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Cecilia Berlanga Alessio Robles
Emma Näslund-Hadley
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HYBRID PARENTAL TRAINING TO FOSTER PLAY-BASED EARLY CHILDHOOD DEVELOPMENT: EXPERIMENTAL EVIDENCE FROM MEXICO*

Cecilia Berlanga Alessio Robles†
Emma Näslund-Hadley†
Enrique Fernández García‡
Juan Manuel Hernández-Agramonte Caballero‡

ABSTRACT

Play during early childhood is key to stimulating children's physical, social, emotional, and cognitive development. However, research on play-based learning is largely limited to high-income countries, and little is known about the use of hybrid interventions (which combine in-person and remote contact) to promote play-based learning at home. This study estimated the effects of a hybrid parental program to promote play-based learning in the state of Morelos, Mexico. We observed a positive impact on parental investment, with an increase of 0.13 standard deviations (SD) when compared to the control group. The treatment group performed the following play-based activities more often than the control group: reading books/looking at pictures (0.12 SD), singing songs (0.11 SD), and playing with toys (0.17 SD), all of which incentivize learning and the development of emotional and cognitive skills in children. The study also found a significant effect of 0.19 SD on the Developmental Milestones Checklist for children of caregivers with the lowest level of parental investment at the baseline. Our findings support the importance of parental training for increased quality and extent of caregiver investments in play activities, especially among children in households with the lowest levels of caregiver investment at the baseline.

JEL Codes: C93, I20, I24

Keywords: Play-based learning, Early childhood development, Parental engagement, Hybrid education, Low- and middle-income countries, COVID-19, randomized controlled trial

† Inter-American Development Bank
‡ Innovations for Poverty Action

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1. Introduction

Play-based learning is, in essence, learning while playing (Danniels and Pyle, 2018). It is a pedagogical approach that focuses on the use of play to promote children's development and learning with particular attention to brain structure and function (Yogman et al., 2018; Pyle, 2018). Play during early childhood stimulates children's physical, social, emotional, and cognitive development. It promotes their imagination and creativity, improves their problem-solving skills, and enhances their readiness to learn by providing the foundations upon which to build skills later in life (Milteer and Ginsburg, 2012; Topor et al., 2010). Through play, young children interact with their environment and build social and emotional ties, offering an ideal opportunity for parents and caregivers to bond and engage with their children (Milteer and Ginsburg, 2012). During play-based learning, adults become active and engaged partners in their children's learning by providing guidance and "scaffolding" the environment. This can occur in an institutional setting or at home (Weisberg, Hirsh-Pasek, and Michnick Golinkoff, 2013).

Parental engagement in play-based learning at home is one of the behaviors most consistently associated with positive child development (Topor et al., 2010). Parents play a crucial role in how play is defined, valued, and practiced (Knauer et al. 2019). Parents who lack awareness of the importance of play may miss opportunities to support their children's development, as measured by the Family Care Index (FCI), which assesses whether the family environment, care practices, and resources are adequate to foster children's development. Studies of parental engagement through play show a positive and significant association with outcomes of children's development, including language skills and cognitive, motor, and socioemotional growth (Hamadani et al., 2010; Zong et al., 2020). These studies indicate that children of parents who score low on the FCI show less satisfactory development outcomes than those whose parents score higher (Zong et al., 2020).

Levels of parental engagement in play activities vary across households, with lower levels of parental investment in low-income households (Attanasio et al., 2015; Zong et al., 2020). Poverty can negatively affect parenting practices and the home atmosphere, depriving children of stimulating environments and compromising their cognitive and socioemotional development. Parents who live in poverty often lack the resources, knowledge, and capabilities to promote the best possible development of their children; in particular, they are less likely to play with them (Knauer et al., 2016; Attanasio et al. 2019; York, Loeb, and Doss, 2019). Other reasons for low levels of parental engagement in play are related to differences in sociocultural understandings of play. Play varies widely across and within cultures as a result of differences in childrearing beliefs, values, and practices, including the types of social interactions experienced during play, the resources used for playing, and the relation play has to other everyday activities; this necessarily has an impact on the quality and quantity of play (Gaskins, Haight, and Lancy, 2017). Parents with lower resources often miss opportunities to play a role as active agents in their child's development and learning because poverty can drain their cognitive resources and because their decisions may be tied to cognitive biases, such as limited attention and "present bias" (Gennetian, Darling, and Aber, 2016; Mateo-Berganza et al., 2020). That is, income instability and scarce resources may cause parents to discount future losses compared with present needs. Poverty-related stress can limit parents' attention to urgent tasks, such as meeting basic needs, while neglecting important tasks that are not time-sensitive, such as engaging in

stimulating play with their children (Mani et al., 2013; Araujo, 2014). Poverty can thus inflict lasting damage on children's development. For this reason, play becomes even more critical in the child's life, as it helps to build stable, safe, and nurturing relationships that buffer against toxic stress and impart the skills to manage stress better (Yogman et al., 2018). Thus, in contexts of poverty and limited learning opportunities, it is crucial to ask what can be done to improve early child development outcomes using play-based learning approaches.

Targeted caregiver or parent interventions can play an important role in mitigating these scenarios (Knauer et al., 2019). The literature defines two broad groups of interventions to support parents' engagement: (i) behavioral nudges, including text-message reminders to promote parent-child interaction, and (ii) parent (or caregiver) coaching and home visits. Whichever approach is used, the aim is to change parenting behaviors to improve child development outcomes (López-Boo and Leer, 2020). Both types of interventions show substantial effects on children's cognitive and psychosocial development in socioeconomically disadvantaged settings (Engle et al., 2011). A study by Knauer and colleagues (2016) indicates that parental support programs can be successful simply by teaching parents to use whatever materials are available to them to create developmentally supportive interactions. These types of interventions are rapidly emerging as an approach to address poverty-related gaps in early development (Gennetian, Darling, and Aber, 2016; de Chambrier et al., 2021). However, there have been few large-scale evaluations of early childhood interventions with a play-based learning approach in low- and middle-income countries.

One of the exceptions is the Jamaican home-visit model, which between 1986 and 1989 provided weekly home visits for children aged 9–24 months and their mothers. Community health workers taught the mothers how to use play to promote child development and improve mother-child interactions. In 2002–03, when the 213 participants were 17–18 years old, researchers did a follow-up study. Results showed that disadvantaged children who received home-based stimulation enjoyed sustained cognitive and educational benefits compared with their peers, with effects of 0.4–0.6 standard deviations (SD) (Walker et al., 2005). Based on the psychosocial stimulation component of this intervention, Attanasio and colleagues (2015) conducted a randomized controlled trial in Colombia. This intervention consisted of weekly home meetings where play activities were modeled for parents and caregivers of 1,420 children aged 12–24 months in the poorest 20 percent of the population. The researchers found increases in cognitive scores and in the use of receptive language (0.26 and 0.22 SD, respectively) in the group receiving the psychosocial stimulus.

In past years, remote interventions, such as text messages, have offered a useful alternative to home visits when face-to-face interactions are not possible, leading to improved parental practices and child stimulation (Barrera et al., 2020). These interventions can also be a cost-effective way to reach remote areas and families challenged by cognitive biases (Mateo-Berganza et al., 2020; Doss et al., 2018), as they offer an exceptionally low-cost, low-technology, and scalable approach to providing parents with encouragement, reinforcement, and support over long periods (York, Loeb, and Doss, 2019). In 2020, as education services shifted from in-person to remote during the COVID-19 pandemic, some remote and hybrid interventions were designed to increase parental engagement with their children. Low-technology

tools such as SMS text messages and phone calls to parents showed that remote instruction can encourage high parental engagement in educational activities and learning gains in children (Angrist, Bergman, and Matsheng, 2021; Hernández-Agramonte et al., 2022).

Hernández-Agramonte and colleagues (2022) designed an intervention to increase parental engagement by sending text messages to preschool children's parents in Costa Rica during the COVID-19 pandemic, providing caregivers with simple learning activities and encouraged them to use the national distance-learning program. The messages raised the number of activities that parents did with their children and improved children's performance on a standardized cognitive test by 0.23 and 0.11 SD, respectively. Remote parental support programs such as this emerged as an effective alternative to in-person programs during the COVID-19 pandemic.

The study presented here is a hybrid play-based parent program in a low-income setting that combined face-to-face and remote support to caregivers of young children.[1] The model is based on Sesame Workshop's program "Play Every Day" (PED), whose aim is to shift caregiver's perceptions about play and its relationship to child development and learning, and to empower them to effectively guide children in learning through play. This program has been implemented in India, Mexico and South Africa (Foulds and Bucuvalas, 2019). This hybrid parental program was designed to raise the quality of caregiver-child interactions and improve child outcomes by training educators to coach caregivers on how to engage in stimulating play with their children. To the best of our knowledge, this is the first rigorous evaluation of a program of hybrid parental training in play-based child development.

The study has two aims. The first is to contribute to the literature on parental engagement through play by expanding the limited number of studies in low- and middle-income countries. The second is to expand the literature on caregiver support interventions delivered through a hybrid model, which is particularly relevant during emergencies such as the COVID-19 pandemic. We hypothesized that caregivers' greater knowledge of play activities and their developmental importance would raise the quality and frequency of their interactions with their children, resulting in improved child development outcomes.

2. Methods

The PED program aims to promote the development of cognitive and socioemotional skills of children aged from a few weeks to 47 months through play between child-caregiver pairs. With the intention of enhancing parental engagement through play-based learning activities in poor households, the program was added to the early education service units of CONAFE (*Consejo Nacional de Fomento Educativo*), a decentralized agency of the Mexican Ministry of Education. These units provide early childhood education to the poorest and most underserved sectors of the population through CONAFE's educators, who coach parents, caregivers, and pregnant women to enrich their parenting practices.

CONAFE's early education sessions and the PED program complemented one another. During CONAFE's group sessions there are two moments where children play games. During the first, children decide what,

[1] The terms "caregivers" and "parents" are used interchangeably in this study.

how and with whom to play (free play). In the second, each caregiver plays with the child to strengthen the affective bond. None of these activities are guided. This is where the PED program became important as it provided caregivers with information about specific play-based activities which promote learning and development of particular skills.

The PED program was implemented for 12 weeks, between March and June 2021, in the south-central state of Morelos, where 59.4 percent of the underage population live in poverty (Coneval, 2020). During these weeks caregivers and parents of 480 families in the treatment group received weekly instruction from CONAFE educators on how to engage in play activities with their children. The activities focused on four modules: personal care, mathematics, environmental awareness, and socioemotional development. Each module had three play activities; each activity was shared on a weekly basis with caregivers. The 12 play activities were adapted to five different age groups, from newborns through children up to 47 months of age. Appendix A provides a description of (i) a typical training session for the educators delivered by the Sesame Workshop, including a summary of the play activities and sample activities from the program (Table A); (ii) play instructions given to caregivers during the educational sessions (some held remotely and some face-to-face[2]); and (iii) an example of how caregivers conducted a play activity with their child.

These activities were initially planned to be carried out in person, but owing to the COVID-19 pandemic the instructions were shared via WhatsApp as well as physically. A small box with one printed card per play activity was mailed to each family.

The evaluation of the PED program was carried out a few weeks after the intervention ended using a mixed method, including (i) an experimental design where one group of early education service units was randomly assigned to the treatment group and another to the control group; and (ii) a qualitative study of caregiver-child interactions through the coding of videos and in-depth interviews with both caregivers and educators.

For this mixed method evaluation, we relied on four main sources of data: (i) phone surveys administered to caregivers and online surveys of educators to capture pre-treatment characteristics; (ii) post-treatment phone and online surveys to measure the impact of the PED program; (iii) qualitative interviews with caregivers and educators; and (iv) video recordings of a play activity performed by caregivers and their children.

2.1 Experimental design and data

One hundred and twenty early education service units (each with one educator) and 994 caregivers (each with one child) participated in the study. A randomized, controlled trial was conducted to quantify the direct impact of the PED program. A stratified random assignment at the level of the education service unit was carried out using baseline survey information on early childhood development and the number

[2] Ninety-seven percent of the education service units engaged in hybrid sessions, while 3 percent engaged solely in remote sessions.

of children per education service unit.[3] Sixty units were randomly assigned to the treatment group and 60 to the control group. A total of 480 caregivers were in the treatment group; 514 in the control group.

Primary data was collected through an educator survey that included items on (i) play activities conducted by caregivers in the home (and as part of CONAFE's regular caregiver education sessions); (ii) teaching methods; and (iii) the perception of play as a learning tool. A caregiver survey included items on home environments, self-reported parental investment in their children, childhood development, child and caregiver stress levels, and game knowledge, as well as the types of play and other activities conducted with children in the home.

Two instruments in the caregiver survey measured the impact of the program on child development and parental investment: the Developmental Milestones Checklist (CDC) and the Family Care Index (FCI).

The CDC collects information on developmental milestones along four dimensions: (i) socioemotional development, (ii) language and communication development, (iii) cognitive development, and (iv) physical development. The instrument is structured around nine age groups: 2–4 months, 4–6 months, 6–9 months, 9–12 months, 12–18 months, 18–24 months, 24–36 months, 36–48 months, 48–60 months (CDC, 2022).

The FCI aims to measure whether families provide their children with an environment that leads to positive developmental outcomes. The FCI's questions measure family care practices and the resources employed in those practices. The instrument investigates, for example, play activities with the child, the variety of play materials, and the availability of books in the home environment.

2.2 Empirical strategy

To evaluate the direct impact of the PED program, we estimated the following ordinary least squares regressions for caregivers:

$$y_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 y_{it-1} + \gamma' X_{it} + \ strata_i + \epsilon_{it}$$

where Y_{it} is the outcome for each individual i at time t; T_{it} is an indicator of whether the individual was assigned to receive the PED program (treatment group); and X_{it} is a matrix of baseline characteristics.[4] We included strata fixed effects and clustered standard errors.

To measure the impact on educators we estimated the following ordinary least squares regression:

$$y_{it} = \beta_0 + \beta_1 T_{it} + \gamma' X_{it} + \ strata_i + \epsilon_{it}$$

[3] To stratify, we calculated quartiles of the Developmental Milestones Checklist and the number of children per education service unit. A total of 16 strata were generated.

[4] Child's age; caregiver's age and gender; index of child discomfort; number of children in caregiver's charge; device index; remote work dummy; parenting style; parental stress; subjective discomfort; and Family Care Index (see appendix C).

where Y_{it} is the outcome for each individual i at time t; T_{it} is an indicator of whether the individual was assigned to receive the PED program (treatment group); and X_{it} is a matrix of baseline characteristics.[5]

2.3. Balance and attrition

We used baseline data to assess the sample balance across treatment status. Table B in the appendix provides information on the sample characteristics: 99 percent of the caregivers were women with a mean age of 29 years; 48 percent of caregivers had completed lower-secondary education, followed by 29 percent with upper-secondary education; 1 percent had no formal education. Of the participating children, 49 percent were girls, with an average age of 35 months. Eighty-three percent of our sample was between 24 and 47 months old.

Table C in the appendix shows the baseline characteristics of the endline sample by treatment status. The experimental groups were balanced, as they did not differ by observable characteristics of children and caregivers, except on two variables: (i) the number of children in the caregiver's charge and (ii) score on the parental stress index (see appendix C).

Attrition of caregivers at the endline was low. Among the 904 participants who answered our endline survey (464 in the control and 440 in the treatment group), attrition was 8 percent in the treated group, and 10 percent in the control group. The main reason for attrition was change in phone number. A total of 118 educators participated in the endline survey (59 in each group). Attrition was 2 percent for both groups and was not correlated with the treatment assignment, a fact that supports the internal validity of the experiment (table 1).

Table 1. Regression of treatment assignment on attrition (no significant effects)

Treatment	0.0263
	(0.0201)
Observations	994
Strata fixed effects	YES

*** p<0.01, ** p<0.05, * p<0.1

Note: Table reports the coefficients of a model that estimates the probability that an observation was lost from the caregiver sample through attrition. The regression includes strata fixed effects. Robust standard errors clustered at the education service level are reported in parentheses.

2.4. Qualitative study

A total of 14 educators and 14 caregivers participated in the qualitative study. Half belonged to the treatment group, the other half to the control group. This study had two parts. The first consisted of a set of qualitative interviews; the second involved the analysis of the caregiver-child interaction during play sessions, where caregivers were asked to engage in a specific play-based activity from the PED program. Because visiting homes for direct observation would have involved health risks during the COVID-19 pandemic, the face-to-face assessment of the play sessions was replaced by video recordings. This limited

[5] Gender, age, and education level of the educator; CONAFE training modality (hybrid, remote or face-to-face).

the number of families selected, since only those with a smartphone (13 percent of the total sample) could participate. We are aware that this implies selection bias and that the results are specific to a subsample. Another limitation of the study is that caregivers might had rehearsed their interaction before recording themselves even though they were asked not to do so. Nevertheless, the results of the qualitative study offer insight into participants' perceptions and uses of the program in the home environment and therefore aid in interpreting the quantitative findings.

The qualitative interviews were transcribed, and the written record of the interview was coded and analyzed. An expert identified and labelled segments of text in the transcriptions of both groups' interviews using the following categories: routine activities, objective of play, activities that foster child development and games played. The responses were compared between treatment and control for each category.

The videos were recorded by the caregivers themselves. Two trained coders independently evaluated the following attributes of the caregivers in their interactions with children: (i) tone of voice, (ii) acceptance of and respect for children, (iii) enjoyment and appreciation of children, (iv) expectations of the child (v) language development, (vi) learning opportunities, (vii) positive affect, (viii) creativity, and (ix) play intention. After the first assessment, the coders compared their scores in a guided discussion to obtain a third and final coding that both coders agreed upon.

3. Results

3.1. Quantitative results, including heterogeneous treatment effects

Educators. We first considered educators' knowledge of play-based learning. The educator survey included seven questions designed to assess their knowledge. These questions inquired about the stages of child development, the objective of specific play-based activities, and the suitability of certain toys for children, among others. The percentage of items answered correctly was calculated and used as a dependent variable in the regression. Educators in the treatment group scored 7 percentage points higher (significant at 5 percent) than the control group (table 2).

Table 2. Educators' knowledge of play-based activities

	(1)	(2)
Treatment	0.0635**	0.0679**
	(0.0298)	(0.0296)
Observations	118	118
Strata fixed effects	YES	YES
Covariates	NO	YES

*** p<0.01, ** p<0.05, * p<0.1

Note: Table reports the coefficients of a model that estimates the impact of treatment on an educator's knowledge of play-based activities. The model in column 2 controls for baseline characteristics including gender, age, and education of the educator and the type of sessions held during the program (remote, hybrid, or face to face). All regressions

include strata fixed effects. Robust standard errors clustered at the education service level are reported in parentheses.

However, we did not find an impact on perceptions about the *importance* of play-based learning. Perception of play was measured using a 2-point Likert scale (agree and highly agree or disagree and highly disagree) with statements meant to assess the extent to which an educator agrees or disagrees on topics such as the importance of play in language and social and cognitive skill development. A perception index was defined as the average of these responses. We found no impact of treatment on this index. A possible explanation is that educators already had a high level of agreement on the importance of play. The baseline survey shows that 97 percent of educators already considered play a relevant strategy for improving children's development outcomes.

Caregivers. Next, we examined whether a better understanding by educators of how to include play in their sessions with the caregivers induces caregivers to increase their engagement in stimulating play with their children. We do find a positive impact on parental investment, as caregivers in the treatment group had an FCI that was 0.13 SD higher than that of the control group (table 3). Disaggregating the index, we found that the treatment group performed the following activities more often: reading books/looking at pictures (0.12 SD), singing songs (0.11 SD), and playing with toys (0.17 SD). Two of these activities are closely related to the PED program, which explicitly suggests looking at pictures to recognize emotions and using toys when playing the "inside and outside" game (see appendix) to develop spatial awareness.

Table 3. Treatment effects on parental investment (FCI, standard deviation)

	(1) FCI	(2) Read books/look at pictures	(3) Tell stories	(4) Sing	(5) Play with toys	(6) Name objects
Treatment	0.131**	0.117*	0.00858	0.110*	0.168***	0.0263
	(0.0523)	(0.0692)	(0.0585)	(0.0560)	(0.0603)	(0.0653)
Observations	904	904	904	904	904	904
Strata FE	YES	YES	YES	YES	YES	YES
Covariates	YES	YES	YES	YES	YES	YES

*** p<0.01, ** p<0.05, * p<0.1

Note: Table reports the coefficients of a model that estimates the impact of treatment on the FCI index. The model controls for baseline characteristics including child's age, child's gender, child's subjective discomfort, caregiver's age, caregiver's gender, caregiver's stress, caregiver's ethnicity, number of children at home, whether there is remote work at home, number of devices in the household, FCI index, parental discomfort index, parenting style index, and punishment index (see appendix C). All regressions include strata fixed effects. Robust standard errors clustered at the education service level are reported in parentheses.

The time caregivers invested in play on the day prior to the survey was used as a proxy for play time. The question was phrased this way to avoid recall bias. These responses were analyzed in two ways, first by

testing for an effect if the caregiver had or had not played the day before, and second by testing whether play time the day before was above or below the population median. For the first case, we found that caregivers in the treatment group were 3 percentage points more likely to have played with their children the day before (significant at 10 percent) (table 4). For the second case, no significant results were found.

We also analyzed caregivers' knowledge and practice of PED program activities. In the endline survey, caregivers were asked whether they knew 4 of the 12 play-based activities of the PED program (1 play-based activity for each of the 4 thematic areas). The responses were added for each caregiver, obtaining the total number of the program's play-based activities they knew (with a maximum of 4), and used as a dependent variable in our model. We found that the treatment group knows 1.2 more play-based activities (out of a total of 4) than the control group (significant at 1 percent) (table 4).

Similarly, caregivers were asked if any adult practiced these 4 play-based activities with their children, and we found that the treatment group practiced 0.5 more play-based activities from the PED program than the control group (significant at 1 percent) (table 4). We also found that caregivers in the treatment group increased by 0.2 SD the number of times in a day they participated in educational sessions (including those available on television) and the number of times they carried out activities taught through CONAFE's early education service units (e.g., building a toy) with their children (table 4).

Table 4. Treatment effects on play time the day before the survey (play dummy), PED knowledge and practice, and CONAFE activities per day (standard deviation)

	(1) Play dummy	(2) PED knowledge	(3) PED practice	(4) With CONAFE activities included
Treatment	0.0327* (0.0185)	1.193*** (0.105)	0.485*** (0.0856)	0.206** (0.0914)
Observations	904	904	904	904
Strata fixed effects	YES	YES	YES	YES
Covariates	YES	YES	YES	YES
Mean dep. var. (control)	0.884	0.924	1.898	0.000
SD dep. var. (control)	0.321	1.048	1.114	1.000

*** p<0.01, ** p<0.05, * p<0.1

Note: Table reports the coefficients of a model that estimates the impact of treatment on measured parental investment using play time, knowledge and practice of PED activities, and practice of CONAFE activities. The model controls for baseline characteristics including child's age, child's gender, child's subjective discomfort, caregiver's age, caregiver's gender, caregiver's stress, caregiver's ethnicity, number of children at home, whether there is remote work at home, number of devices in the household, FCI index, parental discomfort index, parenting style index, and punishment index (see appendix C). All regressions include strata fixed effects. Robust standard errors clustered at the education service level are reported in parentheses.

Although we found a change in caregivers' engagement with play, we found no evidence that this translated into impact of the program on early child development as measured by the CDC index (table 5).

Table 5. Treatment effects on early child development as measured by CDC index (no significant effects)

	(1)	(2)
Treatment	0.0526	0.0627
	(0.0660)	(0.0643)
Observations	904	904
Strata fixed effects	YES	YES
Covariates	NO	YES

Note: Table reports the coefficients of a model that estimates the impact of treatment on childhood development using the CDC index as an indicator. The model controls for baseline characteristics including child's age, child's gender, child's subjective discomfort, caregiver's age, caregiver's gender, caregiver's stress, caregiver's ethnicity, number of children at home, whether there is remote work at home, number of devices in the household, FCI index, parental discomfort index, parenting style index, and punishment index. All regressions include strata fixed effects. Robust standard errors clustered at the education service level are reported in parentheses.

We tested for treatment effect heterogeneity on the two main variables of interest: the CDC index and FCI. A significant effect of 0.19 SD was found on the CDC index of those caregivers who invested less than the median FCI at the baseline (table 6). A possible explanation is that caregivers with low parental investment at the baseline level learn more play-based activities relative to the high parental investment group and therefore gain more from the program. We found no significant heterogenous treatment effects on the FCI of age or parental investment at the baseline.

Table 6. Heterogenous treatment effects on CDC (standard deviation)

	(1)
Treatment	0.19*
	(0.0980)
Treatment x high parental	-0.23**
investment	(0.1158)
Observations	904
Strata fixed effects	YES
Covariates	YES

*** p<0.01, ** p<0.05, * p<0.1

Note: Table reports the coefficients of a model that estimates the heterogenous impact of treatment by varying parental investment on the CDC index (SD). The model controls for baseline characteristics including child's age, child's gender, child's subjective discomfort, caregiver's age, caregiver's gender, caregiver's stress, caregiver's ethnicity, number of children at home, whether remote work is done at home, number of devices in the household, CDC index (SD), parental discomfort index, parenting style index, and punishment index (see appendix C). All regressions include strata fixed effects. Robust standard errors clustered at the education service level are

reported in parentheses.

3.2. Qualitative results

3.2.1. Interviews with educators

In the treatment and control groups alike, educators told caregivers that play was essential for child development. Both groups supported this view with similar arguments, including the importance of play for the development of motor skills, social skills, language and imagination, and an understanding of the five senses. Finally, both groups mentioned that play was useful for learning colors, body parts, and mathematics; for identifying the location and distance between objects; and for describing the weather. Both also mentioned that through play children could learn in a way that was more fun, less rigid, and less boring. This is consistent with the quantitative results, where educators in the baseline survey demonstrated knowledge of the importance of play in children's learning and development. Also, educators in both groups highlighted the importance of play for caregiver-child bonds and emotional ties. This result is consistent with what was obtained in the endline survey, where 94 percent of the educators responded that they agreed or strongly agreed that play helped in the caregiver-child interaction.

3.2.2. Interviews with caregivers

We found a greater knowledge of play-based activities and their purpose in the treatment group, a result consistent with our findings in the quantitative study. In the qualitative interviews we found that caregivers in the treatment and control groups engaged in different play-based activities with their children (see tables D and E in the appendix). Specifically, the treatment group used the play-based activities of the PED program to a greater extent. In contrast, we found that the control group engaged in play-based interactions with their children such as playing with a ball, blocks, or figures; playing games to identify the smell of flowers and flavors of food; or engaging in some other version of the PED play-based activities, for example, singing songs to learn the parts of the body.

We found that both groups believed that play was a tool to improve children's learning, as well as to increase and develop their mobility and skills. The treatment group reported in greater detail that play improved the caregiver-child bond, as they reported knowing more about their child's fears, skills, and weaknesses.

Consistent with the quantitative evaluation, we found that caregivers in the treatment group played more during their daily activities than the control group. Also, the treatment group exemplified in a broader and more precise way how they interacted and integrated play in the interactions with their children and identified more clearly the benefits of play as part of their daily routine. Finally, caregivers in the PED group mentioned that the program helped their children express their feelings, improved their gross motor and language skills, and increased children's interest in learning.

3.2.3. Results of video analysis

Each caregiver in the control and treatment groups was assigned a play-based activity to engage in with their child. Caregivers were asked to record themselves performing this activity, which was later coded based on a codification instrument (see appendix table F).[6] The treatment group had higher-quality interactions than their peers in the control group (appendix table G). Specifically, these caregivers used a more friendly and emotional tone of voice, encouraged taking turns more often, encouraged children to speak, took advantage of opportunities to extend or complement children's learning, and encouraged the children to make comments, ask questions, and broaden their interests (table G).

4. Discussion

The importance of caregiver-child play-based interactions for cognitive and socioemotional development has been extensively researched. Research from Western Europe and the United States has shown that levels of parental engagement in play are lower among poorer parents, but comparable research is scarce outside the high-income countries. Little is known about the use of hybrid interventions that promote play-based learning at home. In this study we used an experimental design to estimate the effects of a hybrid parental program to promote play-based learning in a low resourced setting.

Based on experimental data from 120 educators and 994 caregivers of children aged from a few weeks to 47 months in the state of Morelos, Mexico, we analyzed the effects of the PED program on outcomes for three groups: educators, caregivers, and children. Among educators, we found that training in play-based learning increased knowledge of the importance of play-based activities in developing a variety of skills in early childhood, as well as in strengthening bonds between caregivers and the children they cared for. Among caregivers, we found that the hybrid program increased their investments in their children, as they became more aware of the developmental aims of play-based learning. The program also increased the time caregivers spent playing with their children (higher parental investment) and induced them to perform more activities that promoted children's spatial awareness and their ability to recognize emotions.

Interestingly, the increase in play-based activities was not limited to the activities included in the PED program. The treatment also had a positive effect on the number of daily CONAFE activities performed by caregivers. This could be the result of two factors. First, educators may have improved their delivery of the caregiver training offered in the regular CONAFE content. Second, changing parental knowledge about play may have led to an increased at-home-use of regular CONAFE content.

The qualitative study supports the finding that the PED program increased caregiver investment in children. Although caregivers in the treatment and control groups all perceived play as an important tool for development, those in the treatment group played more in the course of their daily activities than did their peers in the control group. The caregivers in the treatment group identified to a greater extent the benefits of play and the importance of integrating it into the daily routine. The video evaluation also suggests that the caregivers in the treatment group had better interactions with their children than the

[6] The videos were coded by two evaluators who worked independently, then, the evaluators compared their results and if they did not agree a third evaluator was involved so they could all come to an agreement.

control group, further supporting the quantitative finding of increased parental investment as measured by the FCI.

Among children, we found a positive impact on child development outcomes as measured by the CDC among children of caregivers showing the lowest level of investment at the baseline (0.19 SD higher). Since there was no average treatment effect on all children, we can conclude only that the PED model had an effect on child outcomes in contexts of very limited caregiver investment. Future research should look at the medium-term effects of the PED program on CDC outcomes for children of caregivers with different levels of parenting knowledge and investment in their children.

Taken together, the quantitative and qualitative findings from our mixed-method research design suggest that the effects of the PED program stemmed from changing caregiver knowledge about play and from an increase in caregivers' extent and quality of play-based activities with children. The increased investment led to improved outcomes—at least among children in households with the lowest levels of caregiver investment at the baseline.

The PED program and its evaluation took place in a context where the COVID-19 pandemic limited some face-to-face interactions. This had an impact on the treatment delivery. Initially the program was meant to be carried out in the course of regular CONAFE caregiver training sessions. Similarly, the data had to be collected remotely through self-reported measurements. In an ideal environment, child development would have been measured in person.

5. Conclusion

This experimental study addresses an important gap in the research on play-based learning in low- and middle-income countries. It also contributes to the literature by exploring new mechanisms of delivering caregiver support through hybrid models. Our findings suggest that it is possible to influence caregiver practices in a low-income setting by fostering the use of play-based learning and transferring knowledge of the benefits of such learning, which in turn leads to higher quality and frequency of caregiver-child interaction.

In these settings, caregivers report lower levels of play and lower levels of awareness of the importance of play than their peers in high-resource contexts. By expanding the research agenda on play-based learning to encompass more diverse settings and populations, the literature of which this study is a part could make important contributions to early childhood policy in developing countries. As our study focuses on the earliest stages of play—from shortly after birth to the third year—it should be complemented by research in low-income settings on how to foster parental engagement in play during the preschool and primary years. Similarly, because the study was implemented using a hybrid model, future research should deploy and rigorously evaluate a large-scale model to promote play-based learning through face-to-face training.

6. Appendixes

Appendix A. Training from the Sesame Workshop on application of the PED methodology

The educators received training sessions from Sesame Workshop on three occasions. The first sessions were held before the program began to introduce educators to the PED methodology, including the activities presented in table A. The aim was to sensitize them on the importance of play in the learning process during early childhood, to help develop their skills to facilitate play-based learning sessions, and to teach them how to accompany and follow-up with the caregivers during the 12-week period.

Table A. PED play activities

Module	Aim	Play-based activities
Personal care	To learn to identify body parts and their function	1. The parts of the body 2. Visiting the doctor 3. Let's move!
Mathematics	To identify the location and/or position of people or things in relation to others (spatial awareness)	4. Where is it? 5. Inside and outside? 6. Close or far?
Environmental awareness	To encourage the use of their senses to explore the world around them	7. Discovering the senses 8. The animal game 9. How is the weather today?
Socioemotional development	To learn how to identify facial expressions related to simple emotions	10. What does my face say? 11. Guess the emotion 12. How am I feeling?

Source: Play Every Day, Guide for educators, Sesame Workshop, 2021.

The intermediate training sessions were held halfway through the program; the aim was to identify and share achievements, challenges and lessons learned through the development of the program, as well as to strengthen key issues such as quality interactions during play and how to give and receive feedback from caregivers. The third and last training sessions were held during the last month of the program. During these sessions, the educators shared everything they learned during the intervention and gave suggestions for improving the program. All sessions were held remotely via Zoom.

The delivery of play instructions by educators to caregivers during educational sessions

At the beginning of the program, the Sesame Workshop mailed hardcopy packages of printed game cards containing the PED play activities instructions for each of the 12 games to all the families in the treatment group.

At the beginning of each week one of CONAFE's educators shared with the child's caregiver via WhatsApp an audio recording containing the instructions of the play activity of the week, in addition to the printed game card. The educator also sent a video to the caregiver to illustrate how the game should be played. Where epidemiological conditions permitted, sessions demonstrating the play activities were held face-to-face with caregivers. By the end of the week, the educators followed up with the caregivers by phone and WhatsApp to talk about the challenges and achievements they faced during the week. By the end of the 12 weeks, the educators also followed up with the caregivers and asked for their feedback on what they had learned from performing the game activities with their children.

Example of a play-based learning activity of the PED program: Caregiver and three-year-old child engage in the "Inside and Outside" game

This play-based learning activity is part of the mathematics module. The learning objective is to help children identify the location and/or position of people or things in relation to others.

The caregiver first asks the child if he wants to play with her, to which he answers "yes." The caregiver then tells the child that they will play a game with a bucket and his toys.

The caregiver puts a ball inside the bucket and tells the child that "the ball is inside the bucket" and then takes it out and tells the child that "the ball is outside the bucket." The caregiver asks the child to put the ball inside the bucket and asks where the ball is. The child answers, "it's inside." The caregiver then asks the child to take the ball out of the bucket and asks again where the ball is. The child answers, "it's outside." The caregiver then gives the child a narrow jar and asks him what objects will fit inside. The child notices that the ball does not fit in the jar, so he takes his smaller toys and puts them in the jar. The caregiver then asks the child: "Did you put the toys inside or outside the jar?" The child answers "inside." The caregiver compliments the child by saying "well done."

Appendix B. Tables referenced in text

Table B. Baseline characteristics of sample, by treatment status
(n = 994; C = 514, T = 480; 60 clusters)

Variable	Control	Treatment	F-test for joint orthogonality
CDC index	0.860	0.859	0.816
	[0.005]	[0.005]	
Socioemotional CDC index	0.809	0.802	0.664
	[0.008]	[0.008]	
Language/communication CDC index	0.895	0.895	0.499
	[0.006]	[0.007]	
Cognitive CDC index	0.848	0.848	0.682
	[0.008]	[0.008]	
Movement/physical development CDC index	0.887	0.890	0.841
	[0.008]	[0.008]	
FCI index	0.846	0.860	0.370
	[0.008]	[0.011]	
Toys index	0.670	0.663	0.268
	[0.011]	[0.013]	
Parental subjective discomfort	0.203	0.205	0.994
	[0.010]	[0.012]	
Parental stress	0.193	0.214	0.013**
	[0.006]	[0.008]	
Parenting style	0.870	0.866	0.829
	[0.005]	[0.006]	
Punishment index	0.262	0.266	0.903
	[0.007]	[0.008]	
Child subjective discomfort	0.094	0.097	0.600
	[0.008]	[0.008]	
Child age	2.533	2.528	0.884
	[0.045]	[0.052]	
Child gender	0.498	0.483	0.656
	[0.023]	[0.022]	
Children per education service unit	9.541	8.933	0.189
	[0.475]	[0.444]	
Caregiver age	28.451	28.575	0.989
	[0.386]	[0.402]	
Device index	0.543	0.552	0.415
	[0.008]	[0.008]	
Number of children	1.115	1.090	0.065*
	[0.019]	[0.016]	
Lost job	0.525	0.494	0.424
	[0.025]	[0.023]	
Lost income	0.589	0.604	0.514
	[0.021]	[0.026]	
Remote job	0.140	0.165	0.130

Variable	Control	Treatment	F-test for joint orthogonality
	[0.015]	[0.018]	
Limited food portions	0.479	0.396	0.929
	[0.295]	[0.323]	
Limited meals per day	0.510	0.356	0.839
	[0.215]	[0.229]	
Internet access	0.899	0.896	0.667
	[0.014]	[0.014]	
WhatsApp access	0.947	0.923	0.194
	[0.009]	[0.017]	

** p<0.05, * p<0.1

Table C. Baseline characteristics of endline sample, by treatment status
(n = 904; C = 464, T = 440; 60 clusters)

Variable	Control	Treatment	F-test for joint orthogonality
CDC index	0.860	0.860	0.803
	[0.005]	[0.005]	
Socioemotional CDC index	0.810	0.802	0.566
	[0.008]	[0.008]	
Language/communication CDC index	0.896	0.896	0.661
	[0.007]	[0.007]	
Cognitive CDC index	0.847	0.850	0.558
	[0.007]	[0.007]	
Movement/physical development CDC index	0.886	0.893	0.990
	[0.008]	[0.008]	
FCI index	0.845	0.862	0.404
	[0.008]	[0.011]	
Toys index	0.669	0.664	0.312
	[0.011]	[0.013]	
Parental subjective discomfort	0.203	0.196	0.596
	[0.011]	[0.012]	
Parental stress	0.193	0.208	0.087*
	[0.006]	[0.009]	
Parenting style	0.872	0.865	0.951
	[0.005]	[0.007]	
Punishment index	0.263	0.263	0.657
	[0.007]	[0.008]	
Child subjective discomfort	0.097	0.090	0.806
	[0.009]	[0.009]	
Child age	2.512	2.552	0.514
	[0.048]	[0.054]	
Child gender	0.500	0.477	0.552
	[0.024]	[0.022]	
Children per education service unit	9.670	8.977	0.160

Variable	Control	Treatment	F-test for joint orthogonality
	[0.480]	[0.444]	
Caregiver age	28.573	28.657	0.920
	[0.424]	[0.421]	
Device index	0.543	0.553	0.319
	[0.008]	[0.008]	
Number of children	1.110	1.089	0.074*
	[0.019]	[0.016]	
Lost job	0.526	0.482	0.219
	[0.025]	[0.023]	
Lost income	0.582	0.602	0.536
	[0.021]	[0.026]	
Remote job	0.142	0.170	0.127
	[0.016]	[0.019]	
Limited food portions	0.431	0.345	0.912
	[0.331]	[0.349]	
Limited meals per day	0.698	0.336	0.193
	[0.062]	[0.248]	
Internet access	0.899	0.900	0.857
	[0.015]	[0.015]	
WhatsApp access	0.948	0.923	0.120
	[0.010]	[0.019]	

* p<0.1e

Table D. Games mentioned by the treatment group

Game's aim	Mentioned 6–7 times	Mentioned 4–5 times	Mentioned 2–3 times	Mentioned 1 time
Recognize one's body parts and their function	"Body parts"	Songs about body parts	Draw body parts	"Going to the doctor" "Let's move"
Recognize the location of people and things (up, down, near, far)	"Inside and outside"	"Where is…?"	"Close or far?" Hide and seek	
Explore their environment	"Discovering the senses "	" The animal game " "How is the weather today?"		Blind man's bluff
Recognize facial expressions related to simple emotions	"What does my face say?"		"Guess the emotion"	"How am I feeling?"

Table E. Play-based activities mentioned in the control group

Aim of activity	Mentioned 4–5 times	Mentioned 2–3 times	Mentioned 1 time
Recognize one's body parts and their function	Songs about body parts	Body parts bingo Draw body parts	Going to the doctor
Recognize the location of people and things (up, down, near, far)		Hiding and finding objects Asking "where is the object?" Songs about "up" or "down" Playing with a ball to recognize if it is far or close Drawing a circle and playing inside or outside it Building blocks and figures with different sizes and shapes	Order objects and toys
Explore their environment	Recognize the smell of flowers and plants. Taste food, feel different textures (plants, food)	Teaching the name of animals by showing pictures or playing bingo Songs about the temperature (hot or cold)	
Recognize facial expressions related to simple emotions	Recognize feelings by showing pictures or emojis Recognize feelings of another person by making facial expressions	Paint or draw faces showing different emotions	Bingo to recognize feelings The calming glitter jar

Table F. Video analysis codification instrument

#	Code	Module/category	Question	Response scale
1	TONE_1	Tone of voice	The caregiver interacts with excitement, with a friendly tone. That is, the caregiver verbally demonstrates enjoyment of children (Today we are going to play...!).	Yes=1; No=0; NA
2	RESPECT_1	Acceptance/ respect for children	Says instructions in a positive way ("Feet belong on the floor"), not in a restrictive way ("Don't get on the table").	Yes=1; No=0; NA
3	RESPECT_2	Acceptance/ respect for children	The caregiver gives an example of how to play the game.	Yes=1; No=0; NA
4	RESPECT_3	Acceptance/ respect for children	The adult invites the child to play and respects the child's response to the invitation.	Yes=1; No=0; NA
5	RESPECT_4	Acceptance/ Respect for children	The adult identifies when the child has lost interest and ends the game or moves on to another activity.	Yes=1; No=0; NA
6	APPRECIATION_1	Enjoys and appreciates children	The adult makes eye contact with the child during play/when talking to the child, kneels, bends down or sits at the child's level to establish better eye contact.	Yes=1; No=0; NA
7	APPRECIATION_2	Enjoys and appreciates children	Expresses delight/enthusiasm with children's efforts/ Positive and supportive comments are heard from the caregiver.	Yes=1; No=0; NA
8	EXP_1	Children's expectations	During the game, the adult encourages the participants to take turns to participate.	Yes=1; No=0; NA
9	EXP_2	Children's expectations	Respect the children's' turns during play.	Yes=1; No=0; NA
10	LANGUAGE_1	Language development	The caregiver encourages the child to speak or complete words even when the child's language is very basic.	Yes=1; No=0; NA
11	LANGUAGE_2	Language Development	The caregiver shows respectful listening without pressuring the child to talk.	Yes=1; No=0; NA
12	OPPORTUNITY_1	Learning opportunities	The adult takes advantage of opportunities in the dynamic to extend or complement the child's learning.	Yes=1; No=0; NA
13	AFFECTION_1	Positive affection	Caregiver and child laugh, smile.	Yes=1; No=0; NA

#	Code	Module/category	Question	Response scale
14	AFFECTION_2	Positive affection	The caregiver demonstrates affection through physical contact.	Yes=1; No=0; NA
15	CREA_1	Creativity	The caregiver promotes creativity and imagination in play.	Yes=1; No=0; NA
16	INT_1	Intentionality	It is evident that the caregiver has a learning intention in carrying out the activity.	Yes=1; No=0; NA
17	INT_2	Intentionality	During play, the caregiver encourages the child to make comments, encourages questions or broadens the child's interests.	Yes=1; No=0; NA

Table G. Means by category (qualitative instrument)

Category	Control	Treatment
Tone of voice	0.571	0.625
Respect	0.821	0.643
Enjoys and appreciates child	0.786	0.750
Child expectations	0.143	0.250
Language development	0.571	0.750
Learning opportunities	0.571	0.750
Positive affection	0.357	0.313
Creativity	0.000	0.000
Play intention	0.286	0.500
Mean	0.509	0.558

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