

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

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Context

- ▶ Only 20% of children enrolled in preschool in low-income countries in 2019
- ▶ In Mozambique, only 3.5%!
- ▶ Human capital investments from birth to six years old are extremely effective
 - ▶ Attanasio et al., 2022; Bailey et al., 2021; Holla et al., 2021; Sylvia et al., 2021; Black et al., 2017; Almond and Currie, 2011; Heckman et al., 2010
- ▶ Preschool services can be cost-effective and yield long-term effects
 - ▶ Bailey et al., 2021; Holla et al., 2021; McCoy et al., 2018; Yoshikawa et al., 2013; Nores and Barnett, 2010
- ▶ Challenge: scalable preschool policies in contexts of extreme deprivation

This paper

- ▶ Evaluate the Mozambique Early Childhood Development Project or [DICIPE](#)
- ▶ A large-scale [preschool construction program](#)
- ▶ Exploit cluster randomized control trial ([RCT](#)) for evaluation
 - ▶ only a few previous experiences (Bouguen et al., 2018; Berkes et al., 2024)
- ▶ Show its successful implementation resulted in significant
 - ▶ improvements *primary school-age* learning and cognitive skills,
 - ▶ increases in high-quality parental practices, and
 - ▶ high cost-effectiveness

Contributions to the Literature

- ▶ Provide novel evidence that shows positive impacts of preschool construction programs in settings of high deprivation
 1. While previous preschool construction interventions target poverty in some form, our study in the Mozambique context involves a much higher level of vulnerability
 2. Program we study has a stronger take-up of preschool education than other interventions
 3. Stark differences in baseline characteristics and preschool attendance → powerful positive impacts we detect at *primary school-age*
 - ▶ Prior studies in low-income settings find small or null effects on children's skills (e.g., Blimpo et al. (2022) in Gambia, Bouguen et al. (2018) in Cambodia, Donald et al. (2023) in Congo, or Martinez et al. (2017) in Mozambique)
 4. Provide a cost-benefit estimate of scaling a preschool intervention in a context of extreme deprivation

Agenda

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The Early Childhood Development Program (DICIPE)

- ▶ Preschool construction program to expand access to quality ECD services for children aged 3-5 in rural Mozambique
- ▶ Six key features:
 1. Eligible communities had no previous preschool services
 2. Partnership between government and NGOs
 3. Preschools constructed walking distance from primary school
 4. Preschools were staffed with members of the community
 5. Parenting education sessions were held with caregivers
 6. Cost effective: community involvement & household materials

Timeline of DICIPE implementation and data collection



Pictures of the DICIPE preschools



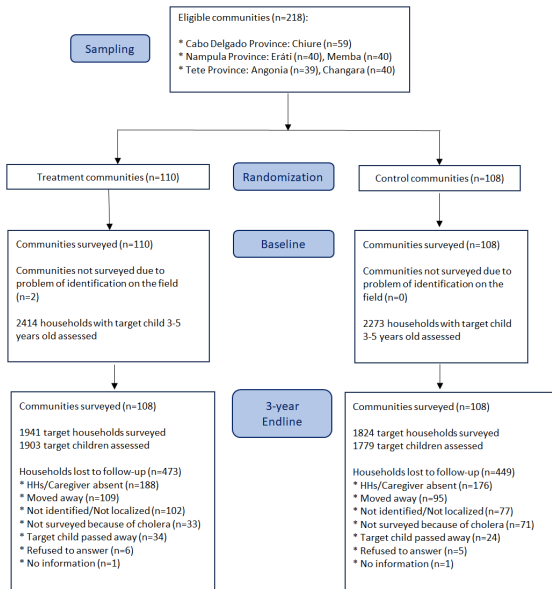
The Early Childhood Development Program (DICIPE)

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			
<i>Presence of:</i>			
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

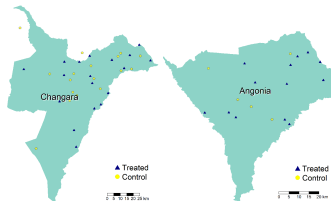
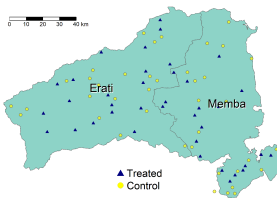
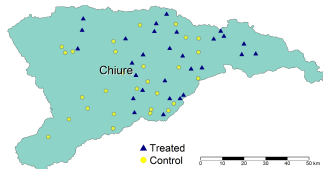
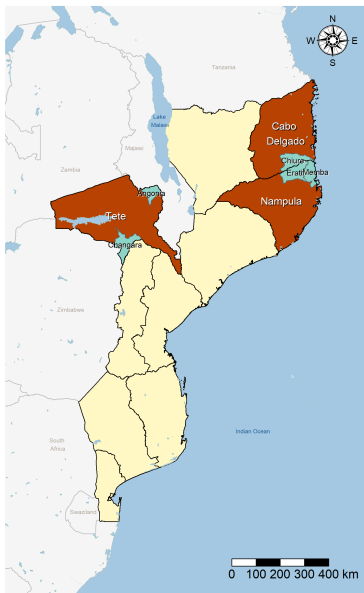
Experimental Design

1. 3 (out of 5) Provinces and 2 Districts within based on:
 - ▶ Representativity, vulnerability, relevance
2. 218 Communities across the districts:
 - ▶ No preschool service (formal or informal);
 - ▶ Has a primary school
 - ▶ Rural.
3. Randomization of communities within district
 - ▶ 110 Treated (2 could not be surveyed) & 108 Control control
4. Sample
 - ▶ 112 preschools
 - ▶ 1941 Treated and 1824 Control Households
 - ▶ 1903 Treated & 1779 Control target children

Experimental Design



Location of Study Provinces, Districts, and Communities



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Summary statistics at baseline reveal acute deprivation

Variable	(1) Control Mean	(2) SD	(3) Treatment Mean	(4) SD	(5) <i>p</i> -value (1)-(3)	(6) 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.		<i>P</i> -Value		N	
Joint F-test	1.287		0.190		4,256	

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Empirical Strategy

- ▶ To study ITT impacts, we estimate the following specification for child i in community c and district s :

$$Y_{ic} = \beta_0 + \beta_1 T_c + \gamma_{s_c} + \varepsilon_{ic}$$

- ▶ Y_{ic} – outcome variable of interest for child i at endline
- ▶ T_{ic} – treatment indicator capturing assignment of community c of child i
- ▶ γ_{s_c} – district fixed effects
- ▶ Standard errors clustered at the community level
- ▶ Robustness check: Double LASSO for selection of controls
- ▶ Multiple hypothesis testing:
 - ▶ Summary index tests following Kling et al. (2007)
 - ▶ Free step-down resampling methodology of Westfall and Young (1993)

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Primary school outcomes

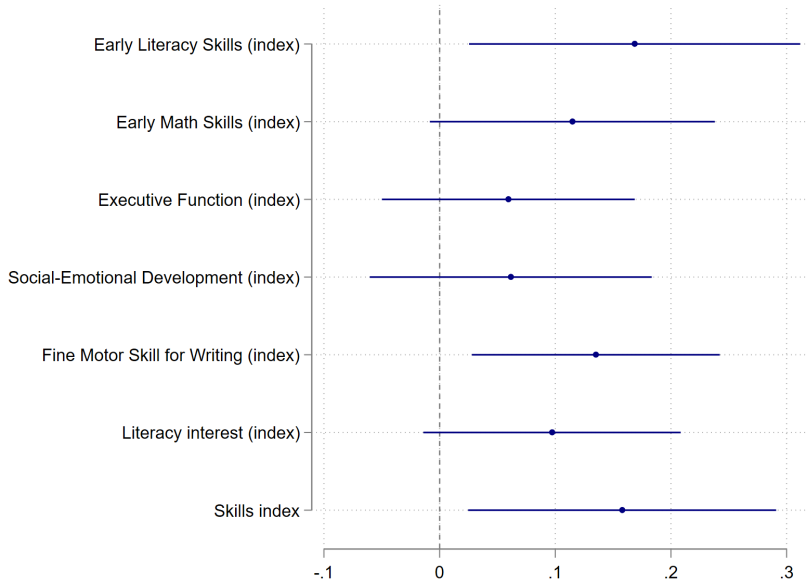
- ▶ We collect information about take-up
- ▶ Primary school enrollment and progression
- ▶ Investigate impact on each factor
- ▶ And on summary index

DICIPE ↑ preschool enrollment & primary-school success

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

- ▶ 6 p.p. more likely to be enrolled in primary school
- ▶ 3 p.p. less likely to repeat a grade
- ▶ 0.16 SD higher on a primary school enrollment index
- ▶ 0.16 SD higher on a cognitive and social-emotional skills index

DICIPE increases cognitive and noncognitive skills



Parental Time Investments

- ▶ We collect information about parental practices and time use
- ▶ No significant effect on labor supply:
 - ▶ Very high at baseline: 98.6% of mothers in control communities work
 - ▶ Decreases by 1.3pp in treated communities

Parents increase quality of interactions which children

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

- ▶ ↑ in Stimulation of 17.1% of a SD for treated parents
- ▶ ↑ in Home Play of 7.7% of a SD for treated parents

Parents become more involved in *primary* school

	(1) Met with principal	(2) Number of meetings	(3) Met with teacher	(4) Number of meetings	(5) In school committee
Treatment	0.067*** (0.021) [0.015]	0.222*** (0.058) [0.003]	0.009 (0.029) [0.742]	0.138 (0.100) [0.424]	0.014 (0.015) [0.605]
Observations	3765	3760	2126	2122	3765
Control mean	0.212	0.398	0.321	0.624	0.138

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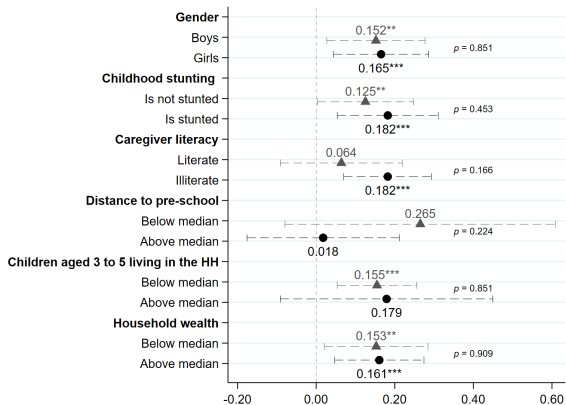
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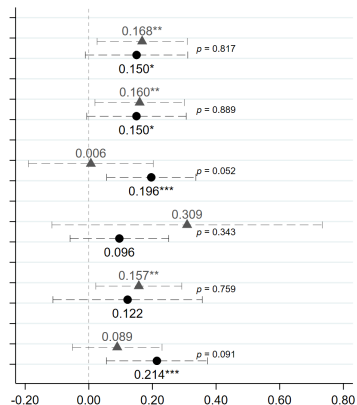
Heterogeneous Impacts

- ▶ Which groups of children benefit more from preschool construction?
 - ▶ Study heterogeneity using interaction terms with characteristics of the
 - ▶ Child: gender and stunting
 - ▶ Caregiver: literacy
 - ▶ Household: distance to nearest preschool, household size, wealth
 - ▶ Find that the program yielded higher benefits to children:
 - ▶ In wealthier households
 - ▶ With illiterate parents
 - ▶ Living closer to the newly constructed preschools

Heterogeneous Impacts



Panel A: Primary School Enrollment



Panel B: Child Skills

Mediation Analysis

- ▶ Which two main components of the program – preschool construction and parental education sessions – contributed to positive impacts?
- ▶ IV strategy exploiting the possibility that preschool enrollment (PE) and parental stimulation index (PS) may vary by baseline households characteristics
- ▶ Since baseline characteristics may directly affect measures of child development, we use treatment X baseline characteristics to instrument for each mediator
- ▶ Exploit baseline information on the distance between households and the preschools as part of the set of excluded instruments since household distance to the construction site is arguably random (similar to Attanasio et al. 2020, 2022)

Mediation Analysis

► First Stage:

$$PE_{ic} = a_0 + \sum_j a_M^j T_c \times X_i^j + \sum_j a_X^j X_{ic}^j + a_T T_c + a_{sc} + \varepsilon_{ic}$$

$$PS_{ic} = b_0 + \sum_j b_M^j T_c \times Z_i^j + \sum_j b_Z^j Z_{ic}^j + b_T T_c + b_{sc} + \varepsilon_{ic}$$

- T_c : treatment indicator variable; X_i^j : vector of baseline characteristics to predict PE; Z_i^j : vector of baseline characteristics to predict PS

► Second Stage:

$$Y_{ic} = \beta_0 + \beta_T T_c + \sum_j \beta_X^j X_{ic}^j + \sum_j \beta_Z^j Z_{ic}^j + \beta_{PE} \widehat{PE}_{ic} + \beta_{PS} \widehat{PS}_{ic} + \gamma_{sc} + \varepsilon_{ic}$$

- Y : child development outcomes; $\widehat{PE}$ and $\widehat{PS}$: predicted values of the mediators

Mediation Analysis for Primary School Enrollment Index

	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-0.214 (0.284)	0.122* (0.065)	-0.181 (0.274)			
Predicted PE	0.513 (0.412)		0.438 (0.412)	0.221** (0.089)		0.189* (0.097)
Predicted PS		0.205 (0.204)	0.138 (0.213)		0.480** (0.227)	0.149 (0.209)
Observations	3680	3677	3677	3680	3677	3677
Overidentification test p-value				0.865	0.813	0.896

- ▶ Results suggest that attending preschool is the most important mechanism through which the DICIPE program affects progress in primary school
- ▶ Qualitative study supports this:
 - ▶ Most facilitators (85%) had a medium or high engagement with the children
 - ▶ Parental education sessions suffered from low compliance – less than 50% of parents reported having ever attended a session

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Cost-effectiveness

	(1) Discount rate (%)	(2) Annual real wage growth (%)	(3) Total cost per child (USD)	(4) Preschool augmentation to lifetime earnings (USD)	(5)	(6)	(7)	(8) Benefit-to-cost ratio Lower	(9) Upper
<i>Panel A. Baseline scenario</i>									
Baseline	3	5.1	76.83	1,491	493	2,598	859	6.4	33.8
<i>Panel B. Alternative scenarios</i>									
5% Discount rate	5	5.1	76.83	749	248	1,305	432	3.2	17.0
0% real wage growth	3	0	76.83	303	100	529	175	1.3	6.9
3% real wage growth	3	3	76.83	760	251	1,323	438	3.3	17.2
Including monitoring costs	3	5.1	81.51	1,491	493	2,598	859	6.1	31.9
High cognitive estimated effect (0.169 SD)				No	No	Yes	Yes		
High cognitive wage returns (13%)				Yes	No	Yes	No		

- Benefits: lifetime earnings from improvement in cognitive skills
- Benefit-to-cost ratios are similar to or higher than ratios estimated in India, Malawi, and Bangladesh (Dillon et al., 2017, Özler et al., 2018, Spier et al., 2020, Holla et al., 2021)

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- ▶ Experimental evidence of a large-scale preschool construction program in highly deprived communities in Mozambique
- ▶ Important results for policy given the low-cost, scalable nature of the intervention
 - ▶ Large increase in preschool enrollment rates
 - ▶ Increase in primary school enrollment
 - ▶ Lower primary school grade repetition
 - ▶ Higher cognitive and social-emotional skills
 - ▶ Higher parental investments
 - ▶ Preschool enrollment is a key mediator