Policy Research Working Paper 10814

From Access to Achievement

The Primary School-Age Impacts of an At-Scale Preschool Construction Program in Highly Deprived Communities

Marina Bassi
Bruno Besbas
Lelys Dinarte-Diaz
Saravana Ravindran
Ana Reynoso

WORLD BANK GROUP
Education Global Practice &
Development Research Group
June 2024

Policy Research Working Paper 10814

Abstract

Using a randomized control trial, this paper studies an at-scale preschool construction program that serves poor communities in rural Mozambique. In addition to the construction of preschools, the program hired local instructors and provided parenting education sessions. The findings show that the program had high take-up rates, significantly increasing access to preschool education. Compared to a small base of 2 percent of children in control communities enrolled in preschool, the intervention increased preschool enrollment rates in treated communities by 73 percentage points. The program also had significant positive effects on enrollment in and progression through primary school, with an increase of 6 percentage points in enrollment in first grade at age 6, and a 0.16 standard deviation impact on an index of cognitive and social-emotional skills. Using machine learning tools, the paper estimates substantial heterogeneity by child development skills at baseline. Moreover, the program caused parents in treated communities to invest more time in supporting their primary school-aged children.

This paper is a product of the Education Global Practice and the Development Research Group, Development Economics. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at mbassi@worldbank.org and ldinartediaz@worldbank.org. A verified reproducibility package for this paper is available at http://reproducibility.worldbank.org, click **here** for direct access.

From Access to Achievement: The Primary School-Age Impacts of an At-Scale Preschool Construction Program in Highly Deprived Communities*

Marina Bassi† Bruno Besbas‡ Lelys Dinarte-Diaz§
Saravana Ravindran¶ Ana Reynoso||

Keywords: Early childhood development, public-private partnership, Mozambique

JEL Classification: I24, J13, L32

*We thank Lúcia Nhampossa for her extremely valuable contributions to this project. We also thank Jem Heinzel-Nelson and Sandra Barros Martins for leading the qualitative data collection activities and analysis. This paper has benefited greatly from the helpful feedback of Orazio Attanasio, Hoyt Bleakley, Damien De Walque, Emanuela Galasso, Sara Heller, Carolina Lopez, Costas Meghir, Norbert Schady, Manisha Shah, Dean Yang, and seminar participants at MWIEDC UChicago 2024 and University of Michigan. This work was supported by the World Bank SIEF Trust Fund. DICIPE was financed by a World Bank and Global Partnership for Education grant through the Education Sector Support Fund (FASE). Ravindran is funded by a startup grant at the Lee Kuan Yew School of Public Policy, National University of Singapore. Juan Fernando Duque provided superb research assistance. The authors have no conflicts of interest to report. The findings, interpretations, and conclusions expressed in this report are entirely those of the authors. They do not necessarily represent the views of the World Bank and its affiliated organizations, its Executive Directors, or the governments they represent.

†The World Bank. Email: mbassi@worldbank.org

‡Email: bruno.besbas@protonmail.com

§Development Research Group. The World Bank. Email: ldinartediaz@worldbank.org

¶Lee Kuan Yew School of Public Policy, National University of Singapore. Email: saravana@nus.edu.sg

||University of Michigan. Email: areynoso@umich.edu

1 Introduction

Although the cost effectiveness of investing in early childhood is widely recognized, only 20% of children living in low-income countries were enrolled in preprimary education in 2019. In Mozambique, the situation is even more disturbing, with only 3.5% of children between 3 and 5 years of age enrolled in preschool (MINEDH, 2020).[1] In a country with one of the highest levels of poverty in the world, low preschool attendance is a huge missed opportunity. A growing body of evidence finds that interventions targeted at children from birth to six years of age have great promise in improving children's lifetime path of human capital and income (Holla et al., 2021; Black et al., 2017; Almond and Currie, 2011; Knudsen et al., 2006; Bos et al., 2024; Attanasio et al., 2022; Bailey et al., 2021; Sylvia et al., 2021; Attanasio et al., 2014).[2] Furthermore, evidence shows that preschool programs in low- and middle-income countries can yield benefit-to-cost ratios ranging between 3.5 and 103.5 (Holla et al., 2021) and that increasing preschool enrollment rates in these countries to 25% could yield an estimated US$10.6 billion through higher educational achievement (Engle et al., 2011). However, designing scalable preschool policies in environments of extreme deprivation has proven challenging due to—among other reasons—inadequate implementation capacity (Bernal et al., 2019; Bouguen et al., 2018; Berkes et al., 2024).

In this paper, we use a cluster randomized control trial (RCT) to evaluate the implementation of a large-scale preschool construction program in Mozambique—the Mozambique Early Childhood Development Project (henceforth DICIPE, from its Portuguese acronym). The program targeted children aged 3 to 5 years living in rural communities in Mozambique and involved unique characteristics that resulted in increased pri-

[1] The small proportion of children who benefit from preschool enrollment does so mainly through private or community schools (MINEDH, 2020).

[2] In a recent meta-analysis, Holla et al. (2021) estimates that preschool education interventions improve children's cognitive and socioemotional skills by an average of 0.15 SD and 0.12 SD, respectively, during the preprimary period. The authors also estimate that in the post-preprimary period, children benefiting from preschool interventions show a significant advantage of 0.07 SD and 0.094 SD in cognitive and social-emotional skills, respectively. Furthermore, preschool programs improve the long-term outcomes of beneficiaries, including educational attainment, labor, and crime outcomes.

mary school age cognitive skills, improved parental practices, and positive spillovers to younger siblings.

The DICIPE program design included three key components that may help explain its particularly high impacts compared to previous studies. First, a preschool center ("escolinha") was built in each treated community. These preschools were strategically constructed *walking distance* from the local primary school, with the aim of generating economies of scale between preschool attendance and primary school enrollment and progression. In addition, pedagogic activities involved the use of locally available, often recycled materials, such as bottle caps, rice sacks, sticks, and home-made educational materials. Second, the program hired local instructors who were selected by community leaders or the community itself. A minimum level of education was required and, to improve preschool quality (Andrew et al., 2024), teaching skills were complemented with upfront and ongoing training. Third, parenting education sessions were held with caregivers, which have proven effective in different contexts (Wang et al., 2023; Mehrin et al., 2022; Sylvia et al., 2021; Carneiro et al., 2023a; Hamadani et al., 2019). Although the program was managed by the government, activities related to these key components were implemented by a third-party provider with strong community engagement and previous experience in preschool programs. This novel feature of the program design helped strengthen capacity within the Ministry of Education and Human Development (MINEDH) in the preschool subsector, and can be relevant for resource-constrained governments that want to implement programs at scale.

We evaluated the DICIPE program in 218 rural communities in the provinces of Cabo Delgado, Nampula, and Tete that met the eligibility criteria.[3] For example, eligible communities should not have had previous formal or informal preschool services. Within the group of eligible communities—which amount exceeded what the program could cover at this phase—110 of them were chosen at random to receive the DICIPE program, and 108 were randomly assigned to the comparison group. This facilitates our rigorous impact

[3]The program was implemented in five provinces of Mozambique, namely Maputo, Gaza, Cabo Delgado, Nampula, and Tete. Data collection and therefore analysis in this paper focus on the three later provinces.

evaluation of DICIPE.

We collected two rounds of data to measure the impacts of the DICIPE program, before the start of the intervention (baseline) and three years later (medium-term follow-up). Baseline data collection took place between September and December 2016 with 4,687 caregivers and children, while endline data collection was carried out from December 2019 to April 2020 with 3,765 caregivers and their children. We complement these survey data with classroom observation and qualitative interviews with caregivers, facilitators, and school administrators from a subsample of communities. This additional data collection was carried out between June and July 2019. We define the youngest child in the household aged 36 to 59 months at baseline as the "target child" that the intervention targeted. Baseline characteristics depict acute deprivation among the target children and families of our sample. The average target child is stunted and the vast majority of caregivers are illiterate (81%).

The impacts of the DICIPE preschool construction program on primary school-age outcomes are positive and large. First, take-up of preschool education increased massively after construction. Compared to a small base of 2% of children in control communities enrolled in preschool, the intervention increased preschool enrollment rates in treated communities by 73 percentage points. The program also had significant positive effects on enrollment in and progression through primary school: children in treated communities were 6 percentage points more likely to be enrolled in primary school (an effect of about 10%) and 3 percentage points less likely to repeat a grade (an effect of about 20%) compared to children in control communities. Overall, we document intent-to-treat (ITT) impacts of 0.16 of a standard deviation (SD) on a primary school enrollment index.

Second, we assess children's cognitive and social-emotional skills and document ITT impacts of 0.16 SD on a skills index. The magnitudes of these estimates are consistent with other early childhood interventions in the literature (see, for example, Bos et al. 2024; Berlinski et al. 2009). Our qualitative surveys suggest that the close proximity of the preschool centers to the families' residence and to the primary school may be a key mechanism behind increased enrollment in preschool and primary education. Moreover,

the qualitative results also suggest that the good quality of student-teacher interactions in preschool may mediate the positive impact on cognitive and social-emotional skills in primary school.

Recent work has highlighted that the treatment impacts of early childhood interventions can differ for subgroups of the sample (Dinarte Diaz et al., 2023). We explore heterogeneous treatment impacts using machine learning tools and causal forests to estimate the Conditional Average Treatment Effect (CATE) (Athey and Wager, 2016, 2019a; Athey et al., 2019a), following Carlana et al. (2022). We observe substantial heterogeneity by child development skills at baseline. For preschool attendance and primary school enrollment, target children with lower scores at baseline benefited more from the program. However, the opposite is true for the skills index. In this case, the target children with higher scores at baseline benefited more, likely due to dynamic complementarities in the formation of skills (Heckman et al., 2010; Conti et al., 2016; Garcıa and Heckman, 2014).

Interestingly, the program impacted other secondary outcomes. First, it resulted in improved parental practices. We leverage data that we collected on parental stimulation and play activities and find that parents in treated communities provide a more stimulating environment for their children (a 0.17 SD effect), engage more in play at home with their children (0.08 SD), and are more involved with the child's primary school. For example, parents and other household members in the treated communities were 32% more likely to meet with the child's primary school principal in the past year relative to those in control communities. Complementing this finding, we observe a slight but significant decrease in the labor supply of mothers, possibly suggesting that the program promoted a redistribution of time use from work to investment in children. The vast majority of caregivers interviewed in the qualitative study report that they perceive improved children's learning, which could serve as a potential mechanism to the increased quality of parental practices.

Second, the program had interesting spillovers to younger siblings of the target child.[4]

[4]We argue that these results are spillovers because these younger siblings were not the target group when the program was being implemented, i.e., these kids were younger than 3 years of age at that time.

Using data on school enrollment from other children in the household, we document large, positive, and statistically significant impacts on preschool attendance for younger siblings, of about 85% of the estimated treatment impact for target children. This result speaks to the cost-effectiveness of the DICIPE program, as newly built preschools will be there to benefit future generations.

Our paper makes important contributions to the literature in at least three ways. First, our study contributes to recent mixed evidence on the impacts of preschool construction programs in developing countries. Although some studies document positive impacts of preschool construction programs (Berlinski et al. 2008, 2009 in Uruguay and Argentina, and Donald and Vaillant 2023 in the Congo, for example), others find small or null effects (see Blimpo et al. 2022 in the Gambia and Castro and da Cruz 2023 in Brazil). Notably, Bouguen et al. (2018) suggest caution based on the results from a randomized evaluation of a preschool construction program in Cambodia, where the impacts on cognition are negative for the cohort with highest program exposure due to substitution from primary to preschool. Our contribution here is twofold. In addition to showing that the preschool construction program we study in Mozambique led to increased enrollment in primary school and positive impacts on skill formation, we also highlight the unique features of DICIPE that may explain these particularly high impacts, namely the interaction between the program and the local primary school system *by design*.

Second, our research also speaks to the evidence on early childhood development (ECD) programs implemented *at scale* that aim to improve child development (Bos et al., 2024; Attanasio et al., 2022; Bailey et al., 2021; Sylvia et al., 2021; Attanasio et al., 2014). Existing studies find significant improvements of at-scale ECD programs on child's cognitive skills. Our paper contributes to these findings by investigating the effects of a program that was implemented through a public-private partnership, which can be a key policy consideration for resource-constrained governments in developing countries, with the aim of developing or expanding capacity in the preschool sector.

Third, our study adds to the debate about why ECD programs have long-term effects if the effects seemingly dissipate in the medium term (Elango et al., 2015; Yoshikawa

et al., 2016). For example, Gibbs et al. (2013); Bitler et al. (2014); Kline and Walters (2016) use data from the large US Head Start public preschool program and find that the initial cognitive impact fades by the first grade, even though the long-term impacts of the program are positive and significant (Bailey et al., 2021). Some studies offer a solution to this puzzle considering the process through which skills form and develop and highlight the importance of skill formation as a multi-skill dynamic process in which different skills complement each other (Heckman et al., 2010; Conti et al., 2016; Garcıa and Heckman, 2014). We find evidence against medium-term fadeout by showing that an ECD program with the characteristics and components of DICIPE can positively impact medium-term outcomes such as children's primary school performance and cognitive skills, at least in communities under highly deprived conditions.

The paper is organized as follows. Section 2 describes the intervention. Sections 3 and 4 provide details on the sampling, randomization, and data collection for the study. Section 5 describes our estimation and inference methods. Section 6 shows our main results on the effectiveness of the program in improving school-age outcomes, our heterogeneity analysis, and intra-household spillovers. Section 7 shows robustness checks. Finally, Section 8 concludes.

2 The DICIPE Program: Components and Implementation

The Mozambique government launched the Early Childhood Development Program (DICIPE) as a national strategy aimed at expanding access to quality Early Childhood Development (ECD) services for children aged 3 to 5 years in rural communities in ten districts in five provinces where no preschool services existed before.[5] A relevant novelty of the DICIPE program is that its components and delivery mode offer the potential for scalability and sustainability, especially when government implementation capacity is limited.

[5]The program was designed following a successfully tested community-based ECD pilot run by Save-the-Children in the Gaza province of Mozambique. Martinez et al. (2012) evaluates this pilot and finds that the intervention participants were more likely to enroll in primary education at the right age and performed better on measures of school-readiness at age 6.

The DICIPE program included three key components: (i) the construction of preschools ("escolinhas"), (ii) the hiring of local instructors ("facilitadores"), and (iii) parenting education activities. In the first and main component, the program aimed to build 350 low-cost preschools across the five provinces.[6] Initially, the classrooms were designed as open structures with cement floors, straw walls, and aluminum roofs, along with outdoor latrines and safe water sources. The infrastructure was later adapted to more traditional and sustainable construction methods while maintaining low costs.[7] Educational activities utilized readily available and often recycled materials, such as bottle caps, rice bags, sticks, and home-made educational materials. The communities played a vital role in the development and maintenance of their centers of ECD. For example, they provided services such as cleaning and minor repairs. A Community Coordinating Committee (CCC) with 10 community members, including the primary school principal, formally linked the ECD center to the community, serving both advocacy and coordinating roles.

Second, the program hired instructors who were members of the community. These instructors were selected by community leaders and residents, in coordination with the third party provider. A minimum level of education was required, typically the 7th grade, and their teaching skills were supplemented with both upfront and in-service training. The planned training for the program included two weeks of initial training and at least one day of training per month. Instructor stipends were nominal, equivalent to approximately US$11 per month, in contrast to the monthly salary of about US$185 for a first-grade teacher. The program required two instructors for each classroom, with up to 35 children per classroom and two classrooms per preschool.

The third component of the program consisted of parenting education activities. The program monitor and facilitators were expected to hold monthly meetings with parents to discuss critical areas for child growth and development, parenting practices, nutrition, and health care.

Figure A1 presents the timeline of the intervention and data collection. The preschools

[6] As we explain later, we collect data and analyze the impacts from three provinces, covering 210 escolinhas.

[7] All preschools included in this study were built with traditional construction materials

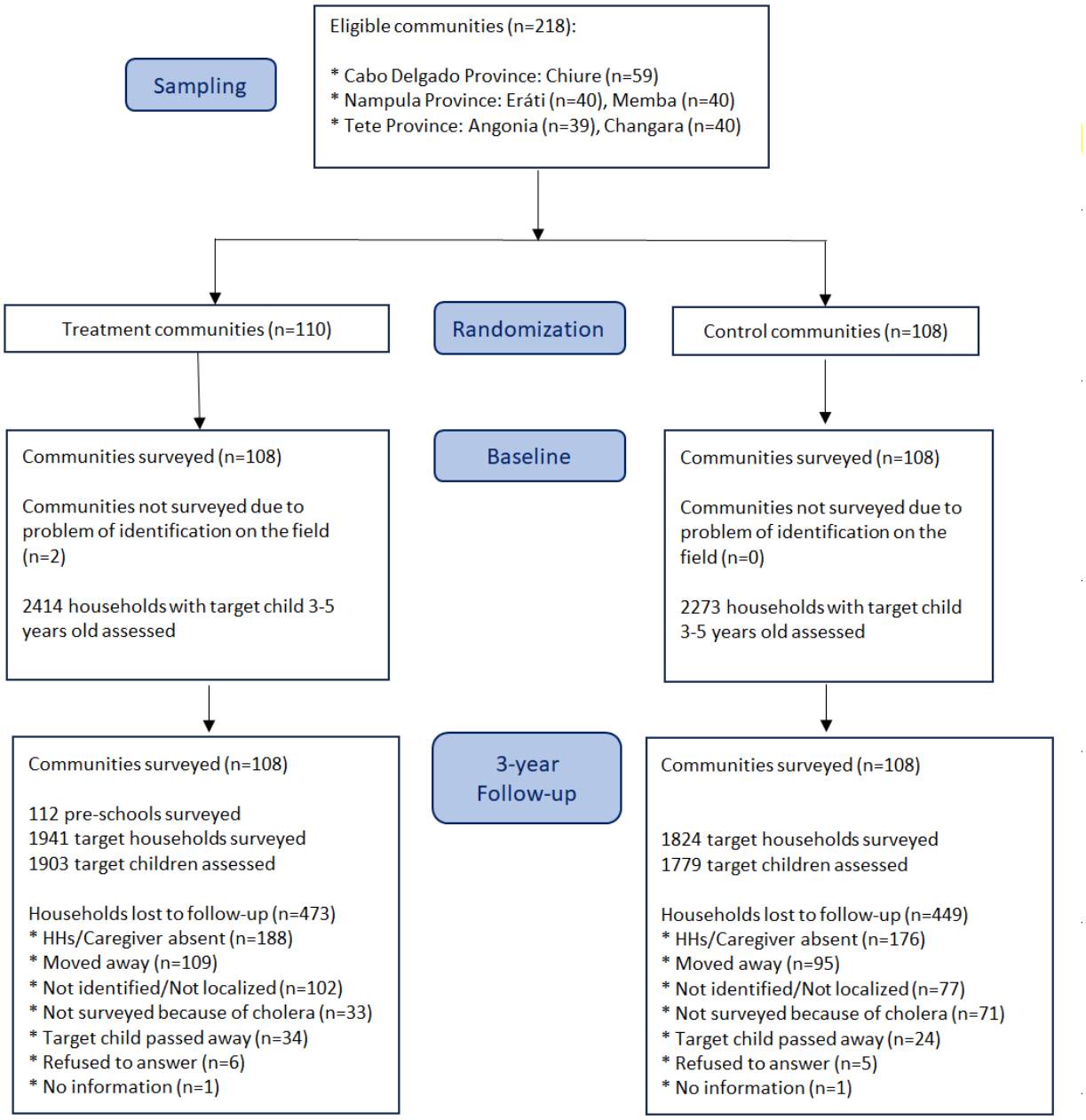
opened between May 2017 and May 2018 and operated from their opening onwards. Summary statistics Table A1 (collected after various months of implementation through the endline survey described in Section 4) reveals the effectiveness of the program components 1 and 2. First, each preschool had on average 4 instructors and 75-79 children enrolled in 2018 and 2019, respectively. An average of 47 children attended the preschools daily, implying a fairly small effective student-teacher ratio. Most preschools were built with a playground (94%) and provided educational games for children (76%). Most preschools also had notebooks or writing paper (56%), pens and pencils (55%), and drawing books or cards (54%). They also had leisure games (56%) and storybooks for children (57%). Instructors had, on average, 8.6 years of schooling, and for most of them, this was their only job. The preschools were open for three hours a day for ten months every year. However, component 3 was not implemented as planned. Although the plan was to hold monthly parenting education sessions, they were held every three months on average.

In terms of delivery modality, the DICIPE program was delivered through a partnership between the Ministry of Education and Human Development (MINEDH) and third-party providers. By the time of the program launch, the MINEDH's implementation capacity was constrained by a parallel rapid expansion in access to primary education and its almost no experience with ECD programs. Fortunately, there was substantial local capacity to implement ECD programs within international and local NGOs. In this sense, the delivery of the ECD package was operated by third-party providers, which were competitively selected and supervised by MINEDH.

3 Experimental Design

The experimental design started with the selection of eligible communities. First, three provinces (out of five provinces participating in the overall DICIPE program) and the two districts within each province—Macomia and Chiúre (Cabo Delgado); Eráti and Memba (Nampula); Angonia and Changara (Tete)—were selected in collaboration with the MINEDH based on their vulnerability, relevance for the intervention, and the extent to which they

Figure 1: Experimental Design and Data



Notes: The figure summarizes the experimental design and data for the study, including sampling, randomization, baseline and 3-year follow-up data collection. *n* refers to the number of observations.

were representative based on geography and socio-cultural factors.[8] At early stages of the implementation of the program, however, the district Macomia in the Cabo Delgado province had to be dropped due to insurgent attacks in the area. Thus, our final sample consisted of five districts in the three provinces.

Second, we selected 218 communities in the five districts (see Figure 1) that met the following eligibility criteria: (i) located in a rural area; (ii) have a primary school; (iii) have more than thirty children between the ages of three and five; and (iv) benefit from no other preschool education intervention during the five years prior to baseline. For practical reasons relating to the construction of preschool facilities, eligible communities should also be accessible by a pickup truck for most of the year. We randomly assigned the sample of 218 eligible communities to receive the program (110 communities) or not (108 communities), stratifying at the district level.

The experiment also required the selection of households to be surveyed and the determination of the "target child" within each household. In each community, we randomly selected up to 24 households that had at least one child in the age range of 36 to 59 months during the baseline in late 2016. Where a caregiver had several eligible children aged 36 to 59 months, the youngest child was selected as the "target child" for our study. In communities with fewer than 24 eligible households, all households were selected for the study. Overall, we surveyed an average of 22 households per community at baseline, which yielded a sample of 4,687 households with at least one child between 3 and 5 years of age. Of these households, 2,414 households were located in treatment communities and 2,273 households in control communities.

[8]This selection criterion included the following indicators: percentage of children aged 6 who were not enrolled in first grade; mortality of under-5 children; the number of children age five and younger; prevalence of malnutrition; and lack of access to safe water sources and sanitation.

4 Data

4.1 Data Collection

Figure A1 presents a timeline for data collection. Baseline data collection took place between September and December 2016. Endline data collection took place approximately three years after the baseline surveys, from December 2019 to April 2020. In both rounds, we followed best practices in survey protocols, and the study was approved by the National Bioethical Committee for Health in Mozambique (CNBS). In-person surveys were conducted in all data collection rounds. The survey instrument was piloted before conducting the baseline survey.

At baseline, we contacted all 4,687 caregivers whose children were eligible to participate in the intervention and consented to enroll in the study to collect their baseline information. Follow-up data was collected from caregivers three years after the baseline survey was conducted. We visited the 4,687 households that took the baseline survey and met the eligibility criteria. Three years after the baseline surveys, we collected follow-up data from 3,765 caregivers and their children (an 80.3% response rate). The follow-up survey included modules to measure child's preschool and primary school enrollment, cognitive and social-emotional skills, and executive function. We also collected information on parental practices and household labor supply. Section 4.2 describes the information that we collected in more detail.

As noted in Section 2, for the communities in the treatment group, we collected endline information on child attendance, preschool infrastructure, and the educator's characteristics, such as their educational background. In addition, we conducted a qualitative study designed to assess the quality of the different components of the DICIPE program, to use these results as suggestive evidence for the potential mechanisms of the intervention. Between June and July 2019, we collected data from a randomly selected sample of 40 communities across the provinces participating in the DICIPE program.[9] We inter-

[9]The qualitative study was conducted in the five provinces as this information was also used for admin-

viewed 320 caregivers, 139 facilitators and 40 members of the Community Coordination Committee (CCC). We also collected classroom observation data from the 40 escolinhas located in these communities. A detailed description of this qualitative study is presented in Appendix A.

4.2 Survey Instruments and Outcomes

In this section, we summarize the survey instruments used to study the first stage (compliance), primary, and secondary outcomes of the study. Table A2 summarizes the survey modules and the corresponding data collection stages.

Compliance

Preschool enrollment. To measure preschool enrollment, we ask caregivers in the baseline and endline surveys if the target child formally enrolled in an *escolinha*. This outcome is measured as a dummy indicator that takes the value 1 if the caregiver reported that the child is enrolled in a preschool center at the time of the survey.

Academic Outcomes

Primary School Enrollment and Academic Achievement. We use our endline survey data to measure if children are currently enrolled at primary school, whether they repeated a grade, and if they were at an appropriate grade for their age. Primary school enrollment is an indicator equal to 1 if the child is formally enrolled in school. "Repeated grade" is an indicator equal to 1 if the child had repeated a grade at least once during the past three years, i.e., since the project started. The variable "appropriate grade for age" is an indicator that takes the value 1 if the child is at a grade that corresponds to their age, while allowing children at the age limit to be in a lower grade.

Child Cognitive and Social-Emotional Skills. At baseline, we measured pre-intervention child development in domains that are considered to play a key role in early development (Sabol and Pianta, 2012; Piek et al., 2008), can stimulate future learning abilities (Cunha and Heckman, 2007), and are potential predictors for cognitive outcomes later in life.

istrative and project monitoring purposes.

Specifically, we used an adapted version of the Ages-and-Stages Questionnaire (ASQ) (Bricker et al., 1999) to collect child development measures relating to communication, gross and fine motor coordination, problem solving, and personal-social development.[10] The ASQ was primarily administered by enumerators specially trained for this activity, with the exception of items relating to child behaviors, which are typically difficult to observe during a household visit. These items were reported by the primary caregiver of the target child. We report an aggregated ASQ score and scores for each of the domains. Scores are standardized using the means and standard deviations of the control group.

At endline, we measured child development using the direct assessment tool of the Measurement of Development Early Learning (MODEL) to asses the school readiness level of target children in our sample.[11] We collected information to measure domains related to early literacy and math skills, executive function (working memory), social-emotional development, fine motor skills for writing, and interest in literacy. This assessment was performed at home in the presence of the primary caregiver. We estimate scores separately for each of these domains. Scores are standardized using the means and standard deviations of the control group.

Outcomes on other household members

Parental Practices. To measure the quality of parental practices, we used an adapted version of the UNICEF Multi-Indicator Cluster Surveys (MICS) and its Family Care Indicator (Hamadani et al., 2010; Kariger et al., 2012) to collect data on (i) the provision of stimulation for children and (ii) the home learning environment (home play activities). The two outcomes were collected at follow up, and we also collected data on the stimulation provided by any member of the household at the beginning of the study. We estimate

[10]The ASQ is composed of age-specific sections, dividing children aged 36 to 59 months into 4 groups of 6-month age intervals. Versions of the ASQ have been extensively adapted and used in several different conditions all over the world including in Chile (Veramendi and Urzua, 2011), Ecuador (Handal et al., 2007), Cambodia (Bouguen et al., 2018), Tanzania (Fernald et al., 2009), and more recently, in a similar setting in Mozambique (Martinez et al., 2017).

[11]The MODEL module was developed through the Measuring Early Learning Quality & Outcomes (MELQO) initiative (UNICEF, 2017) and has been used extensively around the world, including in Bangladesh, Kenya, Madagascar, Sudan, and Tanzania (Raikes et al., 2019). In contrast to the ASQ assessment used at baseline, the MODEL tool is not age-specific and all target children were administered the same items.

standardized indexes for each of these outcomes. All scores are standardized using the means and standard deviations of the control group.

Parental Engagement.

We also collected information on parental participation in school activities, such as meeting the principal of the primary school or the teacher of the target child, and being part of the school community. These outcomes are measured as dummy indicators that take the value 1 if the parent or other household members reported meeting the principal or teacher or being part of the school committee. Moreover, we also collected information on the intensive margin of parental involvement. Specifically, we also asked parents to report the number of meetings they or any other member of the family attended with the principal or teacher.

Sibling Enrollment. To study spillovers of the program on siblings, we use data on the preschool and primary school enrollment collected through the household roster. We include in the estimation sample all children aged 3 to 12 years that were either the child, stepchild, or adopted child of the household head. The preschool and primary school enrollment outcomes are measured as dummy indicators that take the value 1 if the household head reported that each non-target child aged 3 to 12 living in their same household was enrolled in a preschool center or in primary school at the time of the survey.

Other Measures

Quality of Program Key Components. We used an adapted Measure of Early Learning Environments (MELE) instrument. It was adapted by specialists to the Mozambique context and uses two approaches to measure the quality of early learning environments: classroom observation tool[12] and oral interviews to caregivers, teachers (facilitators), and school administrators (CCC member).[13] Using these two approaches, we collected infor-

[12]The MELE Classroom Observation Tool collects information about the activities and interactions that occur during a typical class session, including learning activities; classroom interactions and approaches to learning; classroom space and materials; and facilities and safety. Most items are based on an actual classroom observation and are scored on a 1-to-4-points scale, with higher scores reflecting higher levels of quality.

[13]We adapted the MELE interviews to collect information on pre- and in-service training of teachers; teacher qualifications; supports and training offered to teachers; feedback of the program among teachers,

mation to measure the quality of the physical environment and materials, qualification and training of facilitators, parenting education sessions and parental engagement, classroom practices and interactions. More information on the MELE instrument is presented in Appendix A.

Variables for LASSO Controls. In addition to recording the age and gender of the target child, at baseline we collected anthropometric measures for target children (height and weight) using international standardized procedures and measuring equipment (UNICEF MICS, 2019). For the primary caregiver, we collected the following sociodemographic data: age, sex, education, employment status, and language spoken. We also collected information on other household characteristics, such as household size and the receipt of remittances. This information was provided by the primary caregiver at baseline and follow-up.

4.3 Baseline Summary Statistics

Table 1 displays the mean and standard deviation (hereafter, SD) at baseline for the key characteristics of the target children, caregivers and households in panels A, B and C, respectively. Columns (1) and (2) show these summary statistics for the control group, and columns (3) and (4) for the treatment group. The average baseline age of the target children is 47 months, while the average age of their primary caregiver is 32 years. Figure A2 presents a histogram of the age distribution of the target children at baseline, depicting substantial variation in ages between 36 and 59 months.

The baseline characteristics depict a high level of acute deprivation among the children and families in our sample. Anthropometric measurements at baseline show that the average target child is stunted, with height-for-age that is more than two standard deviations below the World Health Organization (WHO) child growth standards median. The medium of instruction in primary school, Portuguese, is spoken only by 15% of the caregivers. The vast majority of caregivers are illiterate (81%) and 45% never went to school,

school coordinators, and caregivers; and parental engagement in the escolinha.

Table 1: Baseline Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	Control		Treatment		*p*-value	
Variable	Mean	SD	Mean	SD	(1)-(3)	N
Panel A. Target child's characteristics						
Female (%)	0.491	0.500	0.495	0.500	0.628	4,687
Age (months)	47.153	6.469	46.980	6.442	0.454	4,687
Attended preschool (%)	0.006	0.075	0.006	0.079	0.903	4,683
Height-for-age z-score	-2.183	1.128	-2.098	1.174	0.179	4,609
Total ASQ score	0.043	3.381	-0.041	3.349	0.605	4,682
ASQ Communication	-0.002	1.005	0.002	0.995	0.510	4,682
ASQ Gross Motor Coordination	-0.007	1.033	0.006	0.967	0.532	4,677
ASQ Fine Motor Coordination	0.002	1.005	-0.002	0.995	0.988	4,680
ASQ Problem Solving	0.033	1.007	-0.031	0.992	0.107	4,682
ASQ Socio-personal	0.013	0.991	-0.012	1.008	0.245	4,682
Panel B. Caregiver's characteristics						
Female (%)	0.840	0.366	0.833	0.373	0.569	4,686
Age (years)	31.969	8.924	31.874	9.223	0.991	4,666
Speaks Portuguese (%)	0.162	0.368	0.141	0.348	0.253	4,593
No schooling (%)	0.444	0.497	0.457	0.498	0.502	4,660
Years of schooling	2.239	2.592	2.220	2.611	0.736	4,642
Is illiterate (%)	0.811	0.392	0.822	0.383	0.436	4,639
Panel C. Household characteristics						
Stimulation Index (Activities with children)	0.000	1.000	-0.064	0.998	0.497	4,687
Household Size	5.135	1.537	5.083	1.578	0.540	4,687
Number of children aged 0-18	3.143	1.419	3.068	1.419	0.268	4,687
Number of children aged 3-5 in HH	1.081	0.277	1.063	0.247	0.022	4,687
Household receives remittances	0.113	0.317	0.098	0.297	0.264	4,678
Wealth index	-0.000	1.000	-0.013	0.931	0.550	4,687
	F Stat.		*P*-Value		N	
Joint F-test	1.287		0.190		4,256	

Notes: SD stands for *Standard Deviation* and *N* for the number of observations. *ASQ* refers to measures of skills from the standard Ages-and-Stages Questionnaire described in section 4.

resulting in a mean level of completed schooling of only two years.

4.4 Treatment-control Balance and Attrition

Balance. Table 1 also tests for balance between the control and treatment groups at baseline, reporting p-values of differences between groups in column (5). Both groups are consistently well-balanced, suggesting that the randomization worked well in practice. The one exception relates to the number of children in the household aged 3-5 where a small difference appears (control mean of 1.08 versus treatment mean of 1.06; $p = 0.022$). However, it should be expected that 1 in 22 variables would display a difference by chance at the 5% level. Importantly, we test for joint orthogonality of baseline characteristics with treatment assignment using a linear probability model with all the variables listed in Table 1 as explanatory variables and the treatment status as the dependent variable. The p-value of the joint F-test is 0.19, suggesting that baseline characteristics jointly fail to predict the treatment status of the target children.

Attrition. Figure 1 displays the level and causes of attrition across treatment and control groups between the baseline and the endline, three years later. In Table A3, we examine the effect of attrition at endline on the relative composition of the treatment and control groups. We consider two types of attrition at endline: attrition from the child test when a target child did not complete the assessment during the endline survey, and attrition for the household survey when a household could not be found at endline. The two types of attrition are analyzed in columns (1) and (2) of Table A3, respectively. We do not find evidence in support of attrition that is differential by treatment status. Thus, we conclude that the loss of children and households at endline does not affect the comparability of our samples and we consider our experimental setting valid for causal analysis.

5 Estimation Framework and Inference

To study the impacts of the DICIPE program, we estimate the following specification for child i in community c and district s:

$$Y_{ic} = \beta_0 + \beta_1 T_{ic} + \gamma_s + \varepsilon_{ic} \quad (1)$$

where Y_{ic} refers to the outcome variable of interest for child i at endline—outcomes which are defined in Section 4.2; T_{ic} is an indicator variable capturing the assignment of community c where child i was living to the treatment group; γ_s captures district (stratification variable) fixed effects; and ε_{ic} is an error term assumed uncorrelated with treatment given the randomization. Coefficient β_1 measures the difference in mean outcomes between children exposed to the treatment compared to the corresponding control group and can be interpreted as the average intent-to-treat (ITT) effect of the preschool program.

Given the well-balanced treatment and control groups, we do not include control variables in our primary specification. As a robustness check, we follow Bruhn and McKenzie (2009) and conduct a Least Absolute Shrinkage and Selection Operator (LASSO) analysis to identify variables measured at baseline with strong relationships with Y_{ic}, to assess their suitability for inclusion as controls in Equation (1).

In terms of our inference strategy, we estimate and report clustered standard errors at the community level to account for both the sampling design and the inherent correlation of outcomes within communities for unmeasured reasons. As a robustness check, we follow a more agnostic approach to the structure of the standard errors (or a potential fuzzy clustering) and estimate randomization inference standard errors. Randomization inference gives us precise p-values based on the empirical distribution of all estimated treatment effects that could arise under our design and data (after randomly reassigning the treatment status 2,000 times) under the null hypothesis of no effect for any unit.

Finally, we address potential concerns related to multiple hypothesis testing in two ways. First, we report p-values adjusted using the free step-down resampling methodology of Westfall and Young (1993). This procedure controls the family-wise error rate and allows for dependence amongst p-values. 10,000 bootstrap replications were used. Second, we construct indices for outcomes families using Kling et al. (2007). We orient child outcomes such that an increase in the index is always an improvement in the outcome of interest.

Table 2: First Stage & ITT Impacts on Primary School Enrollment

	Preschool	Primary School			
	(1) Enrolled at preschool	(2) Currently enrolled at school	(3) Repeated grade	(4) Appropriate grade for age	(5) Primary school enrollment index
Treatment	0.734***	0.060**	-0.030**	0.057**	0.159***
	(0.020)	(0.026)	(0.015)	(0.026)	(0.052)
	[0.000]	[0.045]	[0.055]	[0.054]	[0.008]
Observations	3764	3760	3742	3760	3680
Control mean	0.019	0.633	0.145	0.631	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using school outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Westfall and Young (1993) p-values are shown in square brackets, where 10,000 replications were used. The primary school enrollment index is constructed over columns (2) to (4) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

6 Main Results

6.1 First Stage: Preschool Enrollment

The DICIPE reduced the cost of access to preschool education through the construction of preschools and the provision of early childhood services in beneficiary communities. Thus, the first stage of our impact evaluation investigates whether DICIPE caused an increase in preschool enrollment.

Participation in the program was high in the treated communities. As shown in column (1) of Table 2, treated communities saw a 73.4 percentage point increase in the enrollment of the target children at preschool compared to the control group, which had a preschool enrollment rate of only 1.9%. This preschool enrollment rate in the control group is not due to proximity to preschools in treated communities, since none of the ECD centers is located within a reasonable walking distance from the households in the control group.[14] Instead, enrollment in the control group is mainly driven by short-term

[14]On average, households in the control group are located 8.4 kilometers from the nearest ECD center in

opportunities for informal childcare rather than community-specific preschool services implemented after baseline. The 35 target children who reported preschool enrollment in the control group were distributed in 18 different communities.

Complementing this evidence, our qualitative survey to caregivers in treated communities reveals high levels of their children's school attendance and satisfaction with the services provided. In fact, 91% of the caregivers interviewed reported that their children attended the preschool center throughout the school year, and 89% reported that their children attended the escolinha 5 days a week. In addition, 95% of the caregivers interviewed reported that their child was happy to attend the escolinha. This high satisfaction level may have been a potential mechanism driving the impact of the program on preschool enrollment.

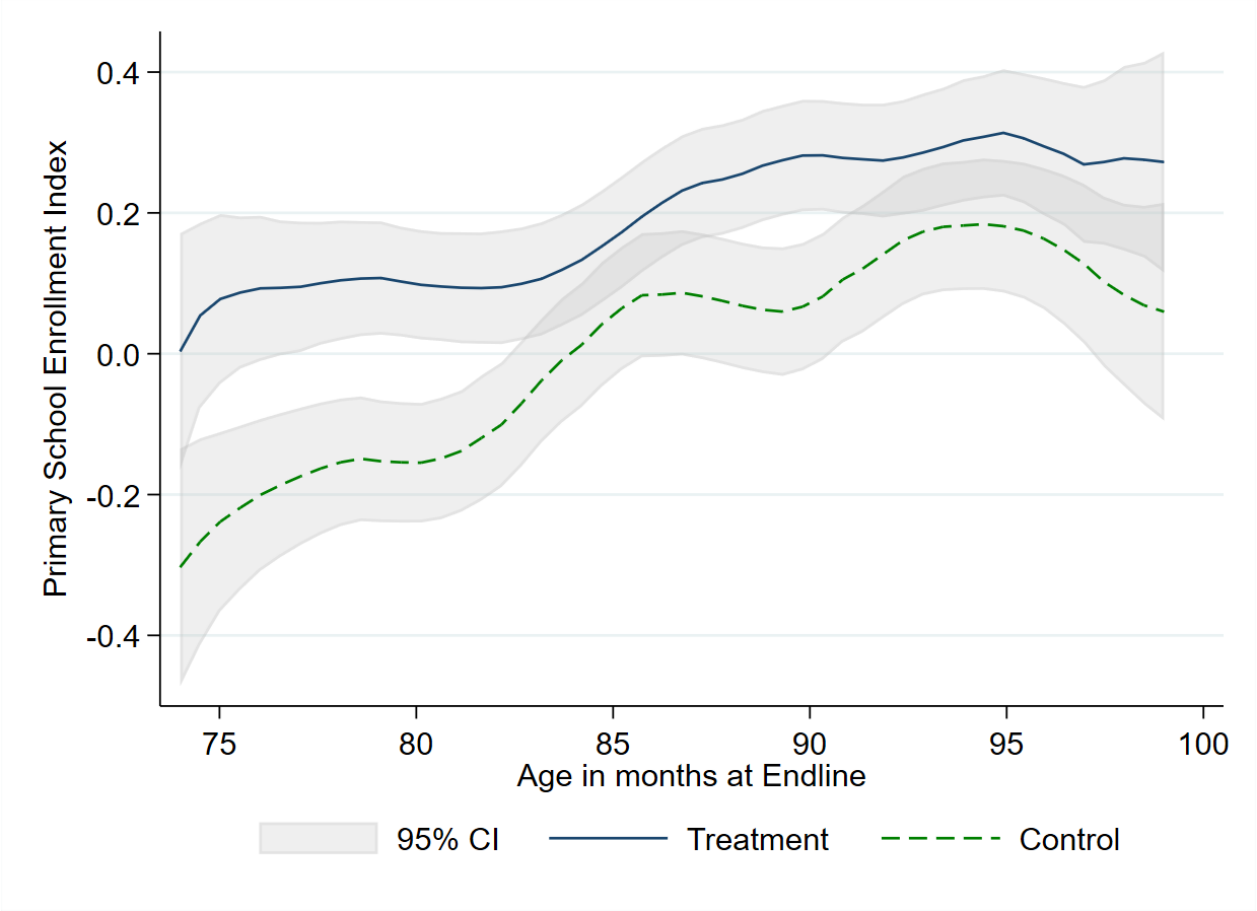
6.2 Overall effects on primary-school success and skills

The DICIPE preschool construction program had large and positive impacts on primary school outcomes, as shown in Table 2. Children in treated communities are six percentage points more likely to enroll in primary school (Column (2)) and three percentage points less likely to repeat a school grade (Column (3)) than children in the control group. Moreover, using the age of the children at the end of the study and the current grade reported at school, we constructed an indicator for attending the appropriate grade for the age. Column (4) reports that treated children are 5.7 percentage points more likely than the control group to have the appropriate grade for age. All our estimates are statistically significant, with p-values adjusted for multiple hypotheses testing (henceforth MHT) ranging from 0 to 0.055.

In column (5) of Table 2, we present ITT impacts on a primary school enrollment index that was constructed over current primary school enrollment, grade repetition, and grade-for-age appropriateness. We find that overall, treated children have a primary school enrollment index that is 0.16 SD higher than control children—estimate which is signif-

the treatment group.

Figure 2: Non-parametric Distributions of the Primary School Enrollment Index by Treatment Status



Notes: The figure plots nonparametric distributions of the primary school enrollment index by treatment status. 95% confidence intervals are shown. The distributions were generated using kernel-weighted local polynomial smoothing. The primary school enrollment index was constructed over the variables "currently enrolled at primary school", "repeated grade," and "appropriate grade for age" following Kling et al. (2007).

icant at the 1% level after adjusting for MHT. Figure 2 nonparametrically estimates the relationship between the primary school enrollment index and age by treatment status. Enrollment in the treatment group exhibits stochastic dominance over the control group, with children in treated communities enrolling significantly earlier (the p-value of a Kolmogorov–Smirnov test for equality of distributions equals 0).

One reason why access to DICIPE escolinhas increases enrollment and success in primary school is that access to preschool directly affects children's primary school readiness, which increases the benefit from primary school education. In addition, a unique indirect mechanism of the DICIPE is that the ECD centers were built in a location close to a pri-

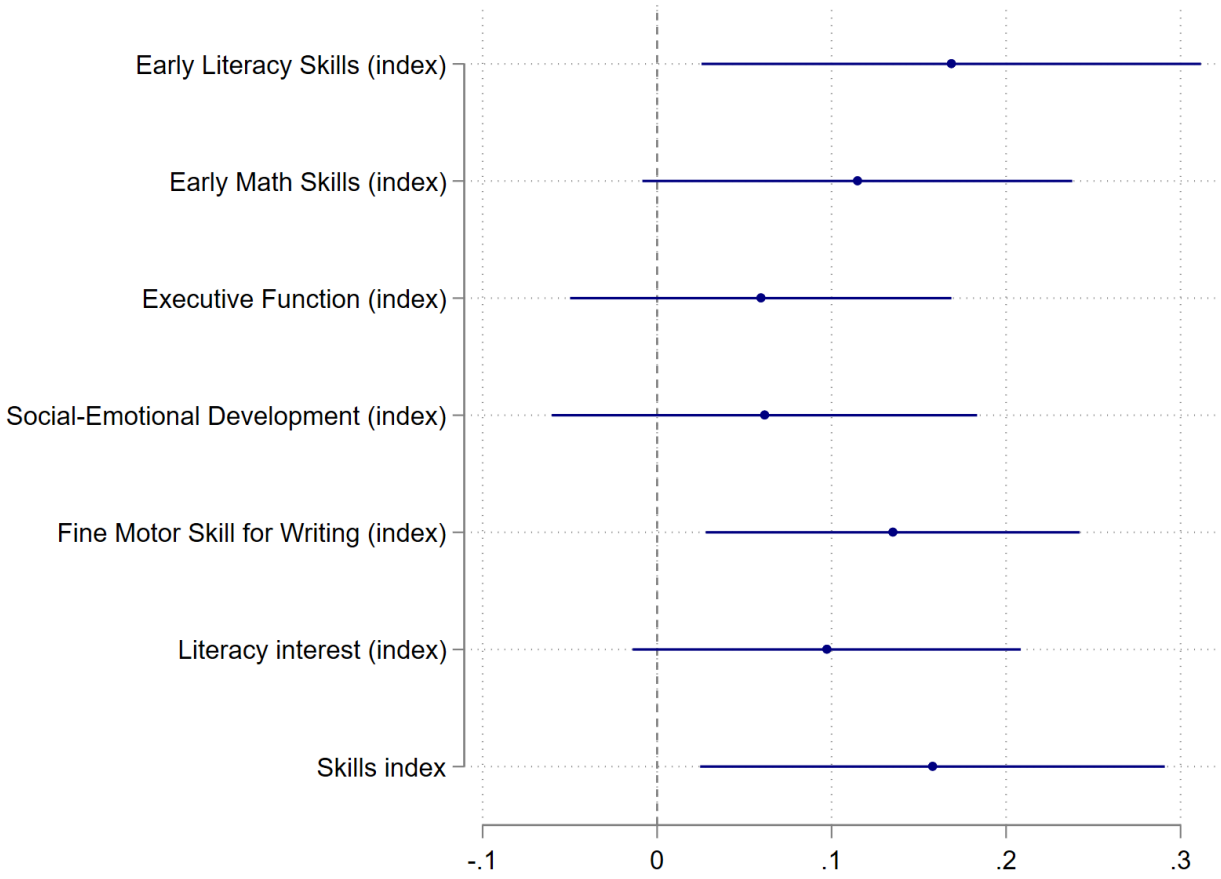
mary school in order to create positive synergies between the two. In fact, as part of the program's design, the primary school principal was expected to support the ECD center and participate as a member of the Community Coordination Committee (CCC). Children and their parents may also have familiarized themselves with the primary school, facilitating primary school enrollment.

We provide suggestive evidence of the importance of the potential mechanism of close proximity between families' residences, the preschool, and the primary school. In our qualitative survey on a random sample from treated communities, almost 70% of the parents interviewed reported walking less than 15 minutes from their homes to the preschool center. Since the primary school is also by design close, distance could help explain enrollment in both preschool and primary education.

Furthermore, we find evidence that the DICIPE program significantly improved children's cognitive and social-emotional skills, as assessed using the MODEL instrument. We evaluated early literacy skills, early math skills, executive function, social-emotional development, and fine motor skills for writing, all of which are measures in SD units. Our results are shown in Figure 3 and columns (1) to (5) of Table A4, respectively. We estimate 0.17 SD ($p < 0.05$) and 0.11 SD ($p < 0.1$) improvements in early literacy and math skills, respectively, as well as 0.14 SD ($p < 0.05$) improvements in fine motor skills for writing. Furthermore, target children in treatment communities demonstrated a 0.1 SD ($p < 0.1$) higher interest in literacy.

We estimate 0.16 SD ITT impacts on a skills index constructed over these variables (Table A4, column (7)). The estimated impact on skills is of magnitude consistent with but smaller than other early childhood interventions in the literature. For example, Bos et al. (2024) study a large-scale home visiting intervention in Bangladesh and estimate impacts ranging from 0.12–0.23 SD on child cognition, language, and socio-emotional scores. Similarly, Berlinski et al. (2009) study a large expansion of universal pre-primary education in Argentina and estimate 0.23 SD impacts on third-grade test scores. In general, the intervention led to positive and sizeable impacts on post-preschool cognitive and socioemotional skills of the children who benefited from the program.

Figure 3: ITT Impacts on Child Cognitive and Social-Emotional Skills



Notes: This figure presents ITT estimates on the target child's cognitive and social-emotional skills. The circles and corresponding solid lines represent the point estimates and 95% confidence intervals. Exact estimated coefficients are presented in columns (1) to (5) of Table A4. OLS estimates at the target child-level are presented using outcomes collected at endline. Standard errors are clustered at the community level. Estimates are expressed in standard deviation units of control group. All regressions include district fixed effects. The skills index is constructed over the six sub-indices following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

In addition to the ITT impacts presented, we also estimate Local Average Treatment Effects (LATE) using two-stage least squares instrumental variable estimation. We instrument for preschool enrollment using the treatment assignment. The LATE parameters are treatment effects for children induced by the intervention to enroll in preschool. The exclusion restriction requires that any impact of the treatment is acted on through preschool enrollment. LATE estimates of preschool enrollment on primary school outcomes are shown in Table A5 of the Appendix D. These LATE estimates are slightly larger in magnitude relative to the ITT estimates, consistent with the lower than universal take-up of preschool enrollment. LATE estimates of preschool enrollment in skills are shown in Table A6 of Appendix D.

We use our qualitative study to explore two well-known potential mechanisms for the impacts of DICIPE on children's cognitive and social-emotional skills: teacher-student interactions and learning practices in preschools. Our analysis of the MELE instrument (described in Section 4) suggests that the quality of the interactions between teachers and children was high in the escolinhas. Our data includes a measure of how the facilitator engaged with students, any disciplinary methods used, and the participation of the children. The results show that most facilitators (85%) had a medium or high engagement with the children, indicating that they showed affection towards students and were welcoming and encouraging the ideas and participation of the students. Moreover, approximately 80% of the classrooms scored medium or high level of children engagement. Lastly, 93% of the facilitators used positive techniques to redirect or guide children's behavior and 73% of all teachers were observed to be rarely or never engaging in negative physical or verbal interactions with children (i.e., yelling, pinching, striking, etc.).

In contrast, classroom practices were not particularly overwhelming. The majority of preschools scored a basic level in classroom practices[15] for most subject areas, that is, the lesson was taught but using memorization and repetition only. The only exception was the

[15] As described in Appendix A, classroom practices were rated on a scale of 1 to 4 points, indicating that 1 = learning activity did not occur; 2 = basic level (lesson taught using memorization and repetition); 3 = medium level (some play-based cleaning, connections to concrete objects, etc.); 4 = high level (play-based, open ended questions, real-life connections).

assessment of *gross motor skills*, skills in which almost 70% of preschools score a high level of quality in classroom practice. Moreover, 43% of all learning activities were done in a whole group/entire class, instead of using an approach that can improve student learning, such as alternative structures of grouping of students. As our qualitative data suggest, this could be in part explained by the fact that most facilitators 85% had no previous teaching experience and received less training than originally planned (87% received 5 days or less of upfront training).

6.3 Heterogeneous Impacts

Recent work has highlighted that the treatment impacts of early childhood interventions can differ for subgroups of the sample (Holla et al., 2021). In this section, we explore heterogeneous treatment impacts using machine learning tools following the recent literature on heterogeneous treatment effects to ensure that our results of heterogeneous impacts are not driven by ex-ante choices of subgroups (Athey and Imbens, 2016; Davis and Heller, 2017; Athey et al., 2019b; Athey and Wager, 2019b; Carlana et al., 2022; Chernozhukov et al., 2023).

We estimate the Conditional Average Treatment Effect (CATE) and include in the causal forest the following baseline variables: target child characteristics (gender, age, height-for-age z scores and ASQ scores), parental characteristics (education and stimulation index) and household characteristics (size, number of children, and wealth index). We used predictions on the expected treatment effect for each target child, given the covariates, to investigate treatment heterogeneity. We divide the sample into two groups: the top and bottom half of the predictions. Tables 3 to 5 report the balance tests for the CATE and the p-values adjusted for multiple hypothesis testing for our three main outcomes: (i) the first stage impacts on preschool attendance, (ii) the primary school enrollment index and (iii) the skills index. The first row of each table highlights that across the three outcomes, we observed significant differences in CATE for the groups predicted to have high and low CATE (p-value equal to 0).

We observe substantial heterogeneity by child development skills at baseline (mea-

Table 3: Conditional Average Treatment Effect: Went to Preschool

Variable	(1) Low Predicted CATE	(2) High Predicted CATE	(3) Diff. (1)-(2)	(4) p-value (1)-(2)
Conditional Average Treatment Effect (CATE)	0.707	0.780	-0.074	0.000
Female (%)	0.503	0.483	0.020	0.234
Age (years)	6.567	6.349	0.219	0.000
Height-for-age z-score	-1.695	-2.548	0.853	0.000
ASQ Communication	0.099	-0.094	0.193	0.000
ASQ Gross Motor Coordination	0.076	-0.070	0.146	0.000
ASQ Fine Motor Coordination	0.345	-0.349	0.694	0.000
ASQ Problem Solving	0.153	-0.220	0.373	0.000
ASQ Socio-personal	0.287	-0.296	0.583	0.000
Caregiver: Speaks Portuguese (%)	0.157	0.147	0.010	0.422
Caregiver: No schooling (%)	0.450	0.433	0.017	0.310
Caregiver: Years of schooling	2.247	2.290	-0.043	0.617
Caregiver: Is illiterate (%)	0.788	0.839	-0.051	0.000
Stimulation Index (Activities with children)	7.113	7.450	-0.337	0.005
Household Size	4.959	5.337	-0.378	0.000
Number of children aged 0-18 in Household	2.960	3.324	-0.364	0.000
Number of children aged 3-5 in Household	1.057	1.092	-0.035	0.000
Household receives remittances	0.099	0.100	-0.002	0.869
Wealth index of household	-0.046	0.134	-0.180	0.010
Observations		3680		

Notes: The table reports the descriptive statistics of target children in the bottom 50% (column 1) and top 50% (column 2) of the predicted Conditional Average Treatment Effect (CATE) on preschool attendance. Column 3 reports the difference between column 1 and 2. Column 4 shows the p-value of the t-test adjusted for multiple hypothesis testing.

Table 4: Conditional Average Treatment Effect: Primary School Enrollment Index

Variable	(1) Low Predicted CATE	(2) High Predicted CATE	(3) Diff. (1)-(2)	(4) p-value (1)-(2)
Conditional Average Treatment Effect (CATE)	0.120	0.212	-0.092	0.000
Female (%)	0.499	0.487	0.011	0.489
Age (years)	6.482	6.435	0.047	0.004
Height-for-age z-score	-1.841	-2.399	0.558	0.000
ASQ Communication	0.035	-0.030	0.065	0.047
ASQ Gross Motor Coordination	0.036	-0.029	0.065	0.042
ASQ Fine Motor Coordination	0.056	-0.058	0.114	0.001
ASQ Problem Solving	-0.026	-0.040	0.013	0.686
ASQ Socio-personal	0.156	-0.164	0.320	0.000
Caregiver: Speaks Portuguese (%)	0.169	0.135	0.034	0.004
Caregiver: No schooling (%)	0.429	0.454	-0.024	0.135
Caregiver: Years of schooling	2.430	2.107	0.324	0.000
Caregiver: Is illiterate (%)	0.783	0.844	-0.061	0.000
Stimulation Index (Activities with children)	6.957	7.605	-0.648	0.000
Household Size	5.511	4.783	0.728	0.000
Number of children aged 0-18 in Household	3.474	2.809	0.665	0.000
Number of children aged 3-5 in Household	1.084	1.065	0.019	0.030
Household receives remittances	0.090	0.109	-0.020	0.047
Wealth index of household	0.540	-0.452	0.992	0.000
Observations		3680		

Notes: The table reports the descriptive statistics of target children in the bottom 50% (column 1) and top 50% (column 2) of the predicted Conditional Average Treatment Effect (CATE) on the primary school enrollment index. Column 3 reports the difference between column 1 and 2. Column 4 shows the p-value of the t-test adjusted for multiple hypothesis testing.

Table 5: Conditional Average Treatment Effect: Skills Index

Variable	(1) Low Predicted CATE	(2) High Predicted CATE	(3) Diff. (1)-(2)	(4) p-value (1)-(2)
Conditional Average Treatment Effect (CATE)	0.085	0.248	-0.163	0.000
Female (%)	0.508	0.478	0.030	0.065
Age (years)	6.429	6.488	-0.060	0.000
Height-for-age z-score	-2.065	-2.176	0.111	0.003
ASQ Communication	-0.185	0.191	-0.376	0.000
ASQ Gross Motor Coordination	-0.109	0.115	-0.224	0.000
ASQ Fine Motor Coordination	-0.253	0.251	-0.503	0.000
ASQ Problem Solving	-0.363	0.297	-0.660	0.000
ASQ Socio-personal	-0.042	0.035	-0.077	0.022
Caregiver: Speaks Portuguese (%)	0.153	0.151	0.003	0.829
Caregiver: No schooling (%)	0.392	0.491	-0.099	0.000
Caregiver: Years of schooling	2.628	1.908	0.720	0.000
Caregiver: Is illiterate (%)	0.795	0.832	-0.037	0.004
Stimulation Index (Activities with children)	7.080	7.482	-0.402	0.001
Household Size	4.926	5.369	-0.444	0.000
Number of children aged 0-18 in Household	2.968	3.315	-0.346	0.000
Number of children aged 3-5 in Household	1.077	1.071	0.006	0.502
Household receives remittances	0.102	0.097	0.004	0.668
Wealth index of household	-0.358	0.446	-0.804	0.000
Observations		3680		

Notes: The table reports the descriptive statistics of target children in the bottom 50% (column 1) and top 50% (column 2) of the predicted Conditional Average Treatment Effect (CATE) on the skills index. Column 3 reports the difference between column 1 and 2. Column 4 shows the p-value of the t-test adjusted for multiple hypothesis testing.

sured using the ASQ). For preschool attendance and primary school enrollment, target children with lower ASQ scores at baseline benefited more from the program. However, the opposite is true for the skills index: here, target children with higher ASQ scores at baseline benefited more. The difference in results here may be due, in part, to dynamic complementarities in skills formation, where skills produced at earlier ages increase the productivity of investment at later ages (Heckman et al., 2010; Conti et al., 2016; Garcıa and Heckman, 2014). As highlighted in our discussion of mechanisms, parental practices matter: predicted impacts are higher across all three outcomes for children whose parents scored higher on the parental stimulation index at baseline. Across the three outcomes, we only observe statistically significant gender heterogeneity for the skills index, where girls were 3.5 percentage points more likely to be represented among students with a lower CATE (p-value of 0.03).

Table 6: Parental Stimulation & Home Play

	(1) Parental Stimulation (index)	(2) Home Play (index)
Treatment	0.171***	0.077*
	(0.054)	(0.045)
	[0.006]	[0.096]
Observations	3760	3763
Control mean	0.000	0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. The parental stimulation index in column (1) was constructed using 12 questions that asked parents about activities they did with the target child, including reading books, singing songs, telling stories, and playing games. The home play index in column (2) was constructed using 7 questions about items that the target child plays with at home, including homemade or store-bought toys and musical instruments. These indices were constructed following Kling et al. (2007). Westfall and Young (1993) p-values are shown in square brackets, where 10,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

6.4 Parental Time Investments

We explore the impacts of the DICIPE program on other outcomes related to parental time investments, motivated by the large bodies of work that highlight the role of parental investments in complementing early childhood interventions (Cunha and Heckman, 2007; Doepke et al., 2019; Attanasio et al., 2020; Ravindran, 2021; Bos et al., 2024) or education interventions in general (see, for example, Yedomiffi 2024; de Walque and Valente 2023; Andrabi et al. 2017; Cerdan-Infantes and Filmer 2016; Avvisati et al. 2013). In our setting, parental investments can be directly linked to program parenting education sessions, as these meetings were used to provide information to teach parents how to enhance their children's growth and development. Indirectly, the program also induced parents to be significantly engaged in the preschool activities.

First, we show that parents in treated communities improved their parental practices related to stimulation and home play relative to parents in control communities. We present our results in Table 6, where we study two common indices of parental practices at home constructed using the UNICEF Multi-Indicator Cluster Surveys (MICS) and

Table 7: Parental Engagement with Primary School Staff

	(1) Parents or other members met with the principal in the past year	(2) Number of meetings with the principal in the past year	(3) Parents or other members met with the teacher of the target child	(4) Number of meetings with the teacher of the target child	(5) Parents or other members are part of the school committee
Treatment	0.067***	0.222***	0.009	0.138	0.014
	(0.021)	(0.058)	(0.029)	(0.100)	(0.015)
	[0.015]	[0.003]	[0.742]	[0.424]	[0.605]
Observations	3765	3760	2126	2122	3765
Control mean	0.212	0.398	0.321	0.624	0.138

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Westfall and Young (1993) p-values are shown in square brackets, where 10,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

its Family Care Indicator (Hamadani et al., 2010; Kariger et al., 2012). Our evidence indicates that parents in treated communities provide a more stimulating environment for their children. Parents were more actively involved in stimulating their children (scoring 17.1% of standard deviation higher than parents in the control group; $p < 0.01$) and the children of the treated communities participated more in play at home (7.7% of a standard deviation higher than in control households; $p < 0.1$).

Second, we find that parents of target children have greater engagement with the child's primary school. It is important to note that the parental education component of the DICIPE program promoted communication between parents and their *preschool*. What we find here is that parents' greater involvement with educators spills over to the primary school environment. These results are shown in Table 7. Column (1) shows that parents and other household members in treated communities were 6.7 percentage points more likely to meet with the child's primary school principal in the past year relative to control communities ($p < 0.01$). Compared to a control mean of 21.2%, this is a sizeable 32% increase. Column (2) shows that parents and other household members had 0.22 more meetings with the principal in the past year, on a control mean of 0.4 meetings (a

56% increase). Although the point estimates are positive, we do not observe statistically significant impacts on the engagement with the child's teacher in columns (3) and (4). We also explored whether parents in the treatment group and other household members were more likely to be part of the school committee. Here, column (5) shows a positive but statistically insignificant impact.

Third, DICIPE causes a small reduction in the labor supply of parents in a context with almost universal labor market participation. For example, 98.6% of mothers in control communities work and that fraction is only reduced by 1.3 percentage points for mothers of eligible children in treated areas. While most papers in the literature show that preschool or childcare programs can increase the labor market participation of (mostly female) caregivers (Berlinski and Galiani, 2007; Berlinski et al., 2011; Halim et al., 2022; Hojman and Boo, 2022; Donald and Vaillant, 2023; Halim et al., 2023; Mata, 2024),[16] these results on the reduction in the household labor supply of mothers are consistent with those of Krafft and Lassassi (2023), who find that pre-primary education may have decreased women's employment.[17]

Taken together, we find evidence that DICIPE increases parental time investments in children through stimulation, home play, and engagement with school principals and induces reductions in the likelihood of working.

Our qualitative analysis from the caregivers survey hints at the possibility that two potential mechanisms why parental practices improved in treated communities are that the program induced parents to be significantly involved in the preschool activities and that parents perceive positive changes in their children's skills that may facilitate parent-child quality engagements. Despite the low compliance with the parenting education activities (instead of monthly sessions, they were held every three months), the families

[16] In a recent evidence review (Halim et al., 2023), the authors review 22 studies that plausibly identify the causal impact of childcare services on maternal labor market outcomes in lower and middle-income countries and find that all but one study report positive impacts on the extensive or intensive margin of maternal labor market outcomes.

[17] This small reduction in the labor supply of female caregivers may indicate that they are the ones investing more time in stimulation activities and with school engagement, being more likely to stay at home rather than participating in the labor market.

strongly participated in other activities in the preschool center. For example, caregivers interviewed reported attending meetings to learn about their children's academic performance at the preschool (81%) and supporting the preschool through maintenance and cleaning or with in-kind contributions (i.e., providing food) (83%). Parents also report improvements in their children's skills, such as increased communication (86%), social interactions (77%) and self-confidence (68%). As a consequence, most caregivers reported improvements in their interactions with their children. At the same time, parents reported a high level of satisfaction with the services provided in the preschool.[18]

6.5 Impact on Siblings

The DICIPE shows important additional impacts on the younger and older siblings of the target children of our evaluation, which we report in Table A7. First, the program has no significant effects on fertility, indicating that the number of younger siblings is not different between control and treated families.[19]

Younger siblings in the preschool age group 3 to 6 in the treatment group were 62 percentage points more likely to attend preschool—an effect that is about 85% of the estimated impact of treatment for the target children. These results are consistent with the timing of preschool construction and the ages of the target children and their siblings. Furthermore, and in accordance with existing evidence (Carneiro et al., 2023b), we do not observe statistically significant impacts on the primary school enrollment of sisters or brothers in the 6 to 12 primary school age group (columns (2) and (3) show the results, respectively).

[18] We asked caregivers to rate on a 1-5 scale how much they agreed with statements such as, "I am satisfied with the quality of education my child receives", "As a parent I feel involved in the school," and "As a parent I feel my opinion matter". The mean rating for these items was 4.04, indicating that caregivers felt well supported and thought positively about school.

[19] These results are available upon request.

7 Robustness of the Results

In this section, we assess the robustness of our results in two ways. First, as we discuss in Section 5, we use a double LASSO approach to identify the variables that can be included in our estimations as controls. The tables in Appendix F present our main results that include the control variables selected by LASSO for each of our main outcomes.[20] The estimated coefficients and their statistical significance show little change after including the control variables selected by LASSO.

Second, we take a more agnostic approach to the structure of the standard errors and estimate standard errors using the RI approach. As discussed in Section 5, RI allows us to assign a *p*-value for a given treatment effect by observing where that treatment effect falls in the distribution of all possible estimated effects from the 2,000 randomizations we simulate under the assumption of no effects (Blattman et al., 2021). As we show in the tables of Appendix G, the magnitudes of the RI *p*-values are very similar to the magnitudes of the *p*-values obtained by estimating standard errors clustered at the community level.

8 Discussion and Concluding Remarks

In this paper, we use a clustered randomized control trial to study the scale-up of the Mozambique Early Childhood Development Project which creates formal preschool education in a context of high deprivation.

Our evaluation indicates that families in treated communities benefited significantly from DICIPE. First, enrollment in preschool increases massively by more than 73 percentage points in the treatment group compared to the baseline 2% enrollment level in control communities. Second, the program has positive and large impacts on children and their families that extend into primary school age. In effect, relative to primary school-aged children in the control group, treated children are significantly more likely to enroll

[20]The table notes in Appendix F specify the variables selected by LASSO, since they vary between the outcomes.

and less likely to repeat a grade in primary school; they score higher in cognitive and noncognitive tests; and they enjoy significantly better quality interactions with their parents. Interestingly, while the impacts on enrollment are more important among children with lower skills at baseline, the impacts on learning are more important for children with higher skills at baseline.

From a policy perspective, our results offer the promise that the DICIPE program will serve as a model for replication, scalability, and sustainability in the rest of Mozambique or in other countries with a similar context. The DICIPE project was a bundled intervention that included two supply-side components (the construction of preschools and hiring and training local instructors) and one component of the demand side (education activities for parents). Although we do not have an exogenous variation that would allow us to causally disentangle the contribution of each type of component, our complementary qualitative study in a smaller random sample in the treated communities reveals that there was greater compliance with implementation for the supply-side components. First, the program required preschools to be located centrally within the community and have adequate infrastructure and materials for learning. We document that almost 70% of the parents reported walking between 0 and 15 minutes from the family homes to the preschool center. In addition, the results of the observation tool show that almost all preschools had adequate spaces for indoor activities and for outside play and equipment for gross motor activities. Furthermore, most preschools were considered structurally safe. Lastly, we find that locally produced learning materials were available in 92% of preschools. A second key component was a minimum level of education and training of local facilitators. Results from the facilitators interviews show that 96% of them have completed the minimum level of education required by the program (7th grade). Furthermore, the results also show that most facilitators received some pre-service training (80%) and in-service training (70%), although less than originally planned.

In contrast, the demand-side component had less compliance than what the DICIPE intended: that parenting educational meetings should be held once a month. In practice, the average number of parenting educational sessions per community was only one every three months and almost 50% of caregivers reported that they had never attended a

parental education class.

In sum, considering these differences in compliance between the two types of key components, we believe that the impacts on preschool and primary education enrollment and learning are most likely driven by the supply-side components, especially the short distances between families' residences to both the preschool and the primary school. In this paper, we provide causal and descriptive evidence of the key characteristics of DICIPE, a successful preschool intervention whose design we expect may serve as a model for future research and education policies.

References

Almond, D. and Currie, J. (2011). Human capital development before age five. *Handbook of Labor Economics*, 4b(15):1315–1486.

Alvarenga, J. H.-N. and Barros, S. H. (2024). A Process Evaluation of the Mozambique Early Childhood Development project (DICIPE) 2015-2019. Process evaluation report, The World Bank.

Andrabi, T., Das, J., and Khwaja, A. I. (2017). Report cards: The impact of providing school and child test scores on educational markets. *American Economic Review*, 107(6):1535–63.

Andrew, A., Attanasio, O., Augsburg, B., Cardona-Sosa, L., Day, M., Giannola, M., Grantham-McGregor, S., Jervis, P., Meghir, C., and Rubio-Codina, M. (2024). Preschool quality and child development. *Journal of Political Economy*, forthcoming.

Athey, S. and Imbens, G. (2016). Recursive partitioning for heterogeneous causal effects. *Proceedings of the National Academy of Sciences*, 113(27):7353 – 7360.

Athey, S., Tibshirani, J., and Wager, S. (2019a). Generalized random forests. *The Annals of Statistics*, 47(2):1148–1178.

Athey, S., Tibshirani, J., and Wager, S. (2019b). Generalized random forests. *The Annals of Statistics*, 47(2):1148 – 1178.

Athey, S. and Wager, S. (2016). Recursive partitioning for heterogeneous causal effects. *Proceedings of the National Academy of Sciences*, 113(27):7353–7360.

Athey, S. and Wager, S. (2019a). Estimating treatment effects with causal forests: An application. *Observational studies*, 5(2):37–51.

Athey, S. and Wager, S. (2019b). Estimating treatment effects with causal forests: An application.

Attanasio, O., Baker-Henningham, H., Bernal, R., Meghir, C., Pineda, D., and Rubio-Codina, M. (2022). Early stimulation and nutrition: the impacts of a scalable intervention. *Journal of the European Economic Association*, 20(4):1395–1432.

Attanasio, O., Meghir, C., and Nix, E. (2020). Human Capital Development and Parental Investment in India. *The Review of Economic Studies*, 87(6):2511–2541.

Attanasio, O. P., Fernández, C., Fitzsimons, E. O., Grantham-McGregor, S. M., Meghir, C., and Rubio-Codina, M. (2014). Using the infrastructure of a conditional cash transfer program to deliver a scalable integrated early child development program in colombia: cluster randomized controlled trial. *Bmj*, 349.

Avvisati, F., Gurgand, M., Guyon, N., and Maurin, E. (2013). Getting Parents Involved: A Field Experiment in Deprived Schools. *The Review of Economic Studies*, 81(1):57–83.

Bailey, M. J., Sun, S., and Timpe, B. (2021). Prep school for poor kids: The long-run impacts of Head Start on human capital and economic self-sufficiency. *American Economic Review*, 111(12):3963–4001.

Berkes, J., Bouguen, A., Filmer, D., and Fukao, T. (2024). Improving preschool provision and encouraging-demand: Evidence from a large-scale construction program. *Journal of Public Economics*, 230:105050.

Berlinski, S. and Galiani, S. (2007). The effect of a large expansion of pre-primary school facilities on preschool attendance and maternal employment. *Labour Economics*, 14(3):665–680.

Berlinski, S., Galiani, S., and Gertler, P. (2009). The effect of pre-primary education on primary school performance. *Journal of Public Economics*, 93(1):219–234.

Berlinski, S., Galiani, S., and Manacorda, M. (2008). Giving children a better start: Preschool attendance and school-age profiles. *Journal of Public Economics*, 92(5):1416–1440.

Berlinski, S., Galiani, S., and Mc Ewan, P. J. (2011). Preschool and maternal labor market outcomes: Evidence from a regression discontinuity design. *Economic Development and Cultural Change*, 59(2):313–344.

Bernal, R., Attanasio, O., Peña, X., and Vera-Hernández, M. (2019). The effects of the transition from home-based childcare to childcare centers on children's health and development in colombia. *Early Childhood Research Quarterly*, 47:418–431.

Bitler, M. P., Hoynes, H. W., and Domina, T. (2014). Experimental evidence on distributional effects of head start. Working Paper 20434, National Bureau of Economic Research.

Black, M. M., Walker, S. P., Fernald, L. C., Andersen, C. T., DiGirolamo, A. M., Lu, C., McCoy, D. C., Fink, G., Shawar, Y. R., Shiffman, J., et al. (2017). Early childhood development coming of age: science through the life course. *The Lancet*, 389(10064):77–90.

Blattman, C., Green, D. P., Ortega, D., and Tobón, S. (2021). Place-based interventions at scale: The direct and spillover effects of policing and city services on crime. *Journal of the European Economic Association*, 19(4):2022–2051.

Blimpo, M. P., Carneiro, P., Jervis, P., and Pugatch, T. (2022). Improving access and quality in early childhood development programs: Experimental evidence from the Gambia. *Economic Development and Cultural Change*, 70(4):1479–1529.

Bos, J. M., Shonchoy, A. S., Ravindran, S., and Khan, A. (2024). Early childhood human capital formation at scale. *Journal of Public Economics*, 231:105046.

Bouguen, A., Filmer, D., Macours, K., and Naudeau, S. (2018). Preschool and parental response in a second best world. *Journal of Human Resources*, 53(2):474–512.

Bricker, D., Squires, J., Mounts, L., Potter, L., Nickel, R., Twombly, E., and Farrell, J. (1999). Ages and stages questionnaire. *Baltimore, MD: Paul H. Brookes*.

Bruhn, M. and McKenzie, D. (2009). In pursuit of balance: Randomization in practice in development field experiments. *American Economic Journal: Applied Economics*, 1(4):200–232.

Carlana, M., La Ferrara, E., and Pinotti, P. (2022). Goals and gaps: Educational careers of immigrant children. *Econometrica*, 90(1):1–29.

Carneiro, P., Galasso, E., García, I. L., Bedregal, P., and Cordero, M. (2023a). Parental beliefs, investments, and child development: Evidence from a large-scale experiment. *Journal of Political Economy*, forthcoming.

Carneiro, P., Rasul, I., and Salvati, F. (2023b). Families as drivers of inequality: Experimental evidence from an early childhood intervention. Technical report, Mimeo.

Castro, M. and da Cruz, B. (2023). Effects of a large-scale program for the construction of daycare and preschool centers on cognitive skills and female employment. *Education Economics*, 0(0):1–26.

Cerdan-Infantes, P. and Filmer, D. (2016). Information, Knowledge and Behavior: Evaluating Alternative Methods of Delivering School Information to Parents. *World Bank Policy Research Working Paper*, (7233).

Chernozhukov, V., Demirer, M., Duflo, E., and Fernández-Val, I. (2023). Generic Machine Learning Inference on Heterogeneous Treatment Effects in Randomized Experiments, with an Application to Immunization in India. *NBER Working Paper*, (w24678).

Conti, G., Heckman, J. J., and Pinto, R. (2016). The effects of two influential early childhood interventions on health and healthy behaviour. *The Economic Journal*, 126(596):F28–F65.

Cunha, F. and Heckman, J. (2007). The Technology of Skill Formation. *American Economic Review*, 97(2):31–47.

Davis, J. M. and Heller, S. B. (2017). Using causal forests to predict treatment heterogeneity: An application to summer jobs. *American Economic Review*, 107(5):546–50.

de Walque, D. and Valente, C. (2023). Incentivizing school attendance in the presence of parent-child information frictions. *American Economic Journal: Economic Policy*, 15(3):256–85.

Dinarte Diaz, L. I., Ravindran, S., Shah, M., Powers, S. M., and Baker-Henningham, H. (2023). Violent discipline and parental behavior: Short- and medium-term effects of virtual parenting support to caregivers. Working Paper 31338, National Bureau of Economic Research.

Doepke, M., Sorrenti, G., and Zilibotti, F. (2019). The economics of parenting. *Annual Review of Economics*, 11(1):55–84.

Donald, A. and Vaillant, J. (2023). Experimental evidence on rural childcare provision.

Elango, S., García, J. L., Heckman, J. J., and Hojman, A. (2015). Early childhood education. In *Economics of means-tested transfer programs in the United States, volume 2*, pages 235–297. University of Chicago Press.

Engle, P. L., Fernald, L. C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A., De Mello, M. C., Hidrobo, M., Ulkuer, N., Ertem, I., et al. (2011). Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet*, 378(9799):1339–1353.

Fernald, L. C. H., Kariger, P., Engle, P., and Raikes, A. (2009). *Examining Early Child Development in Low-Income Countries: A Toolkit for the Assessment of Children in the First Five Years of Life*. World Bank.

Garcıa, J. L. and Heckman, J. J. (2014). Ability, character, and social mobility. *University of Chicago, Department of Economics*.

Gibbs, C., Ludwig, J., and Miller, D. L. (2013). Head Start origins and impacts. *Legacies of the War on Poverty*, pages 39–65.

Halim, D., Johnson, H. C., and Perova, E. (2022). Preschool availability and women's employment: evidence from indonesia. *Economic Development and Cultural Change*, 71(1):39–61.

Halim, D., Perova, E., and Reynolds, S. (2023). Childcare and mothers' labor market outcomes in lower-and middle-income countries. *The World Bank Research Observer*, 38(1):73–114.

Hamadani, J. D., Mehrin, S. F., Tofail, F., Hasan, M. I., Huda, S. N., Baker-Henningham, H., Ridout, D., and Grantham-McGregor, S. (2019). Integrating an early childhood development programme into bangladeshi primary health-care services: an open-label, cluster-randomised controlled trial. *The Lancet Global Health*, 7(3):e366–e375.

Hamadani, J. D., Tofail, F., Hilaly, A., Huda, S. N., Engle, P., and Grantham-McGregor, S. M. (2010). Use of Family Care Indicators and Their Relationship with Child Development in Bangladesh. *Journal of Health, Population, and Nutrition*, 28(1):23–33.

Handal, A. J., Lozoff, B., Breilh, J., and Harlow, S. D. (2007). Effect of Community of Residence on Neurobehavioral Development in Infants and Young Children in a Flower-Growing Region of Ecuador. *Environmental Health Perspectives*, 115(1):128–133. Publisher: Environmental Health Perspectives.

Heckman, J., Moon, S. H., Pinto, R., Savelyev, P., and Yavitz, A. (2010). Analyzing social experiments as implemented: A reexamination of the evidence from the highscope perry preschool program. *Quantitative economics*, 1(1):1–46.

Heinzel, J., Alvarenga-Lima, N., and Barros, S. (2020). A Process Evaluation of the Mozambique Early Childhood Development Project (DICIPE). Technical report, The World Bank.

Hojman, A. and Boo, F. L. (2022). Public childcare benefits children and mothers: Evidence from a nationwide experiment in a developing country. *Journal of Public Economics*, 212:104686.

Holla, A., Bendini, M., Dinarte, L., and Trako, I. (2021). *Is Investment in Preprimary Education Too Low? Lessons from (Quasi) Experimental Evidence across Countries*. The World Bank.

Kariger, P., Frongillo, E. A., Engle, P., Britto, P. M. R., Sywulka, S. M., and Menon, P. (2012). Indicators of Family Care for Development for Use in Multicountry Surveys. *Journal of Health, Population, and Nutrition*, 30(4):472–486.

Kline, P. and Walters, C. R. (2016). Evaluating Public Programs with Close Substitutes: The Case of Head Start. *The Quarterly Journal of Economics*, 131(4):1795–1848.

Kling, J. R., Liebman, J. B., and Katz, L. F. (2007). Experimental analysis of neighborhood effects. *Econometrica*, 75(1):83–119.

Knudsen, E. I., Heckman, J. J., Cameron, J. L., and Shonkoff, J. P. (2006). Economic, neurobiological, and behavioral perspectives on building america's future workforce. *PNAS*, 103(27):10155–10162.

Krafft, C. and Lassassi, M. (2023). Public pre-primary and maternal employment in algeria: Evidence from a natural experiment. *The World Bank Economic Review*, page lhad024.

Martinez, S., Naudeau, S., and Pereira, V. (2012). The promise of preschool in Africa: A randomized impact evaluation of early childhood development in rural Mozambique. *World Bank Working Paper*, (81532).

Martinez, S., Naudeau, S., and Pereira, V. A. (2017). Preschool and child development under extreme poverty: evidence from a randomized experiment in rural mozambique. *World Bank Policy Research Working Paper*, (8290).

Mata, C. (2024). Public Child Care Provision: Unraveling the Consequences of Implementation Variations for Women's Time Allocation. *The World Bank Economic Review*, page lhae004.

Mehrin, S. F., Hasan, M. I., Tofail, F., Shiraji, S., Ridout, D., Grantham-McGregor, S., Hamadani, J. D., and Baker-Henningham, H. (2022). Integrating a group-based, early childhood parenting intervention into primary health care services in rural bangladesh: A cluster-randomised controlled trial. *Frontiers in Pediatrics*.

MINEDH (2020). Análise do sector de educação (esa) relatório final. Technical report, Mozambique Ministry of Education.

Piek, J. P., Dawson, L., Smith, L. M., and Gasson, N. (2008). The role of early fine and gross motor development on later motor and cognitive ability. *Human Movement Science*, 27(5):668–681.

Raikes, A., Koziol, N., Janus, M., Platas, L., Weatherholt, T., Smeby, A., and Sayre, R. (2019). Examination of school readiness constructs in Tanzania: Psychometric evaluation of the MELQO scales. *Journal of Applied Developmental Psychology*, 62:122–134.

Ravindran, S. (2021). Parental Investments and Early Childhood Development: Short and Long Run Evidence from India. *Available at SSRN 3928352*.

Sabol, T. J. and Pianta, R. C. (2012). Recent trends in research on teacher–child relationships. *Attachment & Human Development*, 14(3):213–231. Publisher: Routledge _eprint: https://doi.org/10.1080/14616734.2012.672262.

Sylvia, S., Warrinnier, N., Luo, R., Yue, A., Attanasio, O., Medina, A., and Rozelle, S. (2021). From quantity to quality: Delivering a home-based parenting intervention through china's family planning cadres. *The Economic Journal*, 131(635):1365–1400.

UNICEF (2017). Overview: MELQO: Measuring early learning quality and outcomes.

UNICEF MICS (2019). MICS6 TOOLS. Home-UNICEF MICS.

Veramendi, G. and Urzua, S. (2011). The Impact of Out-of-Home Childcare Centers on Early Childhood Development.

Wang, L., Qian, Y., Warrinnier, N., Attanasio, O., Rozelle, S., and Sylvia, S. (2023). Parental investment, school choice, and the persistent benefits of an early childhood intervention. *Journal of Development Economics*, 165:103166.

Westfall, P. H. and Young, S. S. (1993). *Resampling-Based Multiple Testing: Examples and Methods for p-Value Adjustment*. John Wiley & Sons, Inc.

Yedomiffi, M. (2024). Does Parental Involvement Improve Student Learning? The Role of Monitoring. *Working Paper*.

Yoshikawa, H., Weiland, C., and Brooks-Gunn, J. (2016). When does preschool matter? *The Future of Children*, 26(2):21–35.

Appendix

A Process evaluation

This appendix describes the methods and instruments used to conduct a process evaluation of the intervention and the main results from this process. Further details are presented in Alvarenga and Barros (2024).

A.1 Objective and approach

The process evaluation was designed with the objective of using qualitative results to assess the quality of the different components of the DICIPE program to use this as suggestive evidence for potential intervention mechanisms.

To carry out this qualitative work, we used the Measure of Early Learning Environments (MELE) instrument. The MELE is designed to assess the quality of group-based care in community centers, schools, and kindergartens, for children from age 3 to primary school entry. In this sense, the MELE module includes domains related to pedagogy, interactions, physical environment, parent and community engagement, personnel, play, and inclusion.

The MELE module uses two approaches to measure the quality of early learning environments: classroom observation tool and oral interviews with caregivers, teachers (facilitators), and school administrators. Therefore, the MELE module is designed to take into account the classroom environment, as well as the level of support and engagement from parents, teachers, and communities (MELQO Report, 2017).

The MELE Classroom Observation Tool is designed to capture key activities throughout the day and organized to provide information about the activities and interactions that occur during a typical class session. The tool collects data on learning activities; classroom interactions and approaches to learning; classroom arrangement, space, and materials; and facilities and safety. Most items are based on an actual classroom observation and are scored on a 1-to-4 scale, with higher scores reflecting higher levels of quality. The MELE interviews collected information on pre- and in-service training of teachers; teacher qualifications; supports and training offered to caregivers; and feedback of the program among teachers, school coordinators, and caregivers; and parental engagement in the escolinha.

A team of international and national experts familiar with the DICIPE and Mozambique context reviewed and adapted both the MELE Classroom Observation tool and the three sets of interviews. This process involved reviewing the quality domains, discussing relevant items, and deciding upon a set of items that were viewed as accurately representing the goals of early learning settings in Mozambique specifically.

A.2 Selection of participants

We collected data from a sample of 40 escolinhas in all provinces participating in the study. We randomly selected eight escolinhas per province (4 escolinhas per each of the 2 districts). In each of the 40 communities, we collected the following information: one classroom observation, eight parent or caregiver interviews, up to four facilitator interviews, and an interview from a school coordinator, which in this context is a member of the community coordination committee (CCC). In total, 320 caregivers were interviewed, along with 139 facilitators and 40 CCC members.

This qualitative data collection took place in 2019. We worked with five field teams, one per province. Each team was made up of the following five members: Supervisor, MELE Classroom Observer, and three Enumerators to lead the interviews with caregivers and CCC. The MELE data collection team training was conducted in Maputo City between June 11 and June 18. The training lasted nine days of in-class training and one day in the field for a pilot exercise in the Boane District, Maputo Province. Twenty-five enumerators and supervisors attended the training. On June 20, a one-day pilot exercise was held at the Chinonanquila Escolinha, located in Boane District, Maputo Province.

The fieldwork for the qualitative study started on June 26 and lasted a total of 11 days. The data collection protocol was approved by the National Mozambique Review Board (*Comité Nacional de Bioética para a Saúde*), with an approval reference number 225/CNBS/18 and informed written consent was obtained from the respondents for the video recording.

A.3 Main Results Across Domains

This subsection summarizes the main results presented in Heinzel et al. (2020).

1. Physical environment

A key feature of the DICIPE program design is that escolinhas are considered community-

based and should be located within a central area of the community, close to the primary school. The results show that almost 70% of the parents reported walking between 0 to 15 minutes from the family homes to the escolinha. In terms of space, results suggest that 98% of escolinhas have spaces with an adequate size so that all attending children can comfortably participate in all indoor activities and 93% of schools have schoolyard with adequate space for play and equipment for gross motor activities (for example, swings and slides.) In general, escolinhas were found to have satisfactory access to toilet facilities. 95% of all the escolinhas visited had composting toilets and 78% of all toilets were ranked highly satisfactory having met basic conditions in terms of cleanliness, separation of gender, and being appropriately child-sized. Finally, 90% escolinhas were considered structurally safe.

2. Materials in the classroom.

The DICIPE program aimed to promote the use or readily available, often recycled materials. Results from interviews to facilitators show that 92% of them reported using locally produced materials or a combination of locally and commercially produced materials. 63% of schools visited had writing utensils and close to half of the escolinhas had books. The maximum number of books per escolinha was three.

3. Facilitators qualification and training

The DICIPE program required that the instructors had a minimum level of education (7th grade) and they should participate in upfront and ongoing training. Results from the facilitators interviews show that 96% of them completed at least 7th grade. Moreover, results also show that the majority of facilitators received both types of training. In fact, 80% of facilitators had received pre-service training and 70% received in-service training. However, the number of training days received was lower than originally planned. We also explored facilitators' satisfaction with the level of support and resources they receive. In the survey, we asked facilitators to rate on a 1-5 scale how much they agreed with statements such as "I am satisfied with my job" and "I have adequate resources to carry out my duties," and we find that teachers felt fairly well supported and resourced, with a mean rating of 3.2.

4. Parenting education sessions and parental engagement

The DICIPE project design stipulated that parenting educational meetings should be held once a month. However, the number of parenting educational sessions per community

held was, on average, only one every three months. In addition, almost 50% of caregivers reported that they had never attended a Parental Education class at the escolinha. Despite this low participation of caregivers in the parenting education activities, families strongly engaged in other activities in the escolinha, including participating in the functioning of the escolinha. For example, 81% of all interviewed caregivers reported attending meetings to learn about their children's academic performance at the escolinha. Moreover, more than 60% of caregivers support the escolinha with services such as overall maintenance and cleaning of the escolinha and 23% provide in-kind contributions (i.e., providing food) on a regular basis. Lastly, we also document high satisfaction of caregivers with the services provided at the escolinha. We asked caregivers to rate on a 1-5 scale how much they agreed with statements such as, "I am satisfied with the quality of education my child receives", "As a parent I feel involved in the school," and "As a parent I feel my opinion matter". The mean rating for these items was 4.04, indicating that caregivers felt well supported and thought positively about school.

5. Classroom practices

The MELE Classroom Observations collected key information on instruction practices employed by teachers to teach specific subject areas (i.e. numeracy, literacy, language skills, fine motor skills, etc.). Scoring took into consideration the type of lessons, activities, and or experiences geared towards introducing, practicing, and mastering skills in each particular area. Each item was rated on a 1 to 4-points scale, indicating 1 = learning activity did not occur; 2 = basic level (lesson taught using rote learning); 3 = medium level (some play-based cleaning, connections to concrete objects, etc.); 4 = high level (play-based, open ended questions, real-life connections). The majority of escolinhas scored a basic level for most of the subject areas, except in gross motor skills, under which 70% of all escolinhas scored a high level. Lastly, we find that 43% of all learning activities were done in a whole group/entire class, instead of varying the grouping structure.

6. Classroom interactions

Interactions refer to the type and quality of interactions between teachers and children, and between children and their peers. We also collected data on classroom interactions and approaches to learning using the classroom observation tool. We gathered data on how the facilitator engaged with students, disciplinary methods, children engagement, and other key concepts. The observation items were scored on a 1-to-4-points scale, with

higher scores indicating high levels of quality (i.e. 1 = lowest level of quality, 2 = basic level of quality, 3 = medium level of quality, 4 = highest level of quality). Results show that the majority of facilitators (85%) had a medium or high engagement with the children, indicating that they genuinely appeared to enjoy teaching, showed affection towards students, and were welcoming and encouraging of student ideas and participation. Moreover, approximately 80% of classrooms scored medium or high level of children engagement, indicating that most of children observed were engaged throughout the observation. Moreover, 75% of all classrooms reported children never waiting more than 10 minutes with no specific activity. Lastly, 93% of facilitators scored a 3 or 4 on use of disciplinary methods which means that the vast majority of teachers used positive techniques for redirecting or guiding children's behavior. In addition, 73% of all teachers were observed as rarely or never engaging in negative physical or verbal interactions with children (i.e. yelling, pinching, striking, etc.)

7. Other results

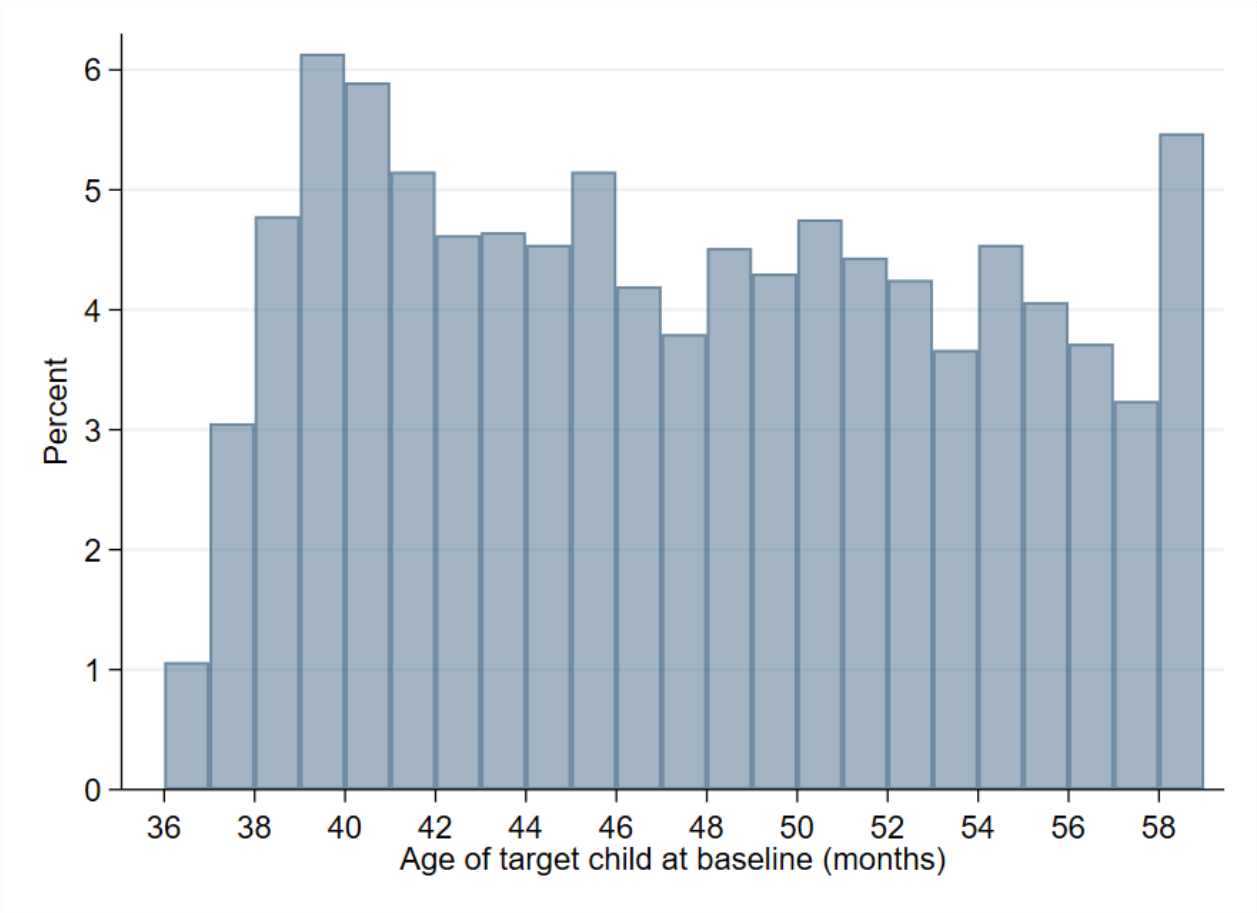
To complement the impacts of the intervention on preschool enrollment, we asked caregivers to report their children's school attendance and satisfaction with the services provided. Overall, we find that 91% of caregivers interviewed reported that their children always attend escolinha (i.e. throughout the entire school year) and 89% reported that their children attend the escolinha 5 days a week. Moreover, we also find high levels of satisfaction with attending school. Specifically, 95% of caregivers reported that their child was happy to attend the escolinha.

B Figures

Figure A1: Timeline for Intervention and Data Collection

The figure presents a timeline of intervention and data collection activities.

Figure A2: Distribution of Ages for Target Children at Baseline



The figure presents the distribution of ages for target children at baseline in months.

C Tables

Table A1: Preschool and Facilitator Summary Statistics (Endline - Treatment Only)

Variable	(1) Mean	(2) SD	(3) N
Panel A. Preschool characteristics			
Number of instructors	3.661	0.812	112
Enrollment in 2019 (Number of children)	74.723	16.134	112
Enrollment in 2018 (Number of children)	79.375	23.147	112
Daily attendance (Number of children)	46.795	15.735	112
Panel B. School equipment and infrastructure			
Presence of:			
Blackboard	0.429	0.497	112
Chalks	0.411	0.494	112
Notebooks or writing paper	0.562	0.498	112
Pens/Pencils	0.554	0.499	112
Drawing Books/Cards	0.536	0.501	112
Card Games	0.286	0.454	112
Building blocks	0.339	0.476	112
Leisure Games (Dolls, stuffed animals, dress-up clothes, etc.)	0.562	0.498	112
Educational Games or Mathematics Materials	0.759	0.430	112
Storybooks (Books with pictures and text)	0.571	0.497	112
Musical instruments	0.295	0.458	112
Playground with swing, ladder, or ramp/slide	0.938	0.243	112
Potable water	0.491	0.502	112
Panel C. Instructor characteristics			
Years of schooling	8.572	1.740	402
Teaches at preschool and has another job	0.266	0.442	410

Notes: This table displays summary statistics for key characteristics of the preschool (including equipment and infrastructure) and facilitators as measured at endline for the treatment group only.

Table A2: Data Collection Instruments

Measure/Instrument	Round of data collection	
	Baseline	3-year follow-up
Anthropometric measures: Height and weight	X	
Ages-and-stages Questionnaire (ASQ)	X	
Measure of Development and Early Learning (MODEL)		X
Parenting and Learning environment module	X	X

Notes: This table summarizes several key instruments used and the corresponding rounds of data collection.

Table A3: Balance in Attrition Rates across Treated and Control Individuals

	(1) Child test score attrition	(2) Household interview attrition
Treatment	-0.002	0.004
	(0.022)	(0.021)
Observations	4687	4687
Control mean	0.213	0.192

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates are presented and standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. "Child test score attrition" is a dummy variable equal to 1 if we could not conduct the child test with the target child at endline. "Household interview attrition" is a dummy variable equal to 1 if we could not conduct the household interview at endline. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A4: ITT Impacts on Child Cognitive and Social-Emotional Skills

	(1) Early Literacy Skills (index)	(2) Early Math Skills (index)	(3) Executive Function (index)	(4) Social-Emotional Development (index)	(5) Fine Motor Skill for Writing (index)	(6) Literacy interest (index)	(7) Skills index
Treatment	0.169**	0.115*	0.059	0.062	0.135**	0.097*	0.158**
	(0.073)	(0.062)	(0.055)	(0.062)	(0.054)	(0.056)	(0.068)
	[0.071]	[0.166]	[0.474]	[0.474]	[0.064]	[0.098]	[0.021]
Observations	3682	3682	3682	3682	3682	3682	3682
Control mean	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes collected at endline. Standard errors clustered at the community level are shown in parentheses. Estimates are expressed in standard deviation units of control group. All regressions include district fixed effects. Westfall and Young (1993) p-values are shown in square brackets, where 10,000 replications were used. The skills index is constructed over columns (1) to (6) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

D Local Average Treatment Effect (LATE) Estimates of Primary School Success and Skills

Table A5: LATE Impacts on Primary School Enrollment

	(1) Currently enrolled at school	(2) Repeated grade	(3) Appropriate grade for age	(4) Primary school enrollment index
Enrolled at preschool	0.085***	-0.065***	0.085***	0.262***
	(0.032)	(0.018)	(0.032)	(0.067)
Observations	3760	3742	3760	3680
Control mean	0.633	0.145	0.631	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. IV estimates using two-stage least squares at the target child-level are presented using school outcomes reported by the caregiver at endline. We instrument for "Enrolled at preschool" using the treatment assignment. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. The primary school enrollment index is constructed over columns (2) to (4) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A6: LATE Impacts on Child Cognitive and Social-Emotional Skills

	(1) Early Literacy Skills (index)	(2) Early Math Skills (index)	(3) Executive Function (index)	(4) Social-Emotional Development (index)	(5) Fine Motor Skill for Writting (index)	(6) Literacy interest (index)	(7) Skills index
Enrolled at preschool	0.195**	0.070	0.070	0.069	0.137**	0.123*	0.164**
	(0.086)	(0.070)	(0.062)	(0.071)	(0.066)	(0.063)	(0.076)
Observations	3682	3682	3682	3682	3682	3682	3682
Control mean	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. IV estimates using two-stage least squares at the target child-level are presented using outcomes collected at endline. We instrument for "Enrolled at preschool" using the treatment assignment. Standard errors clustered at the community level are shown in parentheses. Estimates are expressed in standard deviation units of control group. All regressions include district fixed effects. The skills index is constructed over columns (1) to (6) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

E Impact on Siblings

Table A7: Preschool & Primary School Enrollment Spillovers on Siblings

	(1) Went to preschool (siblings aged 3 to 6)	(2) Currently enrolled at school (sisters aged 6 to 12)	(3) Currently enrolled at school (brothers aged 6 to 12)
Treatment	0.620***	0.031	-0.013
	(0.025)	(0.023)	(0.021)
	[0.000]	[0.180]	[0.525]
Observations	1788	1345	1487
Control mean	0.007	0.823	0.826

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the sibling-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Westfall and Young (1993) p-values are shown in square brackets, where 10,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

F Double LASSO for Selection of Controls

Table A8: First Stage & ITT Impacts on Primary School Enrollment (LASSO Controls)

	Preschool	Primary School			
	(1) Enrolled at preschool	(2) Currently enrolled at school	(3) Repeated grade	(4) Appropriate grade for age	(5) Primary school enrollment index
Treatment	0.736***	0.061**	-0.031**	0.059**	0.164***
	(0.019)	(0.025)	(0.015)	(0.025)	(0.052)
Observations	3764	3760	3742	3760	3680
Control mean	0.019	0.633	0.145	0.631	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using school outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. The primary school enrollment index is constructed over columns (2) to (4) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. All regressions include a vector of control variables selected by LASSO. When the control variables have missing values, continuous variables were imputed with the mean of the interest group (i.e. caregiver, target child or household), and the median for the dummy variables. In this case, the 13 baseline variables selected were: household size, a dummy if the household receives remittances, age (years), years of schooling of the caregiver, a dummy if the caregiver is illiterate, ASQ communication score, ASQ fine motor coordination score, ASQ problem solving score, ASQ socio-personal score, a dummy if the caregiver speaks Portuguese, parental stimulation index, wealth index, and height-for-age z-score of the target child.

Table A9: ITT Impacts on Child Cognitive and Social-Emotional Skills (LASSO Controls)

	(1) Early Literacy Skills (index)	(2) Early Math Skills (index)	(3) Executive Function (index)	(4) Social-Emotional Development (index)	(5) Fine Motor Skill for Writing (index)	(6) Literacy interest (index)	(7) Skills index
Treatment	0.175**	0.123**	0.065	0.068	0.141***	0.100*	0.167**
	(0.072)	(0.060)	(0.055)	(0.060)	(0.054)	(0.056)	(0.066)
Observations	3682	3682	3682	3682	3682	3682	3682
Control mean	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes collected at endline. Standard errors clustered at the community level are shown in parentheses. Estimates are expressed in standard deviation units of control group. All regressions include district fixed effects. The skills index is constructed over columns (1) to (6) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. All regressions include a vector of control variables selected by LASSO. When the control variables have missing values, continuous variables were imputed with the mean of the interest group (i.e. caregiver, target child or household), and the median for the dummy variables. In this case, the 13 baseline variables selected were: household size, a dummy if the household receives remittances, age (years), years of schooling of the caregiver, a dummy if the caregiver is illiterate, ASQ communication score, ASQ fine motor coordination score, ASQ problem solving score, ASQ socio-personal score, a dummy if the caregiver speaks Portuguese, parental stimulation index, wealth index, and height-for-age z-score of the target child.

Table A10: Preschool & Primary School Enrollment Spillovers on Siblings (LASSO Controls)

	(1) Went to preschool (siblings aged 3 to 6)	(2) Currently enrolled at school (sisters aged 6 to 12)	(3) Currently enrolled at school (brothers aged 6 to 12)
Treatment	0.484***	0.036	-0.013
	(0.020)	(0.022)	(0.021)
Observations	2902	1345	1487
Control mean	0.007	0.823	0.826

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the sibling-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Estimates are weighted to give each community an equal weight in the analysis. All regressions include a vector of control variables selected by LASSO. When the control variables have missing values, continuous variables were imputed with the mean of the interest group (i.e. caregiver, target child or household), and the median for the dummy variables. In this case, 10 variables were selected including: education level in years of caregiver, a dummy if caregiver is illiterate, number of children aged 0-18 living in the household, a dummy if caregiver speaks Portuguese, stimulation index, wealth index, household size, a dummy if household receives remittances, height-for-age z-score of target 3-5 and age (years).

Table A11: Complementary Parental Investments: Stimulation & Home Play (LASSO Controls)

	(1) Parental Stimulation (index)	(2) Home Play (index)
Treatment	0.172***	0.070
	(0.054)	(0.046)
Observations	3384	3386
Control mean	0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. The parental stimulation index in column (1) was constructed using 12 questions that asked parents about activities they did with the target child, including reading books, singing songs, telling stories, and playing games. The home play index in column (2) was constructed using 7 questions about items that the target child plays with at home, including homemade or store-bought toys and musical instruments. These indices were constructed following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. All regressions include a vector of control variables selected by LASSO. When the control variables have missing values, continuous variables were imputed with the mean of the interest group (i.e. caregiver, target child or household), and the median for the dummy variables. In this case, the 13 baseline variables selected were: household size, a dummy if the household receives remittances, years of schooling of the caregiver, a dummy if the caregiver is illiterate, ASQ communication score, ASQ fine motor coordination score, ASQ problem solving score, ASQ socio-personal score, a dummy if the caregiver speaks Portuguese, parental stimulation index, wealth index, height-for-age z-score of the target child, and a dummy if female.

Table A12: Complementary Parental Investments: Engagement with Primary School Staff (LASSO Controls)

	(1) Parents or other members met with the principal in the past year	(2) Number of meetings with the principal in the past year	(3) Parents or other members met with the teacher of the target child	(4) Number of meetings with the teacher of the target child	(5) Parents or other members are part of the school committee
Treatment	0.070***	0.248***	0.012	0.160	0.009
	(0.020)	(0.058)	(0.028)	(0.104)	(0.016)
Observations	3388	3383	1968	1973	3388
Control mean	0.212	0.398	0.321	0.624	0.138

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Estimates are weighted to give each community an equal weight in the analysis. All regressions include a vector of control variables selected by LASSO. When the control variables have missing values, continuous variables were imputed with the mean of the interest group (i.e. caregiver, target child or household), and the median for the dummy variables. In this case, the 12 baseline variables selected were: household size, a dummy if the household receives remittances, years of schooling of the caregiver, a dummy if the caregiver is illiterate, ASQ communication score, ASQ fine motor coordination score, ASQ problem solving score, ASQ socio-personal score, a dummy if the caregiver speaks Portuguese, parental stimulation index, wealth index, and height-for-age z-score of the target child.

G Randomization Inference Adjusted *p*-values

Table A13: First Stage & ITT Impacts on Primary School Enrollment (RI)

	Preschool	Primary School			
	(1) Enrolled at preschool	(2) Currently enrolled at school	(3) Repeated grade	(4) Appropriate grade for age	(5) Primary school enrollment index
Treatment	0.734***	0.060**	-0.030**	0.057**	0.159***
	(0.020)	(0.026)	(0.015)	(0.026)	(0.052)
	[0.000]	[0.005]	[0.079]	[0.009]	[0.001]
Observations	3764	3760	3742	3760	3680
Control mean	0.019	0.633	0.145	0.631	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using school outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Randomization inference p-values are shown in square brackets, where 2,000 replications were used. The primary school enrollment index is constructed over columns (2) to (4) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A14: ITT Impacts on Child Cognitive and Social-Emotional Skills (RI)

	(1) Early Literacy Skills (index)	(2) Early Math Skills (index)	(3) Executive Function (index)	(4) Social-Emotional Development (index)	(5) Fine Motor Skill for Writing (index)	(6) Literacy interest (index)	(7) Skills index
Treatment	0.169**	0.115*	0.059	0.062	0.135**	0.097*	0.158**
	(0.073)	(0.062)	(0.055)	(0.062)	(0.054)	(0.056)	(0.068)
	[0.024]	[0.022]	[0.276]	[0.273]	[0.005]	[0.046]	[0.015]
Observations	3682	3682	3682	3682	3682	3682	3682
Control mean	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes collected at endline. Standard errors clustered at the community level are shown in parentheses. Estimates are expressed in standard deviation units of control group. All regressions include district fixed effects. Randomization inference p-values are shown in square brackets, where 2,000 replications were used. The skills index is constructed over columns (1) to (6) following Kling et al. (2007). Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A15: Preschool & Primary School Enrollment Spillovers on Siblings

	(1) Went to preschool (siblings aged 3 to 6	(2) Currently enrolled at school (sisters aged 6 to 12)	(3) Currently enrolled at school (brothers aged 6 to 12)
Treatment	0.620***	0.031	-0.013
	(0.025)	(0.023)	(0.021)
	[0.000]	[0.168]	[0.842]
Observations	1788	1345	1487
Control mean	0.007	0.823	0.826

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the sibling-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Randomization inference p-values are shown in square brackets, where 2,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A16: Complementary Parental Investments: Stimulation & Home Play (RI)

	(1) Parental Stimulation (index)	(2) Home Play (index)
Treatment	0.171***	0.077*
	(0.054)	(0.045)
	[0.005]	[0.117]
Observations	3760	3763
Control mean	0.000	-0.000

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. The parental stimulation index in column (1) was constructed using 12 questions that asked parents about activities they did with the target child, including reading books, singing songs, telling stories, and playing games. The home play index in column (2) was constructed using 7 questions about items that the target child plays with at home, including homemade or store-bought toys and musical instruments. These indices were constructed following Kling et al. (2007). Randomization inference p-values are shown in square brackets, where 2,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A17: Complementary Parental Investments: Engagement with Primary School Staff (RI)

	(1) Parents or other members met with the principal in the past year	(2) Number of meetings with the principal in the past year	(3) Parents or other members met with the teacher of the target child	(4) Number of meetings with the teacher of the target child	(5) Parents or other members are part of the school committee
Treatment	0.067***	0.222***	0.009	0.138	0.014
	(0.021)	(0.058)	(0.029)	(0.100)	(0.015)
	[0.003]	[0.000]	[0.825]	[0.335]	[0.482]
Observations	3765	3760	2126	2122	3765
Control mean	0.212	0.398	0.321	0.624	0.138

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. OLS estimates at the target child-level are presented using outcomes reported by the caregiver at endline. Standard errors clustered at the community level are shown in parentheses. All regressions include district fixed effects. Randomization inference p-values are shown in square brackets, where 2,000 replications were used. Estimates are weighted to give each community an equal weight in the analysis. Covariates are not included in the regressions.

Table A18: Components of the Indices

Index	Variable	Description
Primary School Enrollment	Currently enrolled at school	Dummy variable (Yes=1, No=0)
	Repeated grade	Dummy variable (Yes=1, No=0)
	Appropriate grade for age	Dummy variable (Yes=1, No=0)
Early Literacy Skills (index)	2a. Tell me the name of this part of the body. (point to the eye)	Dummy variable (Correct=1, Incorrect=0)
	2b. Tell me the name of this part of the body. (point to ear)	Dummy variable (Correct=1, Incorrect=0)
	2c. Tell me the name of this part of the body. (point to the tooth)	Dummy variable (Correct=1, Incorrect=0)
	2d. Tell me the name of this part of the body. (point to hand)	Dummy variable (Correct=1, Incorrect=0)
	2e. Tell me the name of this part of the body. (point to the elbow)	Dummy variable (Correct=1, Incorrect=0)
	4a. Here are some letters. Point to each letter and tell me the name: B	Dummy variable (Correct=1, Incorrect=0)
	4b. Here are some letters. Point to each letter and tell me the name: S	Dummy variable (Correct=1, Incorrect=0)
	4c. Here are some letters. Point to each letter and tell me the name: A	Dummy variable (Correct=1, Incorrect=0)
	4d. Here are some letters. Point to each letter and tell me the name: T	Dummy variable (Correct=1, Incorrect=0)
	4e. Here are some letters. Point to each letter and tell me the name: M	Dummy variable (Correct=1, Incorrect=0)
	4f. Here are some letters. Point to each letter and tell me the name: U	Dummy variable (Correct=1, Incorrect=0)
	4g. Here are some letters. Point to each letter and tell me the name: D	Dummy variable (Correct=1, Incorrect=0)
	4h. Here are some letters. Point to each letter and tell me the name: V	Dummy variable (Correct=1, Incorrect=0)
	4i. What letter is that? A	Dummy variable (Correct=1, Incorrect=0)
	4j. What letter is that? Q	Dummy variable (Correct=1, Incorrect=0)
	4k. What letter is that? E	Dummy variable (Correct=1, Incorrect=0)
	4l. What letter is that? R	Dummy variable (Correct=1, Incorrect=0)
	4m. What letter is that? N	Dummy variable (Correct=1, Incorrect=0)
	4n. What letter is that? L	Dummy variable (Correct=1, Incorrect=0)
	4o. What letter is that? O	Dummy variable (Correct=1, Incorrect=0)
	4p. What letter is that? C	Dummy variable (Correct=1, Incorrect=0)
	4b1. Can you show me the word 'cumprimentar' ?	Dummy variable (Correct=1, Incorrect=0)
	4b2. Can you show me the word 'pai' ?	Dummy variable (Correct=1, Incorrect=0)
	4b3. Can you show me the word 'fruta'?	Dummy variable (Correct=1, Incorrect=0)
	5a. What does the letter 'Z' sound like?	Dummy variable (Correct=1, Incorrect=0)
	5b. What does the letter 'S' make?	Dummy variable (Correct=1, Incorrect=0)
	5c.What does the letter 'B' make?	Dummy variable (Correct=1, Incorrect=0)
	5d.What is the sound that the letter 'V' makes?	Dummy variable (Correct=1, Incorrect=0)
	5e.What is the sound that the letter 'F' makes?	Dummy variable (Correct=1, Incorrect=0)
	6a. Discrimination of the Sound of Letters -1 (v)	Dummy variable (Correct=1, Incorrect=0)
	6b. Discrimination of the Sound of Letters -2 (l)	Dummy variable (Correct=1, Incorrect=0)
	6c. Discrimination of the Sound of Letters -3 (s)	Dummy variable (Correct=1, Incorrect=0)
	7a. Understanding Oral Reading: Who stole the cat's hat?	Dummy variable (Correct=1, Incorrect=0)
	7b. Understanding Oral Reading: What colour was the hat?	Dummy variable (Correct=1, Incorrect=0)
	7c. Understanding Oral Reading: Why was the cat chasing the mouse?	Dummy variable (Correct=1, Incorrect=0)
	7d. Understanding Oral Reading: Where did the cat hold the mouse?	Dummy variable (Correct=1, Incorrect=0)
	7e. Understanding Oral Reading: Why did the cat decide not to eat the mouse?	Dummy variable (Correct=1, Incorrect=0)
	8a. Name writing: The child spells his/her name correctly	Dummy variable (Correct=1, Incorrect=0)
Early Math Skills (index)	10a. Receptive Space Vocabulary. Point to the figure with the ball on the chair	Dummy variable (Correct=1, Incorrect=0)
	10b. Receptive Space Vocabulary. Point to the figure with the ball under the chair	Dummy variable (Correct=1, Incorrect=0)
	10d. Receptive Space Vocabulary. Point to the figure with the ball in front of the chair	Dummy variable (Correct=1, Incorrect=0)
	10c. Receptive Space Vocabulary. Point to the figure with the ball next to the chair	Dummy variable (Correct=1, Incorrect=0)
	Verbal counting	Range from 0 to 30
	12a. Forming a Set. Give me three objects.	Dummy variable (Correct=1, Incorrect=0)
	12b. Forming a Set. Give me six objects.	Dummy variable (Correct=1, Incorrect=0)
	12c. Forming a Set. Give me fourteen objects.	Dummy variable (Correct=1, Incorrect=0)
	13a. Identification of Numbers. 2	Dummy variable (Correct=1, Incorrect=0)
	13b. Identification of Numbers. 7	Dummy variable (Correct=1, Incorrect=0)
	13c. Identification of Numbers. 10	Dummy variable (Correct=1, Incorrect=0)
	13d. Identification of Numbers. 8	Dummy variable (Correct=1, Incorrect=0)
	13e. Identification of Numbers. 5	Dummy variable (Correct=1, Incorrect=0)
	13f. Identification of Numbers. 13	Dummy variable (Correct=1, Incorrect=0)
	13g. Identification of Numbers. 17	Dummy variable (Correct=1, Incorrect=0)
	13h. Identification of Numbers. 12	Dummy variable (Correct=1, Incorrect=0)
	13i. Identification of Numbers. 14	Dummy variable (Correct=1, Incorrect=0)
	13j. Identification of Numbers. 20	Dummy variable (Correct=1, Incorrect=0)
	14a. Comparison of numbers. Which number is bigger, 3 or 5?	Dummy variable (Correct=1, Incorrect=0)
	14b. Comparison of numbers. Which number is bigger, 8 or 6?	Dummy variable (Correct=1, Incorrect=0)
	14c. Comparison of numbers. Which number is smaller, 4 or 7?	Dummy variable (Correct=1, Incorrect=0)
	15a. Simple Addition. If you have two balls… And I give you one more ball, how many balls will you have in total?	Dummy variable (Correct=1, Incorrect=0)
	15b. Simple Addition. If you have three balls… And I give you two more balls, how many balls will you have in total?	Dummy variable (Correct=1, Incorrect=0)
	15c. Simple Addition. If you have four balls… And I give you two more balls, how many balls will you have in total?	Dummy variable (Correct=1, Incorrect=0)
	15B1. Simple Written Addition. 1+3=	Dummy variable (Correct=1, Incorrect=0)
	15B2. Simple Written Addition. 2+3=	Dummy variable (Correct=1, Incorrect=0)
	15B3. Simple Written Addition. 6+2=	Dummy variable (Correct=1, Incorrect=0)
	15B4. Simple Written Addition. 4+5=	Dummy variable (Correct=1, Incorrect=0)
	15B5. Simple Written Addition. 3+3=	Dummy variable (Correct=1, Incorrect=0)
	15B6. Simple Written Addition. 9+8 =	Dummy variable (Correct=1, Incorrect=0)