged or frequent school closures. First, contrary to Lee et al. (2021), Agostinelli et al. (2022), and Engzell et al. (2020), we show that remote interventions to increase parental involvement can improve learning, as measured by tests scores. Second, we fill a knowledge gap on preschool children, as all previous studies (Carlana and La Ferrara, 2021; Agostinelli et al., 2022; Grewening et al., 2020; Arriola et al., 2021) have analyzed data on older students. This difference is critical because of its policy implications. Reasoning from our study, for example, governments seeking to mitigate learning losses may choose to place special emphasis on preschool children, who need core concepts to further develop their skills at the primary level and beyond. Third, our study highlights the benefits of summer programs, where the objective is to accelerate the development of foundational skills instead of covering an exhaustive list of topics from the national curriculum. Fourth, we provide experimental evidence from a middle-income country in Latin America that suffered one of the largest death tolls during the pandemic and experienced prolonged school closures from its onset (Dyer, 2021). Despite these adverse conditions, our study shows that remote coaching can improve child development through better parental involvement.

The balance of the paper is organized as follows. Section 2 describes the intervention. Section 3 reviews the data. Section 4 outlines the estimation methods. Section 5 presents the results. Section 6 offers concluding remarks.

2 Program intervention

Educators in Peru worry that preschoolers from vulnerable communities have not mastered the foundational skills required to excel in first grade. This gap was thought to widen following COVID-related school closures. To bridge the gap in preschoolers' learning, MINEDU partnered with Innovations for Poverty Action and the Inter-American Development Bank to design MateWasi.

The program's objective is to accelerate learning of fundamental skills among preschoolers to ready them for subsequent education in mathematics. These foundational skills covered four areas of mathematical ability. First, counting and cardinality, where the child should be able to grasp that the last number in a sequence represents all the objects counted. Second, mathematical operations and algebraic thinking, including the ability to do basic operations with symbols and forms of expression, working with numbers 0 to 10. This includes addition using fingers, verbal explanations, or equations. Third, measurement, including the ability to contrast the size and length of different objects. Fourth, geometry, including the ability to recognize and understand the properties of two- and three-dimensional shapes, copy and draw symmetrical shapes, and understand spatial relations.

MateWasi is an adapted version of an interactive radio instruction program from Paraguay (Näslund-Hadley et al., 2014) in which teacher and students were guided through hands-on, inquiry-based activities that included visualizations of mathematical shapes and relationships, mathematics storytelling, and singing and dancing.

MateWasi is open and free to any household. Our research design therefore randomized remote access to coaches, who called parents and guided them through the program activities. In total, 14 instructors under the guidance of two field coordinators, made weekly phone calls to parents, coaching them to interact with their children. The 10-week coaching component was offered only to the treatment group in our study sample. In addition, parents in the treatment group received text messages and educational materials to which the coaches referred during the phone calls in order to stimulate math-related activities. Figures A.1 and A.2 in the appendix display two such materials. The first is a card about the number five (written in numbers and letters and represented with balls and objects). The second is a calendar of dates of the radio lessons.

MateWasi was implemented in San Martin, a region in northern Peru situated between the eastern slope of the Andes and the Amazon forest (see Figure 1). The region covers 51,253 square meters (19,789 square miles) lying at an average altitude of 500 meters (1,640 feet) above sea level. It contains 395,000 hectares of primary forest along with mountainous terrain and a tropical climate. These combine to form an unusual ecosystem with a rich diversity of flora and fauna.

San Martin is divided into 10 provinces and 77 districts. According to the 2017 census (Peru's most recent), it has 813,400 inhabitants, of whom 25 percent live in poverty and 32 percent in rural areas. Its economy centers on agriculture (31 percent of the labor force) and commercial activities. Seventy percent of households have access to electricity, 20 percent have radios, 50 percent have TVs, and 66 percent have mobile phones. In San Martin, enrollment rates in pre-school and primary school are 74 percent and 93.4 percent, respectively. These figures, along with the corresponding values at the national level, are shown in Table 1.

The timeline of the intervention is shown in Figure 2. In Peru, summer is between January and March; school years begin in March and end in December. The intervention began in January 2021 and ended in March of the same year, extending over the summer break before the children entered first grade.

3 Data

The MINEDU's Regional Educational Office in San Martin provided a list of telephone numbers of pre-school teachers in two provinces: San Martin and Lamas.[1] These teachers had 3,042 telephone numbers of households with children between 4 and 6 years old. From this universe of families, we excluded households without a radio, TV, or internet access, since at least one was needed to follow MateWasi. A total of 1,065 households met this criterion and were included in the baseline survey.[2] We then stratified the sample by children's age and gender, household income, and baseline parental involvement with mathematics activities, and randomly assigned 533 households to the coaching program (the treatment group) and 532 to the control group. Parents in the coaching program were encouraged to participate in the radio program through texted reminders and during the phone calls with the coaches.

Baseline phone interviews were conducted between December 2020 and late January 2021 (see blue vertical lines in Figure 2). In the interviews, we gathered detailed information on children and parents, which is presented below. Table 2 presents the baseline characteristics of the control and treatment groups.

Sixty-one percent of the households were in San Martin; 39 percent in Lamas. On average, each household had 2 children younger than 18 and 1.08 children between 4 and 6 years old. The mean age of parents was 32 years. Ninety percent were women (almost always the mother of the child). Parents had different levels of education: 25 percent had completed primary school; 34 percent had completed secondary school; 18 percent had earned a technical degree; and 12 percent held a university (bachelor's) degree.

[1] These two provinces were chosen because they share the same radio station.

[2] For households with more than one eligible child, we randomly chose one for data collection.

The baseline sample included 1,065 children. Half were girls (48.3 percent). They were, on average, 5 years old at the baseline. Overall, we found no differences between the treatment and control groups, which means that the two groups were balanced at the baseline. Thus, any post-treatment difference can be attributed to the remote coaching component of MateWasi.

To measure cognitive skills, we used a remote version of the comprehensive Early Grade Mathematics Assessment, which includes items to measure spatial ability, oral counting, comparing of quantities, and word problems on addition and subtraction. In addition, we included questions to measure oral comprehension. Children were asked the questions over the telephone. In Table 3 consists of four panels, with different sets of outcomes. Panel I reports the baseline values of learning outcomes for non-attrited observations. In particular, it shows the percentage of correct responses related to different skills (e.g., spatial ability). We also include the percentage of correct responses on all math-related items, the percentage of correct responses for oral comprehension, and the simple average of mathematics and oral comprehension. In all these indicators, we find no differences between the control and treatment groups. Overall, the figures indicate that 70 percent of the responses were correct: 72 percent in mathematics and 65 percent in oral comprehension.

The next two panels show the endline (postintervention) values of intermediate outcomes that could drive potential treatment effects on learning.

The sessions of radio broadcasting and remote coaching ended on March 30, 2021. A few days later, we began the endline survey (see green vertical lines in Figure 2). The questionnaire for the survey was expanded from the baseline version so as to gather information on activities occurring over the summer (i.e., the time of the intervention) to allow us to test for potential mechanisms behind the expected effects on learning.

In Panel II, we report measures of the type and frequency of parental engagement over the summer (i.e., during the intervention). The first row indicates the fraction of parents who engaged in educational activities with their children (extensive margin). The second row shows the number of days per week (intensive margin) when time was spent on educational activities. The third row shows the fraction of parents engaging in mathematics games (counting or comparing objects). The next three rows report the corresponding values for tutoring. The differences in means for these variables suggest that the intervention changed parental behavior, inducing a reallocation of time toward more educational activities, mathematics games, and tutoring.

Panel III shows measures of program engagement derived from questions in the endline survey. First, we asked parents whether they knew about MateWasi. In the control group, 35 percent of parents said they knew about the program. In the treatment group, 90 percent of parents were aware of the program. Then we asked whether they were following the program. The percentage of parents following MateWasi was 26 and 90 percent in the control and treatment groups, respectively. We also asked parents whether they had been reached by the remote coach and received physical materials to facilitate math-related activities. Ninety-five percent of parents in the treatment group received calls from the coach; 90 percent received materials; and 87 percent received texts from the coach. In the control group, parents did not receive calls, materials, or texts.

Panel IV presents summary statistics for an adapted version of UNICEF's Family Care Indicators. In general, these questions were designed to measure parental involvement in activities that foster child development. The variables were included in the baseline and endline surveys, but here we report the endline values, as the baseline data served to ensure balance. Once the program ended, parents were asked whether they practiced the following activities with their children: counting objects, comparing objects (in size, for example), adding and subtracting, reading, telling stories, and singing songs. We see that the likelihood of engaging in math-related activities such as counting objects or doing sums was higher in the treatment group than in the control. Section 5 discusses these differences in greater detail.

The attrition rate was 35 percent. In Table 4, we show that attrition is unrelated to the intervention. Each column comes from a separate regression. In all four columns, the estimated coefficient is small and statistically insignificant, indicating that the treatment had low explanatory power for attrition rates. In column 4, we include a large number of explanatory variables; most are statistically insignificant. Only two (living in San Martin and parent's age) have significant effects. Most of the attrition occurred because of poor cellphone reception or changed phone numbers. Other recent studies conducted elsewhere have similar attrition rates (Angrist et al., 2021; Carlana and La Ferrara, 2021).

Furthermore, the balance on baseline covariates shown in Table 2 remains unaffected if the sample is restricted to observations included in both the baseline and endline surveys (see Table A.1 in the Appendix).

4 Empirical model and identification

Although we randomly assigned access to remote coaching (phone calls, texts, and materials) in our sample, MateWasi (without the coaching) was publicly available and, therefore, open to members of the control group who chose, independently of our project, to take advantage of it. Thus, the empirical analysis aims to estimate the causal effect of access to trained professionals who encouraged and guided parents throughout the MateWasi activities. From here on, we will refer to the remote coaching component as the program or the intervention.

We evaluate the impact of the program using two econometric models. Cognitive outcomes and family care indicators (adapted from UNICEF's Family Care Indicators) were collected both at the baseline and the endline. These data enable us to estimate the impact of the program using the following specification:

$$Y_{is} = \alpha_s + \varphi y_{is}^{BL} + \beta T_i + X_i' \Gamma + u_i \quad (1)$$

where Y_{is} denotes the outcome after the intervention for child (or parent) i in stratum s. Then, α_s captures strata fixed effects. y_{is}^{BL} denotes the baseline value of the outcome variable. T_i is equal to 1 if the child is in the treatment group, and 0 otherwise. X_i is a vector of child (sex, age) or parent characteristics (sex, age, education) as well as a household wealth score. Finally, the error term is written as u_i.

By contrast, measures of parental involvement and program engagement, which were designed to explore the mechanisms behind the treatment effects, were measured only after the intervention. In these cases, we run the following ordinary-least-squares specification:

$$Y_{is} = \alpha_s + \beta T_i + X_i' \Gamma + u_i \quad (2)$$

where all variables are defined in the manner of equation 1. This model is used to explore whether the intervention induced changes in parental involvement such as time dedicated to mathematics activities or tutoring over the summer. It also measures program engagement and compliance.

In both models, the parameter of interest is β, which captures the causal effect of randomly offering access to remote coaching during the implementation of MateWasi. Since control and treatment groups were balanced at the baseline (see Table 2), post-treatment differences in outcomes can be attributed to the intervention, and we can interpret $\hat{\beta}$ as the estimated causal effect of access to remote coaching.

5 Results

We present the intervention's effects on learning outcomes in Table 5. Each column represents a different regression. In the first three columns, the dependent variable is the outcome for mathematics (including spatial ability, oral counting, comparing quantities, and word problems). In the next three columns, the dependent variable measures oral comprehension. In all cases, the outcome has been standardized with respect to the corresponding baseline mean and standard deviation of the control group. Thus, reported coefficients measure the impact in standard deviations. All these coefficients come from the ANCOVA specification in equation 1.

In the first column, we present the results without controls. In the second, we add strata fixed effects. In the third, we further include province fixed effects and individual controls. In the three specifications, we find that the intervention improves learning by 0.12 standard deviations. The point estimates in columns 1 and 3 are statistically significant at the 5 percent level, and the coefficient in column 2 is significant at the 10 percent level. Based on the standard errors (in parentheses), the 95 percent confidence interval of the estimated effect ranges from 0.06 to 0.18 standard deviations. The estimated impacts on oral comprehension—reported in columns 4, 5, and 6—are similar.

These magnitudes are similar to those in Angrist et al. (2021), who found learning gains of 0.121 standard deviations for their "low-tech" intervention (phone calls and texts sent to parents) during school closures in Botswana. Carlana and La Ferrara (2021) found that an online tutoring program for secondary-level students in Milan increased test scores in mathematics, English, and Italian by 0.26 standard deviations, but this program included 3 to 6 hours per week of individual tutoring for each student in the treatment group. Given the greater intensity of this program and its personalized nature, it is reasonable to expect larger effects.

The estimated effects of the remote coaching component of MateWasi indicate that the intervention was successful in increasing learning. We now turn to the mechanisms behind these positive effects by looking at changes in parental behavior over the summer. Table 6 presents the intervention's effects on parental involvement in math-related activities. Because these activities were measured only in the endline survey, an ordinary-least-squares model is used, with random variation in the treatment indicator and post-treatment differences (see equation 2). In the first three columns, we see the effect on the probability of engaging in math-related activities on any given day of the week.

The three point estimates are positive and statistically significant at the 1 percent level, ranging from 0.13 to 0.139. These figures imply that the intervention increased the probability of engaging in math-related activities by 13 percentage points (extensive margin). This increase is 17 percent of the mean of the dependent variable in the control group (76 percent). In columns 4, 5, and 6, we find that the intervention also increased the frequency of engagement in such activities. More specifically, the point estimates show that the frequency of parental engagement increased by 0.6 days per week (intensive margin). On average, parents in the control group engaged in mathematics activities 3.4 days per week. Put differently, the estimated increase in the number of days that contained mathematics activities is 17 percent of the control mean.

In columns 7, 8, and 9, we find the effects on the probability of engaging in mathematics games. The estimated effects reveal that the program increased the likelihood of parents playing mathematics games with their children by 24 percentage points. Given that the mean in the control group is 53 percent, the magnitude of these effects is rather large (almost 50 percent of the mean in the control group). Moreover, all coefficients are statistically significant at the 1 percent level.

Taken together, these results indicate that remote coaches were successful at fostering parental engagement in the extensive and intensive margin. And, more importantly, they nudged parents toward activities involving mathematics games, which could explain the learning gains induced by the program.

Remote coaching also steered parents toward tutoring activities, as seen in Table 7. In the first three columns (1, 2, and 3), we see the estimated effects on the likelihood of parental engagement in tutoring. The point estimates range between 0.091 and 0.097, implying that the intervention increased tutoring by 9 percentage points. These coefficients are statistically significant at the 5 percent level. The estimated effect is equivalent to 20 percent of the mean of the dependent variable in the control group. Columns 4, 5, and 6 report the estimated coefficients for the number of days per week that parents engaged in tutoring. The impacts range between 0.38 and 0.52 additional days. In columns 7, 8, and 9, we measure the impact on the likelihood of engaging in tutoring specifically related to mathematics. We find that the intervention increased the probability of tutoring in math-specific subjects by 12 percentage points. Relative to the mean of the dependent variable in the control group, these effects are sizeable.

We now evaluate whether the remote coaching component increased engagement in MateWasi. Table 8 shows the effects of coaching on the likelihood of being aware of MateWasi (first three columns) and of actually following the program (last three columns). From the first three columns we see that remote coaching increased the likelihood of knowing about the program by 55 percentage points. These positive effects are statistically significant at the 1 percent level and quite large relative to the mean of the dependent variable in the control group (35 percent). Columns 4, 5, and 6 show the estimated effects of the coaching component on the likelihood of following MateWasi. The point estimates range between 0.642 and 0.644; all are statistically significant. Moreover, they are twice as large as the mean in the control group. This evidence suggests that remote coaches increased parental knowledge of and engagement in MateWasi.

In Table 9, we report the associations between receiving program inputs and awareness of and engagement in MateWasi. First, we see that receiving calls (from the coach) is associated with better knowledge of MateWasi. The point estimate in column 1 shows that receiving calls increases the likelihood of knowing about MateWasi by 57 percentage points. Second, we find that receiving materials is also associated with better knowledge of MateWasi. The estimated coefficient in column 2 suggests that receiving materials increases the likelihood of knowing about MateWasi by 56 percentage points. Third, we show that receiving texts is associated with improved knowledge of MateWasi. The point estimate is equivalent to an increase of 53 percentage points in the probability of knowing about the program. In column 4, we see that receiving any of these inputs is associated with higher likelihood of knowing about the program. In the next four columns, we show that receiving each or any of these inputs is also associated with an increased likelihood of following MateWasi.

Taken together, these results suggest that households that actually had access to remote coaching (calls and texts) are those that engaged in program activities and seized the benefits of MateWasi.[3] Table 10 shows the estimated impacts of the coaching component on the family care indicators. These variables were included in the baseline survey, enabling us to apply the ANCOVA model described in equation 1. In Panel A, we present the effects on mathematics activities such as counting and comparing objects and doing addition and subtraction. Columns 1, 2, and 3 show that the intervention increased the likelihood of parents counting objects with their children—an increase equivalent to 9 percentage points. This effect is of moderate magnitude given that the mean of the dependent variable is 80 percent. Columns 4, 5, and 6 tell us that the intervention raised the probability of comparing things. The coefficients show that this probability increased by 13 percentage points. In the last three columns (7, 8, and 9), we show the estimated effects of coaching on the likelihood of adding and subtracting. We see that the intervention increased this likelihood by 10 percentage points. All these coefficients are statistically significant at the 1 percent level, suggesting that remote coaching improved parental involvement, inducing parents to engage in stimulating activities to foster mathematics learning among their children.

In Panel B of Table 10, we present the effects of the coaching component on communication activities, such as parents reading books, telling stories, or singing songs to their children. In columns 1, 2, and 3, we find that the intervention did not increase the likelihood of parents reading to their children. In columns 4, 5, and 6, we see null effects on the likelihood of telling stories. Columns 7, 8, and 9 tell us that the intervention had no impact on the probability of singing songs. These null effects are reassuring, as MateWasi was designed to develop the foundations to accelerate mathematics learning. Therefore, remote coaches were not encouraging parents to engage in reading or telling stories to their children.

We also explore whether the intervention had differential effects according to the gender of the child. We extend our main specification by including an interaction term (treatment x Girl). In Table A.2, we show the results for learning outcomes. In column 1, the point estimate in the first row is positive and statistically significant at the 10 percent level, which means that the intervention improved learning for boys by 0.17 standard deviations. The coefficient on the interaction is negative and not statistically significant. This implies that the effect on girls is the difference between 0.17 and -0.11. That difference, however, is not statistically different from zero. At the bottom of the table, we report the p-value on the test of whether these coefficients are equal. The p-value is 0.151, suggesting that we cannot reject the null hypothesis that both coefficients are equal. In any case, this evidence suggests that the program was more effective with boys than with girls.

[3] In addition, we estimate two-stage least squares regressions using the random assignment to the treatment group as an instrument for each of these inputs (one model per input). In these models, we also find positive and statistically significant effects. The F statistic is large enough too. These results are not shown but available upon request to the authors.

We run analogous regressions to examine gender differences in the mechanisms behind the estimated effects, namely parental involvement and program engagement. The first three columns of Table A.3 report the estimated effect for boys and the differential impact for girls on the likelihood of parents engaging in mathematics activities, the number of days spent doing mathematics activities, and the likelihood of playing mathematics games. We find that parental involvement increased for boys but not for girls. The point estimates suggest that the program increased the likelihood of engaging in mathematics activities by 21 percentage points for boys, but only 5 percentage points for girls (0.21 minus 0.15). At the bottom of the table, the p-value for the test on whether these coefficients are equal is 0.000 in columns 1 and 3, indicating that the effects are statistically different from each other.

In columns 4, 5, and 6, we look at the effects of coaching on the likelihood of engaging in tutoring, the number of days spent tutoring, and the likelihood of math-specific tutoring. In these cases, we also find positive and large effects for boys and smaller ones for girls. In most cases, the difference between the coefficient for boys and the interaction term is statistically significant. In sum, these results suggest that parents of boys responded more strongly to remote coaching than did parents of girls.

Table A.4 reports heterogeneous effects on program engagement. It shows that the intervention increased the likelihood of being aware of MateWasi (column 1) and of following the program (column 2). This, too, is truer for parents of boys than for parents of girls. The point estimates of the interaction term are smaller in magnitude (negative in column 1 and positive in column 2). Moreover, in both columns we reject the null hypothesis that the effects for boys are equal to those for girls (p- values equal to zero). A similar pattern arises in the first three columns of Table A.5. Overall, the evidence suggests that remote coaching led to higher parental involvement—more so for boys than for girls. These differential responses, in turn, led to smaller learning gains for girls than for boys.

Appendix Tables A.6–A.9 report the results of a similar heterogeneity analysis but one focusing on the impact of parents' characteristics. The estimates suggest that increases in learning are driven chiefly by less-educated parents; the impact is close to zero for parents with higher education. This set of results is consistent with the idea that remote coaching is providing support to parents less inclined to provide educational inputs at home. We also find that older parents (above 35 years, the median age in the sample) tend to engage in more educational activities over the summer and are more engaged in the program than younger parents, but this differential provision of inputs does not translate into differences in learning gains.

6 Conclusion and policy implications

Over the past two years, we have witnessed prolonged school closures in developing countries, where public resources to address the pandemic have been scant. Several recent studies have shown that school closures led to sizeable learning losses, especially among students from more vulnerable households. With these constraints in mind, it is fair to ask about policy options that can attenuate such losses during school closures.

We examined the effects of a randomized intervention in which parents of preschoolers were guided by remote coaches through math-related activities such as counting and comparing objects of different sizes. During the summer break, remote coaches made weekly calls and sent text messages to parents, encouraging them to interact with their children. The program was designed to accelerate the development of foundational mathematics skills among children entering first grade. This educational experiment was conducted in San Martin, a northern region of Peru, between January and March 2021. It was designed by Peru's MINEDU, Innovations for Poverty Action, and the Inter-American Development Bank.

Our results show that access to remote coaching improved mathematics learning among preschoolers. The magnitude of the effect (0.12 standard deviations) is consistent with contemporary studies conducted in other settings with students in primary school. Moreover, we find that access to remote coaching led to higher parental involvement in mathematics learning. This evidence suggests that coaches induced parents to allocate more time to child development activities.

These findings have several policy implications. First, it is both feasible and affordable to improve child learning by offering remote support to parents via phone calls or text messages as a complement to interactive radio instructions. Second, parental investments (or inputs) should be encouraged, especially in times of school disruptions. Third, inexpensive technological resources such as text messages or phone calls to maximize the number of households reached by mitigation programs.

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Table 1: Demographic and educational indicators from San Martin

Indicator	San Martin	Peru
Population (in thousands)	813.4	29,382
Fertility rate	2.4	2.2
Poverty rate	25%	20%
Employment rate	94%	95%
% of labor force in agriculture	31%	25%
% of population living in rural areas	32%	21%
% of households with access to electricity	70%	67%
% of households with radio	20%	32%
% of households with TV	51%	56%
% households with mobile phone	66%	65%
Number of primary schools	1,376	38,605
Number of school districts	10	246
Student population (in thousands)	28.2	904
Enrollment rate in primary school	93.40%	93.80%
Enrollment rate in pre-school	74%	84%

Source: INEI (2017), MINEDU (2019). Own elaboration.

Table 2: Balance on covariates

	Control		Treatment			
	Mean	**N**	**Mean**	**N**	**Difference**	**P-value**
I. Household characteristics						
Province = Lamas	0.383	532	0.362	533	0.021	0.47156
Province = San Martin	0.617	532	0.638	533	-0.021	0.47156
Wealth score (1st)	0.200	526	0.203	528	-0.003	0.90240
Wealth score (2nd)	0.184	526	0.212	528	-0.028	0.25967
Wealth score (3rd)	0.209	526	0.193	528	0.016	0.51896
Wealth score (4th)	0.209	526	0.188	528	0.022	0.37911
Wealth score (5th)	0.198	526	0.205	528	-0.007	0.78245
Num. of children below 18 years old	2.062	531	2.028	533	0.034	0.58239
Num. of children between 4-6 years old	1.079	532	1.103	533	-0.024	0.18839
II. Caregiver characteristics						
Age	32.923	531	32.949	533	-0.027	0.95689
Gender (= female)	0.897	532	0.884	533	0.013	0.50003
Rel. child = Father	0.098	532	0.114	533	-0.017	0.37667
Rel. child = Mother	0.836	532	0.826	533	0.011	0.63391
Rel. child = Grandparent	0.032	532	0.032	533	0.000	0.99557
Rel. child = Uncle/Aunt	0.008	532	0.015	533	-0.007	0.24727
Educ. = Preschool	0.030	532	0.021	533	0.009	0.32773
Educ. = Primary	0.254	532	0.253	533	0.000	0.98577
Educ. = Secondary	0.344	532	0.349	533	-0.005	0.86448
Educ. = Technical	0.180	532	0.186	533	-0.005	0.82359
Educ. = University	0.124	532	0.126	533	-0.002	0.93543
III. Child characteristics						
Sex child (= female)	0.483	532	0.478	533	0.005	0.87921
Age child	5.011	532	5.013	533	-0.002	0.96852

Table 3: Descriptive statistics

	Control					Treatment				
	N	Mean	SD	Min.	Max.	N	Mean	SD	Min.	Max.
I. Learning outcomes										
Spatial ability	291	0.876	0.266	0	1	297	0.872	0.267	0	1
Oral counting	291	0.735	0.442	0	1	297	0.667	0.472	0	1
Comparing quantity	291	0.566	0.309	0	1	297	0.556	0.291	0	1
Addition and subtraction word problems	291	0.778	0.266	0	1	297	0.787	0.263	0	1
Math	291	0.724	0.189	0.16	1	297	0.707	0.187	0.04	1
Oral comprehension	291	0.655	0.264	0	1	295	0.642	0.235	0	1
General	291	0.704	0.189	0.15	1	297	0.694	0.182	0.05	1
II. Educational activities during summer										
Education (any day)	342	0.757	0.429	0	1	348	0.897	0.305	0	1
Education (# days)	259	3.413	1.617	1	7	312	4.006	1.511	1	7
Education (math games)	259	0.533	0.500	0	1	312	0.782	0.414	0	1
Tutoring (any day)	340	0.565	0.497	0	1	349	0.662	0.474	0	1
Tutoring (# days)	192	3.568	1.499	1	7	231	3.944	1.466	1	7
Tutoring (math)	190	0.563	0.497	0	1	226	0.699	0.460	0	1
III. Program engagement										
Know about MateWasi	341	0.352	0.478	0	1	349	0.908	0.289	0	1
Follow MateWasi	338	0.266	0.443	0	1	349	0.908	0.289	0	1
Received calls	0	0	0	0	0	343	0.950	0.217	0	1
Received materials	0	0	0	0	0	346	0.907	0.290	0	1
Received texts	0	0	0	0	0	344	0.872	0.334	0	1
IV. Family care indicators										
Count objects	341	0.801	0.400	0	1	348	0.888	0.316	0	1
Compare things	341	0.674	0.469	0	1	347	0.795	0.404	0	1
Addition and subtraction	342	0.696	0.461	0	1	347	0.793	0.406	0	1
Read	342	0.886	0.318	0	1	348	0.882	0.323	0	1
Tell stories	341	0.739	0.440	0	1	348	0.739	0.440	0	1
Sing songs	342	0.731	0.444	0	1	347	0.761	0.427	0	1

Note: Panel I reports baseline values only, Panels II–IV report endling values. Learning outcomes are based on Näslund-Hadley et al. (2018). The spatial ability outcome has two items aggregated as the percentage of correct answers. The oral counting outcome has one item and refers to the percentage of correct answers. The comparing quantity outcome has four items aggregated as the percentage of correct answers. The addition and subtraction word problems outcome has four items aggregated as the percentage of correct answers. The math learning outcome is the average of the four previous outcomes mentioned. The oral comprehension outcome has five items aggregated as the percentage of correct answers. The general learning outcome is the average of the math and oral comprehension scores.

Table 4: Attrition analysis

	Attrition (1)	Attrition (2)	Attrition (3)	Attrition (4)
MateWasi	-0.012	-0.010	-0.012	-0.014
	(0.029)	(0.029)	(0.029)	(0.030)
Province (= San Martin)				0.065*
				(0.034)
Wealth score (2nd)				-0.022
				(0.049)
Wealth score (3rd)				-0.100
				(0.078)
Wealth score (4th)				-0.087
				(0.099)
Wealth score (5th)				-0.108
				(0.118)
Caregiver age				-0.004*
				(0.002)
Caregiver sex (= female)				0.071
				(0.130)
Child sex (= female)				-0.151
				(0.293)
Child age				0.149
				(0.222)
Mean dep. var.	0.351	0.352	0.352	0.351
Observations	1,065	1,063	1,063	1,051
R-squared	0.000	0.045	0.048	0.068
Strata FE	No	Yes	Yes	Yes
Province FE	No	No	Yes	No

Note: Dependent variable = 1 if only baseline. Robust standard errors in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 5: Child learning outcomes

	Math (1)	Math (2)	Math (3)	Oral comp. (4)	Oral comp. (5)	Oral comp. (6)
MateWasi	0.126**	0.115*	0.123**	0.142*	0.128*	0.126*
	(0.061)	(0.060)	(0.061)	(0.073)	(0.073)	(0.074)
Observations	530	528	521	527	525	518
R-squared	0.223	0.361	0.397	0.141	0.277	0.306
Strata FE	No	Yes	Yes	No	Yes	Yes
Province FE	No	No	Yes	No	No	Yes
Controls	No	No	Yes	No	No	Yes

Note: Outcome values are standardized with respect to the mean and standard deviation of the control group at the baseline. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 6: Summer educational activities

	Math (any day) (1)	Math (any day) (2)	Math (any day) (3)	Math (# days) (4)	Math (# days) (5)	Math (# days) (6)	Math games (7)	Math games (8)	Math games (9)
MateWasi	0.139***	0.136***	0.130***	0.593***	0.648***	0.628***	0.249***	0.251***	0.243***
	(0.028)	(0.028)	(0.028)	(0.132)	(0.138)	(0.140)	(0.039)	(0.040)	(0.041)
Mean dep. var.	0.757	0.760	0.760	3.413	3.413	3.412	0.533	0.533	0.533
Observations	690	688	681	571	570	564	571	570	564
R-squared	0.034	0.137	0.161	0.035	0.136	0.153	0.070	0.153	0.171
Strata FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Province FE	No	No	Yes	No	No	Yes	No	No	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 7: Extra-educational activities during summer

	Tutoring (any day)	Tutoring (any day)	Tutoring (any day)	Tutoring (# days)	Tutoring (# days)	Tutoring (# days)	Tutoring (math)	Tutoring (math)	Tutoring (math)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MateWasi	0.097***	0.091**	0.097**	0.376***	0.498***	0.517***	0.136***	0.121**	0.113**
	(0.037)	(0.037)	(0.038)	(0.145)	(0.150)	(0.157)	(0.047)	(0.048)	(0.049)
Mean dep. var.	0.565	0.566	0.563	3.568	3.568	3.561	0.563	0.563	0.561
Observations	689	687	680	423	423	417	416	416	410
R-squared	0.010	0.102	0.127	0.016	0.144	0.187	0.020	0.225	0.256
Strata FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Province FE	No	No	Yes	No	No	Yes	No	No	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 8: Program engagement

	Know about	Know about	Know about	Follow	Follow	Follow
	(1)	(2)	(3)	(4)	(5)	(6)
MateWasi	0.556***	0.556***	0.556***	0.642***	0.642***	0.644***
	(0.030)	(0.031)	(0.031)	(0.029)	(0.029)	(0.030)
Mean dep. var.	0.352	0.353	0.353	0.266	0.267	0.266
Observations	690	688	681	687	685	678
R-squared	0.333	0.385	0.402	0.427	0.479	0.488
Strata FE	No	Yes	Yes	No	Yes	Yes
Province FE	No	No	Yes	No	No	Yes
Controls	No	No	Yes	No	No	Yes

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 9: Program compliance

	Know about	Know about	Know about	Know about	Follow	Follow	Follow	Follow
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Calls	0.577***				0.685***			
	(0.030)				(0.028)			
Materials		0.568***				0.672***		
		(0.030)				(0.028)		
Texts			0.537***				0.646***	
			(0.031)				(0.029)	
Any treatment				0.584***				0.682***
				(0.030)				(0.028)
Mean dep. var.	0.353	0.353	0.353	0.353	0.266	0.266	0.266	0.266
Observations	675	678	676	678	672	675	673	675
R-squared	0.426	0.410	0.378	0.435	0.536	0.516	0.486	0.536
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table 10: Family care indicators

	Panel A: Mathematics activities								
	Count objects			Compare things			Addition and subtraction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MateWasi	0.086***	0.094***	0.099***	0.123***	0.135***	0.140***	0.094***	0.110***	0.103***
	(0.027)	(0.028)	(0.029)	(0.033)	(0.034)	(0.035)	(0.032)	(0.032)	(0.033)
Mean dep. var.	0.803	0.803	0.801	0.675	0.675	0.672	0.698	0.698	0.695
Observations	687	687	680	682	682	675	687	687	680
R-squared	0.032	0.097	0.132	0.039	0.119	0.137	0.064	0.153	0.182
	Panel B: Communication activities								
	Read books			**Tell stories**			**Sing songs**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
MateWasi	-0.003	0.000	-0.011	-0.004	-0.001	-0.007	0.026	0.026	0.018
	(0.024)	(0.025)	(0.025)	(0.033)	(0.033)	(0.034)	(0.032)	(0.032)	(0.034)
Mean dep. var.	0.886	0.886	0.885	0.741	0.741	0.739	0.729	0.729	0.730
Observations	688	687	680	686	686	679	686	686	679
R-squared	0.018	0.085	0.128	0.058	0.136	0.142	0.059	0.141	0.156
Strata FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Province FE	No	No	Yes	No	No	Yes	No	No	Yes
Controls	No	No	Yes	No	No	Yes	No	No	Yes

Note: Outcome values are not standardized. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Reported values for the mean of the dependent variable correspond to the control group at the baseline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Figure 1: Program study areas

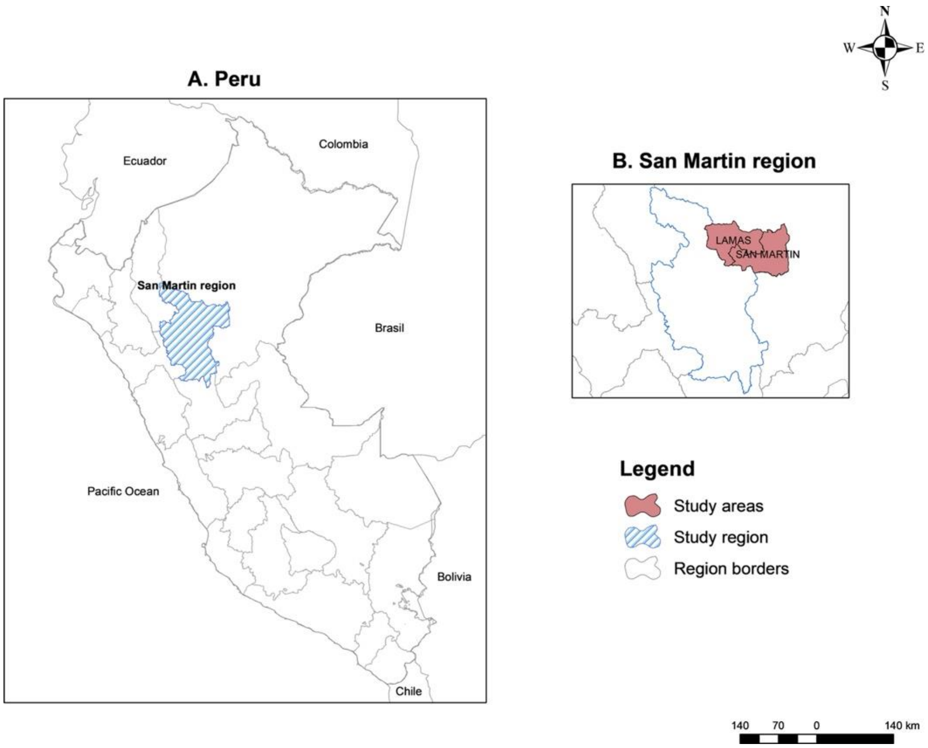
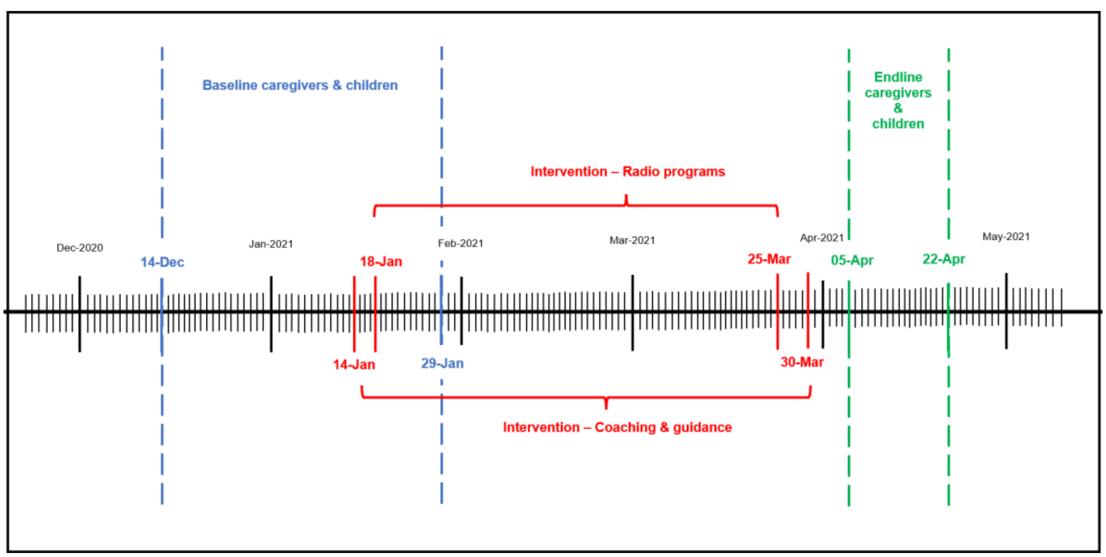


Figure 2: Program timeline



Appendix

Table A.1: Balance on covariates (sample without attrition)

	Control		Treatment			
	Mean	**N**	**Mean**	**N**	**Difference**	**P-value**
I. Household characteristics						
Province = Lamas	0.404	342	0.398	349	0.005	0.88870
Province = San Martin	0.596	342	0.602	349	-0.005	0.88870
Wealth score (1st)	0.201	339	0.212	345	-0.011	0.72254
Wealth score (2nd)	0.189	339	0.229	345	-0.040	0.19672
Wealth score (3rd)	0.227	339	0.194	345	0.033	0.29147
Wealth score (4th)	0.195	339	0.183	345	0.012	0.68685
Wealth score (5th)	0.189	339	0.183	345	0.006	0.83561
Num. of children below 18 years old	2.105	342	2.017	349	0.088	0.26511
Num. of children between 4-6 years old	1.058	342	1.106	349	-0.048	0.02862
II. Caregiver characteristics						
Age	33.339	342	33.146	349	0.193	0.74992
Gender (= female)	0.918	342	0.880	349	0.038	0.09404
Rel. child = Father	0.076	342	0.117	349	-0.041	0.06574
Rel. child = Mother	0.863	342	0.834	349	0.029	0.29300
Rel. child = Grandparent	0.038	342	0.029	349	0.009	0.49363
Rel. child = Uncle/Aunt	0.003	342	0.009	349	-0.006	0.32649
Educ. = Preschool	0.038	342	0.026	349	0.012	0.36089
Educ. = Primary	0.257	342	0.266	349	-0.009	0.78448
Educ. = Secondary	0.336	342	0.315	349	0.021	0.55521
Educ. = Technical	0.184	342	0.198	349	-0.013	0.65238
Educ. = University	0.108	342	0.132	349	-0.024	0.34039
III. Child characteristics						
Sex child (= female)	0.503	342	0.470	349	0.033	0.38612
Age child	5.032	342	4.994	349	0.038	0.51804

Table A.2: Heterogeneity by child's sex and child learning outcomes

	Math	Oral comp.
	(1)	(2)
MateWasi	0.172*	0.129
	(0.089)	(0.110)
MateWasi x Girls	-0.111	-0.004
	(0.121)	(0.148)
Observations	528	525
R-squared	0.364	0.281
Diff. coeff. (p-value)	0.151	0.584
Strata FE	Yes	Yes
Province FE	No	No
Controls	No	No

Note: Outcome values are standardized with respect to the mean and standard deviation of the control group at the baseline. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.3: Heterogeneity by child's sex and summer educational activities

	Math (any day)	**Math (# day)**	**Math games**	**Tutoring (any day)**	**Tutoring (# day)**	**Tutoring (math)**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
MateWasi	0.210***	0.624***	0.304***	0.150***	0.618***	0.221***
	(0.042)	(0.207)	(0.057)	(0.052)	(0.223)	(0.065)
MateWasi × *Girls*	-0.152***	0.051	-0.103	-0.120	-0.235	-0.215**
	(0.056)	(0.277)	(0.079)	(0.075)	(0.299)	(0.096)
Mean dep. var.	0.760	3.413	0.533	0.566	3.568	0.563
Observations	688	570	570	687	423	416
R-squared	0.146	0.137	0.156	0.107	0.148	0.236
Diff. coeff. (p-value)	0.000	0.206	0.001	0.021	0.081	0.003
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	No	No	No	No	No	No
Controls	No	No	No	No	No	No

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.4: Heterogeneity by child's sex and engagement in program

	Know about	Follow
	(1)	**(2)**
MateWasi	0.574***	0.616***
	(0.043)	(0.043)
MateWasi × *Girls*	-0.037	0.051
	(0.061)	(0.058)
Mean dep. var.	0.353	0.267
Observations	688	685
R-squared	0.385	0.480
Diff. coeff. (p-value)	0.000	0.000
Strata FE	Yes	Yes
Province FE	No	No
Controls	No	No

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.5: Heterogeneity by child's sex and family care indicators

	Count objects	Compare things	Addition and subtraction	Read books	Tell stories	Sing songs
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
MateWasi	0.069*	0.160***	0.121***	0.005	0.044	0.022
	(0.039)	(0.047)	(0.047)	(0.036)	(0.045)	(0.046)
MateWasi × *Girls*	0.048	-0.050	-0.021	-0.009	-0.092	0.005
	(0.056)	(0.067)	(0.065)	(0.050)	(0.066)	(0.065)
Mean dep. var.	0.803	0.675	0.698	0.886	0.741	0.729
Observations	687	682	687	687	686	686
R-squared	0.100	0.120	0.156	0.085	0.139	0.143
Diff. coeff. (p-value)	0.804	0.047	0.175	0.861	0.185	0.868
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	No	No	No	No	No	No
Controls	No	No	No	No	No	No

Note: Outcome values are not standardized. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Reported values for the mean of the dependent variable correspond to the control group at the baseline. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.6: Heterogeneity by parent characteristics and child learning outcomes

	Math (1)	Oral comp. (2)
Panel A: Age		
MateWasi	0.121	0.085
	(0.080)	(0.104)
MateWasi × *Young*	-0.012	0.085
	(0.122)	(0.146)
R-squared	0.361	0.278
Diff. coeff. (p-value)	0.473	1.000
Panel B: Education		
MateWasi	0.184**	0.199**
	(0.076)	(0.091)
MateWasi × *Higher Education*	-0.223*	-0.223
	(0.122)	(0.158)
R-squared	0.368	0.288
Diff. coeff. (p-value)	0.025	0.0.062
Mean dep. var.	0.239	0.274
Observations	528	525
Strata FE	Yes	Yes
Province FE	No	No
Controls	No	No

Note: Outcome values are standardized with respect to the mean and standard deviation of the control group at the baseline. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Young is a variable equal to 1 if the caregiver is under 32 years old (median value). Higher Education is a variable equal to 1 if the caregiver has technical/university education. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.7: Heterogeneity by parent characteristics and summer educational activities

	Math (any day)	Math (# day)	Math games	Tutoring (any day)	Tutoring (# day)	Tutoring (math)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Age						
MateWasi	0.127***	0.664***	0.221***	0.156***	0.436**	0.092
	(0.042)	(0.191)	(0.058)	(0.054)	(0.212)	(0.069)
MateWasi × *Young*	0.016	-0.034	0.057	-0.126	0.133	0.056
	(0.058)	(0.278)	(0.081)	(0.076)	(0.311)	(0.094)
R-squared	0.137	0.139	0.154	0.107	0.153	0.226
Diff. coeff. (p-value)	0.232	0.108	0.208	0.021	0.533	0.811
Panel B: Education						
MateWasi	0.134***	0.588***	0.237***	0.130***	0.534***	0.163***
	(0.035)	(0.172)	(0.049)	(0.044)	(0.182)	(0.055)
MateWasi × *Higher Education*	0.004	0.289	0.041	-0.132	-0.154	-0.143
	(0.060)	(0.272)	(0.084)	(0.082)	(0.320)	(0.106)
R-squared	0.138	0.138	0.158	0.107	0.151	0.232
Diff. coeff. (p-value)	0.131	0.503	0.102	0.020	0.125	0.031
Mean dep. var.	0.760	3.413	0.533	0.566	3.568	0.563
Observations	688	570	570	687	423	416
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	No	No	No	No	No	No
Controls	No	No	No	No	No	No

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Young is a variable equal to 1 if the caregiver is under 35 years old (median value). Higher Education is a variable equal to 1 if the caregiver has technical/university education. Robust standard errors are in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.8: Heterogeneity by parent characteristics and engagement in program

	Know about (1)	Follow (2)
Panel A: Age		
MateWasi	0.561*** (0.044)	0.687*** (0.040)
MateWasi × *Young*	-0.009	0.088
	(0.062)	(0.059)
R-squared	0.385	0.481
Diff. coeff. (p-value)	0.000	0.000
Panel B: Education		
MateWasi	0.540*** (0.038)	0.580*** (0.036)
MateWasi × *Higher Education*	0.051	0.208***
	(0.065)	(0.056)
R-squared	0.389	0.488
Diff. coeff. (p-value)	0.000	0.000
Mean dep. var.	0.353	0.267
Observations	688	685
Strata FE	Yes	Yes
Province FE	No	No
Controls	No	No

Note: Outcome values are not standardized. Reported values for the mean of the dependent variable correspond to the control group at the endline. Young is a variable equal to 1 if the caregiver is under 35 years old (median value). Higher Education is a variable equal to 1 if the caregiver has technical/university education. Robust standard errors in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Table A.9: Heterogeneity by parent characteristics and family care indicators

	Count objects	Compare things	Sum & subtraction	Read books	Tell stories	Sing Songs
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Age						
MateWasi	0.107***	0.214***	0.209***	-0.012	0.021	0.032
	(0.040)	(0.049)	(0.046)	(0.034)	(0.048)	(0.047)
MateWasi × *Young*	-0.026	-0.154**	-0.193***	0.025	-0.042	-0.012
	(0.056)	(0.068)	(0.065)	(0.049)	(0.067)	(0.067)
R-squared	0.099	0.127	0.166	0.086	0.136	0.141
Diff. coeff. (p-value)	0.137	0.001	0.000	0.626	0.556	0.677
Panel B: Education						
MateWasi	0.090***	0.129***	0.111***	-0.015	0.010	-0.012
	(0.034)	(0.040)	(0.040)	(0.032)	(0.041)	(0.039)
MateWasi × *Higher Education*	0.008	0.020	-0.007	0.049	-0.037	0.127*
	(0.059)	(0.072)	(0.068)	(0.051)	(0.071)	(0.070)
R-squared	0.103	0.121	0.156	0.090	0.137	0.146
Diff. coeff. (p-value)	0.324	0.275	0.226	0.397	0.644	0.160
Mean dep. var.	0.803	0.675	0.698	0.886	0.741	0.729
Observations	687	682	687	687	686	686
Strata FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	No	No	No	No	No	No
Controls	No	No	No	No	No	No

Note: Outcome values are not standardized. These estimates come from ANCOVA regressions, where we control for the baseline value of the dependent variable. Reported values for the mean of the dependent variable correspond to the control group at the baseline. Young is a variable equal to 1 if the caregiver is under 35 years old (median value). Higher Education is a variable equal to 1 if the caregiver has technical/university education. Robust standard errors in parentheses. Asterisks denote statistical significance at the 1(***), 5(**) or 10(*) percent level. FE: Fixed Effects.

Figure A.1: MateWasi material example: Card 5

Figure A.2: MateWasi material example: Calendar