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Supporting early childhood development remotely: Experimental evidence from SMS messages☆

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ABSTRACT

Using a randomized field experiment in Costa Rica, we estimate the effect of providing parents of preschool students with regular text messages offering ways to engage their children in educational activities at home. After 15 weeks of intervention, the cognitive skills of children whose families were assigned to the program were 0.11–0.12 standard deviations higher than the control group. We find suggestive evidence that the effect was driven by an increase in parents' involvement as they conducted the activities proposed in the text message campaign.

1. Introduction

Early childhood is a critical life period for the development of abilities and skills decisive for future outcomes (Heckman, 2006). Research documents large benefits to individuals and society from educational investments during early childhood, especially for children living in disadvantaged conditions (Elango et al., 2015). In emergency contexts, families face exceptional constraints in providing sufficient stimulation to children during these early years (Bouchane et al., 2019). The COVID-19 pandemic forced educators worldwide to shift from classroom-based instruction to entirely remote learning strategies, by which students were asked to access educational tools at home. This situation brought on enormous challenges for educational systems, particularly in developing countries, where Internet connectivity and household resources are often limited. Educating preschool students remotely poses an additional challenge, as they require active support from their parents to access and use distance education resources. Preschool students in low-income households are particularly affected by school closures; low-income parents may have limited resources and skills and thus be particularly vulnerable to significant economic and psychological impacts during emergencies.

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This paper evaluates a text message intervention, designed as part of a remote learning strategy implemented by the Government of Costa Rica during COVID-19 lockdown. We conduct a two-level experiment to estimate the direct and spillover effects of the intervention on children's early cognitive outcomes. The program targeted parents of four- and five-year-old preschool students from public schools across the country. The text messages were designed to increase parents' engagement in their children's education by providing information on simple learning activities. In addition, the program sought to encourage a conducive environment for learning at home by addressing various dimensions of parenting, such as parenting style, time management, and healthy habits.

A distinctive feature of this intervention was its implementation in a setting where traditional in-person instruction was disrupted, as government lockdowns during the pandemic forced school closures in Costa Rica (Näslund-Hadley et al., 2020). Most communication between the education providers and parents was conducted through phone calls and text messages when schools closed. Many teachers set up WhatsApp groups for their classes, through which they shared information and resources with parents. The virtual environment provided an opportunity for parents to use new channels of communication to share information about their children's education and interact with one another around relevant issues. We designed our randomized experiment to capture the intervention's spillover effects within groups of parents that shared a preschool teacher (parental networks). This allowed us to examine the dynamics of parental behavior and children's cognitive development within such networks, in addition to evaluating the direct impacts of the intervention.

The experimental sample includes 691 parental networks and 4496 children. First, we randomly assigned networks to either treatment or pure control; and then randomly assigned half of the children in each treatment network to either the treated units that received the text messaging intervention (direct effect group) or the untreated units that did not receive it (spillover group). Through comparing the outcomes across these experimental groups of children – treated, untreated, and pure control – we estimated the direct effect of the text message campaign as well as the spillover effects within the networks.

As school closures limited face-to-face assessments of children's cognitive outcomes, we developed an innovative remote learning assessment by adapting the Early Grade Mathematical Assessment (EGMA) and the Measuring Early Learning Quality and Outcomes (MELQO) test. The assessment was administered over the phone, to overcome potential Internet connectivity issues. Since outcomes were measured about a week after the text messaging program ended, the effects are interpreted as short term. We also collected baseline and follow-up data on parents and household characteristics through online surveys, to measure changes in parental investments and home environments.

We find that the text message program had positive effects. The cognitive skills of students whose parents were assigned to the group that received the text messages were 0.11–0.12 standard deviations (SD) higher than the control group. The effect corresponded mainly to an improvement in early numeracy skills. The impacts are substantial, considering that the intervention lasted just 15 weeks. Consistent with the effects on students' cognitive skills, we find suggestive evidence of greater parental involvement, specifically in the activities proposed through the text message campaign. These results are in line with existing evidence that inexpensive behavioral interventions can empower parents to improve children's outcomes (Bergman, 2019). There is no strong evidence of changes in cognitive skills among students whose parents were part of treatment networks but did not receive the text messages. The absence of spillover effects is robust in most specifications.

Our paper contributes to the literature on educational text messaging interventions (Bergman and Chan, 2021; Berlinski et al., 2022), particularly the studies that focus on promoting learning during school disruptions (Angrist et al., 2023, 2022). It also contributes to studies on parental engagement in early childhood (Hurwitz et al., 2015; Doss et al., 2019; Mayer et al., 2019; York et al., 2019; Barrera et al., 2020; Cortes et al., 2021) and the growing literature that uses phone-based assessments as a tool for measuring student learning (Angrist et al., 2022, 2020; Crawfurd et al., 2021; Rodriguez-Segura and Schueler, 2022). We show that text message interventions can be effective when preschool students are learning remotely at home during school closures, which is consistent with the existing evidence that such interventions are particularly effective when they complement ongoing instruction (Angrist et al., 2022). Our findings have important implications for the provision of early childhood education in emergencies and conflict settings. Text message interventions offer a cost-effective educational tool during school disruptions or when high-technology solutions are less scalable due to limited access to the Internet or digital devices.

2. Intervention

2.1. Institutional background

Costa Rica has expanded access to quality preschool education in recent years, as seen in sharp increases in the participation of four-year olds (from 7 percent to 63 percent) and five-year-olds (from 83 percent to 90 percent) between 2000 and 2015 (OECD, 2017).

In the face of the COVID-19 pandemic, Costa Rica was one of the first Latin American countries to adopt preventive measures, closing its schools on March 12, 2020. The Ministry of Public Education (MEP) then launched the national remote learning program *Aprendo en Casa (AeC)* to continue with the school year, which, as per most school calendars in Latin America, had just begun. The program combined printed materials and technology-based solutions to address heterogeneous household access to telecommunications, aiming to reach a majority of students. Educational content was uploaded onto the MEP's website and adapted for broadcast on television and radio.

Teachers were instructed to communicate with students' families and provide additional material and guidance, typically through phone calls, and WhatsApp groups where Internet was available. According to our baseline data, 98 percent of teachers established a communication channel with families and students, 68 percent were able to communicate with all the families in their class, and an additional 25 percent were able to communicate with more than half of the families in the class. The main purpose of this communication was to supervise the parents' and students' progress with the study materials, to solve questions, and to guide parents through their children's learning process. Teachers reported that most parents had initiated communication with them and were following the guidance they had received.

Though the MEP was quick to provide an alternative to school-based education, the strategy faced several challenges. Preschool students needed the help of adults to access educational materials and guide them through the learning process, but few parents had the training or experience to do so. The MEP provided weekly support: 84 percent of parents reported that MEP staff had reached out to them to discuss AeC and to motivate them to support their children's learning. Such contact was mainly through WhatsApp messages, video calls, and phone calls. Parents found that supporting their children's formal education at home was challenging, with 56 percent reporting that they needed more support from other family members. Their main requests were for more learning activities that could be conducted at home and directions on how to implement them. Meanwhile, the pandemic had severe effects on the home environment and parents' mental health. Our survey data showed that 49 percent of parents presented at least one symptom of frequent stress. These dimensions were, however, out of the programmatic scope of the region's ministries of education, though many of them did acknowledge the need to include components addressing students' home environments in their remote education programs (Näslund-Hadley et al., 2020).

2.2. Text message program

Together with specialists at the MEP, we designed a text message program to support the educational process at home during the pandemic. The campaign was implemented over 15 weeks (August 24–November 30, 2020) and focused on parents of four- and five-year-old children enrolled in public preschools. The messages from the intervention are listed in Appendix C.

Parents in the treatment group received a series of 3–4 weekly messages—up to a total of 54 messages. Text messages were prescheduled to be sent at certain times (between 3 and 5 pm) on particular days of the week using a bulk messaging platform.[2] They aimed to increase child learning by providing parents with simple numeracy and literacy activities[3] that were based on the MEP's preschool curriculum and designed to be implemented at home with no additional support materials. Additionally, a weekly motivational message prompted parents to carry out these the activities.[4] The campaign also provided advice on positive parenting, time management, and healthy habits to help parents create a home environment conducive for learning.[5]

Parents in the spillover and control groups received a shorter information campaign with eight simple messages reminding them of the channels for accessing AeC. All three groups received regular virtual services from AeC.

3. Experimental design

We worked with the preschool education unit of the MEP to gain access to teachers and recruit parents from their classes. We define a network as a group of parents that share the same preschool teacher. During the pandemic, teachers used different means to communicate with parents and coordinate the implementation of the remote education strategy. One of the most common channels was WhatsApp, which enabled teachers to interact with parents in groups using a variety of formats, including text, audio, images, and videos. We asked teachers to share a link with parents that contained a short introduction to the project and an online survey. The survey invited parents of preschool children to join the study and collected baseline information. Our experimental design required networks in which at least two parents consented to participate.

We used a two-level randomized experiment to quantify the direct and spillover short-term effects of the text message campaign. First, we conducted a group-level randomization at the network level to divide the sample into pure control networks and treatment networks. We stratified by the province where the child center was located, network size, and level of parent-initiated communication with the teacher within the network. We used an indicator of large-sized networks constructed as whether the number of parents within the network was higher than the median. Fig. A.1 shows the distribution of network size. For the level of parent-initiated communication, we used an indicator of high-initiative networks constructed as whether all or almost all parents in a network had communicated with the teacher. Since there were 7 provinces, we had a total of 28 strata.

Second, we conducted an individual-level randomization within treatment networks so half the children received the text message intervention and the other half did not. This experimental design allows us to estimate spillover effects, that is, the difference in outcomes between the untreated children in treatment networks (spillover group) and children in pure control networks. We estimate direct effects as the difference in outcomes between treated children in treatment networks (direct effect group) and children in pure control networks.[6]

As shown in Fig. 1, our baseline sample consists of 4496 children. Of the 691 networks in the study, 338 networks were randomly assigned to the pure control group and 353 networks to the treatment group. Within the treatment group, 1072 children were randomly assigned to receive the text message intervention (direct effect group), and 1250 to not receive it (spillover group).[7]

4. Data

For our main analysis, we rely on two sources of information: (i) online surveys administered to teachers and parents at baseline to recruit participants and capture pretreatment characteristics; and (ii) a phone-based learning assessment to measure children's cognitive skills, including early numeracy and literacy skills. The endline child learning assessment was conducted in December after the text message program was complete. See Fig. 2 for a timeline of the project.

(i) Parent and teacher baseline survey. We collected baseline information on teachers and parents by leveraging existing communication channels between the MEP, preschool teachers, and students' parents. Teachers shared an online survey with parents to get their consent to join the study and collect information on pretreatment characteristics, such as household demographics, socioeconomic information, baseline information on the home learning environment and access to play materials, disciplinary practices, and the stress levels of children and parents. See Appendix B.1 for more information about the variables collected.

(ii) Child learning assessment. Our main outcomes of interest are children's cognitive skills. During the implementation of this assessment, Costa Rica was under a strict lockdown that prevented face-to-face data collection. Therefore, the EGMA and the MELQO tests were adapted to develop a learning assessment that could be administered over the phone to overcome Internet connectivity issues. The assessment consisted of multiple numeracy questions on spatial reasoning, oral counting, comparisons, addition, subtraction, and sequences. It also measured a set of early literacy skills, including syllabication, oral comprehension, and expressive vocabulary. We compute a composite score of children's cognitive skills as well as a numeracy score and literacy score. Each score was standardized so that the pure control group had a mean of zero and a SD of one. We incorporated a series of procedures to increase the reliability of the measures collected. The test was administered by enumerators who scheduled a convenient time with the parents to test their child. Parents were provided with support

[2] To develop these messages we followed previous research by Cortes et al. (2021), who show that a three-text-per-week model is associated with greater parental satisfaction and engagement than a one-or five-text-per-week model. We also followed (York et al., 2019), who show that a combination of easy-to-follow information, specific activities, and encouragement was well received by parents and was effective for children.

[3] Numeracy skills included oral counting, number comparisons, addition, subtraction, and sequences. Literacy skills included oral comprehension, expressive vocabulary, and syllabification.

[4] The messages used behavioral tools to address common parent biases regarding early education. They included information on the returns to early childhood development and helped address inaccurate beliefs about the importance of early-age learning. Other messages included positive affirmations of parents' ability to support their children's learning at home. Some of these messages were combined with a loss aversion framing and positive reinforcement.

[5] These messages included tips for planning weekly activities with the children, managing stress, and having effective parent–child interactions. In addition, they recommended physical activity, breathing exercises, singing, playing, and avoiding long hours in front of screens.

[6] For further details on partial population designs, see Moffit (2001), Duflo and Saez (2003), Baird et al. (2018), Vazquez-Bare (2023) and Cruces et al. (2023).

[7] Our power calculations indicate that with this sample size, assuming an intra-cluster correlation of 0.1, a probability of error type I of 0.05, and a power of 0.8, the minimum detectable effect is 0.12 for the child's standardized cognitive score.

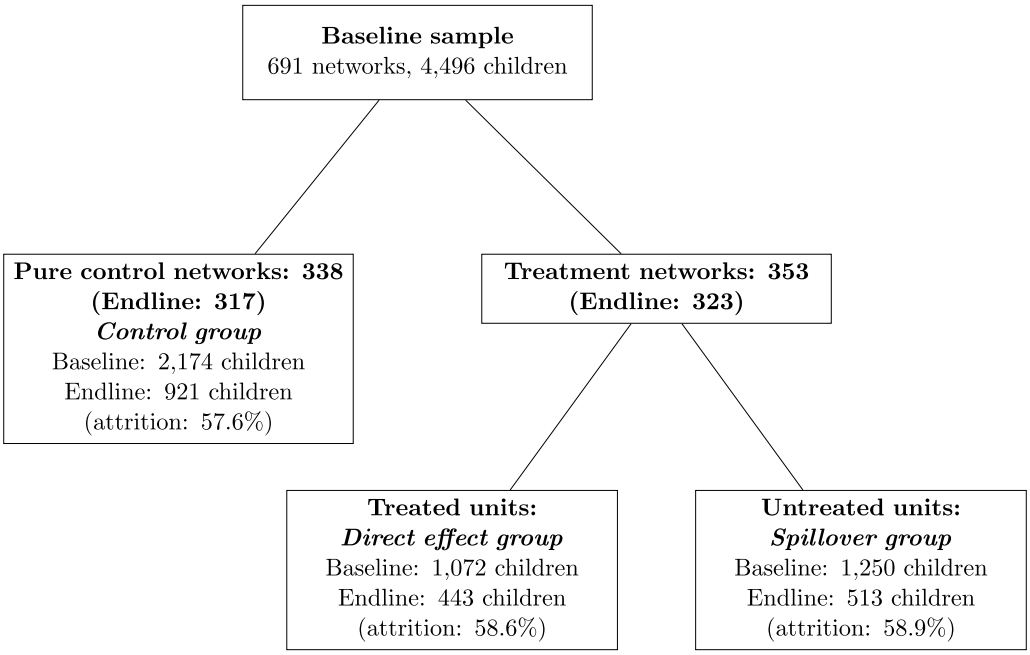


Fig. 1. Experimental design. **Note**: This figure shows the two-level experimental design. The randomization at the network level was stratified by province where the child center is located, network size, and the level of parent-initiated communication with the teacher within the network. There are 28 strata. We define a network as a group of parents who share the same preschool teacher.

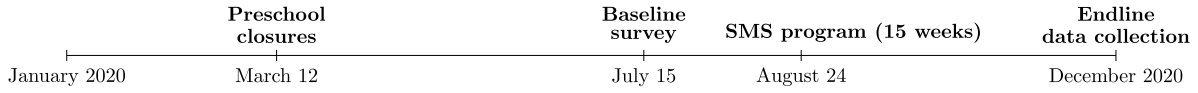


Fig. 2. Timeline of the project. **Note**: The text message campaign was implemented over a period of 15 weeks (August 24 to November 30, 2020). Baseline data were collected through an online household survey. Endline data were collected through a phone survey targeted at children.

to set up the phone call in speaker mode and to prepare a space where their child could take the test without distractions. Parents were told that the test was low stakes, in order to minimize their interference, and they were instructed not to help the child during the test or interrupt the call.

In terms of validity, the Cronbach's alpha coefficient across the 29-item scale is 0.8217, suggesting that items have a high internal consistency to measure cognitive ability. In Appendix B.2 we describe this assessment in detail using Item Response Theory. Additionally, following Hattie and Cooksey (1984) and Angrist et al. (2022), we evaluate the known-group validity for this instrument. We use this method to test whether the assessment is able to detect statistically significant differences across children's age groups in the pure control sample. As reported in Appendix B.2, the assessment discriminates across this characteristic, providing evidence of the construct validity of this remote assessment tool.

5. Empirical strategy

To evaluate the direct and spillover effects of the text message program, we estimate the following ordinary least squares (OLS) regression:

$$Y_{ig} = \alpha_s + \beta_1 D_{ig} + \beta_2 (1 - D_{ig}) \times T_g + X'_{ig}\gamma + \epsilon_{ig}, \quad (1)$$

where Y_{ig} is the outcome for each child i in network g; D_{ig} is an indicator of whether the household was assigned to receive the text message campaign (direct effect group); and $(1 - D_{ig}) \times T_g$ is an interaction term that indicates households that belong to a treatment network but were not assigned to receive the text messages (spillover group). Households in pure control networks are the omitted category; X'_{ig} is a matrix of baseline characteristics, including: child's gender, child's age, parent's gender, parent's age, whether the parent completed high school, whether the parent is head of the household, number of children at home, number of household assets, Internet access, whether the parent is the beneficiary of a social program; whether there is

Table 1
Balance across groups.

	Panel A: Baseline sample				Panel B: Endline sample			
	Direct effect	Spillover	Control	P-value	Direct effect	Spillover	Control	P-value
Child is female	0.47	0.48	0.48	0.860	0.49	0.50	0.51	0.811
Child's age	4.47	4.47	4.48	0.790	4.47	4.46	4.49	0.524
Parent is female	0.96	0.96	0.96	0.512	0.97	0.94	0.97	0.127
Parent's age	31.00	31.13	31.17	0.788	30.83	31.46	31.24	0.272
Parent completed high school	0.55	0.53	0.53	0.571	0.53	0.48	0.50	0.391
Parent is head of household	0.61	0.61	0.60	0.731	0.59	0.62	0.57	0.114
Children at home	2.02	1.98	1.99	0.437	2.10	2.09	2.03	0.463
Household assets	7.32	7.32	7.36	0.818	7.31	7.20	7.25	0.702
Internet access at home	0.78	0.78	0.79	0.545	0.80	0.76	0.80	0.124
Parent is beneficiary of social program	0.19	0.21	0.21	0.537	0.22	0.27	0.23	0.133
Remote work at home	0.18	0.18	0.19	0.659	0.17	0.15	0.15	0.711
Household access to AeC resources	0.93	0.92	0.93	0.484	0.93	0.93	0.94	0.234
Parent stress	0.49	0.51	0.48	0.206	0.52	0.50	0.47	0.345
Child stress	0.29	0.29	0.28	0.921	0.30	0.27	0.28	0.820
Learning activities at home	4.54	4.53	4.53	0.928	4.51	4.49	4.49	0.867
Play materials at home	3.15	3.15	3.17	0.806	3.16	3.10	3.12	0.538
Violent discipline practices	0.16	0.17	0.17	0.800	0.20	0.17	0.18	0.694
Observations	1072	1250	2174		443	513	921	
Attrition rates (%)					58.6	58.9	57.6	

Note: Panel A: Baseline sample (N = 4496) Panel B: Endline sample (N = 1877). This table reports summary statistics for baseline characteristics by treatment assignment. The direct effect group corresponds to individuals in the treatment network who were assigned to receive the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The control group corresponds to individuals who belong to a pure control network. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are globally nonsignificant estimated from a linear regression using each baseline characteristic as the dependent variable. See Appendix B.1 for more information about these variables. All regressions include strata fixed effects. Standard errors are clustered at the network level. There are 1072 observations in the direct effect group, 1250 observations in the spillover group and 2174 observations in the pure control group.

remote work at home, household access to AeC, parent stress, child stress, learning activities practiced at home, use of play materials at home, and use of violent discipline practices.[8] The term α_s denotes the randomization strata fixed effects and ϵ_{ig} is the error term. We cluster standard errors at the network level, allowing for correlation between disturbances of students under the same teacher. Parameter β_1 is interpreted as the direct effect of being selected to receive the text message campaign, whereas parameter β_2 corresponds to the spillover effect of being part of a parental network in which other parents were assigned to receive the text message intervention.

6. Validity checks

6.1. Balance

We use baseline data to assess the sample balance across treatment status. Panel A of Table 1 shows that on average, 48 percent of children were girls and the average age of students was 4.5 years. Among parents, 96 percent were women with an average age of 31 years. Slightly more than 50 percent of the sample of parents had completed high school and 60 percent were heads of households. The average number of children at home was two.[9] Households had on average 7.32 assets. Internet access at home was 79 percent and 20 percent of parents were beneficiaries of a social program. Only 19 percent of parents in the sample reported that someone in their household was working remotely. Use of the government's remote education program AeC was very high, with 93 percent of parents accessing it. As regards emotional stress, 49 percent of parents reported experiencing at least one symptom of frequent stress in the previous week, whereas the figure was 29 percent for children. Parents reported that on average they engaged in 4.54 learning activities during the previous three days and their child used 3.15 play materials at home. Finally, 16 percent of the parents reported using violent disciplinary practices. All these characteristics are balanced across treatment assignment groups, as expected from the randomization procedure.[10]

6.2. Sample attrition

With respect to the baseline sample, attrition rates during the child learning assessment averaged 58.2 percent.[11] These rates are similar to those of telephone surveys conducted in developing countries during times of crisis (Henderson and Rosenbaum, 2020; Ballivian et al., 2015). The loss of respondents was mainly due to a change in parents' phone numbers or their phones being deactivated.[12] Our endline sample included 1877 children for which there were available cognitive outcomes from the remote learning assessment.[13] As reported in Panel B

[8] See Appendix B.1 for more information about these variables.

[9] This corresponds to the number of people under 18 years of age that the caregiver is in charge of. In households where more than one child was eligible (ages 4–5) for the program, we randomly chose one child to be the focus of the study and survey questions.

[10] Table A.3 shows balance on baseline characteristics by stratification variables.

[11] Direct effect group: 58.6 percent, spillover group: 58.9 percent and pure control group: 57.6 percent.

[12] The survey protocol was to make six attempts to reach each assigned parent by phone. Of the 2619 observations that attrited from the baseline sample, enumerators could not reach 60 percent as parents' contact information was not valid anymore, 16.3 percent were reachable but the parent declined to participate, 22 percent answered the phone and started the assessment but did not complete it or the child did not want to continue, and 1.8 percent of the sample could not be used as the child was ineligible due to young age or disability.

[13] After accounting for attrition, our power calculations show that with a probability of error type I of 0.05, a power of 0.8, and an intra-cluster

Table 2
Attrition.

	(1) Attrited from endline sample	(2) Attrited from endline sample
Direct effect group	0.011	0.009
	(0.019)	(0.018)
Spillover group	0.013	0.012
	(0.019)	(0.019)
Child is female		−0.036**
		(0.015)
Child's age		−0.004
		(0.014)
Parent is female		−0.016
		(0.036)
Parent's age		−0.001
		(0.001)
Parent completed high school		0.029*
		(0.016)
Parent is head of household		0.047***
		(0.016)
Children at home		−0.019**
		(0.008)
Household assets		0.006
		(0.005)
Internet access at home		−0.034*
		(0.019)
Parent is beneficiary of social program		−0.070***
		(0.020)
Remote work at home		0.069***
		(0.021)
Household access to AeC resources		−0.041
		(0.027)
Parent stress		0.000
		(0.015)
Child stress		0.005
		(0.018)
Learning activities at home		0.015*
		(0.008)
Play materials at home		0.012
		(0.009)
Violent discipline practices		−0.066***
		(0.019)
Constant	0.576***	0.570***
	(0.012)	(0.104)
Observations	4496	4496
Strata FE	28	28
Networks	691	691
F p-value	0.881	0.844
Mean dep. var	0.583	0.583

Note: This table reports the coefficients of a model that estimates the probability that an observation is attrited from the endline sample. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The control group corresponds to individuals who belong to a pure control network. The model in Column (2) controls for baseline characteristics as described in Model (1). All regressions include strata fixed-effects. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

of Table 1, the experimental groups in the endline sample do not differ based on observable characteristics.

correlation of 0.1, the minimum detectable effect is 0.166 for the child's standardized cognitive score.

We further explore sample attrition by estimating the probability that an observation is not in the endline sample. Results are reported in Table 2. Reassuringly, attrition rates do not differ significantly across treatment arms, which suggests that attrition was not differential. Overall, some observable characteristics are correlated with attrition, although the size of the coefficients is very small in most cases. This sample selection does not affect the internal validity of the estimates but is relevant for extrapolating results. More details about the correlation between baseline covariates and the different sources of attrition are available in Table A.1.

6.3. Characteristics of the children's assessment

We asked parents about their children's experiences during the remote test, for example, whether a child was comfortable or enjoyed the activity, whether the questions were adequate, and if the child understood the questions. We also asked enumerators about the process of applying the remote assessment, including their evaluation of the quality and difficulty of the application, any item that did not work properly, and the duration of the test. Table 3 shows that there are no statistically significant differences in these dimensions across groups. Despite the strategies to mitigate parental interference during the test, we found that 81 percent of the caregivers interrupted at least once and the average number of interruptions was seven, mostly to repeat questions and provide encouragement to the child. However, in Table 4 we show that this behavior is not differential across experimental groups.[14] Overall, this evidence implies that treatment effects are not explained by differences in the remote application of the test.

7. Results

Effects on children's cognitive skills. Examining the raw data first, Fig. 3 plots the distributions of raw scores for the different treatment arms and their corresponding *p*-value from the Kolmogorov–Smirnov test of equality of distributions. Subfigures (a)–(c) compare the direct effect group with the control group. The distribution of numeracy scores of the direct effect group is clearly shifted to the right compared to the control group. Table 5 presents the results for our primary outcomes obtained from estimating Eq. (1). We find that children's cognitive skills are 0.107 SD higher in households assigned to the text message campaign compared to the control group. The coefficient is 0.116 SD when controlling for covariates. This result appears to be driven by numeracy skills rather than literacy skills.[15] Table A.2 in the Appendix shows that the effects are particularly strong for questions related to oral counting and number comparisons. There is some evidence of positive effects on questions related to sequences, but the coefficient is barely significant.

The message campaign was designed to provide parents with the tools to support the cognitive learning of their children. One potential explanation for the treatment heterogeneity is that it specifically intended to include more messages on numeracy skills (33 percent) than literacy skills (22 percent) as parents were probably less familiar with this domain. The remaining messages included content on healthy habits (13 percent), positive parenting strategies (18.5 percent), time management (4 percent), relationship with teachers (5.5 percent), and logistics of the program (4 percent). Another reason why the SMS messages especially affected numerical skills might be because, compared with the standard curriculum in preschool, numeracy may be a novel activity for parents to undertake with their children. Our qualitative data indicate that compared to the control group, 10 percent more

[14] In Tables A.13 and A.14 we show that the results are robust to excluding covariates.

[15] In Table A.15 we show that the results are robust to including enumerator fixed-effects.

Table 3
Characteristics of the children's assessment.

	(1) Child was comfortable	(2) Child enjoyed activity	(3) Questions were adequate	(4) Child understood questions	(5) Application difficulty	(6) Any item did not work	(7) Application quality	(8) Test duration (min)
Direct effect group	−0.014	0.006	0.025	0.026	−0.047	−0.011	0.039	−0.077
	(0.014)	(0.007)	(0.021)	(0.023)	(0.053)	(0.017)	(0.034)	(0.252)
Spillover group	0.011	0.003	0.018	0.039*	0.025	0.005	0.024	0.079
	(0.011)	(0.007)	(0.020)	(0.021)	(0.048)	(0.018)	(0.031)	(0.235)
Observations	1877	1877	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28	28	28
Networks	640	640	640	640	640	640	640	640
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F p-value	0.082	0.764	0.771	0.611	0.215	0.427	0.697	0.603
Mean dep. var (control)	0.947	0.984	0.841	0.800	1.860	0.104	4.276	15.618
SD dep. var (control)	0.225	0.127	0.365	0.400	0.948	0.306	0.626	3.790

Note: This table reports the estimated coefficients from Model (1) using as dependent variables some characteristics of the remote child learning test. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. Variables in Columns (1)–(4) were collected from parents and are measured as dummy variables as described in Appendix B.2. Variables in Columns (5)–(8) were collected from enumerators. The variable in Column (5) is measured with a 5-point Likert scale (where 1 corresponds to very easy and 5 to very difficult). The variable in Column (6) is an indicator variable for whether any item from the test did not work properly during the application. Our measure for application quality in Column (7) was computed as an average of the eight dimensions evaluated by enumerators as described in Appendix B.2. The variable in Column (8) corresponds to the test duration in minutes. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table 4
Parents' interference during the children's assessment.

	(1) Parents interfered	(2) Total interruptions	(3) Repeating questions	(4) Providing encouragement	(5) Offering help	(6) Providing answers
Direct effect group	−0.003	0.204	−0.011	−0.021	0.012	0.038
	(0.023)	(0.471)	(0.028)	(0.028)	(0.029)	(0.026)
Spillover group	0.012	−0.457	−0.005	−0.033	−0.011	0.017
	(0.021)	(0.418)	(0.028)	(0.027)	(0.028)	(0.025)
Observations	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28
Networks	640	640	640	640	640	640
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
F p-value	0.565	0.217	0.856	0.708	0.488	0.488
Mean dep. var (control)	0.810	7.012	0.610	0.603	0.570	0.280
SD dep. var (control)	0.393	8.087	0.488	0.490	0.495	0.449

Note: This table reports the estimated coefficients from Model (1) using as dependent variables some indicators of parents' interference during the test reported by the enumerators. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. Variables in Columns (1), (3)–(6) are dummy variables. The variable in Column (2) corresponds to the number of times that parents interfered during the test. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

parents in the treatment group remembered that the messages included information on literacy skills and 34 percent more parents in the treatment group remembered the information about numeracy. The lack of effects on literacy skills might also be because of the short duration of the intervention. Evidence from the READY4K! text messaging program in the United States finds positive effects on early literacy skills (0.11 SD), but the program lasted eight months (York et al., 2019).

Since there was high engagement in Costa Rica's national remote learning program at baseline (93 percent), the text messaging intervention complemented ongoing remote instruction, rather than replacing it. These effects are consistent with another low-cost intervention, implemented in Botswana during the first year of the COVID-19 pandemic, which finds an increase of 0.12 SD in learning when text messages complement the instruction provided by phone (Angrist et al., 2022). Overall, our results are in line with research evidence that providing timely and actionable information to parents can improve children's cognitive skills (Bergman, 2019). In a context where families' attention was diverted by several issues related to the pandemic, the text message campaign made children's education more salient, easier to remember, and simpler to undertake at home. In particular, the intervention

Table 5
Effects on children's cognitive skills.

	(1) Composite score	(2) Numeracy	(3) Literacy	(4) Composite score	(5) Numeracy	(6) Literacy
Direct effect group	0.107*	0.108*	0.071	0.116**	0.117**	0.080
	(0.057)	(0.059)	(0.056)	(0.054)	(0.057)	(0.054)
Spillover group	0.010	0.065	−0.074	0.029	0.074	−0.046
	(0.057)	(0.057)	(0.057)	(0.055)	(0.056)	(0.055)
Observations	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28
Networks	640	640	640	640	640	640
Covariates	No	No	No	Yes	Yes	Yes
F p-value	0.134	0.524	0.019	0.151	0.507	0.035
Mean dep. var (control)	0.000	0.000	0.000	0.000	0.000	0.000
SD dep. var (control)	1.000	1.000	1.000	1.000	1.000	1.000

Note: This table reports the estimated coefficients from Model (1) using as dependent variables the standardized test scores collected from the remote child learning test. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. The model in Columns (4)–(6) controls for baseline characteristics as described in Model (1). All regressions include strata fixed effects. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

provided the direct effect group with more frequent messages (three-to-four weekly SMSs vs biweekly), more messages in total (54 vs 8 SMS) and more relevant information (cognitive-specific information and activities vs existing information about AeC).

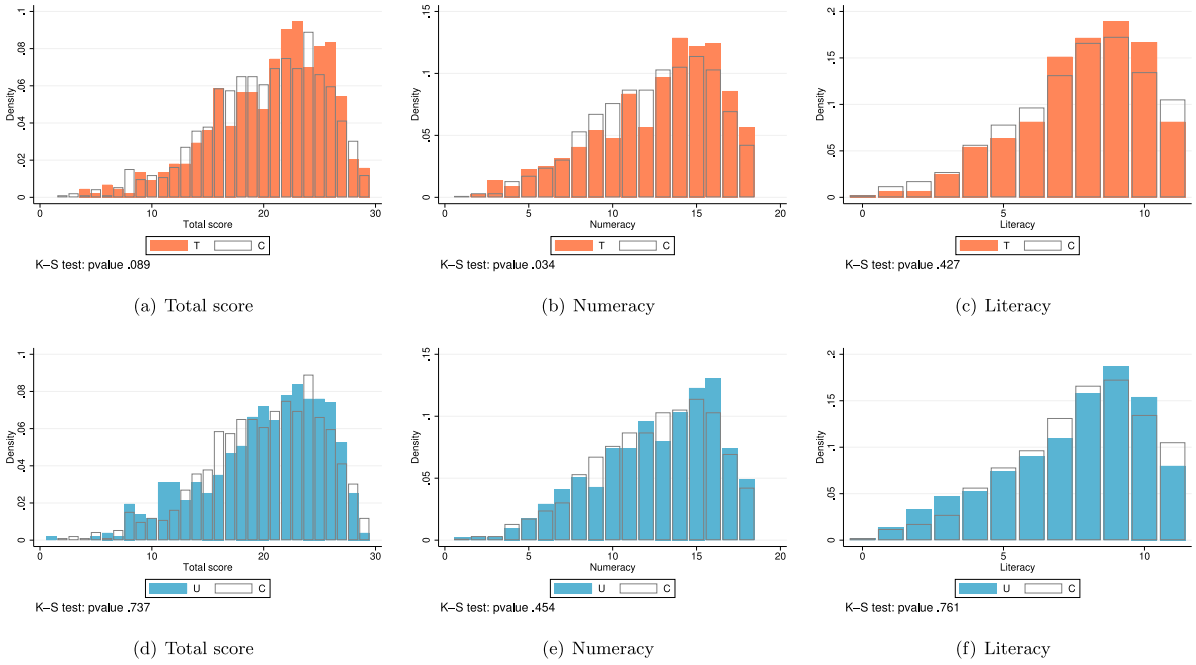
Spillover effects. Across all specifications in Table 5, we find no evidence of effects on children whose parents belonged to a treatment network but were not assigned to receive the text messages. This is consistent with Subfigures (d)–(f) in Fig. 3 that show no differences in the distributions of raw scores of the spillover group and the control group. Given the evidence of direct treatment effects, this absence of spillovers is somewhat surprising as a priori we expected the parental networks to compensate more strongly for the lack of in-person instruction. Note that in our setting, spillover effects cannot occur through peer effects between children in the classroom, as all children receive education only at home. However, one possibility is that we are measuring impacts within networks that may not coincide with groups in which parents interact more actively. The networks we observe are of groups of parents that share the same preschool teacher, but since school closures in Costa Rica occurred very close to the beginning of the academic year, parents probably did not get enough time to know one another before the lockdown.

Treatment heterogeneity. We explore differential impacts by two baseline characteristics of the networks that we used for stratification. As reported in Table 6, we do not find strong evidence of heterogeneous impacts by network size. Table 7 shows that the direct impacts in networks where parent-initiated contact with the teacher was low at baseline are almost four times larger than in high-initiative networks, suggesting that messages may be more effective for children whose parents were initially less connected and thus would probably not have been able to otherwise obtain the communicated information. We further explore the correlated characteristics of these networks in Table A.4. According to the results, parents in low-initiative networks are younger, have fewer assets and are less likely to have internet at home than parents in the high-initiative networks; also, they are relatively more likely to be head of households, beneficiaries of social programs and have more children in charge. According to these demographics, it seems that messages could be more effective for parents that have relatively less experience and resources and greater needs. We note, however, that although the differences between high-initiative and low-initiative networks are sizable, the coefficients of the interaction terms are not statistically significant, so we interpret this evidence as suggestive.

8. Discussion

We now explore potential mechanisms behind the effects on cognitive outcomes using some additional household data collected through an online follow-up survey.[16] Note that parents in this sample responded to both the remote child learning test on the phone and the online survey sent via text message (parents' sample). As shown in Table A.10, attrition rates were more severe, which may raise concerns about sample selection. There is some differential attrition across treatment arms, even though the differences are very small in magnitude (about 2 percentage points) and only significant at the 10 percent significance level. Table A.11 reports the estimated impacts on children's cognitive outcomes using this sample. Compared to the previous results, the size of the coefficients is larger and there is some evidence of spillover effects on numeracy outcomes. One possible explanation for these differences is the treatment effect heterogeneity, where impacts are stronger among the sample of children in households of more responsive parents. In fact, Table A.12 shows that in this sample there are differences in the level of education of parents and the proportion that benefited from a social program compared with the sample that only had the remote learning test. There is also a higher proportion of mothers and a lower proportion of caregivers that are heads of households, which potentially implies more time available to

[16] The text message with a link to the survey was sent before a surveyor called to schedule the child's assessment. During the call, the surveyor reminded the parent to fill out the form. The survey captured information on the main mechanisms through which we expected the intervention to affect children's skills. These included parents' behaviors related to the learning environment at home, the text message campaign, and the government distance learning program. We collected information on the activities parents performed at home with their children and the measures of stress among students and parents. In addition, we measured parents' perception of their child's abilities and their own parental self-efficacy. See Appendix B.1 for more details on how these indicators and scales were constructed.



(a) Total score (b) Numeracy (c) Literacy

(d) Total score (e) Numeracy (f) Literacy

Fig. 3. Distribution of cognitive skills (raw scores). **Note**: This figure plots the distributions of raw scores and the p-values of the corresponding Kolmogorov–Smirnov test. Subfigures (a)–(c) compare the direct effect group with the control group and Subfigures (d)–(f) compare the spillover group with the control group.

spend with their child. This is also suggested by reports of a greater number of children using play materials at home. However, another possibility is that these effects are confounding some selection bias as there is some evidence of small differential attrition across treatment groups. We interpret these results as suggestive evidence.

Delivery and sharing of SMS. We use parents' survey responses to understand the delivery and sharing of the text message campaign. As shown in Table A.5, parents in the direct effect group were 47.8 percentage points more likely to recall having received the text messages as well as 46.7 percentage points more likely to recall the content of the messages than parents in the pure control group. Parents that belonged to a treatment network but were not assigned to receive the text messages did not report recalling the text messages more than the pure control group. This is somewhat expected as the spillover group and the pure control group received the same placebo campaign with eight short messages reminding parents about the AeC. Parents in the direct effect group were also more likely to identify the Ministry of Education as the sender (51.4 percentage points) and less likely to report receiving messages from a teacher (4.5 percentage points). We do not find evidence that parents shared the text messages with the teacher, but we do find that a fraction of parents reported sharing the text messages with other parents (7.5 percentage points). However, there are no statistically significant differences in parents' reports of receiving the messages from other parents. One potential explanation to conciliate these results is that parents shared the messages with other parents outside of the networks defined in the study.

Parental interactions. The results reported in Table A.6 suggest that there were few interactions among parents during this time. Only 20 percent of parents in the control group communicated with other parents from preschool during the last week, and there are no statistically significant differences across groups. Parents in the direct effect group are more likely to report that their children talked to other children from the preschool (8 percentage points) compared to those of the control group (25 percent), which could be an indirect way for parents to interact. Finally, parents in the direct effect or spillover groups are not more likely to contact the teacher than parents in the control group (64 percent).

Learning environment at home. The intervention targeted parental involvement in their child's learning process by (i) providing parents with information on activities that could be easily performed at home to stimulate children's numeracy and literacy skills; and (ii) helping parents create good conditions for their child's learning by targeting healthy habits, positive parenting strategies, and time management. The results of several parent reports about the learning environment at home[17] in Table A.7 suggest that parents in the direct effect group conducted more learning activities with their child compared to the control group. In fact, they reported greater engagement in activities such as counting and naming objects and playing addition or subtraction games, and an increase in the use of play materials at home compared to the control group. Such materials include household objects or objects such as stones and sticks, which were specifically mentioned in the messages as ways to practice counting and vocabulary. Overall, these results are consistent with other studies' findings that text messaging can encourage parental involvement in children's education (Bergman and Chan, 2021; Doss et al., 2019; Berlinski et al., 2022). We do not find evidence of changes in the involvement of parents who belonged to treatment networks but were not assigned to receive the text messages.

[17] See Appendix B.1 for more information about the scales used in this analysis.

Table 6
Effect heterogeneity by network size.

	(1) Composite score	(2) Numeracy	(3) Literacy
Direct effect group	0.119	0.143*	0.047
	(0.083)	(0.086)	(0.082)
Direct effect group × Large network	−0.010	−0.052	0.053
	(0.110)	(0.115)	(0.109)
Spillover group	0.040	0.080	−0.030
	(0.086)	(0.083)	(0.090)
Spillover group × Large network	−0.021	−0.011	−0.031
	(0.113)	(0.113)	(0.114)
Observations	1877	1877	1877
Strata FE	28	28	28
Networks	640	640	640
Covariates	Yes	Yes	Yes
F p-value	0.382	0.495	0.396
Mean dep. var	0.028	0.019	0.032
SD dep. var	1.008	1.011	0.997

Note: This table reports the estimated coefficients from Model (1) using as dependent variables the standardized test scores collected from the remote child learning test, separately by size of the network. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. We define a network as a group of parents who share the same preschool teacher. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal. The mean and SD of the dependent variable is calculated for the control group in small networks.

We also do not find evidence that the intervention translated into changes in parents' perception of their own efficacy, parent stress levels, the use of violent discipline methods, or child stress levels.

Parents' beliefs. More time spent on the activities suggested via SMS might allow parents to learn new information about their child's skills. To explore this, we consider parents' responses to a survey question asking them to evaluate their child's skills across several dimensions. Then, we create a variable that indicates whether the parent's evaluation coincides with the child's performance in the assessment.[18] Column (1) of Table A.8 shows evidence that parents in the direct effect group have a higher score in perceiving the level of their child's skills in domains such as addition, subtraction, and oral comprehension compared to the control group. The results from Column (2) show that parents in the treatment group are more likely than the control group to correctly guess their child's performance in oral counting, number comparisons, addition, and oral comprehension. We interpret these results as suggestive evidence that the intervention might have reduced the gap between parental beliefs and children's actual performance in some domains. As Dizon-Ross (2019) shows, this result has important implications for parental decision-making: parents who can assess their children's performance accurately can make better educational investments.

[18] This variable was constructed as an indicator of whether a parent considers their child as having medium or high ability in each task compared with whether the child correctly answered at least one item under that task during the assessment.

Use of the remote learning program. The text message intervention was designed as a complement to the national remote learning program launched by the Ministry of Education. Table A.9 shows that parents in the direct effect group reported greater interest in continuing the AeC program even after their child went back to in-person instruction (5 percentage points). Interestingly, we find a negative effect in the spillover group on parents' perceived access to AeC resources from the government distance education program. As parents associated the SMSs with the Ministry of Education's AeC activities, this result suggests that parents who did not receive the text messages but learned about the program within their networks may have felt that they had limited access to remote learning programs. Across groups, we do not find any differences in parental reports of children's satisfaction with the AeC program.

9. Cost-effectiveness

The intervention was designed to be scalable for government agencies in the context of school lockdowns and emergencies. It utilized SMS text messages, which are widely accessible through mobile phones. The program's activities were implemented without the need for additional materials, relying instead on common objects found in most contexts such as stones, spoons, beans, and so on. The intervention was low cost, with a cost per text message of approximately US$0.014 (8 Colones). A total of 54 SMS messages were sent to 1072 parents, resulting in a total cost of US$810. The labor costs associated with programming and sending the SMS messages were negligible, since the program utilized a bulk SMS text messaging platform. The intervention leveraged the existing communication channels between teachers and parents to collect contact information through an open-source data collection software. As a result, the estimated cost per child amounted to only US$0.8.

Based on the average effect, the estimated average cost per student for a 0.01 SD increase in learning was US$0.7. The evidence that text messaging programs have nonlinear effects (Head et al., 2013; Pop-Eleches et al., 2011) suggests that there is an optimal number of messages at which the intervention is more cost-effective. In the case of parenting programs, previous studies find an increasing return to additional text messages that begins to plateau around three messages per week (Cortes et al., 2021; Cunha et al., 2017) and has decreasing marginal effects at five messages per week (Cortes et al., 2021). Since our intervention provided between 3–4 messages, it is likely that scaling beyond this point may not yield proportionally greater benefits in expectation per child.

The text message campaign proved to be more cost-effective than other interventions aimed at improving early numeracy skills. According to a study conducted by Bando et al. (2019), 10 interventions implemented in Latin America and the Caribbean had an average cost of US$1.81 per student for a 0.01 SD increase in math test scores. These interventions focused on implementing an inquiry- and problem-based pedagogy, providing didactic materials, teacher training, and supervision.

Our study aligns with others that consider the effects of low-cost technology on learning outcomes. For instance, Berlinski et al. (2022) conducted a study in Chile evaluating the impact of providing information to parents of primary school students through SMS. Their findings indicated that the cost of achieving a 0.01 SD increase in math grades was US$1.21. Furthermore, Angrist et al. (2023) examined the effects of a tutoring program that utilized a combination of SMS and phone calls during school lockdowns. Their study revealed an effect size of 0.30–0.35 SD in numeracy skills, with an estimated cost of US$0.37 for a 0.01 SD increase.

These findings indicate that text message campaigns can be highly cost-effective and scalable interventions that can complement ongoing instruction, providing an accessible and affordable means to improve early numeracy skills.

Table 7
Effect heterogeneity by level of parent-initiated communication with the teacher.

	(1) Composite score	(2) Numeracy	(3) Literacy
Direct effect group	0.266**	0.280**	0.164
	(0.116)	(0.110)	(0.121)
Direct effect group × High-initiative network	−0.190	−0.206	−0.108
	(0.131)	(0.128)	(0.135)
Spillover group	−0.015	0.002	−0.035
	(0.107)	(0.105)	(0.112)
Spillover group × High-initiative network	0.054	0.092	−0.018
	(0.125)	(0.124)	(0.129)
Observations	1877	1877	1877
Strata FE	28	28	28
Networks	640	640	640
Covariates	Yes	Yes	Yes
F p-value	0.014	0.009	0.105
Mean dep. var	−0.059	−0.040	−0.067
SD dep. var	1.099	1.082	1.061

Note: This table reports the estimated coefficients from Model (1) interacting all covariates with an indicator for networks with high level of parent-initiated communication using as dependent variables the standardized test scores collected from the remote child learning test. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The Spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. We define a network as a group of parents who share the same preschool teacher. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal. The mean and SD of the dependent variable is calculated for the control group in low-initiative networks.

10. Conclusion

This paper provides evidence that a large-scale text messaging intervention can be effective in increasing preschool children's cognitive skills at home when schools are closed and education is provided remotely. We conducted a two-level randomized experiment to quantify the short-term direct and spillover impacts of the program. The results show that after 15 weeks of intervention, cognitive skills increased by 0.11–0.12 SDs. The effect is explained mainly by an increase in numeracy skills. We do not find strong evidence that the text message campaign produced spillover effects on children that belonged to treatment networks but were not assigned to receive the text messages.

Our results are consistent with existing evidence that inexpensive behavioral interventions (such as text message campaigns) can empower parents to improve children's outcomes (Bergman, 2019) and offer a low-cost alternative for addressing school disruptions when children do not have access to in-person care. These findings have important implications for the provision of early childhood education in emergencies and conflict settings or in contexts where high-technology solutions are less scalable given households' limited access to the Internet or digital devices.

CRediT authorship contribution statement

Juan Manuel Hernández-Agramonte: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Writing – review & editing, Investigation, Project administration. **Olga Namen:** Conceptualization, Methodology, Software, Formal analysis, Writing – original draft, Writing – review & editing, Investigation. **Emma Näslund-Hadley:** Conceptualization, Methodology, Writing – review & editing, Investigation, Project administration, Supervision, Resources, Funding acquisition. **Maria Loreto Biehl:** Project administration, Resources, Funding acquisition.

Data availability

Data will be made available on request.

Appendix A. Figures and tables

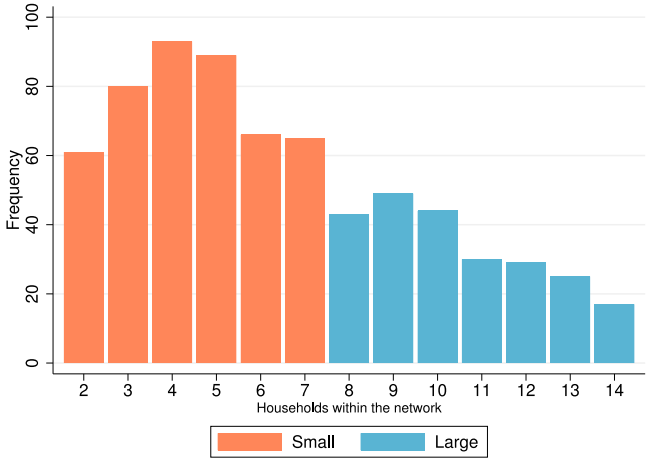


Fig. A.1. Distribution of network size. **Note**: This figure shows the distribution of network size in the experimental sample. Large networks are those with a higher number of parents than the median. We define a network as a group of parents who share the same preschool teacher.

Table A.1
Causes of attrition.

	(1) Incomplete/without child's consent	(2) Unable to reach parent	(3) Parent declined	(4) Ineligible
Direct effect group	0.106	0.078	−0.165	−0.239
	(0.125)	(0.087)	(0.135)	(0.377)
Spillover group	0.172	0.090	−0.194	−0.386
	(0.117)	(0.090)	(0.138)	(0.376)
Child is female	−0.319***	−0.170**	0.192*	−0.767**
	(0.100)	(0.071)	(0.110)	(0.344)
Child's age	−0.163*	0.048	−0.040	−0.196
	(0.093)	(0.068)	(0.110)	(0.329)
Parent is female	−0.380*	−0.043	0.183	14.856***
	(0.213)	(0.174)	(0.294)	(0.190)
Parent's age	−0.002	−0.006	0.007	−0.008
	(0.008)	(0.006)	(0.009)	(0.025)
Parent completed high school	0.096	0.137*	0.171	−0.414
	(0.105)	(0.077)	(0.118)	(0.327)
Parent is head of household	0.208**	0.272***	−0.059	0.105
	(0.103)	(0.075)	(0.113)	(0.327)
Children at home	−0.083	−0.062	−0.219***	0.287**
	(0.055)	(0.038)	(0.071)	(0.125)
Household assets	0.011	0.039	0.002	0.026
	(0.034)	(0.026)	(0.042)	(0.100)
Internet access at home	−0.035	−0.196**	−0.043	−0.447
	(0.128)	(0.089)	(0.147)	(0.350)
Parent is beneficiary of social program	−0.180	−0.333***	−0.323**	0.101
	(0.126)	(0.093)	(0.149)	(0.382)
Remote work at home	0.173	0.299***	0.448***	0.300
	(0.133)	(0.102)	(0.146)	(0.420)
Household access to AeC resources	−0.163	−0.227*	0.027	−0.162
	(0.178)	(0.129)	(0.246)	(0.566)
Parent stress	−0.086	0.059	−0.090	0.049
	(0.101)	(0.075)	(0.124)	(0.326)
Child stress	0.119	0.003	−0.097	0.457
	(0.115)	(0.088)	(0.139)	(0.331)
Learning activities at home	0.063	0.082**	0.015	−0.027
	(0.057)	(0.039)	(0.062)	(0.142)
Play materials at home	0.033	0.036	0.182***	−0.197
	(0.063)	(0.044)	(0.069)	(0.186)
Violent discipline practices	−0.167	−0.314***	−0.248*	−0.976
	(0.128)	(0.096)	(0.145)	(0.595)
Constant	−0.074	−0.664	−1.763	−17.113
	(0.775)	(0.518)	(0.880)	(2.212)
Observations	4496			
Strata FE	28			
Networks	691			
Base outcome	Child is in endline sample			

Note: This table reports the estimation results of a multinomial Logit using as the dependent variable the five possible categories at endline: (i) survey was incomplete or the child did not give consent, (ii) enumerators were unable to reach the parents (iii) parent declined to participate (iv) child was ineligible to participate due to young age or disability, and (v) the child successfully completed the survey and is part of the endline sample. We use (v) as the baseline category. Although some of these correlations can occur by chance, these are some interesting patterns that might be important for future applications of the assessment. For example, the relative odds of having an incomplete survey vs staying in the endline sample increases when the parent is the head of the household. The relative odds of the parent declining the survey vs staying in the sample increases when there is remote work at home. Likewise, when the parent is the head of the household or there is remote work at home there is a positive association in the relative log odds of being unable to reach the parent vs remaining in the endline sample. The relative odds of being ineligible vs staying in the endline sample will increase when there are more children at home. This perhaps has to do with the head of the household being busier or having more things going on at home, and thus having less time and attention to answer their phone or to participate. Xiao et al. (2021) found an increase in reported workload and time spent at workstations for parents working from home during the pandemic which may reduce the time availability for engaging with their children. On the other hand, having Internet access at home and the parent being a beneficiary of a social program are associated with a decrease in the relative log odds of being unable to reach the parents vs remaining in the endline sample, presumably because parents who are more connected and receive these benefits are more likely to have their contact information available and up to date. During the pandemic, different government agencies delivered monthly support programs to households in Costa Rica which required the family to be available for confirming their participation and reception of the program. Government support can also make households more resilient in dealing with the challenges posed by the pandemic. Clemens (2022) indicates that government programs can reduce the incentive for households to migrate therefore increasing the probability of recontacting them. The relative odds of the parent declining the survey vs staying in the endline sample also decreases when the parent is the beneficiary of a social program or there are more children at home, probably because parents who receive these benefits are more used to responding to similar phone calls.

Table A.2
Effects on children's cognitive skills (specific tasks).

	(1) Spatial reasoning	(2) Oral counting	(3) Number comparisons	(4) Addition and subtraction	(5) Sequences	(6) Comparisons (weight and size)	(7) Syllabification	(8) Oral comprehension	(9) Expressive vocabulary
Direct effect group	0.081	0.124**	0.118**	0.031	0.095*	0.004	0.027	0.064	0.096
	(0.054)	(0.052)	(0.055)	(0.060)	(0.056)	(0.058)	(0.055)	(0.055)	(0.059)
Spillover group	0.064	0.016	−0.001	0.074	0.062	0.091*	−0.076	0.049	−0.074
	(0.054)	(0.056)	(0.056)	(0.056)	(0.056)	(0.054)	(0.057)	(0.054)	(0.055)
Observations	1877	1877	1877	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28	28	28	28
Networks	640	640	640	640	640	640	640	640	640
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F p-value	0.765	0.080	0.067	0.528	0.599	0.189	0.111	0.815	0.009
Mean dep. var (control)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SD dep. var (control)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
RW adjusted p-values									
Direct effect group	0.389	0.020	0.060	0.960	0.251	0.994	0.960	0.598	0.277
Spillover group	0.598	0.969	0.994	0.512	0.602	0.268	0.512	0.765	0.512

Note: This table reports the estimated coefficients from Model (1) using as dependent variables the standardized test score collected from the remote child learning test, separately for each task. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were themselves not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal. The last two rows report multiple hypotheses adjusted p-values implementing the Romano–Wolf correction that controls for the familywise error rate among the nine outcome variables under test (Clarke et al., 2020; Clarke, 2021)

Table A.3
Balance on baseline characteristics by stratification variables.

	Large networks				Small networks				High-initiative networks				Low-initiative networks			
	Direct effect	Spillover	Control	P-value	Direct effect	Spillover	Control	P-value	Direct effect	Spillover	Control	P-value	Direct effect	Spillover	Control	P-value
Child is female	0.48	0.51	0.50	0.783	0.51	0.49	0.52	0.669	0.49	0.49	0.52	0.635	0.49	0.50	0.48	0.901
Child's age	4.44	4.45	4.45	0.996	4.50	4.47	4.54	0.290	4.47	4.46	4.49	0.582	4.45	4.47	4.50	0.786
Parent is female	0.98	0.95	0.97	0.277	0.96	0.94	0.96	0.437	0.97	0.94	0.96	0.070	0.95	0.95	0.98	0.259
Parent's age	30.72	31.11	31.02	0.594	30.97	31.86	31.50	0.442	30.84	31.64	31.56	0.143	30.80	30.88	30.15	0.629
Parent completed high school	0.58	0.54	0.52	0.292	0.46	0.41	0.48	0.282	0.53	0.48	0.52	0.496	0.54	0.47	0.45	0.416
Parent is head of household	0.53	0.66	0.55	0.007	0.66	0.58	0.58	0.165	0.58	0.61	0.56	0.280	0.61	0.67	0.60	0.321
Children at home	2.09	2.16	1.98	0.044	2.13	2.01	2.10	0.216	2.05	2.03	2.02	0.942	2.30	2.27	2.07	0.179
Household assets	7.32	7.19	7.41	0.186	7.30	7.22	7.06	0.157	7.38	7.27	7.32	0.727	7.06	7.00	7.00	0.951
Internet access at home	0.83	0.78	0.81	0.381	0.77	0.73	0.79	0.202	0.82	0.78	0.81	0.269	0.76	0.69	0.77	0.428
Parent is beneficiary of social program	0.20	0.31	0.20	0.012	0.23	0.24	0.26	0.694	0.21	0.26	0.22	0.295	0.25	0.32	0.26	0.419
Remote work at home	0.18	0.15	0.16	0.870	0.16	0.14	0.15	0.798	0.17	0.15	0.14	0.549	0.14	0.12	0.18	0.374
Household access to AeC resources	0.92	0.90	0.94	0.169	0.94	0.95	0.95	0.860	0.92	0.91	0.95	0.097	0.94	0.97	0.94	0.574
Parent stress	0.53	0.53	0.47	0.184	0.51	0.48	0.48	0.840	0.53	0.51	0.48	0.325	0.47	0.47	0.45	0.949
Child stress	0.32	0.29	0.28	0.504	0.27	0.25	0.29	0.440	0.30	0.28	0.28	0.818	0.28	0.26	0.30	0.771
Learning activities at home	4.51	4.43	4.44	0.597	4.52	4.56	4.54	0.899	4.52	4.49	4.47	0.743	4.49	4.50	4.53	0.942
Play materials at home	3.13	3.09	3.13	0.848	3.19	3.10	3.10	0.403	3.17	3.10	3.13	0.577	3.13	3.10	3.07	0.770
Violent discipline practices	0.23	0.21	0.22	0.826	0.16	0.14	0.14	0.837	0.21	0.18	0.19	0.715	0.18	0.14	0.18	0.747
Observations	245	272	500		198	241	421		346	392	711		97	121	210	

Note: This table reports summary statistics for baseline characteristics by treatment assignment group and stratification variables. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals that belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are globally nonsignificant, estimated from a linear regression using each baseline characteristic as the dependent variable. See Appendix B.1 for more information about these variables. All regressions include strata fixed effects. Total observations in each group are: Large networks (N = 1017), Small networks (N = 860), High-initiative networks (N = 1449), Low-initiative networks (N = 428).

Table A.4
Baseline characteristics by level of parent-initiated communication with the teacher.

	Networks		Diff. p-value	Obs.
	High-initiative	Low-initiative		
Child is female	0.50	0.49	0.612	1877
Child age	4.47	4.48	0.879	1877
Parent is female	0.96	0.96	0.743	1877
Parent age	31.41	30.50	0.013	1877
Parent completed high school	0.51	0.48	0.260	1877
Parent is head of household	0.58	0.62	0.092	1877
Children at home	2.03	2.18	0.015	1877
Household assets	7.32	7.01	0.002	1877
Internet access at home	0.80	0.75	0.019	1877
Parent is beneficiary of social program	0.23	0.28	0.070	1877
Remote work at home	0.15	0.16	0.895	1877
Household access AeC resources	0.93	0.95	0.190	1877
Parent stress	0.50	0.46	0.138	1877
Child stress	0.29	0.28	0.813	1877
Learning activities at home	4.49	4.51	0.629	1877
Play-materials at home	3.13	3.09	0.469	1877
Violent discipline practices	0.19	0.17	0.256	1877

Note: This table reports summary statistics for baseline characteristics in the endline sample separately by high-initiated and low-initiated networks. The p-value corresponds to the test that the difference between the groups is equal to zero estimated from a linear regression using each baseline characteristic as the dependent variable. See Appendix B.1 for more information about these variables. Standard errors are clustered at the network level.

Table A.5
Delivery and sharing of SMS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Received SMS	Remember SMS content	Received SMS from:			Shared SMS with:	
			MEP	Teacher	Parent	Teacher	Parent
Direct effect group	0.478***	0.467***	0.514***	−0.045**	−0.006	0.008	0.075***
	(0.031)	(0.036)	(0.031)	(0.021)	(0.004)	(0.016)	(0.022)
Spillover group	−0.028	−0.018	−0.025	−0.014	0.005	−0.010	−0.013
	(0.035)	(0.027)	(0.033)	(0.022)	(0.007)	(0.014)	(0.016)
Observations	1090	1090	1090	1090	1090	1034	989
Strata FE	28	28	28	28	28	28	28
Networks	547	547	547	547	547	531	518
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F p-value	0.000	0.000	0.000	0.179	0.084	0.277	0.000
Mean dep. var (control)	0.406	0.168	0.356	0.106	0.005	0.034	0.048
SD dep. var (control)	0.492	0.374	0.479	0.309	0.073	0.183	0.214

Note: This table reports the estimated coefficients from Model (1) using as dependent variables several measures of delivery and sharing of SMS. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals that belong to a pure control network. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.6
Parental interactions.

	(1) Parent talked to other parent from preschool	(2) Child talked to other child from preschool	(3) Parent contacted the teacher
Direct effect group	0.000	0.080**	0.028
	(0.031)	(0.035)	(0.037)
Spillover group	−0.027	0.030	−0.016
	(0.028)	(0.033)	(0.034)
Observations	1090	1090	1090
Strata FE	28	28	28
Networks	547	547	547
Covariates	Yes	Yes	Yes
F p-value	0.409	0.224	0.266
Mean dep. var (control)	0.191	0.245	0.635
SD dep. var (control)	0.394	0.431	0.482

Note: This table reports the estimated coefficients from Model (1) using as dependent variables several measures of parental interactions. The direct effect group corresponds to individuals in the treatment network who were assigned to receive the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were themselves not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.7
Learning environment at home.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Parental engagement			Socio-emotional outcomes			
	Learning activities at home	SMS proposed activities	Play materials at home	Parental efficacy	Violent discipline practices	Parent stress	Child stress
Direct effect group	0.144**	0.388***	0.091*	0.002	−0.001	0.022	0.006
	(0.057)	(0.117)	(0.052)	(0.024)	(0.023)	(0.034)	(0.022)
Spillover group	0.024	0.155	0.023	−0.001	0.029	0.042	−0.013
	(0.055)	(0.117)	(0.053)	(0.022)	(0.025)	(0.033)	(0.019)
Observations	1090	1090	1090	1090	1090	1090	1090
Strata FE	28	28	28	28	28	28	28
Networks	547	547	547	547	547	547	547
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F p-value	0.045	0.069	0.256	0.929	0.295	0.617	0.445
Mean dep. var (control)	4.558	4.135	3.319	3.484	0.155	0.316	0.090
SD dep. var (control)	0.880	1.681	0.836	0.312	0.362	0.465	0.287

Note: This table reports the estimated coefficients from Model (1) using as dependent variables several measures of parental engagement with learning practices and socioemotional outcomes. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.8
Parent's beliefs.

	(1) Parent's evaluation	(2) Parent's evaluation coincides with assessment
Oral counting	0.052	0.106***
	(0.044)	(0.032)
Number comparisons	−0.010	0.075***
	(0.039)	(0.025)
Addition	0.109**	0.090***
	(0.051)	(0.035)
Subtraction	0.089*	0.027
	(0.050)	(0.037)
Expressive vocabulary	0.011	0.055
	(0.022)	(0.038)
Oral comprehension	0.066**	0.024**
	(0.033)	(0.010)
Observations		1090
Strata FE		28
Networks		547

Note: This table reports the coefficients for the direct effect group estimated from Model (1) using as dependent variables some measures of parents' beliefs. Each cell corresponds to a separate regression. The variable in Column (1) corresponds to the parent's evaluation of the child's skills tested during the assessment in each task. This variable takes values between 1 and 3. The variable in Column (2) is an indicator for when the parent's evaluation coincides with the assessment result. This variable was constructed as an indicator of whether the parent considers that the child has medium or high ability in each task compared to whether the child answered correctly at least one item of that task during the assessment. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively.

Table A.9
Use of the national remote learning program *Aprendo en Casa* (AeC).

	(1) Parent wants AeC to continue	(2) Child accessed AeC	(3) Child satisfied with AeC
Direct effect group	0.050**	0.009	0.002
	(0.020)	(0.024)	(0.030)
Spillover group	0.033	−0.076***	0.006
	(0.021)	(0.029)	(0.030)
Observations	1090	1083	939
Strata FE	28	28	28
Networks	547	546	500
Covariates	Yes	Yes	Yes
F p-value	0.479	0.006	0.904
Mean dep. var (control)	0.884	0.886	0.830
SD dep. var (control)	0.320	0.319	0.376

Note: This table reports the estimated coefficients from Model (1) using as dependent variables some measures of the use of the national remote learning program. The variable in Column (1) indicates whether the parent considers it helpful that the resources from AeC continue to be delivered when their child returns to preschool. The variable in Column (2) indicates whether the parent reported that their child accessed AeC resources. The variable in Column (3) indicates whether the parent reported their child as very satisfied or satisfied with the resources from AeC. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects and control for baseline characteristics as described in Model (1). Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.10
Validity checks for the parents' sample.

Panel A: Attrition		
	(1) Attrited from parents' sample	(2) Attrited from parents' sample
Direct effect group	0.022	0.021
	(0.016)	(0.016)
Spillover group	0.026*	0.024*
	(0.015)	(0.014)
Observations	4496	4496
Strata FE	28	28
Networks	691	691
Covariates	No	Yes
F p-value	0.846	0.821
Mean dep. var	0.758	0.758

Panel B: Balance on baseline characteristics				
	Direct effect	Spillover	Control	P-value
Child is female	0.50	0.51	0.53	0.900
Child's age	4.48	4.44	4.49	0.311
Parent is female	0.95	0.96	0.98	0.231
Parent's age	31.31	31.43	31.45	0.852
Parent completed high school	0.55	0.49	0.52	0.514
Parent is head of household	0.53	0.59	0.56	0.320
Children at home	2.00	2.14	2.05	0.202
Household assets	7.42	7.20	7.26	0.468
Internet access at home	0.79	0.77	0.81	0.572
Parent is beneficiary of social program	0.22	0.28	0.25	0.449
Remote work at home	0.19	0.15	0.14	0.283
Household access to AeC resources	0.92	0.92	0.96	0.007
Parent stress	0.52	0.51	0.47	0.595
Child stress	0.33	0.28	0.29	0.681
Learning activities at home	4.55	4.52	4.52	0.795
Play materials at home	3.24	3.12	3.18	0.344
Violent discipline practices	0.19	0.14	0.20	0.076
Observations	249	287	554	
Attrition rates (%)	76.7	77.0	74.5	

Note: This table reports validity checks for the sample that responded to both the remote child learning test on the phone and the online survey sent via text message (parents' sample). The model in Panel A estimates the probability that an observation attrited from the parents' sample. Column (2) controls for baseline characteristics as described in Model (1). The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects. Standard errors clustered at the network level are reported in parentheses. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. Panel B reports summary statistics for baseline characteristics by treatment assignment group conditional on being in the parents sample. The p-value corresponds to the F test that the coefficients of the direct effect group and the spillover group are globally nonsignificant estimated from a linear regression using each baseline characteristic as the dependent variable.

Table A.11
Effects on children's cognitive skills (parents' sample).

	(1) Composite score	(2) Numeracy	(3) Literacy	(4) Composite score	(5) Numeracy	(6) Literacy
Direct effect group	0.196**	0.206***	0.122	0.194**	0.209***	0.113
	(0.078)	(0.078)	(0.076)	(0.076)	(0.075)	(0.074)
Spillover group	0.070	0.140*	−0.053	0.095	0.159**	−0.028
	(0.075)	(0.074)	(0.076)	(0.073)	(0.072)	(0.074)
Observations	1090	1090	1090	1090	1090	1090
Strata FE	28	28	28	28	28	28
Networks	547	547	547	547	547	547
Covariates	No	No	No	Yes	Yes	Yes
F p-value	0.151	0.466	0.035	0.239	0.567	0.081
Mean dep. var (control)	−0.006	−0.027	0.026	−0.006	−0.027	0.026
SD dep. var (control)	0.998	0.991	1.001	0.998	0.991	1.001

Note: This table reports the estimated coefficients from Model (1) using as dependent variables the standardized test scores collected from the remote child learning test using the sample that includes children whose parents responded to both the remote child learning test on the phone and the online survey sent via text message (parents' sample) The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. The model in Columns (4)–(6) controls for baseline characteristics as described in Model (1). All regressions include strata fixed effects. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.12
Baseline characteristics of the endline sample by availability of parents' survey.

	Is in parents' sample		Diff. p-value	Obs.
	1	0		
Child is female	0.52	0.48	0.121	1877
Child's age	4.48	4.48	0.684	1877
Parent is female	0.97	0.95	0.042	1877
Parent's age	31.41	30.91	0.160	1877
Parent completed high school	0.52	0.48	0.033	1877
Parent is head of household	0.56	0.63	0.003	1877
Children at home	2.06	2.07	0.726	1877
Household assets	7.28	7.21	0.284	1877
Internet access at home	0.79	0.79	0.760	1877
Parent is beneficiary of social program	0.25	0.22	0.054	1877
Remote work at home	0.15	0.16	0.817	1877
Household access to AeC resources	0.94	0.93	0.239	1877
Parent stress	0.49	0.49	0.852	1877
Child stress	0.30	0.27	0.252	1877
Learning activities at home	4.53	4.45	0.155	1877
Play materials at home	3.18	3.04	0.001	1877
Violent discipline practices	0.18	0.19	0.748	1877

Note: This table reports summary statistics for baseline characteristics in the endline sample separately by whether observations have available information from the parents' sample. The p-value corresponds to the test that the difference between the groups is equal to zero estimated from a linear regression using each baseline characteristic as the dependent variable. See Appendix B.1 for more information about these variables. All regressions include strata fixed effects. Standard errors are clustered at the network level.

Table A.13
Characteristics of the children's assessment (excluding covariates).

	(1) Child was comfortable	(2) Child enjoyed activity	(3) Questions were adequate	(4) Child understood questions	(5) Application difficulty	(6) Any item did not work	(7) Application quality	(8) Test duration (min)
Direct effect group	−0.013	0.006	0.023	0.024	−0.044	−0.009	0.034	−0.130
	(0.014)	(0.007)	(0.021)	(0.023)	(0.054)	(0.017)	(0.035)	(0.252)
Spillover group	0.011	0.003	0.021	0.037*	0.043	0.007	0.010	0.103
	(0.012)	(0.007)	(0.020)	(0.021)	(0.050)	(0.017)	(0.033)	(0.233)
Observations	1877	1877	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28	28	28
Networks	640	640	640	640	640	640	640	640
Covariates	No	No	No	No	No	No	No	No
F p-value	0.086	0.734	0.932	0.613	0.137	0.427	0.514	0.433
Mean dep. var (control)	0.947	0.984	0.841	0.800	1.860	0.104	4.276	15.618
SD dep. var (control)	0.225	0.127	0.365	0.400	0.948	0.306	0.626	3.790

Note: This table reports the estimated coefficients from Model (1) using as dependent variables some characteristics of the remote child learning test. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals that belong to a pure control network. Variables in Columns (1)–(4) were collected from parents and are measured as dummy variables as described in Appendix B.2. Variables in Columns (5)–(8) were collected from enumerators. The variable in Column (5) is measured with a 5-point Likert scale (where 1 corresponds to very easy and 5 to very difficult). The variable in Column (6) is an indicator for whether any item from the test did not work properly during the application. Our measure for application quality in Column (7) was computed as an average of the eight dimensions evaluated by enumerators as described in Appendix B.2. The variable in Column (8) corresponds to the test duration in minutes. All regressions include strata fixed effects and exclude covariates. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.14
Parents' interference during the children's assessment (excluding covariates).

	(1) Parents interfered	(2) Total interruptions	(3) Repeating questions	(4) Providing encouragement	(5) Offering help	(6) Providing answers
Direct effect group	−0.006	0.136	−0.015	−0.023	0.007	0.037
	(0.023)	(0.469)	(0.028)	(0.027)	(0.029)	(0.026)
Spillover group	0.018	−0.346	−0.003	−0.033	−0.000	0.026
	(0.021)	(0.420)	(0.028)	(0.026)	(0.028)	(0.025)
Observations	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28
Networks	640	640	640	640	640	640
Covariates	No	No	No	No	No	No
F p-value	0.361	0.365	0.720	0.768	0.822	0.722
Mean dep. var (control)	0.810	7.012	0.610	0.603	0.570	0.280
SD dep. var (control)	0.393	8.087	0.488	0.490	0.495	0.449

Note: This table reports the estimated coefficients from Model (1) using as dependent variables some indicators of parents' interference during the test reported by the enumerators. The direct effect group corresponds to individuals in the treatment network who were assigned to the text message campaign. The spillover group corresponds to individuals who belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. Variables in Columns (1), (3)–(6) are dummy variables. The variable in Column (2) corresponds to the number of times that parents interfered during the test. All regressions include strata fixed effects and exclude covariates. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Table A.15
Effects on children's cognitive skills (including enumerator FE).

	(1) Composite score	(2) Numeracy	(3) Literacy	(4) Composite score	(5) Numeracy	(6) Literacy
Direct effect group	0.093*	0.100*	0.054	0.102**	0.108*	0.062
	(0.054)	(0.058)	(0.052)	(0.052)	(0.056)	(0.050)
Spillover group	0.013	0.070	−0.074	0.029	0.077	−0.051
	(0.055)	(0.056)	(0.055)	(0.054)	(0.056)	(0.054)
Observations	1877	1877	1877	1877	1877	1877
Strata FE	28	28	28	28	28	28
Enumerator FE	53	53	53	53	53	53
Networks	640	640	640	640	640	640
Covariates	No	No	No	Yes	Yes	Yes
F p-value	0.186	0.648	0.029	0.208	0.619	0.053
Mean dep. var (control)	0.000	0.000	0.000	0.000	0.000	0.000
SD dep. var (control)	1.000	1.000	1.000	1.000	1.000	1.000

Note: This table reports the estimated coefficients from Model (1) using as dependent variables the standardized test scores collected from the remote child learning test. The model in Columns (4)–(6) controls for baseline characteristics as described in Model (1). The direct effect group corresponds to individuals in the treatment network who were assigned to receive the text message campaign. The spillover group corresponds to individuals that belong to a treatment network but were not assigned to receive the text messages. The omitted category is the control group, which corresponds to individuals who belong to a pure control network. All regressions include strata fixed effects and enumerator fixed effects. Standard errors clustered at the network level are reported in parentheses. We define a network as a group of parents who share the same preschool teacher. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively. The p-value corresponds to the F test that the coefficients of the direct effect group and spillover group are equal.

Appendix B. Data sources and construction of variables

B.1. Main variables collected through online surveys

- **Parent stress:** This variable indicates whether the parent reported feeling stressed frequently during the past week. We used a modified version of the Center for Epidemiologic Studies Depression Scale Revised (CESD-R, 2020). This dummy equals 1 if the parent reported either "Often" or "Most of the time" for any item. Items: 1. Feel tired or without energy; 2. Have trouble falling sleep; 3. Not have appetite; 4. Feel sad/depressed; 5. Feel nervous/worried. This variable is available for baseline and endline. Possible item responses: Never/rarely (less than a day) [value = 1]; Sometimes (1–2 days) [value = 2]; Often (3–4 days) [value = 3]; Most of the time (5–7 days) [value = 4].

- **Child stress (reported by parent):** This variable indicates whether parents reported that their child was feeling stressed frequently during the past week. We used a modified version of the CESD-R (2020). This dummy equals 1 if the parent reported either "Often" or "Most of the time" for any item. Items: 1. Was nervous/tense; 2. Worried too much; 3. Was sad; 4. Could not sleep well. This variable is available for baseline and endline. Possible item responses: Never/rarely (less than a day) [value = 1]; Sometimes (1–2 days) [value = 2]; Often (3–4 days) [value = 3]; Most of the time (5–7 days) [value = 4].

- **Play materials at home:** This variable indicates whether the child plays with certain objects. It takes values between 0 and 4. Items were adapted from UNICEF's MICS6 Questionnaire for Children under Five (UNICEF, 2020). This index is constructed as the summary score of the following four indicators: 1. Household objects or objects found outside (pots, rocks, sticks); 2. Store-bought toys; 3. Homemade toys; 4. Technology (smartphone, tablets, computer). This variable is available for baseline and endline. Possible item responses: Yes [value = 1]; No [value = 0].

- **Learning activities at home:** This variable indicates whether during the past three days, the parent or any other household member (older than 15 years old) engaged in certain activities with the child. It takes values between 0 and 5. Items were adapted from UNICEF's MICS6 Questionnaire for Children under Five (UNICEF, 2020). This index is constructed as the summary score of the following five indicators: 1. Read books/look at pictures; 2. Tell stories; 3. Sing songs; 4. Play; 5. Name objects or draw things. This variable is available for baseline and endline. Possible item responses: Yes [value = 1]; No [value = 0].

- **SMS proposed activities:** This variable indicates whether during the past three days, the parent or any other household member (older than 15 years old) engaged in certain activities with the child. It takes values between 0 and 6. This index is constructed as the summary score of the following six indicators: 1. Do exercise; 2. Count objects; 3. Compare objects "bigger/smaller than"; 4. Play using adding and subtraction games; 5. Name objects from the household/food/animals; 6. Play separating words into syllables. This variable is available for endline. Possible item responses: Yes [value = 1]; No [value = 0].

- **Violent discipline practices:** This variable indicates whether parents or any other adult in the household have used certain discipline practices with the child in the past month. Items: 1. Took away privileges, forbade something; 2. Explained why behavior was wrong; 3. Shook him/her; 4. Yelled at him/her; 5. Gave him/her something else to do; 6. Spanked him/her with bare hand; 7. Hit him/her with a belt or hard object; 8. Called him/her dumb or lazy; 9. Hit him/her on the face; 10. Hit him/her on the hand. The dummy variable indicates whether parents responded they have used any practice in 3, 4, 6, 7, 8, 9, or 10. Items were adapted from UNICEF's MICS6 Questionnaire for Children under Five (UNICEF, 2020). This variable is available for baseline and endline. Possible item responses: Yes [value = 1]; No [value = 0].

- **Household assets:** This index indicates whether the household has certain services/goods at home. It takes values between 0 and 13 and is constructed as the summary score of the following indicators: 1. Bathroom; 2. Refrigerator; 3. Motorcycle; 4. Car; 5. Piped indoor water; 6. Electricity; 7. Air conditioner; 8. Color TV; 9. Radio; 10. Telephone; 11. Smartphone; 12. Computer/laptop; 13. Tablet This variable is available for baseline. Possible item responses: Yes [value = 1]; No [value = 0].

- **Parents' perception of their child's skills tested during the assessment:** This variable shows how parents evaluate their child's skills in certain tasks. Each item takes values between 1 and 3. We look at each item separately. Items: 1. Counting more than 10 objects (oral counting); 2. Distinguishing between "more objects" and "less objects" (number comparisons); 3. Addition; 4. Subtraction; 5. Knowing the name of food/kitchen/bathroom items (expressive vocabulary); 6. Understanding stories or simple instructions (oral comprehension). Possible item responses: Low [value = 1]; Medium [value = 2]; High [value = 3].Using this information, we also construct an indicator of whether the parents' perception coincides with the assessment result. To do that, we create a dummy variable of whether the parent considers that their child has medium or high ability in each task and compare that with whether the child correctly answered at least one item of that task during the assessment. These variables are available for endline.

- **Parental efficacy:** This variable shows how much parents agree with certain statements about their parental efficacy. This index takes values between 1 and 4 and is constructed as the average value of the following 11 items: 1. I feel prepared to support my child's education; 2. Sometimes I react too strongly when my child misbehaves; 3. I can help my child to learn new things; 4. I understand my child's feelings; 5. I can construct a happy and peaceful home; 6. I can control my child's emotions;7. Being a parent is manageable, any problems are easily solved; 8. I can explain things to my child; 9. I can follow routines with my child; 10. I frequently tell my child I love him/her; 11. I congratulate my child for doing things right. Some items were taken from Gibaud-Wallston & Wandersman's Parenting Sense of Competence Scale (Johnston and Mash, 1989). This variable is available for endline. Possible item responses: Strongly disagree [value = 1]; Disagree [value = 2]; Agree [value = 3]; Strongly agree [value = 4]

- **Teacher reported high level of parent-initiated communication within the network:** This variable shows how many families have communicated with the teacher during the pandemic. This indicator takes a value of 1 if the teacher reported either "Almost all" or "All". This classifies networks as "high-initiative" or "low-initiative". Possible item responses: Nobody [value = 1]; Some [value = 2]; Half [value = 3]; Almost all [value = 4]; All [value = 5]. This variable is available for baseline.

B.2. Remote assessment of early childhood cognitive skills

We designed an instrument to measure cognitive ability in early childhood based on a remote adaptation of existing standardized tests

such as the Early Grade Mathematics Assessment EGMA (RTI International, 2009) and the Measuring Learning Quality and Outcomes (UNESCO et al., 2017).[19] These tests provide relevant and valid content to capture key cognitive skills in the early childhood. We complemented this information with insights from officials and early childhood experts at Costa Rica's Ministry of Education (MEP) to align the instrument with specific requirements of the curriculum and the local context. Our telephone-based instrument is intended to be used as a low-stakes assessment to monitor early cognitive ability and not as a screening test for diagnostic use. In addition, we specifically tailor our instrument to account for the restriction that, due to poor Internet connectivity in the areas of interest, the cognitive tasks could not rely on visual aids.[20]

Informed consents. Enumerators introduced themselves and asked to speak with the person in charge of the child's education. They explained that they were calling from Innovations for Poverty Action, a nongovernmental organization working with the MEP as part of a study within the "Aprendiendo en Familia" program. Then, they asked whether they could proceed to provide more information and when was a good time to call back. It was explained that this was an invitation to participate in a study to learn about child development during the lockdown and that it consisted of a short survey via text message and an activity with the child over the phone that included some questions and games that should take about 20 min. It was highlighted that this activity was not an evaluation of the child and it was completely voluntary and confidential. As an incentive to participate in the assessment test, we offered caregivers the possibility to enter a raffle to win a tablet. When caregivers consented to participate and before starting any activity, enumerators told children that they were interested in knowing more about the things that children know and can do and for that reason they were inviting them to talk to them and play some games. They said that if they wanted to stop talking at any point they should tell them and then they we asked whether they would like to participate.

Protocol. Enumerators told caregivers to find a place without noise or distractions for the call, make sure they were in a place with a stable phone signal, and verify that the device had enough power charge for the call. Then, enumerators asked caregivers to put the cell phone on speaker and make sure that the child was seated in front of the device and hands free, without touching the device. Importantly, caregivers were asked to stand behind the child and avoid interrupting or helping in answering the questions. To mitigate potential caregiver interference, the enumerator explained that they should let the child answer the questions by himself/herself and clarified that caregivers are not supposed to interrupt to provide answers, repeat the questions, or encourage their child. In addition, whenever there was any interruption from the parents, the enumerator said to the caregivers "remember not to provide answers to your child or repeat the questions, or encourage him to answer. The most important thing here is his or her own effort". Other reminders said, "The best way to help your child is letting him to respond by himself", "Do not worry because this activity does not have any grading" and "Your child is doing a very good job".

Data collection tools. We used *SurveyCTO* to design and construct a survey form in ODK language that allows collecting data from a mobile app. The advantages of this tool include real-time collection and monitoring, the possibility of adding audio and text audits for quality verification, and plug-ins to integrate mobile services with the *SurveyCTO* app. We provided specific mobile devices and headphones to the field staff to ensure the that they all had the recommended technology for the activities. The average test was 15.63 min long with 86 percent of the children spending between 10 and 20 min, 11 percent spending between 20 and 30 min, 2 percent spending less than 10 min, and less than 1 percent spending more than 30 min.

Scores. The scale contains 29 items grouped into 9 tasks: (i) spatial reasoning, (ii) oral counting, (iii) number comparisons, (iv) addition and subtraction, (v) sequences, (vi) weight and size comparisons, (vii) syllabication, (viii) oral comprehension and (ix) expressive vocabulary. We treat items as binary in the sense that each of them can be either correct (score = 1) or incorrect (score = 0), and compute a composite score as the sum of all the items, giving each item the same weight. This implies that each item is equally important to each other and that all items are positively related to cognitive ability. Missing responses when the child did not know the answer are counted as incorrect. The average raw composite score was 20.20 (SD = 5.16, min = 1, max = 29). We also compute a numeracy score and a literacy score as the sum of items that are related to each knowledge area. These are spatial reasoning, oral counting, number comparisons, addition and subtraction, sequences, and weight and size comparisons for numeracy; and syllabication, oral comprehension, and expressive vocabulary for literacy. The average numeracy raw score was 12.57 (SD = 3.54, min = 1, max = 18) and the average literacy raw score was 7.63 (SD = 2.38, min = 0, max = 11). Each of these scores was standardized to have a mean of zero and a standard deviation of one in the pure control group.

Validity and reliability. The Cronbach's alpha coefficient across the 29-item scale is 0.8217, suggesting that items have high internal consistency to measure cognitive ability. We complement this evidence with Item Response Theory to characterize items in terms of their difficulty/location and discrimination/information parameters by fitting a two-parameter logistic (2PL) model.[21] Fig. B.1 shows that there are four items about number comparisons, sequences, and listening comprehension that are relatively difficult (positive estimates). The items that are the least difficult are about weight and size comparisons, oral comprehension, and spatial reasoning. In terms of discrimination, the items that can distinguish low- and high-ability children focus on syllabication and sequences. Those least likely to distinguish abilities focus on listening comprehension and number comparison. Fig. B.2 shows the expected score for different levels of estimated children's ability: children with above-average ability are expected to have a composite score above 21 and about 95 percent of randomly selected children are expected to score between 9.77 and 27.

Known-groups method. We provide an additional validity test (Hattie and Cooksey, 1984) to show that the assessment is able to discriminate across children age groups that are theoretically expected to differ. Each cell corresponds to a two-sample t test with unequal differences. We use the sample in the pure control group. Standard errors are reported in parentheses. Significance at the 1, 5 and 10 percent levels is indicated by ***, ** and *, respectively (see Table B.1).

Enumerators. The assessments were applied by trained enumerators with relevant experience with technology and data collection, as well as previous experience working with children during interviews, test application, or teaching. Enumerators shared their opinions about the difficulty of the application itself, 75.81 percent considering it easy or very easy to collect and 90 percent reporting that all items worked properly during the application. We also asked enumerators to evaluate the quality of the test application in several dimensions using a Likert scale from 1 to 5 (where 1 is very low and 5 is very high). Their feedback shows an overall satisfaction with the assessment's administration in terms of the call quality, the communication with the caregivers, and the child and the environment of the home during the assessment: background noise, distractions from people in the room, child's attitude, etc. (see Table B.2).

[19] In 2020, we worked with the Ministry of Education of Peru and the *Instituto Colombiano de Bienestar Familiar* (ICBF) in Colombia on a pilot to test a remote version of the MELQO questionnaires as a tool to measure early childhood development. These questionnaires were a useful input for the final version of the instruments used in this study.

[20] For example, we do not include items related to writing, mental transformation, letters', numbers' or shapes' identification.

[21] For estimation we use the Stata package for IRT.

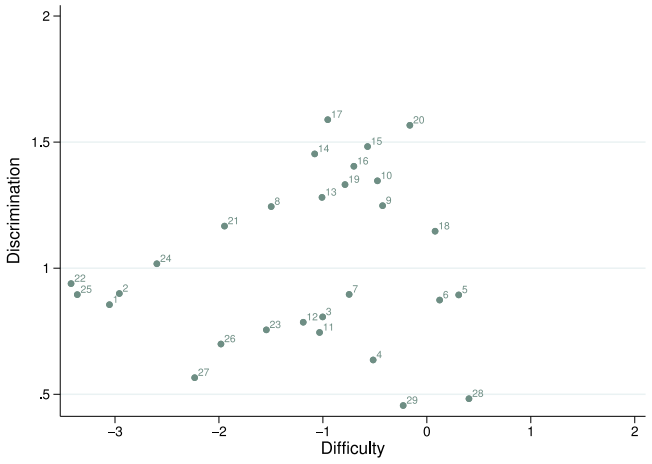


Fig. B.1. 2PL item parameters.

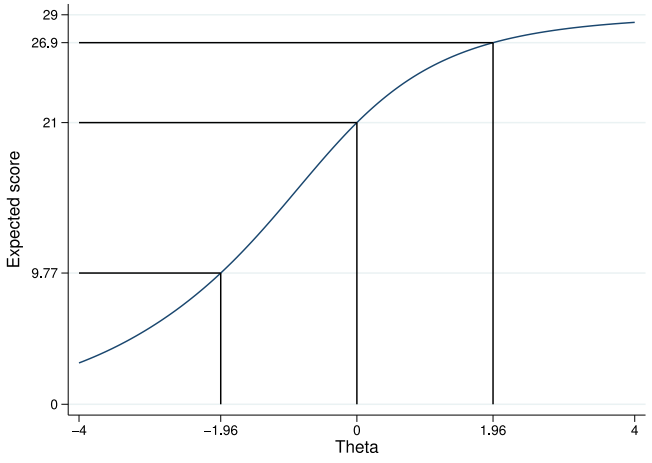


Fig. B.2. Test characteristic curve.

Caregivers. We asked caregivers to be near the child and monitor the phone call while the call was taking place. This implies that they have a very important role during the administration of the test. We gathered qualitative information from them and overall, results were very positive in terms of the child being comfortable during the assessment and the child enjoying the activity. In addition, caregivers considered that the questions asked od the child were adequate for their age-group and believed that their child understood the questions (see Table B.3).

Table B.1
Known-groups method.

	Difference in score by child age (four to five years)
Composite score	2.221***
	(0.330)
Numeracy	1.433***
	(0.224)
Literacy	0.788***
	(0.155)
Spatial sense	0.103***
	(0.031)
Verbal counting	0.183***
	(0.031)
Number comparison	0.375***
	(0.080)
Addition and subtraction	0.239***
	(0.073)
Sequences	−0.427***
	(0.087)
Comparisons	0.107***
	(0.040)
Syllable awareness	0.294***
	(0.096)
Listening comprehension	0.293***
	(0.079)
Expressive vocabulary	0.201***
	(0.051)
Observations (control group)	921

Table B.2
Enumerators' reports.

	Mean	Std. Dev.	Min	Max
Call quality	4.494	0.774	1	5
Communication with caregiver	4.746	0.505	1	5
Communication with child	4.368	0.814	1	5
Parent behavior	4.054	0.965	1	5
Child understood instructions	4.117	0.891	1	5
Child understood activities	4.103	0.890	1	5
Child attention	4.170	0.906	1	5
Environment at home	4.226	0.935	1	5
Observations	1877			

Table B.3
Caregivers' reports.

	Mean	Std. Dev.	Min	Max
Child was comfortable	0.946	0.226	0	1
Child enjoyed activity	0.986	0.119	0	1
Questions were adequate	0.853	0.354	0	1
Child understood the questions	0.815	0.388	0	1
Observations	1877			

Appendix C. Messaging campaign by topic

See Table C.1.

Table C.1
Messaging campaign by topic

	Topic	Message
1	Healthy habits	Movement helps oxygenate the brain and strengthen the heart! Your child needs 2 h of movement a day until his cheeks turn red.
2	Healthy habits	Screens affect brain development. Monitor what your child sees and limit screen use to no more than 2 h at a time. You are very important to your child! Playing the games we suggest can help you learn many things for your future.
3	Healthy habits	Movement boosts learning! Have your child play games at home, run, dance, and jump.
4	Healthy habits	Hello! Screens affect brain development. Monitor what your child sees and limit screen use to no more than 2 h at a time.
5	Healthy habits	Play produces chemicals in your child's brain making them feel relaxed, happy, and positive. Play dance, tickle, run I'll catch you...
6	Healthy habits	Play is the best medicine if your child is anxious, stressed, aggressive, or sad. Play 30 minutes without interruption.
7	Healthy habits	Sleep eliminates toxins, stress, and allows you to learn faster. Try to always sleep at the same time, without using technology an hour before.
8	Literacy	Let's separate words into parts! Say a word, for example: azul, then divide it into parts saying a - zul, and for each part jump! Practice daily!
9	Literacy	Let's play name objects! In the kitchen with your child, name objects you see. Point to an object and ask your child: What is this? if he does not know, tell him
10	Literacy	Tell your child stories while you hug him. For example, say: Let me tell you about something you did when you were a baby. Ask him questions about what he tells you.
11	Literacy	Let's separate words into parts! Say a word, for example: azul, then divide it into parts saying a - zul, and for each part, jump! Practice daily!
12	Literacy	Let's play name objects! In the bathroom with your child, name the objects you see. Point to an object and ask your child: what is this? if he does not know, tell him.
13	Literacy	Sit down with your child, give him a hug and a kiss. Read stories, recipes, stories, and ask questions about what you read. Did you enjoy it when your child showed you how to count things? That and more you can learn every day with your love and support, make this week's games and have fun!
14	Literacy	Let's play name objects! Ask your child to name all the fruits and vegetables he knows. Help him and make a list together.
15	Literacy	Ask your child about something that happened. For example: Tell me what you like to eat the most? Talk, listen, and ask questions.
16	Literacy	Let's separate words into parts! Look for objects in the kitchen; for example: olla (pot). Divide it into parts by saying o-lla. For each part, clap your hands. Practice daily
17	Literacy	Let's play name objects! Ask your child to name all the animals they know. Help him and make a list together.
18	Literacy	Let's separate words into parts! Find an object in the bathroom, for example: jabon (soap), divide it into parts saying ja-bon. For each part, clap. Practice daily!
19	Literacy	Let's play name objects! In the kitchen with your child, name objects you see. Point to an object and ask your child: What is this? if he does not know, tell him. Everything your child learns today will last a lifetime. Help him by doing activities at home, you play an important role in his development!
20	Numeracy	Help your child understand the meaning of fewer objects. Frequently use vocabulary such as gifting, giving, taking away, reducing, and diminishing.
21	Numeracy	Let's play counting! Ask your child to count to the highest number they know, then tell him the next number and ask him to repeat. Practice daily!
22	Numeracy	Let's play addition! Ask your child, for example: you have 4 objects and I give you 2 more, how many objects are you going to have. Play daily with different amounts.
23	Numeracy	Your child can now identify numbers from largest to smallest. Look for groups of objects at home, count them and ask which group has more things. Practice daily!
24	Numeracy	Let's play with numbers! Ask your child: What number comes before 6? What number comes after 6? Practice daily with other numbers!
25	Numeracy	Let's play subtraction! Ask your child, for example: you have 5 apples and you eat 2, how many apples do you have left? Practice daily with different amounts.

(*continued on next page*)

Table C.1 (*continued*).

26	Numeracy	Let's play counting! Ask your child to count objects such as beans, spoons, or stones. Encourage him to reach a higher number each time.Practice daily!
27	Numeracy	Find 7 objects, put 5 in a box; ask your child to add 2 and ask: how many objects are in the box? Play daily with different amounts.
28	Numeracy	Let's play compare numbers! Say two numbers to your child and ask him to tell you which one is bigger and which one is smaller. Practice daily!
29	Numeracy	Let's play with numbers! Give your child a number from 1-15, and ask: What number comes first? What number comes after? Practice daily!
30	Numeracy	Let's play subtraction! Ask your child: you have 6 chickens and you give 4 to a friend, how many chickens do you have left? Practice daily with different amounts! Doing activities at home with your child can help them learn how to learn. Have fun with the activities that we propose!
31	Numeracy	Let's play counting! Ask your child to count backwards from 10 out loud: 9, 8, . . . Then ask him to count backwards from 20. Practice daily!
32	Numeracy	Let's play addition! Ask your child, for example: you have 6 objects and I give you 3 more, how many objects are you going to have? Play daily with different amounts. Everything your child learns today will last a lifetime. Help him by doing activities at home, you play an important role in his development!
33	Numeracy	Your child can now identify numbers from largest to smallest. Look for groups of objects at home, count them, and ask which group has more things. Practice daily!
34	Numeracy	Let's play with numbers! Ask your child: What number comes before 8? What number comes after 8? Practice daily with other numbers!
35	Numeracy	Let's play counting 2 by 2! Ask your child to count by 2s: 2, 4, 6... to the highest number he knows. Practice daily! Talking frequently with your child will help him have the skills to be successful in the future. Do together the activities that we propose!
36	Numeracy	Let's play with numbers! Give your child a number from 1-15 and ask what number comes first? What number comes after? Practice daily! You can help your child develop skills to be successful. You can practice different ways of thinking this week with the tips we give you. Your child can learn new things every day. Don't let him miss out on valuable learning for life! Help him with games that we propose every week
37	Numeracy	Find 9 objects, put 3 in a box, ask your child to add 6 and ask: how many objects are in the box? Play daily with different amounts.
38	Positive parenting	Parents influence how their children feel. Appear calm. If you are upset, try to call a friend, family member and take 5 deep breaths
39	Positive parenting	Your child is learning to control impulses and emotions. You can set limits with love, firmness, and perseverance.
40	Positive parenting	Remember to hug your child often. A hug awakens feelings of calm and happiness.
41	Positive parenting	Movement reduces stress. Exercise for 30 min 4 days a week. In the first 10 min you will feel better.
42	Positive parenting	Remember that your child's brain is not like an adult's. He is still learning to express his emotions. Speak with patience and love.
43	Positive parenting	Play games with your child giving hugs, kisses, tickles, and dance together. Make your child feel happy.
44	Positive parenting	When feeling anxious, avoid overreacting with your child: take a deep breath through your nose for 5 s, hold for 5 s, and release air through your mouth for 5 s.
45	Positive parenting	Remember that your child is learning to express emotions. When he throws tantrums it is because he does not know another way to express himself. Put his emotions into words
46	Positive parenting	Sometimes your child can make you anxious and overreact. Sing, hum a song, gargle, stimulate the throat. That helps to relax.
47	Positive parenting	Remember that your child's brain is developing. Use positive ways to correct him. Yelling and spanking negatively affect his learning and his brain.

(*continued on next page*)

Table C.1 (*continued*).

48	Teachers	During the pandemic, maintain the link with your child's teacher to continue their learning process and the development of their skills.
49	Teachers	Try to contact your child's teacher to find out about educational activities. Don't let him miss out on a valuable opportunity to learn! Reading, learning words, and talking with your child will help him or her be a good student. Do together the activities that we propose!
50	Teachers	If in doubt, contact your child's teacher for help with educational activities. He plays a very important role in helping your child learn. The home is the first educational environment. Do not miss the opportunity to learn something new today. Help your child's development by doing activities this week
51	Time management	Make a weekly plan with activities to help your child learn, play, and communicate with friends. Write it on a piece of paper and put it on the wall.
52	Time management	Try to maintain routines with your child. Follow a plan: start with breakfast, then educational activities, continue with physical exercises, homework, and games! You can help your child prepare for when they return to class! You can practice the activities and tips we give you every week!
53	Introduction	Welcome to the program APRENDIENDO EN FAMILIA. Every week you will receive an SMS with tips that will support you in your child's education. We hope that these messages are helpful! The SMS will give you some tips on healthy habits for you and your child and simple games to learn different ways of thinking. APRENDIENDO EN FAMILIA is an initiative of the Ministry of Public Education of Costa Rica.
54	Farewell	This is the last SMS of APRENDIENDO EN FAMILIA. We hope that you have enjoyed the content and keep using these messages with your child. You have done a great job, congratulations!
	Control group	The Strategy APRENDO EN CASA has television and radio programs, work guides and online materials dedicated to your child. Ministry of Public Education of Costa Rica.

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