The Relationship Between Early Childhood Education Access and Quality, Neighborhoods, and Children's Developmental Outcomes in Rural Indonesia

by

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A dissertation accepted and approved in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy

in Quantitative Research Methods in Education

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Summer 2024

DISSERTATION ABSTRACT

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Title: The Relationship Between Early Childhood Education Access and Quality, Neighborhoods, And Children's Developmental Outcomes in Rural Indonesia

In recent years, the government of Indonesia has made it a priority to improve the quality of currently operated Early Childhood Education (ECE) centers in rural Indonesia. The rapid proliferation of ECE centers throughout the nation is exciting progress and yet poses a challenge to ensure that these ECE centers are providing high-quality programs for young children. In this three-paper dissertation, I seek to understand the complex relationships between family- and neighborhood wealth, access to quality ECE, and children's outcomes. I draw my analytical sample from data collected as a part of an ECE evaluation project in rural and relatively poor villages in Indonesia in 2013. In my first article, I examine the probability of enrolling in a high-quality ECE center based on children's socio-economic backgrounds using multilevel linear probability model. In the second article, I investigate the direct and indirect influences that structural and process quality in ECE have on children's outcomes using multilevel structural equation modeling framework. In the third and final article, I investigate village characteristics that are associated with ECE quality and examine whether the association between village characteristics and children's outcomes differ based on the quality of ECE children attend using multi-level regression model.

I find that in the villages included in the 2013 study, access to higher ECE quality is lower for children from higher poverty villages. I also find that teachers' years of teaching experience and ECE facilities (educational, water, health and hygiene facilities) are significantly associated with process quality and there is evidence of a small indirect effect of these structural

quality indicators on student outcomes via process quality. Lastly, I find that higher community participation, higher safety, and lower poverty rates in the village are significantly associated with higher ECE quality. Moreover, I find that the relationship between village characteristics and some children's outcomes differ based on ECE quality they attended.

These findings highlight the need for policy initiatives to prioritize certain regulable structural quality factors to improve children's learning experiences in rural communities and to prioritize ECE quality improvement programming in villages with higher levels of poverty and violence.

ACKNOWLEDGMENT

I would like to express my gratitude to people who helped me complete this otherwise impossible journey. Dr. David Liebowitz, thank you for your confidence and trust in me since my first day in the program, your guidance, feedback, and unsurpassed support both in my academic and personal life throughout my PhD program helped me to grow as a quantitative researcher and policy analyst. I also would like to thank my exceptional committee members. Dr. Kathleen Scalise for her mentorship and the valuable opportunity she gave me to allow me to teach in higher education, as well as serving on my committee; Dr. Cengiz Zopluoglu for his thoughtful feedback to improve my analytical methods and opportunity to work alongside and learn advance statistical analysis in my early years in the program; Dr. Sara Schmitt for providing her content expertise on early childhood education and development as well as her warmth in supporting me as a mother and scholar. I also would like to thank the ECED project evaluation of the World Bank that granted me access and use the dataset for my dissertation.

I want to thank all my QRME fellows for our friendships, happy hours and weekly check-in meetings, especially Claire my role model, my mentor, my best friend. Havisha, you are a brilliant and kind person, I am so glad our paths crossed, Anwesha, Janette, Errol and Manuel thank you for our sweet friendships. A PhD is a long and often lonely journey, but you all made it more bearable and fun. A special thank you to the Co-op family center's teachers and staff for being our "village" and caring for our babies with such a high-quality care. The Co-op played such a monumental role in the completion of my study as a mother and PhD student. We are so blessed to be part of Coop family. I also want to extend my gratitude to the UO Graduate Christian student fellowship for their prayers and companionships.

Finally, I owe a big thank you to my family. Jonathan, thank you for being a wholesome husband and exceptional Baba for the girls. You are my biggest supporter! You have endured many long hours of solo-parenting on the weekends, sacrificed sleeping at night, taken care of me during many breakdowns and always made sure I had all delicious food, coffee, bubble tea, and trips to keep me sane and happy. You are also a very insightful discussion partner and rigid proofreader. My two babies, Kiyara and Aveline thank you for being mama's source of strength, when I am weak, the two of you reminded me that I have superpower to overcome anything. Mom Ria thank you for your unwavering prayers and keep telling me *"Mey pasti bisa, Tuhan Yesus pasti tolong"*. Papa, I did it! Thank you for instilling the faith and confidence in me that I will have my doctoral degree since I was a little girl (*Mey nanti sekolah sampai S3*)! I know that you are smiling in heaven. Calliesta, Hestin, and Okky for being my rock, my protector, and faithful supporter throughout my life. It is an honor and a privilege to grow up together with each of you.

DEDICATION

My dear husband, Jonathan, whose love, sacrifice, wisdom, and strength carried me through this season and forever till death do us part.

My two wonderful baby girls, Kiyara and Aveline, the reason I wake up every morning even when I did not want to. Over anything, I love being Mom for the two of you the most!

Mama and Papa, whose love, prayer, care, inspiring me to pursue all my dreams

Early young children in Indonesia and everywhere. May we create a safe and happy place for each of you to grow and find your own way in this world

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CHAPTER I

INTRODUCTION

The growing commitment to expanding access of early childhood education (ECE) for young children has been documented across the globe, especially in the places where it was formerly less available such as in low- and middle- income countries (Black et al., 2017).The attention and investment in early childhood care and education are driven by the understanding that the early years of a human's life are critical to their development, in which healthy and nutritious food intake coupled with nurturing, warm, and richly stimulating experiences during these periods may further strengthen their development. Cross-disciplinary studies are supportive of this effort. Neuroscientists suggest that the most rapid brain development happens during these first years of life when more complex neural connections multiply when receiving appropriate stimulus (Newberger, 1997; Shonkoff & Phillips, 2000). Robust evidence in the field of education also suggests that participation in high-quality ECE programming is associated with short- and long-term academic benefits such as children's readiness to enter formal schooling both academically and socially (Bakken et al., 2017; Nores & Barnett, 2010; Gorey, 2001).. Moreover, in a broader sense from an economic and public policy perspective, society at large is also considered to benefit through the potential public investment return, calculated by the reduced cost of potential school remediation, lower rates of crime, and improved overall society well-being (Heckman, 2012; Belfield et al., 2006)..

However, providing high quality access to all children is challenging. Evidence from various contexts shows that access to high-quality ECE program is unequal, particularly for traditionally disadvantaged students such as those with lower socio-economic status, from racial minority backgrounds, and children with special needs status (Bassok & Galdo, 2016; Hatfield et

al., 2015). This fact is especially worrisome because robust evidence suggests that high-quality ECE has larger benefits for children in these populations (Bustamante et al., 2022; Krieg et al., 2015; van Huizen & Plantenga, 2018a). This inequality perhaps results from the second-class position of ECE in the education system when compared to other more established levels of education such as K-12. In many countries, ECE is not yet included in the formal public schooling system and is considered to be a private matter under family responsibility. This attitude can constrain funding allocations necessary to run effective ECE programs.

In the US, for example, universal public education only starts in the kindergarten, while preschool is mostly catered by private services which largely operate using tuition charged to the child's family and occasionally receive a modest subsidy from public funding. There are some rare exceptions, such as the Head Start programs which are fully government-funded. Additionally, the need of childcare program for young children before school age is especially important in households where the primary caregiver(s) is employed. Chaudry et al., (2017) argue that it is more common these days for children to experience non-parental care from a very young age, potentially because of the increased number of working mothers with young children. Full-day ECE programs play a more of supportive caregiving role to help employed parents caring for their children during daily working hours.

In the Indonesian context, the typical ECE program is a less-than-full day childcare to support working parents and focuses on providing young children with developmentally appropriate stimuli to help them be more ready to enter formal education. This is evident in the ECE statistics report in 2021 where full-day daycare program only comprises about 1 percent of the total ECE programs in Indonesia (MOEC 2022). The most common ECE program is kindergarten and playgroup (both are considered preschool in Indonesia as formal schooling

begins at the first grade of elementary school) that usually only provide short-hour services (an average of 3 hours per day). The evaluation of current preschool offerings in Indonesia with the strongest causal warrant found that increased preschool availability did not cause women to earn more or accrue more compensated work hours, most likely due to the 3-hour per day service instead of full-day ECE (Halim et al., 2022).

In addition to supporting children's school readiness, in 2013, the government of Indonesia proposed a holistic and integrated ECE model that is designed to be the hub where other essential services for children could be provided every month such as health checkups, immunization, supplementary vitamins, nutritious meals, and additional parenting classes for parents/caregiver (MOEC, 2015). These additional services were administrated by respected service providers or professionals such as nurses and parenting class trainers. The goals of this integrated ECE program are to improve holistic developmental outcomes for children, improve positive parenting behaviors, and address developmental problems such as stunting or malnourishment in young children.

The Indonesian government recognizes ECE centers in villages as a strategic platform to reach young children in rural and poor villages. The number of ECE programs has rapidly increased, particularly in the rural villages, over the past two decades. The majority of them were initiated through the village fund (Mahrofi, 2022) as well as a massive ECE project that was largely funded by the loan from World Bank in 2009 – 2013 (Hasan et al., 2013). However, based on the national ECE report in 2020, about 75 percent of all ECE center in Indonesia are not or not yet accredited and among those that have received their accreditation, only 16% are rated as "A" (high quality) or about 4 percent of all ECE centers (N = 7993 out of 202,991). This

national data shows an urgent need to improve the quality of currently operated ECE centers in Indonesia so that children can receive the maximum benefit of participation in an ECE center.

Additionally, in my personal experience as an ECE specialist in Indonesia where I often visited ECE centers in rural villages, I witnessed how ECE programs in rural villages are struggling to operate. That said, for uncertain reasons and despite limitations, in some villages children and teachers were thriving. One of my main responsibilities was to improve the quality of ECE centers by providing teacher professional development, creating culturally contextualized lesson plans, and collaborating with the community to collectively support the sustainability of these centers. These direct encounters and engagements with children, teachers, and the community in rural villages have allowed me to reflect on the quality of ECE in the context of rural villages.

The complexity of the effort to provide access to high-quality ECE bears unique promises and challenges that warrant a more in-depth understanding of local context and dynamics. One issue I noticed was that the support of the village community can make a difference. In villages where ECE programs and teachers were supported by strongly knit communities (such as via regular visits from village head, monthly performance incentive, and active participation of parents and community members), the programs tend to thrive. On the other hand, ECE programs in villages with land disputes, conflicts between village leaders, and apathy from the community tend to struggle to maintain regular operations.

The combination of national data on ECE quality in Indonesia and my personal experience intrigued me to investigate more about the availability and quality of the ECE offer in Indonesia. Specifically, I want to understand whether disparities in accessing high-quality ECE in Indonesia exists based on children's socio-economic backgrounds. I also want to understand

the characteristics of ECE centers and village that are associated with high-quality ECE and potentially can foster a positive and high-quality learning experience for children in rural villages.

Using data collected as part of the program evaluation of this ECE project in Indonesia, I explored three different research topics in three distinct articles presented respectively in Chapter II, III, and IV, with a concluding fifth chapter where I summarize the overall takeaways from this dissertation and direction for future study. This data is not representative of the national Indonesian population, rather, it reflects the characteristics of rural villages in Indonesia (Hasan et al., 2013; Nakajima et al., 2019).

In chapter II, I present my first article which examines the disparities in access to higher quality ECE program based on children's socio-economic backgrounds – both of their household and neighborhood. Using a multilevel linear probability model, I find that children from high poverty neighborhoods have a lower probability of enrolling in higher-quality ECE, and I find no evidence of any difference in children's probability of enrolling in higher-quality ECE based on their household income.

My second article in Chapter III examines important predictors of high-quality learning experiences and interactions in the ECE classroom and whether those predictors are associated with children's outcomes. I extend a previous study that looked at the direct relationship between each quality indicator and children's outcomes (Brinkman et al., 2017) in two ways. First, I estimate the relationship of structural quality features (inputs) and process quality (interactions and children's experiences during ECE programming). Then I further test whether there is an indirect effect of structural quality via process quality on children's outcomes using multilevel structural equation modeling (MSEM). I find that educational, health, and hygiene infrastructure

and facilities, years of teacher's teaching experience are significant predictors of ECE process quality. Among others, ECE infrastructure and facilities have the most consistent indirect relationship on all children's outcomes via process quality.

Lastly, in Chapter IV, I looked at ECE center and children in the broader village context to examine the association of village characteristics (poverty rate, safety, and community participation) on ECE quality and children's outcomes while accounting for the fact that children's outcomes are correlated with other residing in their same village. I find that stronger community participation and higher safety indicators in rural villages are associated with higher ECE quality, while higher village poverty rate is linked to lower ECE quality. In relation to children's outcomes, I find that community participation, village poverty and an indicator of a violence-free village have positive associations with one or more children's outcomes. When I include ECE quality as moderator, I find that ECE quality matters more in higher poverty neighborhoods. I also document a buffering effect of ECE quality in less safe villages on children's language and cognitive outcome; in fact, children enrolling in higher quality ECE in less safe villages performed better than those in more safe villages. Moreover, ECE quality only further intensifies the more positive outcomes that already exist in villages with higher community participation and safety.

These three research articles contribute to the overall governmental effort of improving the quality of ECE centers in Indonesia. My study suggests that access to higher quality ECE is equal for children regardless of their socio-economic status in high poverty and rural villages in Indonesia. More importantly, I identified structural quality inputs and village characteristics that are associated with high quality ECE. These indicators can guide policymakers in their efforts to improve ECE quality especially in poor and rural villages in Indonesia.

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CHAPTER II

DISPARITIES IN CHILDREN'S ENROLLMENT IN HIGHER-QUALITY EARLY CHILDHOOD EDUCATION PROGRAM BY SOCIOECONOMIC BACKGROUND IN RURAL INDONESIA

Introduction

Ensuring children in their early years have access to high-quality early childhood programming has been a shared educational goal around the world over the past few decades. The proportion of children enrolled in early childhood education (henceforth, ECE) has increased globally over the past 20 years, with the aim of reaching all children regardless of their background. However, to date, substantially less attention has been paid to the quality of the offer (Raikes, 2022; Yoshikawa et al., 2018). Studies in western-white dominated countries have found disparities in the quality of ECE centers in urban settings that serve larger proportions of students from low-family incomes and who are racially minoritized. Children from lower-income and minority groups are more likely to attend lower quality centers compared to their more advantaged peers (Bassok & Galdo, 2016; Cloney, Cleveland, et al., 2016; Hatfield et al., 2015; McCormick et al., 2023). However, little is known about whether this systematic inequality persists in developing countries and in rural settings where racial demographics are more homogenous.

To shed light on this issue of inequity, this study aims to identify disparities in access to higher-quality ECE center in rural villages in a developing country context. Specifically, it examines the pattern of higher-quality ECE accessibility in rural Indonesia, as Indonesia is one

of the middle-income countries that has dramatically increased its ECE centers specifically to reach those in rural and poor villages over the past two decades.

There exists a global commitment to incite the expansion of ECE around the world. The Sustainable Development Goals (SDGs) endorsed by the country members of the United Nations in 2012 specifically acknowledges in target 4.2 that by 2030, *all girls and boys have access to quality early child development, care and preprimary education so that they are ready for primary education*. This target encourages the adopting country members to invest in young children's healthy development through early childhood care and education programs and catalyzes extra attention to children's holistic needs during these first five years of their life. The movement to prioritize high-quality early childhood education which caters to children aged 0-5 years old is supported by evidence-based studies across disciplines. Neuroscientists, for example, argue that the most rapid development of human brain happens in early years of life (Newberger, 1997; Shonkoff & Phillips, 2000), while a positive, caring and stimulating environment could help children reach their maximum potential development (Rushton et al., 2010; Sinclaire-Harding et al., 2018). Education researchers have documented links between early childhood education participation and children's school readiness as well as long-term academic socioemotional and academic benefits (Bakken et al., 2017; Nores & Barnett, 2010; Gorey, 2001). Further, economists have documented the high investment return of public expenditure on early childhood education based on potential savings that could be accrued through the absence of schooling, public health, and societal problems such as remedial education, reduction in referrals to special education services and the criminal justice system. Some have therefore argued public investment in early childhood education, to be more cost effective than any other social program (Heckman, 2012; Belfield et al., 2006).

Public investment in early childhood education and care has notably increased globally and particularly in economically developing countries (Black et al., 2017). Access to ECE has increased as data shows that the enrollment rate in pre-primary education programs across the globe increased by 28 percent, from 33% in 2000 to 61% in 2020, with the most dramatic changes occurring in low- and middle- income countries (World Bank, 2022). The increasing accessibility to ECE program in developing countries aims to close the gap of developmental outcomes as one study estimated that about 80 million children were at risk of not meeting their development milestone in low- and middle- income countries due to malnutrition and poverty (McCoy et al., 2016).

Among many, one country that is persistently committed to improving early childhood care and education is Indonesia. In the past two decades, Indonesia has implemented targeted policies and programs to support the development of the nation's young children. The initiatives include policy reforms to prioritize early childhood education programs, such as the establishment of an independent early childhood education (ECE) directorate under the ministry of education, and the inclusion of ECE in the National Education System law in 2003 (Hasan et al., 2013). Programs and initiatives to increase access to early childhood services throughout the country were also apparent through the establishment of a large number of new centers and the revitalization of existing ECE programs to reach children from previously underserved communities, including those from low-income backgrounds in rural areas of Indonesia. For example, the government has endorsed the "one village, one ECE center" program since 2012 to boost the accessibility of ECE for children and to encourage village governments to allocate an annual budget to support ECE program at the village level (Adriany et al., 2019). Government-collected data shows that the total number of kindergartens and playgroups in Indonesia

increased from 126,379 centers in 2011 to 177,585 centers in 2019 alone (MOEC, Indonesian Ministry of Education and Cultural, 2020).

The growth in the number of ECE programs throughout the country is suggestive of positive results as a consequence of the Indonesian government's commitment and efforts to increase ECE accessibility. Nevertheless, when looking at the equal opportunity for children based on their background characteristics, data shows that enrollment in any ECE, regardless of the quality, is still lower for children from traditionally disadvantaged backgrounds such as children with disabilities, from rural areas, and from lower-income households. The Indonesian National Bureau of Statistics (2020) recorded that enrollment rates in any ECE program are lower for children from low-income and rural settings, as well as those with disabilities. Another study found a similar disproportionate participation rate (used interchangeably with enrollment rate) in ECE programs with higher enrollment for those from the top-quantile income household compared to their peers at the bottom-quantile income household (Senza et al., 2020).

Furthermore, when the quality of ECE is considered, the rapid quantitative growth poses a potential threat to educational quality. In 2020, governmental records show that 75 percent of all ECE centers were not accredited (MOEC, 2020) with those in rural village and non-formal settings tending to have lower quality (Adriany et al., 2019). While only a smaller fraction of children from rural, lower income background enrolled in an ECE center, those who did enroll were more likely to attend a center of lower quality, based on the Ministry's designation. This unfortunate pattern is not uncommon. In other contexts, where student or community level data and their ECE program quality information are available, studies have found the quality of ECE centers varies across communities. In the United States, studies identified that ECE centers in communities with high concentrations of low-income and high-minority residents were lower

quality compared to those in more affluent communities (Bassok & Galdo, 2016; Hatfield et al., 2015). The similar finding is also evident in Australia, in which ECE centers were limited and lower quality in lower income communities compared to those in higher income communities (Cloney, Cleveland, et al., 2016). As a consequence, children from lower-income families were found to have a lower probability of enrolling in a higher-quality ECE programs (Bassok & Galdo, 2016; Cloney et al., 2016; McCormick et al., 2023). This pattern is explained by the lack of high-quality ECE programs availability in the community where these groups of children reside.

The disparities in ECE quality based on socioeconomic status is problematic because studies have shown that quality matters especially for children from disadvantaged backgrounds. Participation in high-quality ECE programming is associated with long-term positive benefits for children, with larger effects detected for those from low-income backgrounds (Bustamante et al., 2022; Krieg et al., 2015; van Huizen & Plantenga, 2018a). In contrast, enrolling in a low-quality ECE program not only imparts minimal benefit, but is potentially harmful for child development (Baker et al., 2008); one study found negative association between children's developmental outcomes and hours spent in the low-quality ECE programs (McCartney et al., 2010).

As studies have shown that participation in high-quality ECE programs benefits low-income children the most, while participation in low-quality ECE brings minimal even harmful effect, the enrollment rate to any ECE program regardless of the quality is not capturing the complete picture of accessibility to ECE. To evaluate the progress of ECE accessibility for all children, one needs to consider rates of participation in *high-quality* ECE programs, not only rates of participation in *any* ECE program to achieve the policy objective of narrowing gaps in educational opportunity. This study addresses the gap in knowledge on availability and

enrollment to high-quality ECE for children from low-income backgrounds in Indonesia, both based on children's membership in a low-income household and residence in a low-income neighborhood.

Answering this question is particularly challenging in the Indonesian context because it requires data about students' background characteristics and the quality of the school they attend. The annual nationwide ECE statistics published by the Ministry of Education only collects the enrollment rate and aggregated school level information without measuring the process quality of individual schools. Therefore, to address this question, I leverage data that measures both children's characteristics and ECE quality collected in 2013 as part of an impact evaluation study of an ECE project in Indonesia to estimate the probability of children from low-income backgrounds accessing higher-quality ECE. With the knowledge of availability and access to high-quality ECE, the government as well as the community will be able to address the issue in a more targeted manner to improve learning opportunities for children from low-income backgrounds, both in quantity as well as the quality. Given this motivation, I seek to answer the following research question: To what extent does enrollment to higher-quality ECE programs (defined in this study as centers in the top quartile of ECERS-R score) differ by children's household and neighborhood poverty status in rural Indonesia?

Following the trend of lower enrollment in high quality ECE for children from a lower-income background found in other contexts, I anticipated a similar pattern to be observed in this study. In particular, I hypothesized that higher rates of childhood poverty (both at the family and neighborhood levels) would be associated with a lower probability of enrolling in a higher-quality ECE center. To preview my results, I found differences in the probability of enrolling in higher-quality ECE centers between children from higher- and lower-poverty villages (0.3

percentage point differences on a base enrollment rate in high-quality centers of 21 percent). However, I found no differences in probability of enrolling in higher-quality ECE centers based on children's household poverty level.

Principles of Access and Quality in ECE

My research question stems from the profound principle of equal opportunity in education. There is a common goal to ensure every child, regardless of their background, has an equal right to pursue education which is protected by national constitutions and the United Nation's Universal Declaration of Human Rights. Coleman (1968) argued that there are four elements that should be considered in providing equal education opportunity including: free education, common quality curriculum, equal opportunity for diverse populations, as well as equal education opportunity in all geographical locations. The concept of equal opportunity to education is particularly important because it determines one's opportunity to secure economic and social goods in the future.

In the context of ECE, the equal opportunity to quality ECE is defined as providing an equal start for children as they transition from a home to community environment before the formal schooling experience begins. The mechanism by which high-quality ECE programs influence children's long term academic and economic outcomes is that such programs apply active learning and child-initiated experiences that foster children's personal dispositions that are central for their participation in school and society in general. Schweinhart et al., (1993) theorized that high-quality ECE programs that allow children to independently plan their ideas, generate experiences, and reflect on their accomplishments will promote important personal

dispositions such as initiative, responsibility, curiosity, trust, confidence, independence, and divergent thinking.

Accessibility of ECE

Studies examining access to ECE have used a variety of proxies of accessibility with the most common indicators conceived of as availability and affordability. Friese et al. (2017, p. 5) operationalized access to early care and education as a condition when "parents, with reasonable effort and affordability, can enroll their child in arrangement that supports the child's development and meets the parents' needs." To follow up this definition, Thomson et al. (2020) examined 124 articles and reports on access to ECE and found that in the literature, there are at least five dimensions of access to ECE. The first dimension is reasonable effort on the part of parents or caregivers. The authors define reasonable effort as an adequate availability (number of slots available, enrollment, capacity) in close geographic proximity to where the caregivers reside or work, as well as a readily available information about ECE programs for parents and caregivers. The second dimension is affordability, which assesses whether the ECE cost can be afforded or even waived completely for parents with limited resources to enroll their children. This may depend on whether or not the ECE is publicly funded or subsidized. The third dimension is whether the ECE supports children's development which is usually measured by the quality of ECE, and specialized services offered that are tailored to children's needs. The fourth dimension examines whether the ECE meets parents' needs in terms of type of service offered and hours of operation. Lastly, the equity dimension examines the extent to which ECE reaches underserved children such as those from low-income, high language diversity, and rural/urban areas.

Policy makers and researchers seem to agree that access to ECE is complex and consists of multidimensional indicators. Although the most common measure found in the literature is the enrollment rate in ECE – and this is true in the Indonesian context as well – more efforts are being made to include other dimensions such as the quality of ECE, alignment with parents' needs, and equity to create a more complete understanding of access to ECE. In this study, children's enrollment to an ECE program is used to measure the accessibility of ECE.

Quality of ECE

Similar to access to ECE, the concept of quality of ECE is also considered complex and multifaceted (Edwards, 2021) where it is grounded in socioecological, constructivist, attachment, and learning theories (Chen & Wolf, 2021). In general, there are two types of quality measures found in the literature: structural and process quality. Structural quality refers to the organization and implementation of ECE services both at macro and micro levels. At the macro level, structural quality is usually regulated in the national policy by setting accreditation, minimum child-to-staff ratios, maximum group size, and the required professional training and education of the teachers. Meanwhile at the micro center level, it includes the duration of service and other center-based policies to ensure children's health and safety. Structural quality is then conceptualized as factors that are important in creating adequate learning environments for children. Process quality, on the other hand, can be perceived as a product of structural quality, which reflects the interaction and overall child experience in an ECE setting, such as teacher-student interactions, provision of learning activities, and the physical and emotional care they receive. This study uses the Early Childhood Environment Rating Scale, Revised (ECERS-R) rating score that measures both structural and process quality of the early childhood education learning environment.

ECERS-R as Instrument to Measure ECE Quality

The ECERS-R has been widely used and translated internationally to measure the quality of preschool programs in at least 20 countries (Chen & Wolf, 2021). Clifford et al., (2010) reported that ECERS-R has good test-retest and interrater reliability with agreement within one point was reached on 92 percent of the items and the total interclass correlation was 0.915. There are 43 items in total that measure seven subscales: Space and Furnishings, Personal Care Routines, Language-reasoning, Activities, Interaction, Program Structure, and Parents and staff. Similar to other well-known ECE quality measures, ECERS-R was developed and tested in developed, industrialized countries. Studies show that when it is used in developing countries adaptation to the local context is necessary to improve the predictive power and to match local classroom settings and quality standards (Chen & Wolf, 2021; Li et al., 2014). In Indonesia, Brinkman et al., (2017) adapted the ECERS-R by only using 28 out 43 items that were included in the Indonesian national ECE quality standards. In this study, I use the composite ECERS-R score based on both the full 43 items as well as the 28 items Brinkman et al. identified as most relevant to the national ECE standards. I provide more details on the ECERS-R scoring system in the Method section.

Background and ECE Program Setting

Type of ECE Programs Available in Indonesia

Pre-primary education is yet to be included in the mandatory education system for children in Indonesia. The country adopts a 12-year compulsory education with four levels of education starting from *Sekolah Dasar* (Elementary grade 1 to 6), *Sekolah Menengah Pertama* (Junior secondary school grade 7 to 9), to *Sekolah Menengah Akhir* (Senior secondary school grade 10 to 12). Nonetheless, there is an exhaustive list of policies governing the implementation

of ECE programs issued throughout the past decade including the national curriculum of ECE and the standards of the ECE programs. Under the Ministry of Education, ECE is categorized into formal and non-formal based on the type of service and the age of children served (Chen & Wolf, 2021) (see Table 2.1).

Table 2.1. Types of Formal and Non-formal Early Childhood Education in Indonesia

Type of Service	**Age served**	**Formal/non-formal**	**Minimum service length**	**Max student teacher ratio**
Daycare	0-6 years old *Priority for 0-4 years old	Non-formal	1 x 120 mts / week	1:4
Playgroup (*Kelompok Bermain*)	2-6 years old *Priority for 3-4 years old	Non-formal	2 X 180mts / week	1:8
Other type of ECE (*Satuan Paud Sejenis*)	0-6 years old	Non-formal	1 x 120 mts / week	1:4 1:8 1:15
Kindergarten (*Taman Kanak-kanak/ Raudatul Athfal*)	4-6 years old *Priority for 5-6 years old	Formal	5 x 180mts / week	1:15

The distinction between the formal and non-formal ECE categories has an implication on the initiation, implementation, and evaluation of the programs where more restrictive and structured regulations are applied to formal ECE programs compared to the non-formal ones. ECE programs can be initiated by the government (village/district/city level), an individual, community, or a legalized organization. The initiation process is relatively straightforward and requires the submission of the request to the district office of Education (DOE) with administrative documentation and ownership of the land and space where the activity will be conducted. To grant the permission, the DOE will consider if the applicants meet the criteria, the

availability of existing ECE programs, the number of targeted children population in the community, and capacity of the center.

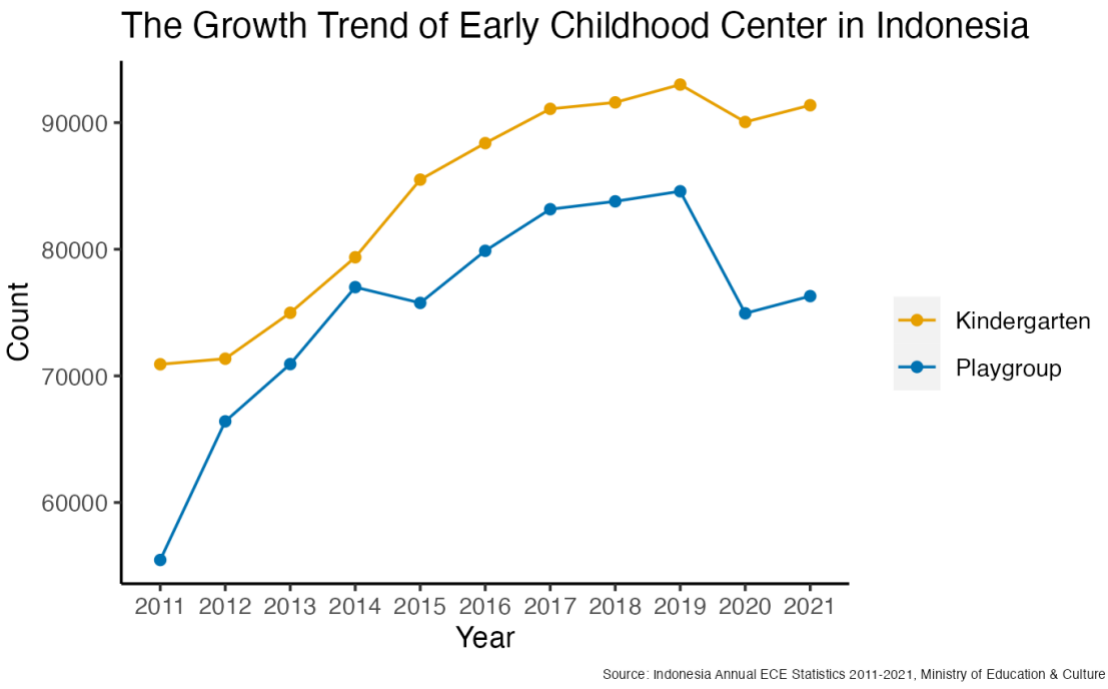
Growth of Early Childhood Education in Indonesia Across the Years

Indonesia has invested a large proportion of its national education budget, including relying on various sources of loans, to expand the early childhood programs for children living in rural areas with relatively high rates of poverty. Further, the government has promulgated various policies to ensure the programs' sustainability. In 2001, the Indonesian government tasked the newly established early childhood education directorate under the Ministry of Education and Culture with accelerating ECE program and policy efforts throughout the country (Hasan et al., 2013). Need assessment studies were conducted to map the pressing problems and informed the government on strategies to take. UNESCO (2003) reported that some of the most pressing problems regarding ECE programs in Indonesia were limited coverage and access, low participation among children from low-income families, and low quality of ECE services. Therefore, the initial goal of the policy makers was to first expand the availability of the ECE programs throughout the country by starting new community-based centers as well revitalizing the existing ECE programs.

The large expansion of the number of ECE programs to improve accessibility was deemed to be necessary for Indonesia at the stage of expanding their education infrastructure. Figure 2.1 shows the rapid growing of ECE programs across the years, with an exception in 2020 during the COVID-19 pandemic where the non-formal ECE programs seem to have been more susceptible to close down. However, by the end of academic year 2019-2020, only about 24 percent of total centers were accredited by the national government, with 42 percent of

kindergartens and only 9 percent of non-formal ECE programs accredited (MOEC, Indonesian Ministry of Education and Cultural, 2020).

Figure 2.1. The Growth of ECE program in Indonesia



Policies about Quality Standards in Indonesia

To ensure the quality of ECE programs, the government published the national ECE standards in 2009 and a slightly updated version in 2014. The policy contains both structural and process quality standards including children development competencies, teaching content, learning process, learning evaluation, teacher and staff, facilities, management, and funding. The ECE quality standard policy contains eight sections: 1. Children development indicator based on age, 2. The learning content (curriculum/lesson plan), 3. Process quality, 4. Assessment and

evaluation, 5. Teacher and staff qualifications, 6. Facilities & infrastructure, 7. Standard Management, and 8. Funding.

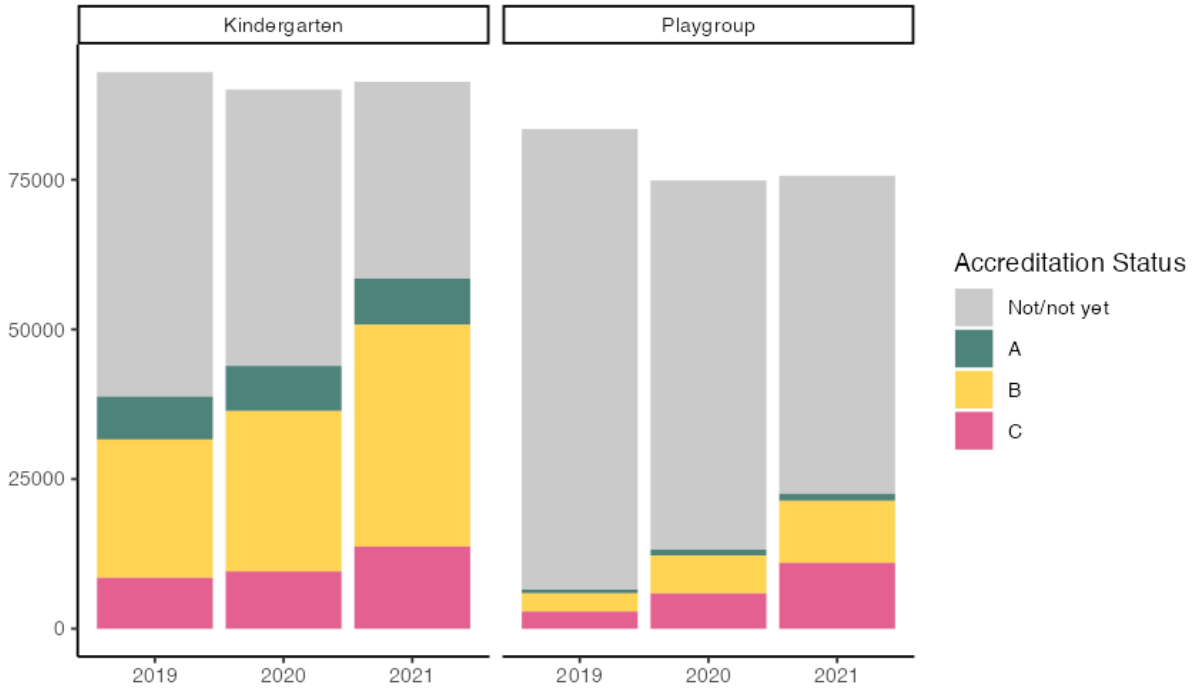
When carefully looking at the requirements, only structural aspects of the quality indicators, such as minimum teacher education, duration, student and teacher ratio and minimum physical space, have measurable parameters to guide the ECE programs, whereas there are fewer indicators on process quality measures. For example, the guidance mentions that children's learning activities should be done through play with an emphasis on child-centered learning principles: active participation, interaction with teacher, peers, and environment, independency, creativity, imagination, based on child developmental needs, interest driven, and contextual. However, there is no further explanation how learning through play might look like in the classroom, how to implement child-centered learning, or what kind of teacher-child interaction can promote healthy development. The lack of behavioral indicators and detailed guide to implement this classroom process quality standard in the classroom setting may not be helpful for teachers, as well as hinder the overall ECE program self-evaluation of whether the high process quality has been implemented in the ECE programs.

The ECE program teaching positions are differentiated into teacher, teacher assistant, and teacher aide. The minimal education requirement for a teacher is a bachelor's degree in education/psychology, while the teacher assistant and aide should at least hold a high school degree with certified training in ECE. While this standard is strictly enforced for teachers in kindergarten as a formal ECE service, the teacher in non-formal ECE is considered equivalent to a teacher assistant/aide and only required to hold a high school degree at minimum. In the updated 2014 version of the regulations, the teacher in a non-formal service must hold at minimum a 2-year diploma. Nonetheless, the lack of the full adherence to the policy persisted as

it was reported in 2014 that 6 percent of non-formal ECE teachers only hold a junior secondary degree. To monitor the implementation of ECE programs, the government publishes annual ECE statistics that focus on reporting enrollment and structural quality indicators such as teacher education background, physical building condition, ECE accreditation status, teacher per student ratio for each province and aggregated to national level. Meanwhile the indicator of process quality is not addressed at all in these reports (MOEC, Indonesian Ministry of Education and Cultural, 2014, 2015, 2016, 2017, 2018, 2019, 2020)

Furthermore, to enforce the implementation of high-quality ECE, the Indonesian government established an ECE accreditation board (BAN PAUD) to assess and provide accreditation ratings. Centers are rated on the following scale: A, B, C, or not accredited. A score of "A" represents higher quality, "B" mid-level quality, "C" lower quality, and centers that are not accredited are below the lowest threshold. Accreditation status data, presented in Figure 2.2, shows increasing numbers of accredited ECEs every year. The number of A-rated ECEs appears stagnant, while B-rated and C-rated ECE centers steadily increased across the years. This accreditation system, however, neither has any implication on funding nor additional support. Instead, Yulindrasari (2014) argues that the accreditation process placed an additional administrative burden for already overwork, low-paying ECE centers teachers without any follow up to improve ECE quality.

Figure 2.2 Accreditation Status of ECE Centers in Indonesia from 2019-2021



Source: 2019-2021 Annual ECE Statistics Report - Ministry of Cultural and Education
Notes: Data for both Kindergarten and Playgroup accreditation status are only published in 2019-2021 reports. There was a decrease in number of ECE centers in 2020 due to Covid19 Pandemic.

Method

Data

I draw my analytical sample for this study from the Early Childhood Education and Development (ECED) Impact Evaluation in Indonesia. The data was collected at the end of the ECED project in 2013 based on programs implemented in 2009-2012. This project aimed to reach an estimated 738,000 children aged 0 to 6 years and their parents/caregivers living in 3,000 villages within 50 poor districts throughout Indonesia. Each village that was part of the project received a block grant of US$18,000 dispersed across three years for two ECE centers. The grant was meant to be managed by the village to achieve these intervention goals: (a) enhance and expand the existing ECE service; (b) increase the participation of children and families from low-income backgrounds; (c) improve the quality of the community program; and (d) comply

with the essential health and safety standards (Pradhan et al., 2013). Hasan et al. (2013) explain the three main parts of the intervention. First, each village appointed one teacher and one child development worker (CDW). Second, these two village representatives received in total 200 hours professional development training in topics including the "background of early child development and practical information on setting up and teaching in an ECED center, but not including an explicit curriculum manual" (Hasan et al., 2013, p. 113). A set of modules were shared with participants, but no step-by-step manual was given to the participants to encourage flexibility and autonomy in developing the center for each village. Third, each village wrote a proposal with detailed program and budget plans on how the funds were to be used for the 3-year implementation either to (1) establish new ECED services or (2) enhance the quality of existing service. 80 percent of the villages chose the first option.

The impact evaluation of this project only involved 9 out of a total of 50 districts that received the grant. Within each district, 20 villages were randomly assigned to receive staggered implementation: early and late with an 11-month gap between the first and the second batch of implementation. In addition, another 10 villages with matched characteristics were selected as the "never-treated" control group. Due to incompliance of the randomization process, some mitigation steps were taken with details recorded in the study protocol (Pradhan et al., 2013).

Analytical sample

For this chapter, I only include children who have household information and were enrolled in ECE program in 2013 when endline data was collected. My analytical sample is 1343 children, who were enrolled in 428 ECE program, in 270 villages. 99% of these children go to the ECE program located within their own village. To answer my research question, I linked five different datasets: a. Children early developmental index, b. Household dataset, c. Village

dataset, d. ECE quality dataset (ECERS-R) and e. ECE program profile dataset. To link children and household information, I used the unique household identification number. Then, to link village information to the ECE program, I used the unique village identification. Lastly, ECE quality rating data and ECE program profile were linked to each child using unique ECE facility identification.

Overall, the mean of children's age is 4.82 years old with a SD of 0.54, and there were an equal proportion of female and male students. 4.2 percent of students are identified with special need status and the mean of household wealth index is 9.71 (maximum of 21) (Table 2.2). At the village level, most of my sample live in rural setting (93 percent) with the average rate of village poverty at 36 percent. There is a bunching pattern of village poverty rates at around 20 – 40 % (Figure 2.3, Panel A). The average village population is 4,088 with SD of 2,962, and a majority of villages are clustered around below 2,500 as shown in Figure 2.3, Panel B. In the center level, the average ECE quality score is 2.88 (maximum of 7) with the SD of 1.01 and 80 percent of these centers receiving some sort of governmental support.

Figure 2.3A Histogram of Village Poverty Rate

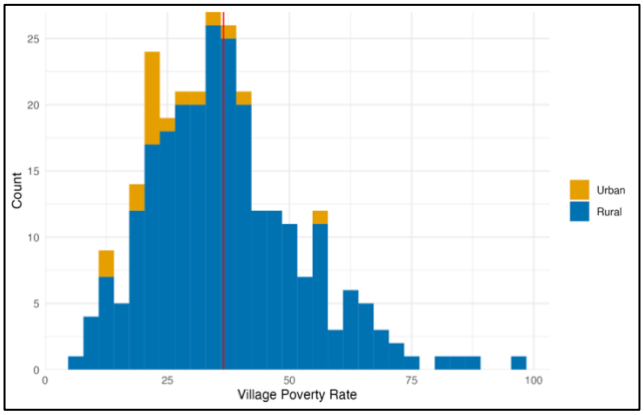


Figure 2.3B Histogram of Village Population Rate

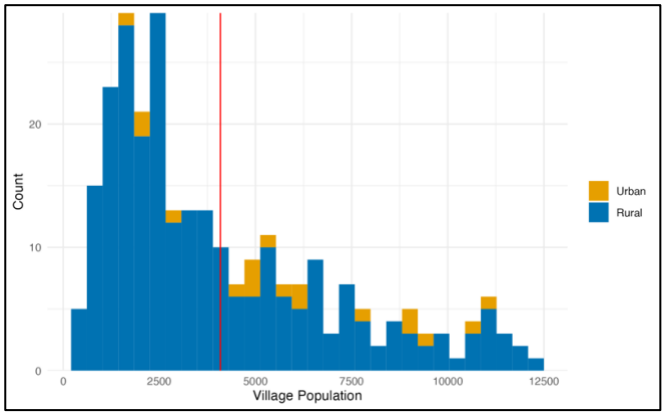


Table 2.2 Summary Statistics		
Children Characteristics		N= 1343
Child Age	1,343	4.82 (0.54)
Male Student	1,343	666 / 1,343 (50%)
Special Need status	1,343	56 / 1,343 (4.2%)
Total Household Wealth Index	1,343	9.71 (2.72)
Enrolled in higher-quality ECE (1=Yes)	1343	285 /1343 (21%)
Village Characteristics		N= 270
Rurality	270	252 / 270 (93%)
Population	270	4,088 (2,962)
% of Low-income Household	270	36 (16)
Total Household	270	1,240 (1,044)
ECE Center Characteristics		N = 428
ECE Quality Rating (ECERS-R)	428	2.88 (1.01)
Higher-quality ECE	428	97 / 428 (23%)
Receiving Government Support	428	342 / 428 (80%)
Type of ECE Program	428	
Islamic Kindergarten		44 / 428 (10%)
Islamic Preschool		3 / 428 (0.7%)
Kindergarten		187 / 428 (44%)
Non-project Playgroup		47 / 428 (11%)
Project Playgroup		147 / 428 (34%)

[1] Mean (SD) or Frequency (%)

Missing data

The process of filtering my analytical sample contributed to the elimination of some observations with missing data. My primary inclusion criterion is based on two conditions. I restrict my sample to children who have complete individual household and neighborhood information and were enrolled in an ECE program at the time the data was collected. Since the data collection process was part of a longitudinal study that followed children from the first year of project implementation in 2009, a large portion of children had graduated ECE program by 2013. After the first filtering process, 8,427 children remained. The second step is to link these students to their household dataset using unique household identification that present in both datasets. I could only retain 1,389 students with complete household information, while the other 7,038 children were missing their household ID. I contacted the principal investigator of this data set from the World Bank via Zoom, and they confirmed that a large proportion of children enrolled in an ECE program measured at the end line were newly recruited as a booster sample. These newly recruited children were not measured in the previous data collections, nor was their household information collected unlike their original participant-peers. The last step of sample restriction is to link the student with their village poverty rate information. There are 9 villages that were not included in the collection of village-level data, resulting in 41 children (2.95%) without village information. I attempted to impute the village poverty rate from data collected in 2010, however, the correlation between poverty rate in 2010 and 2013 dataset is weak ($r = .29$) suggesting that there was a dramatic change in village poverty rate between these two time periods. Therefore, imputing missing village poverty rates based on 2010 data might not be appropriate. There was 0.3% (N=5 children in 3 ECE centers) missing data on ECERS-R Score

and ECE profile. I decided to drop those with missing village and ECE center information. In the end, the total of my analytical sample for this chapter is 1,343.

This data exclusion has the potential to compromise my statistical power to detect true differences as well as to limit the generalizability of my findings. I addressed this in two ways. First, I ran a statistical power analysis to estimate the minimum sample required to detect meaningful differences in access to higher-quality ECE. Based on previous literature, the difference in the probability to enroll in higher-quality ECE by children's background ranged from 5 – 17 percentage points (McCormick et al., 2023). If I select the midpoint of these estimates (11 percentage points) as my minimum detectable effect size, with $\alpha = 0.05$ and 0.80 power, the minimum sample size to detect an effect of this size is 254. My sample exceeds these requirements. Second, to address the external validity of my study, I compared the mean differences between included and excluded children sample in this study. The results (displayed in Appendix A, Table A1) indicate that while some characteristics are statistically different across the included and excluded groups, they are small in magnitude and not consistently indicative of a different typology of student in, as opposed to out, of my sample. The proportion of children's sex and special need status in both sets are not statistically different. On average, the sample included in my analysis is slightly older (by 0.13 years), live in slightly poorer villages (by 2%) and a larger percentage of them live in a rural area (by 4%) than those excluded. Thus, despite the sample restrictions, there are not dramatic differences in the observable characteristics to which my sample might generalize. However, I am unable to rule out the possibility that my sample restrictions systematically exclude some students who differ in unobservable ways from those in my analysis; thus, potentially limiting the generalizability of my results.

Measures

Predictor variables

Student characteristics (and those of the community in which they reside) are the predictors for this research question. I use caregiver/head of household reported household wealth index. The household wealth index is constructed based on a 21-item checklist in which the caregiver/head of household was asked whether their household was included as the beneficiary of national cash-fund program for low-income family and whether the household owned certain properties such as transportation vehicles, land, and cattle. I sum these items and generate a single index using principal components analysis.

Another predictor is the percentage of low-income families in the village that is calculated based on the proportion of the reported number of low-income households divided by the number of total households in the village.

Outcome variable

I model my outcome variable as a binary indicator of whether children enroll in higher-quality ECE programs (1) or not (0). A higher quality ECE program is defined as a center in the top quartile (top 25 percent) of the ECERS-R scores. I then assign the centers in the top quartile a value of 1 (Yes) to denote the higher-quality ECE programs and 0 (No) for the remaining centers. The quality of ECE program was measured using Early Childhood Environment Rating Scale, Revised (ECERS-R; Harms et al., 2005). In this dataset, the ECERS-R rating was collected by two trained independent raters for each center. In my analytic sample, 23 percent of all centers were of high quality (97 of 428). This number differs from 25 percent due to the sample restrictions detailed above.

The final ECERS-R score used in this study follows the Brinkman et al., (2017) scoring system where the first rater's score is used as an instrument for the second rater's scores to correct for measurement error across raters. In addition to using the average total 43 item ECERS score, I will also conduct my analysis using only the average of 28 out of 43 items that align with Indonesian ECE quality regulation as suggested by Brinkman et al., (2017) . The subset of 28 items includes all 7 subscales of the original ECERS-R; however, there are some items within subscales that were not included. In other words, all subscales were represented in a slightly shorter version. For example, for space and furnishing, only 3 out of 8 items are included, while for the parent and staff subscale only 3 out of 6 items were included. The detailed list of items included and excluded in the shorter, contextual version can be found in Brinkman et al., (2017).

Covariates

Individual level covariates, children's gender, age, special need status are included as covariates because parents/caregiver may have preference to prioritize enrolling their children on ECE based on children's gender, age, or special education status. I also included three center-level covariates: kindergarten/non-kindergarten, Islamic/non-Islamic school, and whether receiving governmental support. The inclusion of these center-level covariates is to account for differences in ECE quality that are attributable to the types of ECE. For example, since Indonesia policy requires higher quality a standard for kindergarten (formal ECE) instead of other type of non-formal ECE programs, then share of variance in ECE program quality may can also be explained by the type of ECE, with the expected higher quality pertains to kindergarten. Thus, Islamic school has additional religion-based curriculum and activities that are not captured in the quality rating, lastly schools receiving support from government might be systematically lower / higher quality than those without governmental support.

Analytical strategy

First, to decide whether to treat my estimation as a single or multi-level model, I fit an unconditional model in which I regressed the outcome variable on village cluster. The intraclass correlation (ICC) is .80 suggesting that the share of variation enrollment probability in higher quality ECE centers is strongly associated with cluster membership (Finch et al., 2019), in this case children within village. High ICC suggests nonindependence and autocorrelation in the multilevel data structure (Lai & Kwok, 2015). Therefore, I decided to use a multi-level linear probability model. Then, since I am only interested in the average group differences, I will only fit the two-level random intercept model to account for the clustered nature of my data. A multilevel linear probability model is preferred for my primary analysis for easier and more consistent interpretation compared to logistic regression in which the magnitude of the estimated coefficients will vary substantially depending on the presence of covariates (Mood, 2010). In other words, logistic regression estimation is heavily affected by omitted variables or unobserved heterogeneity in the model. As robustness check, I also provide estimates from a multilevel logistic regression model with similar conclusions (Appendix A, Tables A2 and A3).

I fit a series of multilevel linear probability models with the binary outcome variable (coded 1 for enrollment in higher quality program) as a function of students' household and village percent of poverty, adjusting for gender, type of program and students' age, then systematically introduce the interaction of household and neighborhood poverty. Specifically, the model specification for this research question is:

Level 1

$$Y_{ij} = \gamma_{0j} + \gamma_{1j}W_{ij} + X_{ij} + \varepsilon_{ij}$$

Level 2

$$\gamma_{0j} = \gamma_{00} + \gamma_{01}VP_j + \gamma_{02}(W_{ij} * VP_j) + C_{j+}U_{0j}$$

$$\gamma_{1j} = \gamma_{10}$$

Where *Y* is the probability of child *i* enrolling in higher-quality ECE center *j*, γ_{1j} is my first coefficient of interest, the estimated probability of a higher-wealth child enrolling in a higher-quality ECE center for child *i* in center *j*. γ_{01} is my second coefficient of interest, the estimated probability of a child *i* residing in a higher-wealth village enrolling in a higher-quality ECE center *j*. γ_{02} is my third coefficient of interest, the estimated probability of a cross level interaction between children household wealth and village poverty on enrolling in higher-quality ECE center *j*, while holding constant child-level covariates X, and center level covariates C. In particular, at Level 1 these covariates are: gender and special education status, and at Level 2, these center characteristics are: type of service (playgroup/kindergarten and non-Islamic/Islamic) and by receiving support from government. I allow in my error structure for random variation in the intercept across villages U_{0j} and an idiosyncratic, child-level error term ε_{ij}.

Results

Variation in Access to Higher Quality ECE Program

I begin my analysis by looking at the raw differences of children's enrollment to higher quality ECE program by children characteristics (Table 2.3). Overall, descriptive differences between enrollees in lower-quality and enrollees in higher quality ECE were not significant, except for children with special needs status. Students from lower-income households enrolled in higher quality ECE at 2 percentage points greater frequency compared to lower-quality ECE; however, I was unable to conclude that this was due to anything other than idiosyncrasy in my sample. Male students were also slightly more likely (4 percentage points) to enroll in higher-quality ECE, though this was again not statistically different from zero. However, children with special need status enrolled at 3 percentage point higher rates in lower-quality ECE. Children from lower income villages also were slightly overrepresented in lower-quality ECE, though again I am unable to reject the null that they enroll at equivalent rates in higher-quality ECE.

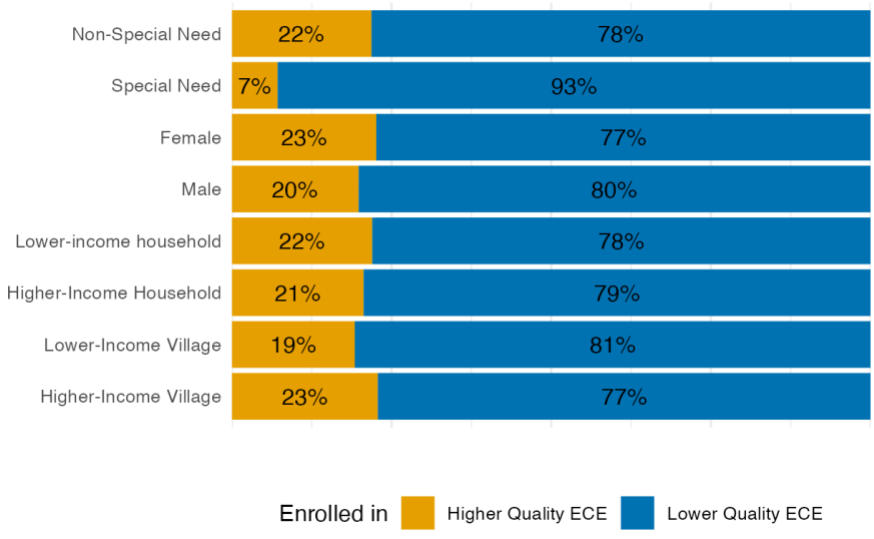
Table 2.3. Students Characteristics by whether enrolled in a Higher Quality ECE

Children Characteristics	Enrolled in Lower-Quality ECE	Enrolled in Higher-Quality ECE	**p-value**[2]
Lower income household	0.45	0.47	0.5
Male	0.50	.54	0.2
Special need status	0.05	0.014	0.008***
Lower-income village	0.46	0.41	0.11
Sample (N)	1,058	285	

*p<0.1; **p<0.05; ***p<0.01

I also plot the enrollment to ECE by quality for all children characteristics (Figure 2.4). Overall, children's enrollment to higher quality ECE program is relatively low (7%-23%) across all categories. However, this reflects the operational definition of higher-quality ECE in this study, in which I assigned the ECE center in top 25% quality rating as higher-quality ECE. Figure 2.4 shows raw disparities are relatively small between each group except for children with special needs status. Data shows that children with special need status enrolled in higher-quality ECE at 15 percentage points lower than their peers without special education status. Differences in enrollment to higher-quality ECE were also observed by sex and village poverty. Male students enrolled at 3 percentage points lower compared to female students, and students from poorer villages enrolled at 4 percentage points lower rates than their peers from wealthier villages. Finally, based on household income, children from lower and higher income enrolled at similar rates with, surprisingly, children from lower income household enrolled at 1 percentage point higher than their higher income household peers.

Figure 2.4 Raw differences of enrollment in Higher-Quality ECE by Children Characteristics



Moreover, I generate two boxplots with the household wealth and village poverty rate (divided into quintiles) along the horizontal axis and continuous ECE Quality score on the vertical axis. Children from villages with less concentrated low-wealth families enrolled in higher quality ECE, with average ECE quality slightly lower in each group at higher rates of poverty (Figure 2.5, Panel B), while there is a less stark difference of attended ECE quality based on children's household income (Figure 2.5, Panel A).

Figure 2.5A

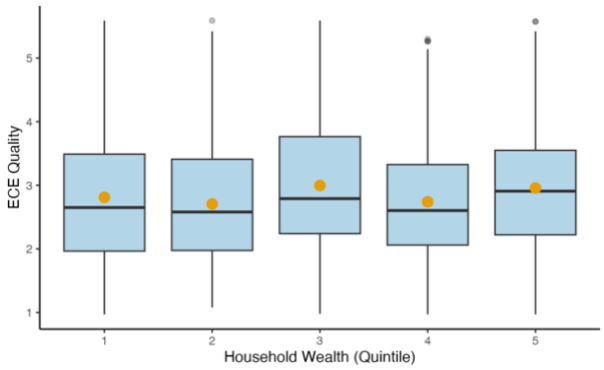
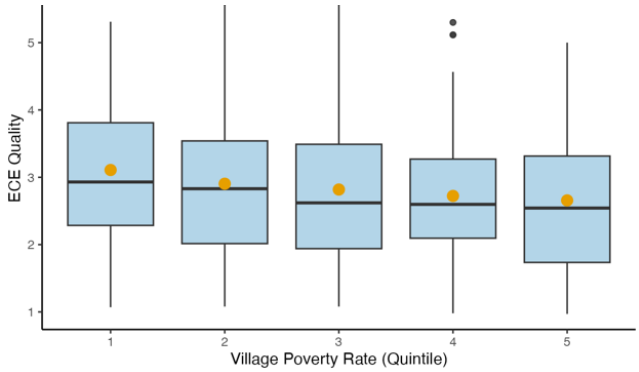


Figure 2.5B



Note: Yellow dot represents group mean

I continue to examine differences in enrollment to higher quality by children's characteristics using a regression model. I want to look at the specific child characteristics that contribute to the likelihood of enrolling in higher-quality ECE while adjusting for other characteristics and variance attributable to village cluster. Additionally, the lack of differences in enrollment to high-quality ECE observed in the descriptive analysis, could be biased in situations where low-income families were, perhaps, systematically sorted into certain village that have less access to higher quality centers. As I presented earlier in method section, the ICC of 0.8 from an unconditional random intercept model where I regress my outcome on village cluster without any other predictors suggests that the probability of enrollment is strongly associated

with village membership. Thus, to account for the clustering effect, I fit all my models with a village random effect. I present my two-level linear probability regression results in Tables 2.4 and 2.5. In model 1 and 3, I regress my outcome on each of my main predictors (children's household wealth and village poverty rate) individually on the probability of enrollment in higher quality, then, I gradually introduce the child and center covariates in model 2, 4, 5, 6, and interaction term in model 7.

The percent of low-income families in a village seems to be a small magnitude yet consistent significant predictor across models. Children who live in a higher poverty village were 0.3 percentage points less likely to enroll in higher quality ECE program. In model 6, where I include both predictors and covariates, data shows that children from wealthier household were 0.3 percentage points more likely to enroll in higher-quality ECE center compared to children from lower-income families. However, no interaction effect was found, and the relationships are no longer significant in model 7. In Table 2.5, where I use contextualized ECERS-R score with the inclusion of only 28 out of 43 items, similar relationship patterns emerge where living in a village with a higher poverty rate relates to lower probability of enrolling in higher-quality ECE program. Similarly, wealthier children have a statistically equivalent probability of enrolling in a more contextualized higher-quality ECE center as their less well-off peers. My additional analysis using multilevel logistic regressions, especially for my preferred model in which I include all my covariates and interaction term (Model 7), shows a difference in direction of relationship for household wealth predictor (negative coefficient). However, both estimations using logistic regression and linear probability model for household wealth are not statistically significant. Furthermore, both logistic and linear probability models show a negative and statistically significant ($p < 0.1$) relationship for village poverty variable, and a non-significant

interaction term between household and village SES predictors. In this paper, I prefer to discuss results from the linear probability model for easier and more consistent interpretation compared to logistic regression in which the magnitude of the estimated coefficients will vary substantially depending on the presence of covariates (Mood, 2010). The results for multilevel logistic regression models can be found in Appendix A, Tables A2 and A3.

To test the robustness of these results, I investigate whether a similar relationship is also evident in villages that have two ECE centers with different ECE quality. For this analysis, I restrict my sample to only include children whose village has two ECE programs, one with lower quality and the other one with higher quality. The purpose is to examine probability of enrolling in higher quality ECE by family and neighborhood poverty after accounting for all village-level characteristics. I use a village fixed effect estimation approach in this smaller sample analysis to account for any geographically invariant characteristics within village that may determine children's enrollment to ECE center. This fixed effect approach allows my estimated probability coefficients to be orthogonal or independent from any village characteristics, and thus may better characterize whether families of different backgrounds that (theoretically) have access to the same ECE centers sort into ones of different quality. For this smaller subset of my sample, I have 176 children enrolled in 64 centers located in 32 villages. In Tables 2.6 and 2.7, I find a positive but non-significant probability of children enrolling in higher-quality ECE based on their household income indicator. This means when there are two different quality ECE centers within the same village, in other words, within relatively the same distance from their home, there is no significant difference in probability to enroll in higher-quality ECE based children household income. The result is consistent whether using the full items or the contextualized items ECERS-R scores.

Table 2.4 Relationship between Children's Characteristics and the Probability of Enrollment in Higher-Quality ECE (43 ECERS-R Items)

Predictors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Household Wealth	0.002 (0.002)	0.002 (0.002)			0.002 (0.002)	0.003 * (0.002)	-0.000 (0.005)
Village Poverty			-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)
Household Wealth x Village Poverty							0.000 (0.000)
Student Covariates		X				X	X
Center Covariates				X		X	X
Random Effects							
ICC	0.81	0.81	0.81	0.82	0.81	0.82	0.82
N	270 village	270 village	270 village	270 village	270 village	270 village	270 village
Observations	1343	1343	1343	1343	1343	1343	1343
Marginal R^2 / Conditional R^2	0.000 / 0.810	0.000 / 0.810	0.011 / 0.811	0.038 / 0.826	0.011 / 0.811	0.039 / 0.827	0.039 / 0.827
AIC	-17.888	6.871	-19.527	-61.724	-7.644	-27.326	-9.756
log-Likelihood	12.944	3.565	13.763	37.862	8.822	24.663	16.878

Notes: Cells report coefficients and associated standard errors in parentheses * *p<0.1* ** *p<0.05* *** *p<0.01*

Table 2.5 Relationship between Children's characteristics and the Probability of Enrollment in Higher-Quality ECE (28 Contextualized ECERS-R)

Predictors	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Household Wealth	0.002 (0.002)	0.002 (0.002)			0.002 (0.002)	0.003 (0.002)	0.001 (0.005)
Village Poverty			-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)	-0.003 * (0.001)
Household Wealth x Village Poverty							0.000 (0.000)
Student Covariates		X				X	X
Center Covariates				X		X	X
Random Effects							
ICC	0.82	0.82	0.82	0.82	0.82	0.82	0.82
N	270 village	270 village	270 village	270 village	270 village	270 village	270 village
Observations	1343	1343	1343	1343	1343	1343	1343
Marginal R^2 / Conditional R^2	0.000 / 0.817	0.000 / 0.817	0.011 / 0.818	0.033 / 0.828	0.011 / 0.818	0.034 / 0.829	0.034 / 0.829
AIC	-21.312	3.638	-23.091	-53.321	-11.104	-18.942	-1.029
log-Likelihood	14.656	5.181	15.546	33.660	10.552	20.471	12.514

Notes: Cells report coefficients and associated standard errors in parentheses * *p<0.1* ** *p<0.05* *** *p<0.01*

Table 2.6 Relationship between Children's characteristics and the Probability of Enrollment in Higher-Quality ECE (Full items - Village Fixed Effect Estimation)

	(1)	(2)	(3)	(4)
Household Wealth	0.016	0.018	0.022	0.023
	(0.016)	(0.016)	(0.016)	(0.016)
Child Covariates		X		X
ECE Covariates			X	X
Village FE	X	X	X	X
Village clustered SE	X	X	X	X
Observations	176	176	176	176
R2	0.291	0.299	0.513	0.515

Table 2.7 Relationship between Children's characteristics and the Probability of Enrollment in Higher-Quality ECE (Contextualized items - Village Fixed Effect Estimation)

	(1)	(2)	(3)	(4)
Household Wealth	0.016	0.018	0.023	0.024
	(0.016)	(0.016)	(0.016)	(0.016)
Child Covariates		X		X
ECE Covariates			X	X
Village FE	X	X	X	X
Village clustered SE	X	X	X	X
Observations	176	176	176	176
R2	0.291	0.299	0.513	0.515

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. Cells report coefficients and associated standard errors in parentheses. Each column reports results of a separate ordinary least squares regression where enrolled in high-quality ECE indicator is regressed against children household wealth. First model is without any covariates, the second model adds child covariates (sex, age and sped status), the third model is with center covariates (indicator of Islamic school, kindergarten, government support), and model four is with all child and center covariates. All models control for village fixed effects and cluster standard errors at village level.

Discussion and Policy Implication

Improving access of quality ECE program to all children throughout the country has been the main policy focus of early learning in Indonesia. Previous reports and studies have found that in Indonesia, the enrollment rate to any ECE program regardless of the quality to be lower for children from lower-income families (National Bureau of Statistics, 2020; Senza et al., 2020). However, disparities in access to high-quality ECE programs is still unknown because the availability of individual children's data and the quality of ECE they attend is not yet available. Using a publicly available dataset of ECED project evaluation collected by the World Bank in Indonesia, I was able to link children's background information and the quality rating of the ECE they are currently enrolled in. In this study, I use two indicators of children's socioeconomic status: a. the poverty rate in their village-of-residence and b. their household income. I will discuss my findings and the policy implication in the following section.

First, I find evidence that children from higher poverty neighborhoods have lower probability in enrolling to higher-quality ECE program in which one additional percentage point in village poverty is associated with 0.3 percentage point decrease in the probability of enrolling in higher quality ECE program ($\beta = -0.003$, $SE = 0.001$, $p < 0.1$. 95% CI [-0.006 – 0.001]). Although it seems small in magnitude, this 0.3 lower percentage point difference in access is meaningful since my village poverty rate variable is in percentage (0 – 100) scale. For example, if the average population of children aged 3 – 6 years old is two hundred people in each village, a village with 75% low-income families will have 45 fewer children who have access to higher quality ECE and other village with 10% low-income family will only have about 6 less children that have access to higher-quality ECE compared to village without any low-income families.

The result is consistent both using full item and contextualized items ECERS-R score. This finding is aligned with other studies in different contexts that find that the children from low-income backgrounds are less likely to enroll in higher-quality ECE (McCormic et al., 2023, Valentino, 2018). One explanation is that the quality of ECE centers in low-income communities are usually lower due to lack of support and resources. In Australia, Cloney et al., (2016) found that families in lower socioeconomic neighborhoods are most likely faced with limited ECE options within close proximal distance of lower quality compared to those living in higher-income neighborhoods.

This reveals that the ability to financially support higher quality service is usually exclusive to those with affluent socioeconomic background. In Indonesia, although ECE has been regulated in the national education system since 2003, it is yet to be included in the free and compulsory public education mandated by the government. This separation bears at least two consequences. First, the privatization of ECE programs and second, the ECE funding scheme. In urban areas, it is common to find a wide range of ECE options from highly expensive ECE centers in urban upper-middle-class communities that apply the franchise ECE approach to free (or with minimum monthly fee) ECE programs in middle-lower class community. Caregivers have more freedom to choose where to send their children for school. In the rural areas, however, the options are more limited as villages tend to contain one or two centers at most, if at all. Village governments are being encouraged to take an active part to form ECE centers and allocate their annual budget to support ECE center development. Whether and how the ECE programs in rural areas are running is heavily reliant on the village government and village community initiatives themselves. Therefore, in rural settings, the village characteristics as a whole seem to play a larger role in the existence of ECE program.

My second predictor is children household wealth. After controlling for other predictors and covariates (Model 7), I find that there is no difference in probability to enroll based on children's household wealth in both with full items and Indonesian Contextualized ECERS-R score. I then proceed to extend my analysis in a more restricted sample which only include children in a village with two ECE centers, one with higher-quality and the other with lower quality. I estimate my regression coefficient with a village fixed effect to account for all geographically invariant characteristics. When distance is no longer a factor to consider in the more restricted sample of villages with two ECE centers with different levels of quality, I still find that household wealth not a significant predictor of children's probability to enroll in higher-quality ECE.

In this context, it seems like Indonesian children, regardless of their socio-economic backgrounds, have a relatively fair chance to enroll either in higher- and lower- quality ECE. I perceive this result not as contradictory with other studies, but instead that it provides a unique pattern of enrollment of ECE in rural setting where accumulative and communal resources in the village perhaps have more influence on children chance to enroll in higher-quality ECE instead of individual family resources. Adriany and Saefullah (2015) argue that in urban society, where more options of ECE centers are available, caregivers with more social capital are able to exercise their means to be highly selective and choose the most suitable school for the child. In rural society, however, the opportunity to leverage this freedom to choose is restrained by limited options.

An alternative explanation is caregivers may have other considerations in choosing an ECE program than the quality parameter defined by the measurement used in this study. For

example, in this study, although two centers are located in the same village, one might be even closer to home instead of the other one, which is more preferable. Anderson & Mikesell (2019) identified in rural setting in United States, caregivers are more likely to select family- or home-based child-care, and this might be driven by personal preferences that involve complex decision making process (Carlin et al., 2019). However, due to data limitation, I am unable to rule out certain reasons that might be driven the selection of ECE in this study.

In Indonesia, although ECE has been regulated in the national education system since 2003, it is yet to be included in the free and compulsory public education mandated by the government. This separation bears at least two consequences. First, the privatization of ECE programs and second, the ECE funding scheme. In urban areas, it is common to find a wide range of ECE options from highly expensive ECE centers in urban upper-middle-class communities that apply the franchise ECE approach to free (or with minimum monthly fee) ECE programs in middle-lower class community. Caregivers have more freedom to choose where to send their children for school. In the rural areas, however, the options are more limited as villages tend to only have one or two centers at most, if at all. Whether and how the ECE programs in rural areas are running is heavily reliant on the village government and village community initiatives themselves. In terms of generalizability, the conclusion of this study is limited to the population that are similar to my sample, children living in rural villages with an average of more than one third of its population are considered low-income.

This study has two major limitations. First, this study is using a decade-old dataset that might not reflect the current disparities of high-quality ECE accessibility in Indonesia. Future study should include more recent and broader geographic characteristics such as a sample with an equal proportion of urban and rural contexts that are representative of Indonesian population

in general. This limitation also highlights the need for a more comprehensive data collection that includes ECE process quality and children demographics for continuous ECE programs evaluation nationwide. Second, although my analyses used the Indonesian contextualized ECERS-R score, the proxy ECE quality is considered foreign and not utilized by the government to measure ECE quality. Therefore, the definition of quality might be biased and not fully capture ECE quality as perceived by the local community. Future studies can further investigate caregiver preferences in choosing the suitable ECE option for their children in rural areas and utilize a more current and representative dataset if available.

Conclusion

Overall, in this study I find that children from higher village poverty rate have lower access to higher-quality ECE. This study has two contributions to the growing literature on child access to high-quality ECE in the context of rural villages. First, this study indicates that the average village poverty rate tends to be a more consistent predictor of children's probability of enrolling in higher-quality ECE compared to household income. Second, I find that individual household wealth does not associate with children's chance to enroll in higher quality ECE in rural village. These findings call for a targeted support at the village level to improve children's equal access to high-quality ECE centers in rural Indonesia. As the Indonesian government pushes a public agenda to increase the number of ECE centers to all villages across the country, it is necessary to provide extra and targeted support for villages with high proportion of low-income families to ensure they deliver a high-quality learning experience.

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Appendix A. ADDITIONAL TABLES

Table A.1 Comparison of summary statistics between children included and excluded in the analysis.

Variable	N	Included N = 1,343[1]	Excluded N = 6,838[1]	p-value[2]
Male	8,180	666 / 1,343 (50%)	3,409 / 6,837 (50%)	0.9
Special Need Status	8,181	56 / 1,343 (4.2%)	264 / 6,838 (3.9%)	0.6
Age	8,179	4.82 (0.54)	4.69 (1.13)	0.004***
Village Poverty Rate	8,181	38 (17)	36 (16)	<0.001***
ECE quality	8,181	2.84 (1.05)	2.94 (1.04)	<0.001***
Rurality	8,181	1,285 / 1,343 (96%)	6,325 / 6,838 (92%)	<0.001***

[1] Mean (SD) or Frequency (%)

[2] *p<0.1; **p<0.05; ***p<0.01

Table A.2 Estimations with multilevel logistic regressions (Full ECERS-R Items)

	Dependent Variable (full items):						
	Probability of Enrolling in Higher Quality ECE (Logistic Regression)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Household Wealth Index	0.077	0.087			0.074	0.047	-0.181
	(0.069)	(0.070)			(0.069)	(0.065)	(0.181)
Village Poverty			-0.022	-0.024	-0.021	-0.039	-0.040
			(0.033)	(0.040)	(0.033)	(0.027)	(0.026)
Household Wealth x Village Poverty							0.008
							(0.005)
Student Covariates		X				X	X
Center Covariates				X		X	X
Number of Village	270	270	270	270	270	270	270
Observations	1,343	1,343	1,343	1,343	1,343	1,343	1,343
Akaike Inf. Crit.	557.434	561.670	558.190	499.842	559.015	553.086	556.060

Bayesian Inf. Crit.	573.042	592.886	573.798	531.058	579.826	605.113	613.289
Note:	*p<0.1; **p<0.05; ***p<0.01, Cells report coefficients and associated standard errors						

Table A.3 Estimations with multilevel logistic regressions (Indonesian Context ECERS-R)

	Dependent Variable (IDN Context):						
	Probability of Enrolling in Higher Quality ECE (Logistic Regression)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Household Wealth Index	0.073	0.077			0.070	0.152*	-0.063
	(0.068)	(0.069)			(0.068)	(0.079)	(0.181)
Village Poverty			-0.023	-0.027	-0.021	-0.032	-0.044*
			(0.033)	(0.039)	(0.033)	(0.036)	(0.026)
Household Wealth x Village Poverty							0.004
							(0.005)
Student Covariates		X				X	X
Center Covariates				X		X	X
Number of Village	270	270	270	270	270	270	270
Observations	1,343	1,343	1,343	1,343	1,343	1,343	1,343
Akaike Inf. Crit.	562.740	567.680	563.364	514.029	564.313	537.163	572.165
Bayesian Inf. Crit.	578.348	598.896	578.972	545.245	585.124	589.190	629.395
Note:	*p<0.1; **p<0.05; ***p<0.01, Cells report coefficients and associated standard errors						

CHAPTER III

THE RELATIONSHIP OF STRUCTURAL QUALITY, PROCESS QUALITY, AND STUDENT OUTCOMES

Introduction

Studies in a wide variety of contexts have shown that the quality of early childhood education matters in generating positive benefits for children's development (Bakken et al., 2017; Krieg et al., 2015; Rao et al., 2019). Participation in high quality ECE is linked to better academic and social-emotional outcomes (Suchodoletz et al., 2023; van Huizen & Plantenga, 2018b), while participation in lower-quality ECE is associated with minimal, even negative, outcomes (Baker et al., 2008; Britto et al., 2011; McCartney et al., 2010). Therefore, underlining the importance of children's participation in high-quality ECE program has become one of the most prioritized agendas globally. However, what constitutes high-quality is still debatable and perceived to be subjective across communities and nationalities.

Raikes et al. (2023) argues that the lack of consensus in mutual definition of quality in ECE stems from differences in models, systems, and policies of ECE implemented in each context. For example, there is variation in how countries adopted different strategies to implement childcare system based on children's age. In Estonia, there is a fully unitary system for education and care for children from birth to primary school entry, in the Czech Republic, Italy and Poland there are two distinct systems for children from birth to 3 years old and from 3 years old to primary school entry, and in Chile there are three level of ECE provision, 0-2, 2-4, and 4-6 years old. There are also differences in educational beliefs, for example, the differences of foundational discourses about children's participation in curricula across countries (Phillips et al., 2020) and children's expected attitudes and behaviors in society (Gunnestad et al., 2022). For

example, in the context where children are expected to promote social harmony and obedience, an ECE center will be perceived as high-quality if the teacher can lead children to follow their instruction as a group and if children can play together without disrupting other peers, while individual exploration after one's own curiosity and interest might be regarded as disorganized and disruptive.

While indicators of high-quality ECE are considered contextual, in general, the literature on ECE quality seems to agree that ECE quality has two distinctive features: *structural* and *process quality*. *Structural quality* refers to the inputs, features, and characteristics of the ECE program that can include: (a) the physical environment such as infrastructure, facilities, play space; (b) group characteristics such as child to teacher ratio, duration; and (c) caregiver and teacher characteristics such as teachers' education and training, experience, and salary (Peterson & Elam, 2022; P. Slot, 2018). *Process quality*, on the other hand, refers to the actual interaction between children, teachers, peers, and materials that children experience in an ECE center throughout the day (Slot, 2018). For example, assessments for classroom process quality will look at teacher responses to children's questions, how teachers manage the classroom, and what method of discipline teachers enforce in the classroom.

Studies examining the relationship of ECE quality and children's outcomes have found that process quality is a more consistent and stronger predictor of children's developmental outcomes compared to structural quality (Burchinal, 2018; OECD, 2018). Structural quality is often found to have only a weak or insignificant relationship to children's outcomes. For example, von Suchodoletz et al., (2023) conducted a meta-analysis study which includes 185 articles between 2010-2020 in five regions and found that while a joint combination of structural and process quality generates significant differences in children's outcomes, when separated,

none of the effect sizes of structural quality indicators were significant in all eight children's outcomes. On the other hand, effect sizes of process quality were significantly related to all children's outcomes.

These findings are aligned with how experts believe the direction of the relationship manifests between each feature of quality and children's outcomes. Slot (2017) argues that instead of being directly related to children's outcomes, structural quality acts as a precursor of process quality that will eventually be associated with children's outcomes. For example, one indicator of structural quality is student-to-teacher ratio, a smaller student-to-teacher ratio is perceived to be better because it will create an environment that allow more individualized interactions between teacher and student by enabling a more meaningful and less divided interaction from teacher to students.

Although more indirect in influencing children's outcomes, structural quality features are often of the interest of policymakers and used as quality standards of ECE centers in regulations and policies at the national and sub-national levels (Raikes et al., 2023). There are at least two reasons that structural quality is more commonly used as a quality proxy at larger scale compared to process quality. Firstly, structural quality can easily be regulated in policy and enforced on the ECE center (Phillipsen et al., 1997). There is clear threshold that can be set and is easy for ECE teachers and administrators to follow. For example, a minimum educational background of a bachelor's degree in early childhood education or maximum student-to-teacher ratio. Secondly, it requires the least amount of resources to measure or evaluate at scale level compared to process quality (Raikes et al., 2023). A regular administrative report will typically include structural quality indicators such as the number of teachers with a certain educational background or the teacher-to-child ratio, while process quality requires lengthy and direct classroom observation by

trained assessors. It is cost effective and requires less effort to produce a quantitative report of structural quality indicators.

Literature Review

Association between ECE quality and children's outcomes

A large number of studies have investigated the relationship between ECE quality and children's outcomes. To date, there are at least four comprehensive literature reviews or meta-analysis looking at the relationship of ECE quality and children's outcomes globally. A meta-analysis that includes 60 years of publication from 1960-2007 looking at two structural quality indicator, group size and student-to-teacher ratio, on children's outcomes concludes that class sizes below 20 and child–teacher ratios at or below 10:1 are enough to generate positive children's developmental outcomes (Bowne et al., 2017). It is suggested that the trade-off between the cost of further lowering the student-to-teacher ratio and the minimal improvements in children's outcomes is not worth the investment in terms of policy changes at scale. Another meta-analysis including 39 studies, using mostly data from the US, specifically looking at teacher education background found that there is no or weak association between teacher education background and various children's developmental outcomes (Falenchuk et al., 2017). This study further concluded that teacher education is not a strong driver of improved children's outcomes at the ECE level. These findings suggest that process quality is a stronger predictor of children outcomes compared to structural quality. An OECD (2018) review reported that lower student-to-teacher ratio in ECE classroom, higher education levels among teachers, and participation in ECE training consistently predict high-quality staff and child interaction (process quality). However, all these structural quality features except participation in professional development seem have inconclusive relationship with children's developmental outcomes. This

finding echoes the meta-analysis study that summarizes the pooled effect sizes from 185 articles by von Suchodoletz et al., (2023) discussed earlier. In their analysis, significant relationships with children's outcomes were found when effect sizes of both structural and process quality were combined, however when teased apart, only process quality was found to have positive significant relationship with children's outcomes. These results indicate a directionality of structural quality to process quality and later process quality to children's outcomes.

Association between structural and process quality features

Instead of examining the direct relationship of structural quality on children's outcomes, some studies have looked at the relationship between structural and process quality. The three most commonly studied structural features are student-to-teacher ratio, group size, and teacher formal pre-service education background. A study located in four states in the USA found that highly-educated and more experienced teachers as well as lower student-to-teacher ratios were associated with better ECE process quality (Phillipsen et al., 1997). Similarly, comparing data from four countries finds that each country has different important structural features that are linked to process quality, for example, the strongest predictor of ECE quality in Germany is student-to-teacher ratio, in Portugal is physical space, while in both USA and Spain is teacher education (Cryer et al., 1999). This suggests that each context has different strongest predictors of ECE process quality that are specifically relevant to each population and education system. One meta-analysis (Manning et al., 2019) reviewed 49 articles and concludes that higher teacher and caregiver formal education is associated with higher process quality as measured using environment rating scales (ECERS, ECERS-R, ITERS, and ITERS-R). The relationship remains positive when the lead teacher formal education was linked to all seven subscales (Language-

reasoning, Activities, Interaction, Program Structure, Parents and Staff, Space and Furnishings, and Personal Care Routine).

Furthermore, student-to-teacher ratio is, perhaps, the most consistent predictor of process quality across contexts. In China, the lower teacher-to-student ratio coupled with higher group size is associated with lower quality of teacher – children interactions and less opportunity for children to access learning materials (Hu et al., 2016; Li et al., 2016). Similarly, in both Poland and Netherlands, classes with a lower student-to-teacher ratios were found to have more positive, warm, and supportive classroom climate compared to classes with a higher student-to-teacher ratio (Wysłowska & Slot, 2020). In the USA, Hanno et al., (2021) documented student-to-teacher ratio and group size as the most consistent predictor of classroom process quality across all models of ECE service including community-based child care (CCC), family child care (FCC), Head Start (HS), and public school prekindergarten (PSP).

Indirect relationship between structural quality and children's outcomes via process quality

A few studies have formally tested the indirect effects of structural quality indicators and children's outcomes via process quality using mediation analysis via structural equation modeling (SEM). First, employing structural equation modeling, NICHD Early Child Care Research Network (2002) finds a significant indirect effect of student-to-teacher ratio and group size on children's cognitive outcome via child care quality in the US daycare context. Another study situated in Denmark tested for direct and indirect relationships between structural quality and children's outcomes via process quality and found that no structural characteristic has a direct relationship with outcome, instead, the demographics of children in the class (in this study: proportion of non-Danish students) was found to be associated with language outcomes via

emotional support and classroom organization (Slot et al., 2018). In China, one study examined the effect of school expenditures on children outcomes using multilevel structural equation modeling (MSEM) via three dimensions of classroom process quality: instructional support, emotional support, and classroom organization (Hu et al., 2017). This study finds that although there is no direct relationship, teacher salary has indirect relationship with all three children's outcomes (vocabulary, math, and science) via instructional support. Meanwhile, expenditures for facilities and teacher training yield no significant relationship directly and indirectly to children's outcomes (except for vocabulary outcome). In their comprehensive literature review of quality indicators and children outcomes, Slot (2018) argues that evidence testing the indirect relationship of structural quality to student outcomes is still limited and calls for future study examining this hypothesized relationship in more diverse context and with inclusion of more understudied structural quality indicators.

Background and Context: ECE Quality in Indonesia

Policy about ECE Quality

Improving the quality of ECE programs is the key policy focus for Indonesia after the massive expansion of ECE centers throughout the country. There is an urgent need to improve the quality of ECE program throughout the nation since only about 24 percent of total centers are accredited by the national government, with 42 percent of kindergartens and only 9 percent of non-formal ECE programs accredited (MOEC, 2020).

To ensure the quality of ECE programs, the government published the national ECE standards in 2009 and a slightly updated version in 2014 (MOEC, 2014). The ECE quality standard policy contains eight sections: 1. Children development indicator based on age, 2. The learning content (curriculum/lesson plan), 3. Process quality, 4. Assessment and evaluation, 5.

Teacher and staff qualifications, 6. Facilities & infrastructure, 7. Standard Management, and 8. Funding.

Process Quality

In terms of process quality, the policy mentions that children's learning activities should be done through play with an emphasis on child-centered learning principles, which emphasizes: active participation, interaction with teacher, peers, and the environment, independence, creativity, imagination, based on child developmental needs, interest, and contextual. The routine of the activity throughout the program is divided into opening session to help children be prepared mentally and physically to participate in learning activities, then a content session that consists of learning through playing activities, and a closing session to help children reflect on their experience and discuss the plan for the next class session. However, there is no further detailed information of how these principles are translated into day-to-day practice in the classroom. For instance, how active learning might look like in the classroom or how the interaction between staff and child should be.

Structural Quality

The structural quality of ECE programs in Indonesia is measured along four dimensions: teacher and staff qualifications, infrastructure, management, and funding. For teacher qualifications, the ECE program teaching positions are differentiated into teacher, teacher assistant, and teacher aide. The minimal education requirement for a teacher is a bachelor's degree in education/psychology, while the teacher assistant and teacher aide should at least hold a high school degree with certified training in ECE. While this standard is strictly enforced for teachers in kindergarten as a formal ECE service, the teacher in non-formal ECE is considered equivalent to a teacher assistant/aide and only required to hold high school degree at minimum.

In the updated 2014 version of the regulations, the teacher in a non-formal service must hold at minimum a 2-year of post-secondary diploma. Nonetheless, the lack of the adherence to the policy persisted as it was reported in 2014 that 6 percent of non-formal ECE teachers only hold a junior secondary degree.

Next, for the infrastructure, all types of ECE center should have adequate size indoor (about $3m^2$ per child), outdoor space, safe and non-toxic educational facilities (learning materials, toys, play equipment), hand washing facilities, trash bin, toilet, clean water, and first aid kit. Regarding funding, the policy only mentions the potential source of funding from national government, district government, private organization, community, or other entities. There are no stipulations about the proportion of the funding allocation from each of these sources. The summary of center characteristics across three age groups is specified in Table 3.1.

Table 3.1. ECE center-level structural quality standard

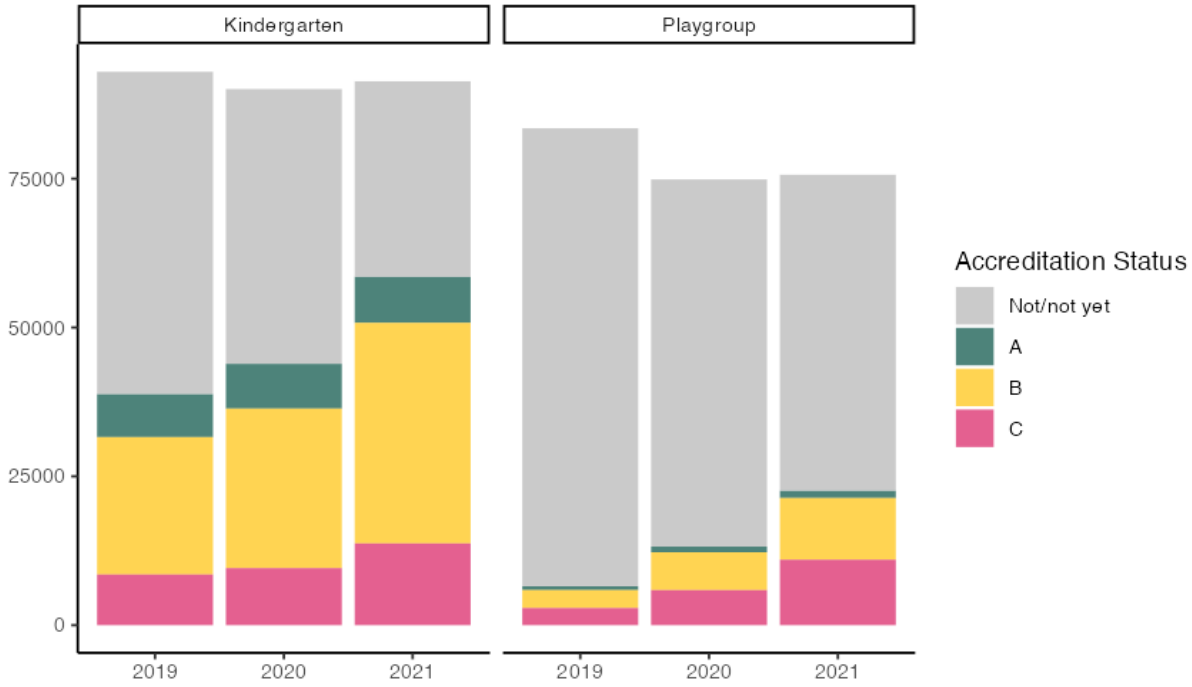
Age	Type of service	Minimum service duration	Student teacher ratio
0-2 years old	Daycare, integrated ECE	1 x 120 mts / week	4:1
2-4 years old	Daycare, playgroup, integrated ECE	2 X 180mts / week	8:1
4 - 6 years old	Kindergarten, playgroup, daycare, integrated ECE	5 x 180 mts / week	15:1

Note: Integrated ECE refers to all other programs cater to the need of early young children that are integrated with other existing service, for instance: parenting classes, mother and child health service.

To monitor the implementation of ECE programs, the government publishes the annual ECE statistics that focus on reporting enrollment and structural quality indicators such as teacher education background, physical building condition, ECE accreditation status, teacher per student ratio for each province and aggregated to the national level. Meanwhile the indicator of process quality such as the quality of student-teacher interaction is not addressed at all in these reports.

Furthermore, to enforce the implementation of high-quality of ECE, the Indonesian government established an ECE accreditation board (BAN PAUD) to assess and provide accreditation rating (scale A, B, and C or not accredited) with A meaning higher quality, C lower quality, and the last category is Not Accredited for below the lowest threshold. Accreditation status data, presented in Figure 3.1 below, shows an increasing number of accredited ECE centers every year. The number of A-rated ECE seemed to be stagnant, while B-rated and C-rated ECE centers are steadily increasing year by year. This accreditation system, however, has no implication on funding nor additional support. Instead, (Yulindrasari, 2014) argues that the accreditation process places an additional administrative burden for already overworked, low-paid ECE centers teachers without any follow up to improve ECE quality.

Figure 3.1. Accreditation Status of ECE Centers in Indonesia from 2019-2021



Source: 2019-2021 Annual ECE Statistics Report – Ministry of Cultural and Education
Notes: Data for both Kindergarten and Playgroup accreditation status is only published in 2019-2021 reports. There was a decrease in number of ECE centers in 2020 due to Covid19 Pandemic.

Current study

This current study is an extension of Brinkman et al. (2017) that examined the relationship of each quality feature on children's outcomes in rural Indonesia. This previous study, using the same dataset used in this current study, found that observed classroom process quality is a modest and reliable predictor of four out of five children's outcomes (physical health, social competence, language and cognitive development, and communication and general knowledge). Meanwhile, among all structural quality indicators, only teacher post-secondary education, student-to-teacher ratio, and hours of operation were found to be associated with one or two children's outcomes. Brinkman et al., (2017) concluded that process quality is the stronger predictor of children's outcomes compared to structural quality. The lack of consistent association between structural quality and children's outcomes in this study could indicate the

pattern of relationship as theorized among quality features and children's outcomes, in which, structural quality acts as the precondition of process quality that will in turn influence children's outcomes. Theory also suggests that structural quality is indirectly linked to children's outcomes via process quality. Therefore, I argue that instead of only examining the direct association between each quality indicator on children's outcomes, research should further investigate the relationship between structural and process quality and whether there is any indirect relationship between structural quality and children's outcome via process quality. It is important to know which structural quality features can foster strong and supportive interactions between teacher and children as well as overall high-quality learning experiences in ECE center.

This current study offers three contributions to the existing literature. First, while previous studies documenting the relationship between structural and process quality features were mostly situated in developed countries with relatively abundant resources and established ECE systems, this study is among the first to investigate relationship between structural and process quality in the context of poor and rural areas with limited resources in a developing country which only recently expanded ECE availability throughout the nation. Second, Slot (2018) argued that most studies of ECE quality only included two most common structural quality indicators: teacher education and student-to-teacher ratio. In this study, I included a more extensive set of structural quality indicator, for example, teacher salary, ECE facilities, and length of service. Lastly, despite the strong theoretical assumption of the indirect relationship between structural quality and children's outcomes, an extensive literature review only identified three articles that attempted to test this indirect relationship in the United States and Denmark (Slot, 2018). The majority of previous studies measured the direct relationship of structural quality and children's outcomes. This study employs a structural equation modeling framework

to test the theorized indirect relationship of structural quality on children's outcomes via process quality.

In this study I find that teacher's years of teaching experience, educational facilities, health and hygiene facilities, and student-to-teacher ratio are significant predictors of classroom process quality after adjusting for other structural quality indicators and a set of ECE center covariates. Moreover, I further find that all three structural quality indicators are indirectly associated with all five children's outcomes.

Theoretical Framework

Burchinal (2018) argues that measurement of quality in ECE is deeply rooted in attachment, development, and social-learning theory. In attachment theory, originally developed by Bowlby (1976), a child is described to have a critical period where they need a strong and secure relationship with the primary caregiver(s) in order to develop secure attachment. A child with a secure attachment early in life tends to have strong social-emotional skill to explore their surroundings. In an early childhood education setting, teachers or caregivers become non-parental attachment figures that provide care for the child. These attachment figures should provide *sensitive responsiveness*, which means that they are able to understand a child's needs and feelings, and are able to provide appropriate responses to those cues in a timely and affectionate manner (Shirvanian & Michael, 2017). For example, teachers can provide comfort by holding, carrying, or gently rocking when children are in distress, or giving meals or milk when children are hungry. Thus, child developmental theory and social learning theory suggest that children have complex developmental domains such as physical, socio-emotional, language, and cognitive domains that needs to be stimulated appropriately based on their age in ways that are relevant and based on their interests. The implication in the early childhood education context is teachers and caregivers need to understand different stages of child development and be able to provide activities that can foster each developmental domain appropriately.

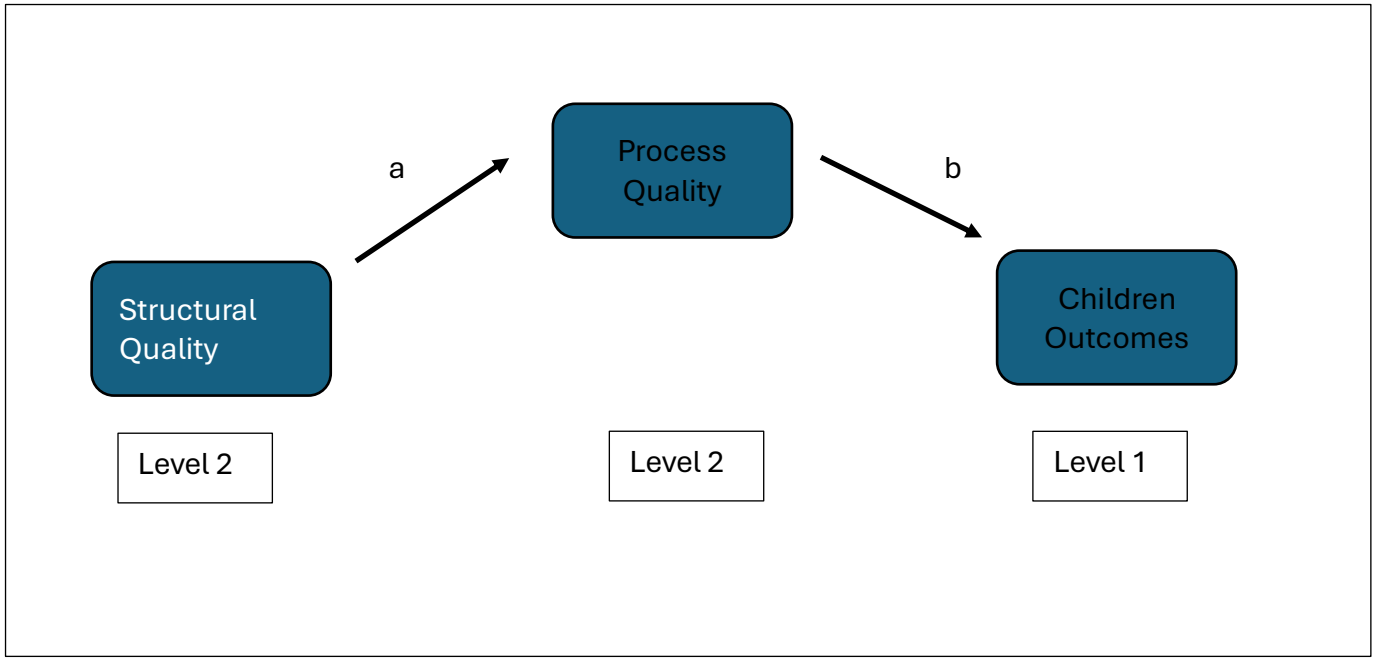
The quality of ECE is then measured with the consideration of the combination of these important aspects, caregivers' and teachers' skills to provide warmth, sensitive care and responses to children needs as well as developmentally appropriate activities to foster healthy development in each domain. It also takes into account the safety, health, and child-stimulation levels of the physical environment of the center through the availability of educational learning

tools and health and hygiene facilities. In a review of commonly used ECE quality measurements in low- and middle-income countries, Chen & Wolf (2021) discuss two categories of measurements. Firstly, Early Childhood Education Rating System (ECERS) and Classroom Assessment Scoring System (CLASS) that were developed in high-income countries and could be adapted for LMIC, and, secondly, MELE and TIPPS that were specifically developed for LMIC settings. They argue that local adaptation is central in the use of these assessment tools to truly reflect the quality of ECE based on the local context. Some efforts of adaptation have been documented; for example, only including items that were also measured in local quality standards in Indonesia (Brinkman et al., 2017) and adding items to assess collective activities and whole-group teaching in China and Cambodia (Chen & Wolf, 2021).

The present study was built upon the hypothesized mechanisms of how the features of quality relate to student outcomes. Studies which investigate the association between different features of quality on students' outcomes tend to theorize a dynamic pathway for how quality affects students' outcomes. Process quality is perceived to be most directly related to children's developmental outcomes because it is reflected in the day-to-day experience of children in the ECE program. It includes the teacher-student interaction quality, learning activities and learning opportunities. Meanwhile the structural quality, such as professional development funds for teachers and caregivers, curriculum, ratio and group size, is more distal but also important as an enabling factor for high quality programming process (Slot et al., 2018). One alternative pathway design is that structural quality could be the precondition of process quality. When the structural quality standards are met, the learning process quality will be increased and in turn the ultimate goal, improved children's outcomes, will be achieved. This theory suggests there is a mediating pathway of process quality for the association between structural quality and children's outcomes

(Burchinal, 2018). Although this mechanism is well known and commonly used as the basis of ECE policies, empirical findings to test this relationship are limited (Melhuish et al., 2015). Therefore, beyond examining the relationship between the structural and process quality, this study extends previous work by testing this dynamic pathway. In this study, I extend the previous finding using the same dataset that only found significant direct effect of process quality and children's outcomes (Brinkman et al., 2017). Assuming that there is significant association between structural and process quality detected in my analysis, I will then investigate whether there is an indirect path between structural quality indicators on childhood outcomes via process quality. Conversely, if there is no relationship found between structural and process quality, this mediation pathway would not be tested. The conceptual framework for the second article is displayed in Figure 3.2:

Figure 3.2 Conceptual Framework



Research Questions:

1. What is the association between structural quality indicators and process quality?
2. To the extent that structural quality is related to process quality, is there any indirect relationship between structural quality and children's outcomes via process quality?

Hypothesis

I expected a significant association between structural quality and process quality. I anticipated that teachers' education levels and experience would be associated with higher process quality, and I anticipated that more availability of learning materials and other supporting facilities would also be associated with higher classroom process quality. Additionally, I expected lower student-to-teacher ratios and class sizes to be associated with higher process quality. For the indirect effect estimation, I anticipated there to be a significant indirect effect between these structural quality dimensions and children's outcomes through process quality.

Method

Data

I draw my analytical sample for this study from the Early Childhood Education and Development (ECED) Impact Evaluation in Indonesia. The data was collected at the end of the ECED project in 2013 based on program implemented from 2009-2012. This project aimed to reach an estimated 738,000 children aged 0 to 6 years and their parents/caregivers living in 3,000 villages within 50 poor districts throughout Indonesia. Each village that was part of the project received a block grant of US$18,000 dispersed across three years for two ECE centers. The grant was meant to be managed by the village to achieve these intervention goals: (a) enhance and expand the existing ECE service; (b) increase the participation of children and families from low-income backgrounds; (c) improve the quality of the community program; and (d) comply with the essential health and safety standards (Pradhan et al., 2013). Hasan et al. (2013) explains

the three main parts of the intervention. First, each village appointed one teacher and one child development worker (CDW). Second, these two village's representations received a total of 200 hours professional development training with topics about "background of early child development and practical information on setting up and teaching in an ECED center, but not including an explicit curriculum manual" (Hasan et al., 2013, p. 113). A set of modules were shared with participants, but no step-by-step manual was given to the participants in order to encourage flexibility and autonomy in developing the center for each village. Third, each village wrote a proposal with a detailed program and budget plan on how the funds were to be used for the 3-year implementation either to (1) establish new ECED services or (2) enhance the quality of an existing service. 80% of the villages chose the first option.

The evaluation study only involved 9 out of a total of 50 districts that received the grant. Within each district, 20 villages were randomly assigned to receive staggered implementation: early and late with an 11-month gap between the first and the second batch implementations. In addition, another 10 villages with matched characteristics were selected as the "never-treated" control group. Due to incompliance of the randomization process, some mitigation steps were taken with detailed recorded in the study protocol (Pradhan et al., 2013).

The main studies resulted from this evaluation have been published in some peer reviewed journals such as the impact of ECE project (Brinkman, Hasan, Jung, Kinnell, & Pradhan, 2017), Quality of ECE (Brinkman et al., 2017), comparison of ECE pathways (Nakajima et al., 2019), gender gaps in children's outcomes (Nakajima et al., 2020), and the sustainability of ECE centers after the project ended (Nakajima et al., 2021). The complete dataset collected in this evaluation is publicly available with permission from the World Bank. I obtained the dataset by making a formal request to the World Bank database center (World Bank,

2019) and received approval to use their dataset to answer my own research questions. The details on variables used in this study will be discussed in the measures section.

Analytical Sample

I present the summary statistics of ECE center and children characteristics in Tables 3.2 and 3. 3, respectively. The analytical sample of this study are 8,382 children who were enrolled in 583 ECE centers during project endline data collection in 2013. Overall, the mean of children's age is 4.71 years old with a SD of 1.06, and there are an equal proportion of female and male students. A small percentage of children in the sample (4%) were identified as having special needs.

Regarding teacher characteristics at the center level, more than half of the teachers held a high school diploma as their highest education level (56%) with an average teaching experience of around 6 years. The majority of teachers (81%) have participated in ECD training/ professional development and 70% of them have prior working experience with young children. These teacher characteristics are aggregated at the center level.

As to the center and group characteristics, 93% of these centers are located in rural areas. There is an average of 13 children per teacher and 24 children per group. The length of ECE service in this study is considered short, with an average of 12 hours of service per week, ranging from a minimum of 3 hours to a maximum 28 hours per week. These are typical operational hours for ECE centers in Indonesia with the exception of Daycare services that provide longer hours. There are no daycare programs included in this dataset. ECE environmental rating using ECERS-R scale (maximum of 7) is constructed in three different ways in this study and therefore generates three composite scores: the mean of process quality score with the full 43 items is 2.79,

the mean for the Indonesian contextualized version with 28 items is 2.91, and the mean for the constricted process quality version with 23 items is 3.43.

Table 3.2. ECE Program Characteristics

Variable	N	N = 583[1]
Teacher Characteristics:		
Teacher Education: High school	583	0.55 (0.38)
Teacher Education: Bachelors' degree	583	0.42 (0.38)
Teaching Experience (years)	583	6.6 (5.3)
Education attainment (years)	583	13.29 (1.50)
Prop teachers with ECD working experience	583	0.70 (0.37)
Prop teacher with ECD training	583	0.81 (0.30)
Center and group characteristics:		
Rurality	583	544 / 583 (93%)
Student to teacher ratio	583	13 (7)
Group size	583	24 (11)
Weekly duration (hours)	583	12.6 (3.9)
Health and Hygiene Facilities	583	5.80 (2.16)
Education Facilities	583	15 (5)
Receiving Government Support	583	450 / 583 (77%)
ECERS-R (Overall)	583	2.79 (0.94)
ECERS-R (Indonesian Contextualized)	583	2.91 (1.03)
ECERS-R (Process quality items)	583	3.43 (0.91)
Type of ECE	583	

Table 3.2. ECE Program Characteristics

Variable	N	N = 583[1]
Kindergarten		222 / 583 (38%)
Islamic Kindergarten		52 / 583 (8.9%)
Non-Project Playgroup		67 / 583 (11%)
Islamic Preschool		5 / 583 (0.9%)
Project Playgroup		237 / 583 (41%)

[1] Mean (SD) or Frequency (%)

Table 3.3. Children Characteristics

Variable	N	N = 8,382[1]
Female	8,382	4,232 / 8,376 (50%)
Special need status	8,382	335 / 8,376 (4.0%)
Age	8,382	4.71 (1.05)
Children's Early Development Index:		
Physical Health and well-being	8,376	8.10 (1.44)
Emotional Maturity	8,334	6.37 (1.37)
Social Competence	8,345	6.78 (1.69)
Language and Cognitive	8,347	6.70 (2.61)
Communication and General Knowledge	8,373	6.00 (2.06)

[1] Mean (SD) or Frequency (%)

Missing data

There are small percentages of missing data at the ECE center level. First, 8 out of 591 centers (1.3%) have no ECERS-R score. Assuming that this missingness is at random, I only included ECE centers with ECERS-R score for my analysis. Next, there are 1–2 ECE centers (0.1 – 0.3%) that were missing some structural quality indicators, and I replace these missing values with each respective variable mean.

In the child-level data, there is a small amount of missingness for each of the children's development outcome, the primary outcome variable in this study, ranging from 0.08% – 0.5%. I assume the values are missing at random and drop all observations that have missing values on the children's developmental index when modeling the respected children's outcomes.

Measures

Predictor variables

The primary predictor variables are structural quality indicators. In this study, I use two categories of structural quality: the first is center and group characteristics and the second is teacher characteristics. The center and group characteristics are: student-to-teacher ratio, group size, length of teacher service, educational facilities, and health and sanitation facilities. Student-to-teacher ratio is constructed by dividing the number of students by the number of teachers in the center, group size is constructed using numbers of number of children divided by number of rooms available in the center, length of service (in minutes) per week is calculated using reported start and end time multiply by days of meeting per week. Educational facilities are the number of educational facilities available (maximum score of 27), and health and sanitation facilities are the total number of health and sanitation facilities available (maximum score of 6) including clean

water, a toilet, a trash bin, a hand washing sink, weight, height, and head circumference measurements, and a first aid kit.

The aggregated teacher characteristics at the center level include the percentage of teachers with post-secondary education, years of teaching experience, the percentage of teachers with previous ECD-related working experience, and the percentage of teachers with ECE training experience. All variables are calculated by dividing the number of teachers with certain characteristics by the total number of teachers. I standardized all my predictors to have a mean of zero and standard deviation of one for easier comparison because these variables are on different scales.

Outcome variables

For the first research question in this article, the outcome variable is the observed classroom quality scores measured by ECERS-R. I use three versions of ECERS-R composite scores. First, the original ECERS-R score is constructed based on the full set of 43 items. Second, the contextualized ECERS-R score in which I only included 28 items that are discussed in Indonesian ECE quality standard as suggested by Brinkman et al., (2017). Lastly, I also construct ECERS-R score based on the approach suggested by Lipscomb et al. (2014), in which I extract items that measure teacher-student daily interactions and activities in ECE to capture a more specific process quality aspect of ECERS-R. For this last ECERS-R score version, I include 22 items: teacher-student interaction (supervision of gross motor activities, supervision of children other than gross motor, staff–child interactions, and interactions among children), behavior management (discipline), cognitive support/language reasoning (books and pictures, encouraging children to communicate, using language to develop reasoning skills, and informal use of language), and classroom organization/program structure (schedule, free play, and group

time) and adding Activities sub-scale (Fine motor, Art, Music/movement, Blocks, Sand/water, Dramatic play, Nature/science, Math/number, Use of computers, and Promoting acceptance of diversity). These items capture how well the teachers are preparing and implementing each sub-activity with children. I fit my model with these three versions of composite ECERS-R score and compared the results. The inclusion of items in my three ECERS-R constructs is listed in the Table 3.4.

Table 3.4. The inclusion of items in the three ECERS-R versions in this study.

Full set ECERS-R (43 Items)	Indonesian Contextualized ECERS-R (28 items)	Concise Process Quality Items (22 Items)
Space and Furnishings 1. Indoor space 2. Furniture for routine care, play and learning 3. Furnishings for relaxation and comfort 4. Room arrangement for play 5. Space for privacy 6. Child-related display 7. Space for gross motor play 8. Gross motor equipment Personal Care Routines 9. Greeting/departing 10. Meals/snacks 11. Nap/rest 12. Toileting/diapering 13. Health practices 14. Safety practices Language-Reasoning 15. Books and pictures 16. Encouraging children to communicate 17. Using language to develop reasoning skills 18. Informal use of language Activities	Space and Furnishings 1. Indoor space 2. Space for gross motor play 3. Gross motor equipment Personal Care Routines 4. Toileting/diapering 5. Health practices 6. Safety practices Language-Reasoning 7. Books and pictures 8. Encouraging children to communicate 9. Using language to develop reasoning skills Activities 10. Fine motor 11. Art 12. Music/movement 13. Blocks 14. Sand/water 15. Nature/science 16. Math/number Interaction 17. Supervision of gross motor activities	Language reasoning 1. Books and pictures 2. Encouraging children to communicate 3. Using language to develop reasoning skills 4. Informal use of language. Interaction 5. Supervision of gross motor activities 6. Supervision of children other than gross motor 7. Staff–child interactions, 8. Discipline 9. Interactions among children Program Structure 10. Schedule 11. Free play 12. Group time Activities 13. Fine motor 14. Art 15. Music/movement 16. Blocks

19. Fine motor 20. Art 21. Music/movement 22. Blocks 23. Sand/water 24. Dramatic play 25. Nature/science 26. Math/number 27. Use of TV, video, and/or computers 28. Promoting acceptance of diversity Interaction 29. Supervision of gross motor activities 30. General supervision of children (other than gross motor) 31. Discipline 32. Staff-child interactions 33. Interactions among children Program Structure 34. Schedule 35. Free play 36. Group time 37. Provisions for children with disabilities Parents and Staff 38. Provisions for parents 39. Provisions for personal needs of staff 40. Provisions for professional needs of staff 41. Staff interaction and cooperation 42. Supervision and evaluation of staff 43. Opportunities for professional growth	18. General supervision of children (other than gross motor) 19. Discipline 20. Staff-child interactions Program Structure 21. Schedule 22. Free play 23. Group time 24. Provisions for children with disabilities Parents and Staff 25. Provisions for parents 26. Staff interaction and cooperation 27. Supervision and evaluation of staff 28. Opportunities for professional growth	17. Sand/water 18. Dramatic play 19. Nature/science 20. Math/number 21. Use of TV, video, and/or computers 22. Promoting acceptance of diversity

As presented in the table above, the contextualized ECERS-R contains all seven sub-scales of the full item version. Items that are not applicable in the Indonesian ECE context were removed. For example, in space and furnishing sub-scale, item Furnishings for relaxation and comfort as well as item Space for privacy were excluded. Since most ECE centers (except daycare service) operate for only around 2-3 hours per day, a resting area is usually not part of the classroom setting. Space for privacy is also less likely to be available in these short duration ECE centers because children are encouraged to use the time for group play and interaction. In another example, on the Personal Care Routines subscale, item Meals/snacks is excluded because ECE centers in Indonesia do not typically provide food and drinks for children during service hours. Instead, families are expected to prepare a daily snack/lunch box and drinking water from home for their children, except when the ECE center is hosting a health and nutrition specific program.

Contrary to the first two versions that retain seven sub-scales, the last version, the concise ECERS-R score, contains only four subscales that specifically capture the activities and interaction in ECE. The Language and Reasoning subscale captures the communication, use of language, and literacy experience. The Interaction subscale captures general teacher-children and children-to-children interaction as well discipline and supervision for children. The Program Structure subscale examines the flow of activities and The Activity subscale looks at specific rich-stimuli activities tailored to children developmental needs.

Considering the definition of process quality as the actual interaction and activities that children experience during their time in an ECE center, both full items and Indonesia-specific items, arguably, are still incorporating a few structural indicators such as furniture and physical space such as availability of indoor learning materials and gross motor equipment. The subscale

Parent and Staff is also excluded because only staff-children and children-to-children's interactions are the main focus of process quality.

For the second research question, observed classroom quality (ECERS-R) scores are used as a mediating variable to predict student outcomes. Therefore, in this research question, my outcome variable is the children's Education Development Index (EDI) score. EDI has been reported as a valid and reliable measurement with high internal consistency (Cronbach's alpha = 0.86) and convergent validity (0.19 to 0.38) when compared to similar measures (Brinkman et al., 2017). EDI measures five developmental domains: Physical Health and Well-Being, Social Competence, Emotional Maturity, Language and Cognitive Development, and Communication Skill and General Knowledge in which each domain is scored from 1 (low) to 10 (high). During data collection, one teacher in each center filled out the EDI for all sample children who enrolled in that center.

Covariates

I include three center-level covariates: the type of service a. kindergarten vs preschool, b. non-Islamic vs Islamic ECE center) and c. by whether receiving support from government. The inclusion of type of center is to account for differences in ECE quality that are attributable to the types of ECE. For example, since Indonesian policy requires higher quality standards for kindergarten than for preschool, a share of the variance in ECE program quality may be explained by the type of ECE. Islamic based centers might be focused more on children's religious knowledge and practices that are not necessarily captured in the ECE quality construct. The last center covariate, whether ECE center receiving any type of support from government, can indicate that ECE center received larger funding or teachers in the ECE have opportunity to participate in the professional development organized by the governmental agencies that can

influence overall ECE quality. Finally, additional child-level covariates including child age, child gender, special need status for second research question because these variables are associated with children's outcomes.

Analytical Strategy

To address the first question, I examine the relationship between structural and process quality, focusing on the extent to which structural quality features of ECE predict process quality. I use OLS to predict overall ECERS scores as a function of the center-level student-to-teacher ratio, group size, length of teacher service, educational facilities, health and sanitation facilities, percentage of teachers with post-secondary education, years of teaching experience, percentage of teachers with previous ECD related working experience, and percentage of teachers with ECE training experience. I also include a vector of center-level variables (C) as covariates. Formally:

$$Y_j = \beta_{0j} + \beta_1 Structural_j + C_j + \varepsilon_j$$

Where *Y* is the observed process quality ECERS score as a function the structural qualities of ECE including teacher-level characteristics and center-level characteristics listed above denoted as *Structural*, adjusting for a vector of center-level variables, ***C.*** This represents three dummy coded center-level variables: the type of service (kindergarten vs preschool), Islamic school and receiving governmental support and a center-level error term ε_j.

Multilevel Mediation Analysis

For the second research question, I examine the multilevel indirect mediating effect of process quality on the association between structural features and children's outcomes using a

multilevel structural equation modeling (MSEM) framework (Preacher et al., 2010). I assume that process quality is mediating the relationship between structural quality and children's outcomes. In my model, I only include structural quality indicators that are significantly associated with process quality. I analyze the indirect (*a*b*) effect of structural quality on children's development outcomes measured by the Early Developmental Index (EDI) with process quality as the mediating variable within MSEM framework model with Maximum likehood (ML) estimation, using the *lavaan* package in R (Rosseel, 2012) to account for children nested in ECE center, while adjusting for children's background characteristics.

SEM is a multivariate analysis technique that—under certain, strong assumptions—simultaneously models both the causal relationships between endogenous and exogenous variables, and the causal relationships among endogenous variables (Gunzler et al., 2013). In mediation analysis using a SEM framework, three estimations are generated simultaneously. First, the *direct effect* estimates the pathway from the exogenous variable (structural quality) to the outcome (student outcomes) while adjusting for the mediator (process quality). Second, the *indirect effect* describes the pathway from the exogenous variable (structural quality) to the outcome (student outcome) through the mediator (process quality). Finally, the *total effect* is the sum of the direct and indirect effects of the exogenous variable (structural quality) on the outcome (student outcomes).

This is a 2–2–1 model where the predictor variable (structural quality) and the mediator (process quality) at level 2 (ECE center level) predict development outcomes at level 1 (individual child). The unconditional model ICC of each student outcome and design effect with clustering at ECE center level is presented in Table 3.5, suggesting there is a strong relationship among the scores of individuals within the same cluster and justifying my multi-level approach.

In this model, there is no latent variable included because all my predictor, mediator, and outcome variables are observed. The MSEM framework in my study is used only to test the mediating pathway where I could specify the structure of relationship among variables, predictor (X) to Mediator (M) and Mediator (M) to Outcome (O). MSEM may represent a superior approach to estimating indirect effects with nested data over other tools (e.g HLM) due to its ability to reduce bias and confidence interval coverage especially in model with level 2 mediator (Preacher et al., 2011; Shi et al., 2024)

MSEM Model specification:

Level 1: Within-Center

$$Y_{ij} = \beta_{0j} + \beta_{ij}(Child's\ Sex) + \beta_{ij}(Child's\ Age) + \beta_{ij}(Child's\ sped) + \varepsilon_{ij} \quad (1)$$

Level 2: Between-Center

$$\beta_{0j} = \gamma_{00} + \gamma_{c\prime}X_j + \gamma_b M_j + \boldsymbol{C}_j + U_{0j} \quad (2)$$

$$M_j = \beta_0 + \beta_a X_j + \boldsymbol{C}_j + r_j \quad (3)$$

Indirect effect: $\beta_a{*}\gamma_b$

Where in level 1, *Y* is the observed children's outcomes as a function of children level covariates and a child-level error term ε_{ij}. In Level 2, $\gamma_{c\prime}$ is the estimated direct effect of Structural quality indicator *X* on group level children's outcomes, γ_b is the estimated direct effect of Process Quality (moderator) on group level children's outcomes, adjusting for $\boldsymbol{C}$ center-level covariates

and group level error term U_{0j} (equation 2). Lastly in equation 3, M_j is the indicator of my mediating variable (process quality), β_a is the estimated relationship of structural quality indicator on process quality, $\boldsymbol{C}$ center-level covariates, and center-level error term *r.* In this 2-2-1 model, both predictor and mediator variables are in the group level, therefore β_a is obtained at a single level (group level only without cross level interaction) (Krull & MacKinnon, 2001). The parameter of interest in my study for research question 2 is the estimated indirect (mediating) effect, $\beta_a{}^*\gamma_b$. The preceding description assumes a single structural quality indicator; however, I have multiple. I detail the full framework in Figure 3.3.

In my *lavaan* model estimation, I also specify indirect effect term as product of path a (predictor – mediator) and path b (mediator – outcome). The amount of indirect terms estimation is based on number of significant predictors in research question 1 analysis.

Figure 3.3 Hypothesized Multilevel model on the relations between structural quality, process quality, and Children Outcomes

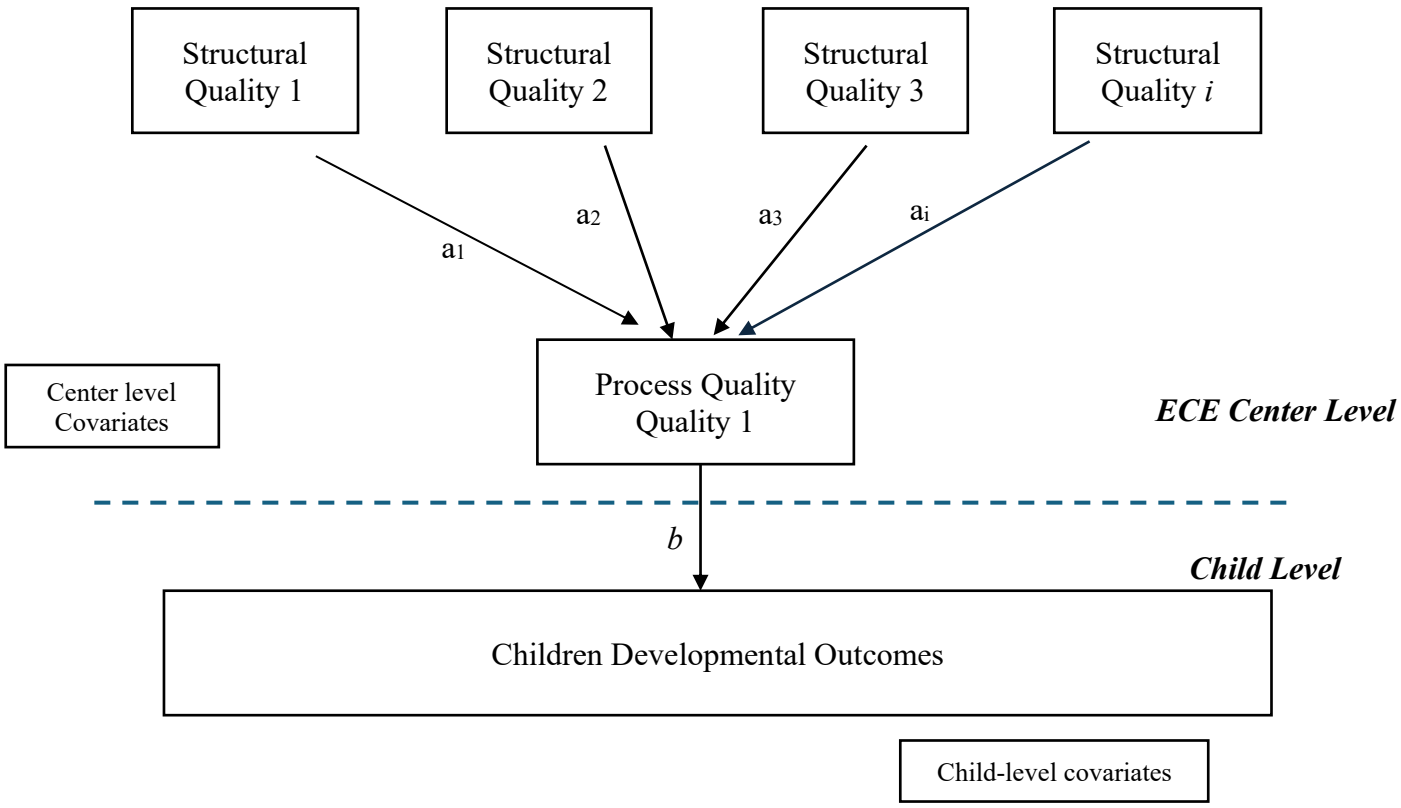


Table 3.5. Design Effect and ICC

Outcomes	Design Effect	Unconditional model ICC
Physical health & well-being	6.21	.79
Social competence	6.18	.39
Emotional maturity	6.35	.40
Language & cognitive	6.48	.41
Communication & general knowledge	6.93	.31

In seeking to use such a model to make credibly causal conclusions, I make two assumptions related to the direction of relationship between variables. First, structural quality causes differences in observed process quality and second, observed process quality causes differences in students' outcomes. However, given the lack of children's random assignment to teacher, class and ECE center, as well as the nature of cross-sectional data, I am unable to

establish a causal relationship between these variables. In particular, the assumptions I describe above that the structural quality features are determined exogenously is unlikely to hold. Therefore, the regression results should be interpreted as correlational rather than a causal relationship.

I examine the adequate model fit using these following parameters: (a) a root mean square error of approximation (RMSEA) value of less than 0.08 (with <0.06 considered ideal); (b) a comparative fit index (CFI) of 0.90 or above (with >0.95 considered ideal); and (c) a standardized root mean square residual (SRMR) of less than 0.09 (with <0.08 considered ideal (Hu & Bentler, 1999).

Results

Descriptive Statistics

The characteristics of ECE center and children were previously discussed in the method section. The correlations among study variables are presented in Table 3.6. The correlations were in expected directions. The correlations coefficient among predictor variables were in the low to moderate range indicating non-multicollinearity and thus the estimates are not likely to be highly unstable or biased by the inclusion of covariates.

Relationship between Structural and Process Quality

In Table 3.7 I report the estimated relationship between structural quality and process quality. The conclusion is similar for the three ECERS-R constructs I use in the analysis. For teacher characteristics variables, I find that when accounting for other all other predictors, one additional *SD* of teachers' years of teaching experience is associated with higher classroom process quality of 0.11-0.12 *SD*. In regard to center and group characteristics, I find that both educational and hygiene facilities available at school are positively associated with classroom quality. One additional *SD* of educational facilities is associated with higher classroom process quality by 0.23- 0.24 *SD*. Likewise, centers with one *SD* higher health and hygiene facilities have classroom process quality ratings 0.29 – 0.31 *SD* higher. Lastly, for group characteristic, student-to-teacher ratio is negatively associated with classroom quality, in which an additional SD of student to ratio is linked to 0.1 *SD* lower classroom quality. This student-to teacher and ECE quality relationship, however, is only significant for process quality with the full item and contextual ECERS-R score.

For models with concise ECERS-R, I find three significant predictors of ECE process quality. First, one SD of additional years of teaching above the mean is associated with 0.12 SD

above the mean increase in ECE quality (β = 0.12, $p < 0.01$, 95% CI [0.03, 0.2]). Second, one SD additional increase above the mean in Health and Hygiene facility is associated with 0.29 SD increase above the mean in ECE quality (β = 0.29, $p < 0.001$, 95% CI [0.19, 0.29]). Lastly, one additional increase above the mean in educational facilities is associated with 0.24 SD increase above the mean in ECE quality (β = 0.24, $p < 0.001$, 95% CI [0.14, 0.34]). The magnitude of these coefficients is relatively small according to the common effect sizes threshold (Sullivan & Feinn, 2012). However, these magnitude of relationship between structural and process quality are relatively similar in comparison with other studies. For example, the magnitude relationship of teachers' years of experience and process quality is around 0.033 (Hu et al., 2017) to 0.3 (Hanno et al., 2020). Moreover, the strongest predictor in these models is the two of my facility variables.

Table 3.6. Correlation among variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
ECE Center Level													
1. ECERS-R Score													
2. Years of teaching Experience	.17**												
3. Student-to-teacher ratio	0.02	-.07**											
4. Health & Hygiene Facilities	.42**	.06**	.18**										
5. Education Facilities	.40**	.17**	.14**	.60**									
6. Kindergarten	-.04**	.38**	-.19**	-.23**	-.12**								
7. Islamic ECE	-.15**	.07**	-.16**	-.27**	-.23**	.30**							
8. Government support	0.01	.16**	-0.02	-0.02	.04**	.25**	-.08**						
Child level													
9. Age	-.04**	.18**	-.12**	-.09**	-.06**	.35**	.10**	.16**					
10. Physical health & well being	.03**	.07**	-.04**	.04**	.05**	.09**	.03**	0.01	.30**				
11. Social Competence	.05**	.10**	-.05**	.09**	.10**	.07**	0	.03**	.24**	.56**			
12. Emotional maturity	.08**	.12**	-.03**	.08**	.07**	.08**	-.03**	0	.19**	.48**	.66**		
13. Language and Cognitive	0	.11**	-.09**	-0.01	0.01	.18**	.06**	.04**	.45**	.53**	.59**	.46**	
14. Communication and General knowledge	.04**	.04**	-.09**	.06**	.07**	.09**	.03**	.03**	.27**	.57**	.68**	.44**	.57**

Note: *p<0.05; **p<0.01; ***p<0.001,

Table 3.7 OLS Estimates of Structural and Process Quality

	ECERS-R		
	(Overall)	(Contextualized)	(Concise Process Quality)
% High School Graduates	-0.060	-0.055	-0.095
	(0.132)	(0.129)	(0.161)
% Post-Secondary Graduates	-0.010	-0.003	-0.074
	(0.136)	(0.134)	(0.162)
Teacher Year of Teaching Experience	0.123**	0.115**	0.120**
	(0.036)	(0.036)	(0.041)
Teacher with ECE work experience	0.018	0.007	-0.008
	(0.037)	(0.038)	(0.038)
Teacher with ECD training	-0.072	-0.070	-0.075
	(0.045)	(0.045)	(0.042)
ECE Duration per week	0.038	0.070	-0.019
	(0.048)	(0.049)	(0.045)
Student-to-Teacher Ratio	-0.105**	-0.102*	-0.048
	(0.040)	(0.040)	(0.041)
Group Size	0.016	0.029	0.001
	(0.041)	(0.042)	(0.038)
Wash Facilities	0.312***	0.3***	0.289***
	(0.05)	(0.051)	(0.051)
Education Facilities	0.232***	0.243***	0.240***
	(0.04)	(0.05)	(0.049)
Center Covariates	X	X	X
Observations	583	583	583
R^2	0.270	0.271	0.236
Adjusted R^2	0.254	0.254	0.219
Residual Std. Error (df = 569)	0.864	0.864	0.884
F Statistic (df = 13; 569)	16.221***	16.264***	13.528***

Note: **p<0.05; **p<0.01; ***p<0.001. Cells report coefficients and associated heteroscedastic robust standard errors. All variables were standardized to have means of 0 and SD of 1. Three center-level covariates included in the models are binary indicators of whether center is kindergarten, Islamic school, and supported by the government.*

Indirect Relationship between Structural and Process Quality

After exploring which structural quality indicators that are significantly related to classroom process quality, I further examine the theorized directionality of ECE quality features on children's outcomes. In other words, is structural quality indirectly influencing student outcomes via classroom process quality? I use multilevel structural equation modeling (MSEM) to test the indirect effects of four significant indicators of structural quality on each child outcome via process quality using three ECERS-R constructs separately. All my MSEM models exceeded the goodness of fit criteria with (a) a root mean square error of approximation (RMSEA) value of less than 0.06; (b) a comparative fit index (CFI) above 0.95, and (c) a standardized root mean square residual (SRMR) of less than 0.08 (L. Hu & Bentler, 1999). Specifically, my models fit the data extremely well with RMSEA $\leq$ 0.018, SMRM $\leq$ 0.033, CFI $\geq$ 0.974. The detail model fit parameter for each model will be presented in the path diagrams (Figures 3.4-3.5).

My models with full item ECERS and Contextualized ECERS-R scores have the same conclusion and significance levels, while in the model with concise process quality, although it generates similar results, the indirect effects were significant only for two children's outcomes. For efficiency, I summarize my findings of the indirect effects estimations with contextualized and concise ECERS-R score in Table 3.8. I will focus on discussing the results using concise ECERS-R score in which I tease out items that are specifically measuring the activities as well as teacher and children interaction in ECE center (for reference on items inclusion see Table 3.4).

The mediation analyses with MSEM using concise process quality ECERS-R score were run separately for each children's outcomes. First, I find that teachers' years of teaching experience is significantly associated to children's emotional maturity (estimate = 0.009, $p <$

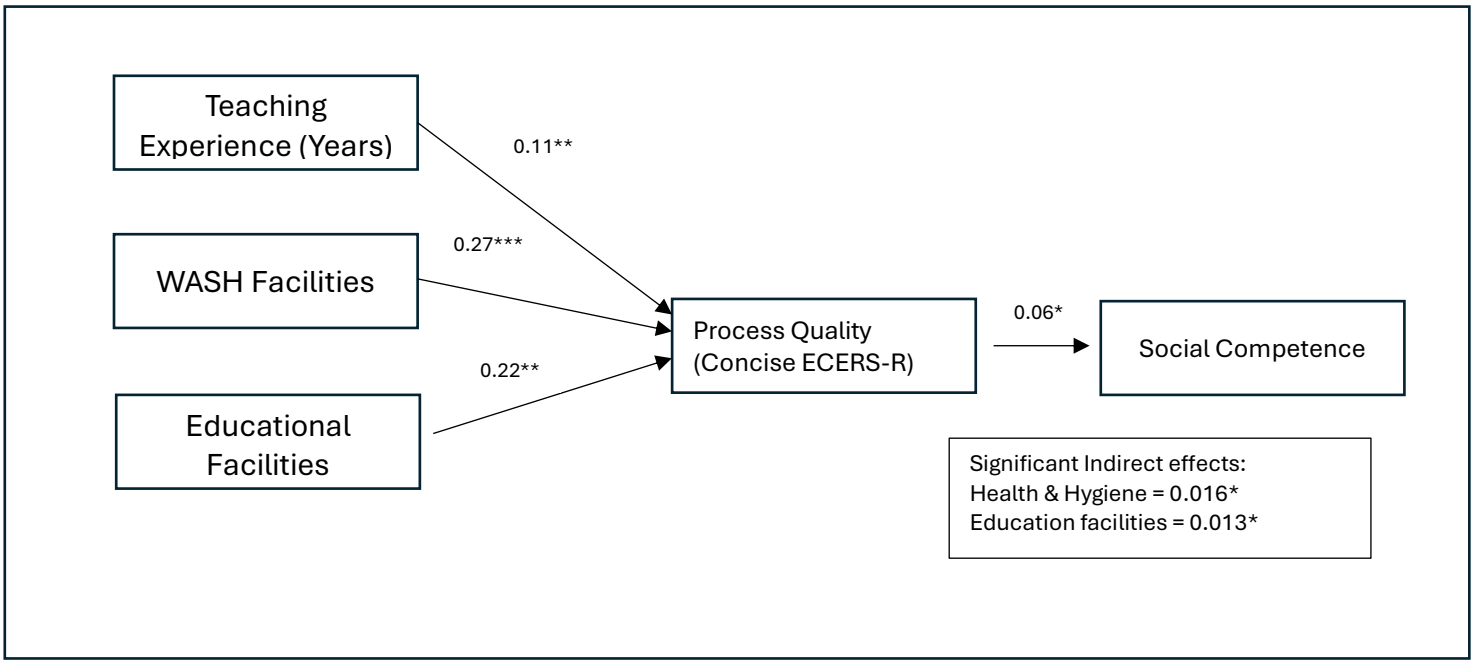
0.05, 95% *CI* [0.01, 0.02]) indirectly via process quality. Next, health and hygiene facilities is significantly linked to children's social competence (estimate = 0.016, $p < 0.05$, 95% *CI* [0.01, 0.03]) and emotional maturity outcome (estimate = 0.023, $p < 0.01$, 95% *CI* [0.01, 0.04]) indirectly via process quality. Finally, educational facility is significantly associated to children's social competence (estimates = 0.013, $p < 0.05$, 95% *CI* [0.00, 0.02]) and emotional maturity outcome (estimates = 0.019, $p < 0.01$, 95% *CI* [0.01, 0.03]) indirectly via process quality.

Table 3.8 Estimates of Indirect effects of Structural Quality and Children Outcomes via Process Quality

Indirect Effects	Physical health & well being	Social Competence	Emotional Maturity	Language and Cognitive	Communication & General Knowledge
Mediator: Indonesian contextual ECERS-R					
Teaching Experience → ECERS-R → Outcome (a_1b)	0.009* (0.004)	0.011* (0.005)	0.012* (0.005)	0.007 (0.004)	0.008* (0.004)
Health & Hygiene Facilities → ECERS-R → Outcome (a_2b)	0.022** (0.008)	0.029*** (0.009)	0.031** (0.009)	0.018* (0.008)	0.022** (0.008)
Educational Facilities → ECERS-R → Outcome (a_3b)	0.015 ** (0.006)	0.021** (0.035)	0.023** (0.007)	0.013* (0.006)	0.016* (0.007)
Student-to-teacher ratio → ECERS-R → Outcome (a_4b)	-0.008* (0.004)	-0.01* (0.005)	-0.011* (0.005)	-0.006 (0.003)	-0.008* (0.004)
Mediator: Concise ECERS-R					
Teaching Experience → ECERS-R → Outcome (a_1b)	0.004 (0.003)	0.006 (0.004)	0.009* (0.004)	0.002 (0.003)	0.005 (0.003)
Health & Hygiene Facilities → ECERS-R → Outcome (a_2b)	0.010 (0.007)	0.016* (0.008)	0.023** (0.008)	0.005 (0.006)	0.014 (0.007)
Educational Facilities → ECERS-R → Outcome (a_3b)	0.008 (0.006)	0.013* (0.035)	0.019** (0.007)	0.004 (0.005)	0.011 (0.007)

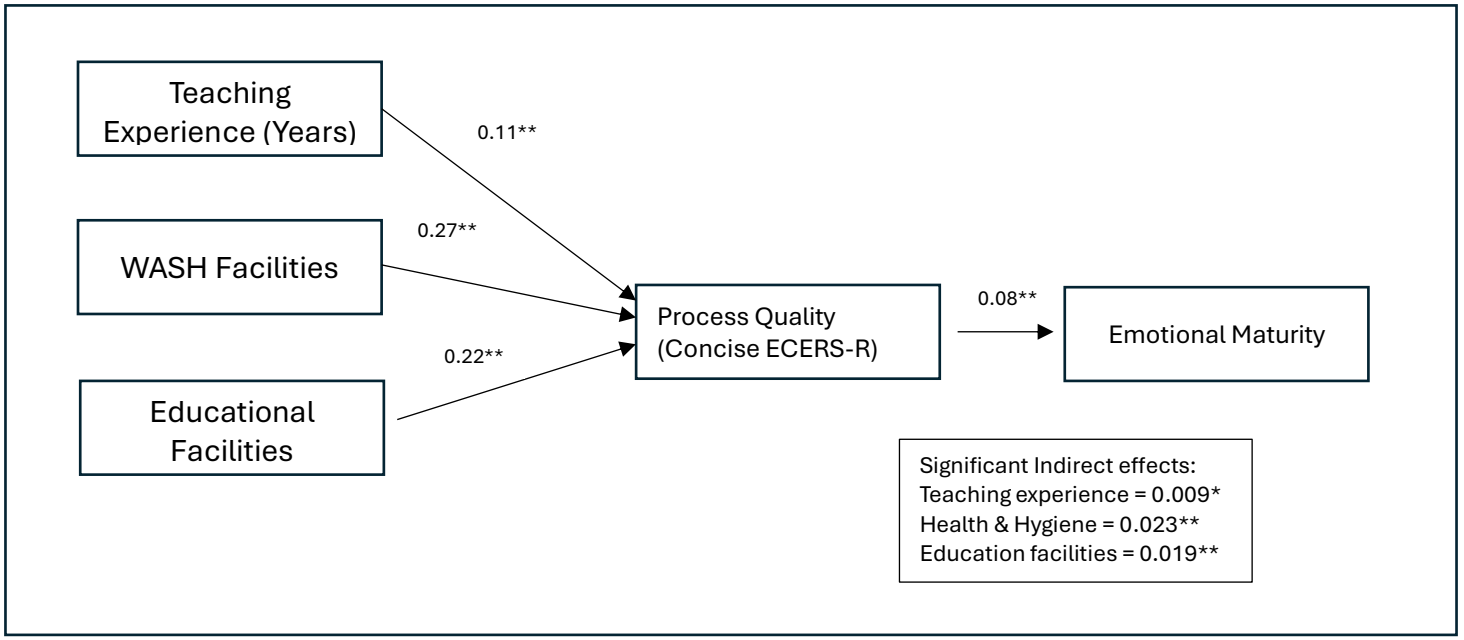
Note: **p<0.05; **p<0.01; ***p<0.001. Cells report coefficients and associated standard errors. All variables were standardized to have means of 0 and SD of 1. Three center-level covariates included in the models are binary indicators of whether center is kindergarten, Islamic school, and supported by the government. Three child-level covariates included in all models: Age, Special need status, and Sex.*

Figure 3.4 Path Diagram Quality and Social Competence



Note: **p<0.05; **p<0.01; ***p<0.001. Fit Measures: CFI = 0.983, RMSEA. 0.017, SRMR = 0.037*

Figure 3.5 Path Diagram Quality and Emotional Maturity



Note: *~p <0.1; *p<0.05; **p<0.01; ***p<0.001. Fit Measures: CFI = 0.984, RMSEA. 0.016, SRMR = 0.032*

Discussion and Implications

Ensuring children have access to high-quality ECE center is undoubtedly a goal shared globally and has increasingly become a priority of public investment. A large number of studies support the notion that ECE quality matters for children's developmental outcomes. However, studies in various contexts indicated that quality indicators can look different across contexts and cultures (Raikes et al., 2023) as shown by a variety of important structural predictors of high-quality interaction and learning activities in ECE program in different communities and countries (Phillipsen et al., 1997).

In this study, I use data from rural and relatively poor villages in Indonesia that were part of an ECD project that was focused on expanding the availability of ECE center in rural Indonesia. The first part of my analysis is to examine the relationship between structural quality and process quality. I use a comprehensive set of structural quality indicators including center, group, teacher characteristics, and center level covariates to predict process quality. In this study, Using the concise process quality items from the ECERS-R measure, I find that there are three significant predictors of process quality, teacher years of teaching experience and two of my ECE center facility indicators (educational and health and hygiene facilities).

Average teacher years of teaching experience is significantly associated with classroom process quality. This finding is consistent with some previous literature that also find positive relationship between years of teaching experience and process quality (Phillipsen et al., 1997; Slot et al., 2017). The magnitude of my estimation is relatively small ($\beta = 0.12$, $p < 0.01$, 95% CI [0.03, 0.2]) according to the common Cohen's d effect sizes threshold (Sullivan & Feinn, 2012). However, these magnitude of relationship between structural and process quality are relatively similar in comparison with other studies. It is not uncommon to find the small magnitude yet

significant relationship between these two quality indicators. For example, the magnitude relationship of teachers' years of experience and process quality is around 0.033 (Hu et al., 2017) to 0.3 (Hanno et al., 2020) suggesting that teacher experience is not too strong but consistent predictor of process quality. In addition, I also find a small significant indirect effect of teacher years of teaching on emotional maturity via concise classroom quality (estimate = 0.009, $p <$ 0.05, 95% *CI* [0.01, 0.02]). Although, as a note, this teacher characteristic should be interpreted cautiously since I do not link specific teacher characteristics with their classroom quality, and rather use the average years of teaching experience in the center level. In broader literature context, teachers' year of teaching experience relationship with process quality and student outcome is inconclusive as some studies find no significant relationship between years of teaching and outcomes (McMullen et al., 2020; Pianta et al., 2005) or even negative association between years of teaching and teacher sensitive behavior (Wilcox-Herzog, 2004). A meta-analysis reviewing 32 articles mostly situated in the US find non-significant or weak direct effect years of teaching on a variety of children outcomes (McMullen et al., 2020). Graham et al., (2020) argue that differences in conceptualization and year cut-off use in the study might contribute to this different conclusion. Another explanation is the curvilinear nature relationship between these variables. One study in China finds non-significant linear but significant non-linear relationship of years of teaching and teacher's emotional support and classroom organization in which quality of teaching is declined after 15 years of experience. My study suggests that experienced teacher presence in the ECE center is associated with higher process quality. It is important to make sure high-quality teachers are retained in their teaching job at ECE centers.

I also find that educational facility is significantly associated with higher ECE process quality. The importance of the physical environment around children in the context of ECE is perhaps best explained by the notion that environment as the third teacher in the classroom, in addition to the teacher and the child, which is central to Regio Emilia's approach (Strong-Wilson & Ellis, 2007). This approach perceives objects and physical spaces around children as a source of teaching and learning in which children can explore, spark their imagination, and create meaning based their own perspective. Studies capturing the role of physical environment as the third teacher on children's learning in a developing country (Ghana) found that lack of learning material resources such as books and play kits in ECE centers including limitation of physical infrastructure such as free space for children to move around hindered a meaningful interaction between teacher and children as well as constrained children's own exploration (Frimpong, 2019; Frimpong, 2021).

Another perspective of how availability of learning material and physical environment is related to children's day-to-day experiences in ECE centers is through promoting children's participation. Knauf (2019) observed the physical environment in 6 ECE centers in three countries, Germany, New Zealand, and the USA and found that children's meaningful participation in learning experience is strongly supported by the accessibility in which children can independently access books or learning and playing materials, diversity of learning and playing materials available to stimulate children's skills, and children self-representation in the classroom through the incorporation of their interests in the curriculum or physical representation such as the display of children's arts on the wall.

The lack of learning and playing materials in ECE centers due to lack of operation funding has been regarded as one of the core issues of quality ECE centers, especially in

developing countries that are massively increasing the number of ECE programs targeting low-income families and communities (Neuman & Okeng'o, 2019; Woodhead et al., 2009). My findings highlight the importance of investment in learning material availability in ECE centers that strongly apply learning through play which requires children's hands-on experiences to manipulate objects.

In addition to educational facilities, I also find that health and hygiene facilities availability is a strong predictor of ECE process quality. In addition, indirect effects of health and hygiene facilities on student outcomes via contextualized ECERS-R score are also found in all children outcomes. Although the evidence specifically linking health and hygiene and classroom process quality per se in the literature is limited, studies have documented that the availability of clean water as well health and hygiene facilities in ECE centers (and school in general) is essential to provide healthy and safe environment as basic right for children (Ngcongo & Tekere, 2023; Sharma & Adhikari, 2022). One study in Malawi documented that the inadequate water and hygiene facilities and practice in ECE centers have exposed children to faecal-oral diseases such as diarrhea and potentially disrupt the overall learning activities at center (Mwapasa et al., 2023). This aspect is very crucial in ECE centers, especially because young children have specific developmental needs where they still need help toileting and developing health and hygiene habits such as washing hands before eating or after using the toilet. In this sense, the availability of hygiene facilities can also be considered as part of learning. Young children are also very susceptible to infectious diseases considering their still-developing immune system.

My finding highlighting the importance of basic ECE infrastructure availability on ECE process quality and children's outcomes in the context of rural Indonesia resonates with a study capturing the typical challenges of privately-run rural preschool with inadequate ECE funding. In

rural China, Hu et al., (2016) document that the majority of the ECE programs are in critical shortage of basic furnishing for play, learning, routine care in classroom and outdoor space as well as toilet. Similar needs are also captured in Nigeria where lack of play and learning materials hindered the implementation of ECE daily activities (Oludele et al., 2015; Oluwafemi et al., 2014). Due to lack of funding to support ECE operational needs, Hu et al., (2016) suggest that one of possible solution is to merge ECE center with public elementary schools that received more financial supports from the government and have relatively more adequate infrastructure such as a playground or toilet.

Descriptive data shows that about 80% of teachers in this study have participated in ECD professional development, suggesting the joint effort of non-governmental and governmental agencies to improve ECE teachers' capacity through professional development has reached most of the teachers. However, without adequate support of learning materials and other basic infrastructure, teachers will struggle to implement their knowledge. This finding calls for support to improve basic infrastructure of ECE centers that are essential for high-quality classroom and children's outcomes. External funding should be made available to support the procurement of high-quality learning materials and provide basic need of health and hygiene facilities in ECE centers. Thus, teachers should not be left alone to carry the burden of providing high-quality learning experience for children.

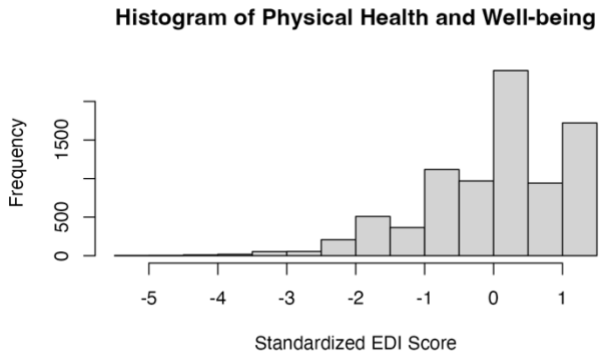
The current Indonesian ECE quality standard policy has addressed the availability of basic infrastructure including educational and health & hygiene facilities, as well as regulation of student-to-teacher ratio based on child age group. My findings provide evidence that these structural quality features are important for fostering higher process quality as well as indirectly associated with children outcomes. Therefore, efforts to guide and assist ECE centers to adhere

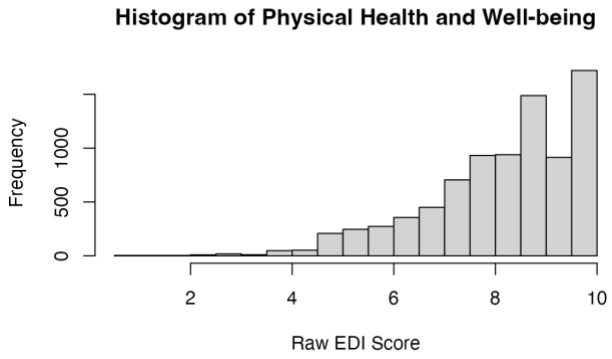
to the quality standard set by the government is needed. Financial support should also be allocated specifically targeting the procurement of high-quality and sustainable educational facilities and to ensure the availability of basic health and hygiene infrastructure such as clean water and toilet for daily operational needs. In addition, incentives to retain experienced and high-quality teachers in their job and to ensure proportion teacher and children is in accordance with student to teacher ratio standard should also be prioritized.

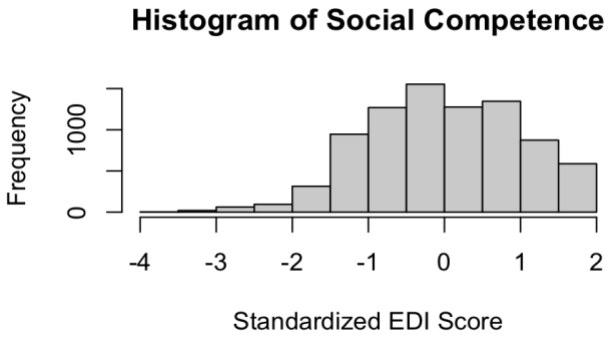
Appendix A

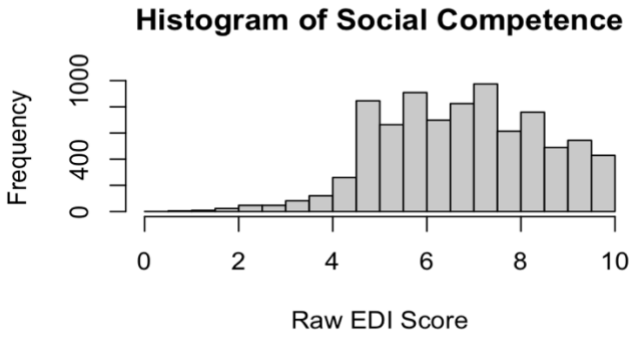
Wall decoration 1. Children arts displayed on the wall. 2. Crayons, coloring pencils, markers 3. Toy shelves 4. Bookshelves 5. Table and chair for teacher 6. Carpet / floor mat. 7. TV 8. DVD/VCD 9. Sound system. 10. Radio tape 11. Children tables 12. Children chair 13. Indoor educational toys 14. Swing 15. Slide 16. See saw 17. Merry-go-rounds 18. Climber 19. Tunnel 20. Sand box 21. Ball 22. Balance beam 23. Other outdoor 24. Other outdoor 25. Other outdoor 26. Children books	1. Clean water 2. Toilet 3. Trash bin 4. Hand washing facility (Soap, sink) 5. Weigh measurement 6. Heigh measurement 7. Head circumference measurement 8. First aid kit

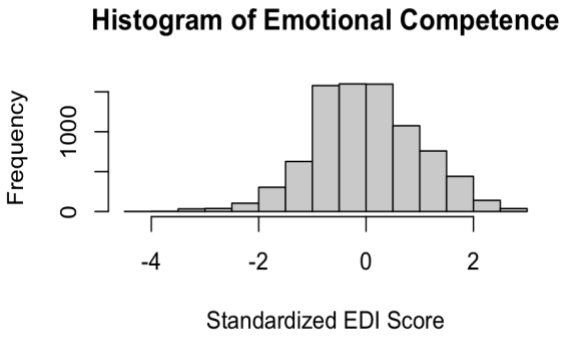
Additional Figures

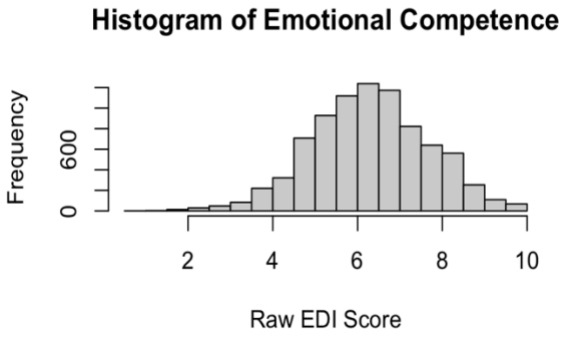


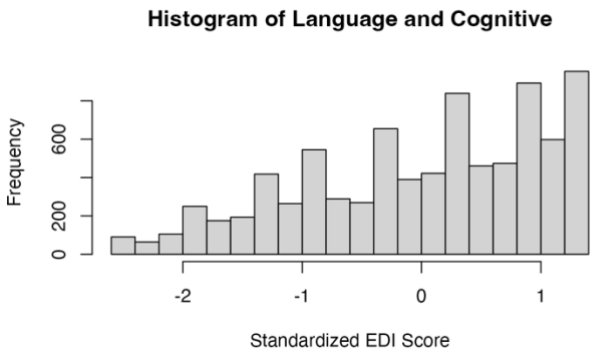








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600
-2
-1
0
1
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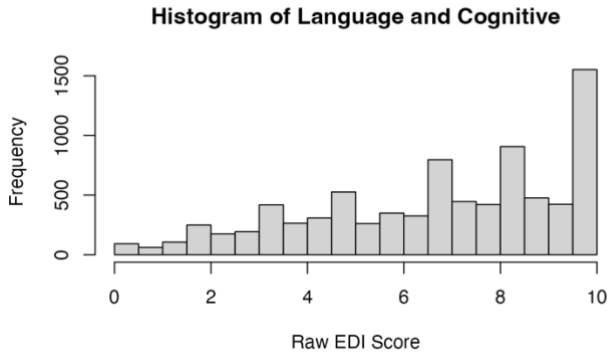
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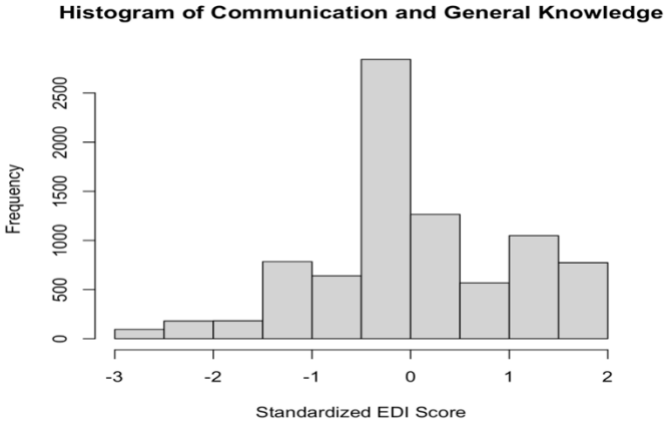
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1
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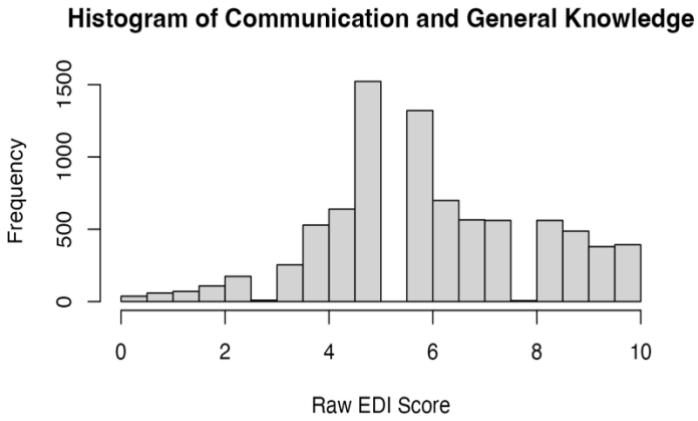
Standardized EDI Score


Histogram of Communication and General Knowledge
Frequency
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4
6
8
10
Raw EDI Score

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CHAPTER IV

THE RELATIONSHIP OF VILLAGE CHARACTERISTICS, ECE QUALITY AND CHILDREN'S OUTCOMES

Introduction

It takes a village to raise a child! This common aphorism highlights the role which the collective community plays in a child's life. Reupert et al., (2022) explain that "the village" encompasses actors and agencies across varying proximity levels with a shared responsibility to provide a safe and healthy environment for children to develop. This proverb is particularly relevant in the Indonesian context, where the village (or neighborhood) plays a significant role in a child's life, not only because of the informal nature of social interactions among the people within the village but the comparatively high responsibility for early childhood education (ECE) that is devolved to the village-level government. As the majority of community based, privately-owned and unaccredited ECE programs in rural areas are located within a village, the village government is perceived as the frontline and primary partner of the Ministry of Education to support ECE programs at the village level (ECE Directorate, 2022). Despite the significant role of the village both in the informal and formal education services in Indonesia, to the best of my knowledge, studies that specifically examine the relationship between village characteristics, ECE quality, and children's outcomes in Indonesia are still very limited.

Neighborhood characteristics play an important role in children's lives. Robust evidence, mostly from the United States, has documented the relationship between children's development outcomes and the environment surrounding children's lives beyond their family. These studies mostly examine environmental factors that are negatively and positively associated with children's healthy development (Leventhal & Brooks-Gunn, 2000; McCoy et al., 2015).

Neighborhood-level disadvantages, such as neighborhood poverty, violence, or exposure to environmental hazards such as waste pollution are found to be associated with negative children's outcomes, such as lower level of school readiness (Morrissey & Vinopal, 2018; Wolf et al., 2017), lower academic achievements (Persico et al., 2016), higher levels of behavioral problems (Caughy et al., 2008, 2013), and increased health problems (Lumeng et al., 2006). Meanwhile, neighborhood advantages including the presence of educated and more affluent people, availability of facilities, higher-quality ECE, and strong social cohesion and participation, tend to be associated with positive children's outcome (De Marco & Vernon-Feagans, 2013; Dupéré et al., 2010; Froiland et al., 2014). Some of these associations persist into adulthood. Although most of these findings are from correlational studies, three causal studies that address selection bias are also in support of the significant effects of neighborhood characteristics on children outcomes (Chetty et al., 2016; Persico et al., 2016; Persico & Venator, 2021).

In the context of developing countries, where the proportion of lower-income populations is relatively higher, governments have turned their attention to expanding ECE targeting early young children. The presence of an ECE center in the community that provides a safe and stimulating space for children is perceived as one of the strategic ways to buffer the potential negative effects of neighborhood disadvantages on children's outcomes (McCartney et al., 2007; Parkes et al., 2021). Understanding the relationship between neighborhood characteristics and children's outcomes is important in the overall effort of ensuring healthy development in children. The goal of this study is to provide empirical evidence to support and guide the current national efforts on improving ECE quality in villages with relatively higher rates of disadvantages.

Using data collected as a part of the ECED evaluation project in Indonesia, I examine the relationship between village poverty rate, village safety, and village community participation on first ECE quality and then children's outcomes. I also explore whether the relationship between village and children's outcomes are different based on the quality of ECE that children attended. In the first part of my study, I find that three village characteristics are significantly associated with ECE quality. Specifically, the village poverty rate is associated with lower quality ECE, while strong community participation and the child-friendly village indicator are associated with higher ECE quality. Secondly, I find that both village poverty and community participation are also consistently associated with all children's outcomes. Lastly some significant interaction effects between village characteristics and ECE quality were observed across children's outcomes. The interaction relationships inform the role of ECE quality on a continuum of village characteristics. The interactions of village characteristics and ECE quality findings suggest that high ECE quality is especially important in high poverty and high violence villages where high quality ECE has a protective role that is associated with similar or even better children outcomes compared to children in wealthier and safer villages. On the contrary, children who live with higher rates of disadvantages and are enrolled in lower ECE quality centers tend have the lowest outcomes. This finding calls for urgent and targeted intervention to improve ECE quality in villages with high rate of disadvantages.

Understanding the neighborhood characteristics associated with ECE quality and child development is essential in the overall efforts to improve the quality of ECE in rural areas. In addition to policy and programming targeting the ECE center such as teacher professional development or procurement of facilities, policymakers can also focus on improving certain village characteristics that are associated with higher-quality ECE. Second, the findings of this

study can also help policy makers to map out which kind of village a high quality ECE center is likely to have the strongest impact in and can be prioritized for extra support in improving ECE quality. Increasing ECE quality requires substantial effort and resources, therefore, it is important to identify specific sections of the population that will receive the most benefit.

Literature Review

Neighborhood Characteristics and Children Outcomes

Neighborhood characteristics may influence one's well-being through the relationship and experiences among the community members as well as access to resources. In their book *Neighborhood to Neurons*, Shonkoff and Phillips (2000) explore four mechanisms in which neighborhood and community may influence children's outcomes. First, *stress theory*, which posits potential exposure of neighborhood physical, social, and psychological threats to family and children such as exposure to environmental hazards or community violence. An example of this theory is a quasi-experimental study conducted by Persico et al., (2016) that compared children who were exposed to toxic pollutants before birth have lower cognitive and behavioral outcomes when compared to their un-exposed siblings. Similarly, in another quasi-experimental study, Persico & Venator (2021) also found that school age-children who were exposed to toxic air pollutants have lower test score and higher suspension compared to those who were not.

Another neighborhood threat is community violence. The level of safety in the neighborhood is also important for children development. Studies have shown that children who were exposed to crimes and violence in the community tend to have higher distress symptoms (Farver et al., 2005), behavioral problems (Caughy et al., 2008), and suppressive emotional regulation (McCoy et al., 2016).

Studies have also documented relationship between neighborhood poverty rate and children's outcomes. Correlational studies have linked the neighborhood-level poverty and children's outcomes where children living in higher poverty communities have lower school readiness skills compared to their peers (Wolf et al., 2017). This relationship pattern remains after taking into account child and family characteristics (Morrissey & Vinopal, 2018). Additionally, the well-known experimental study Moving to Opportunity, where randomly selected families from high-poverty neighborhoods were given the opportunity to move into lower-poverty neighborhoods, was conducted to systematically establish causal relationships between neighborhood characteristics and children's long-term outcomes. Based on data from this experiment, Chetty et al., (2016) found that children who moved during childhood into lower-poverty neighborhood had higher college attendance rates, higher income at age 28, and lower single parenthood rates compared to those who did not. Notably, these benefits were concentrated among children who moved at earlier ages (under 13). This finding suggests that the timing in which children were exposed to a certain living situation might moderate the relationship between neighborhood context and outcomes.

Second, *social organization theory*, which proposes the importance of role models and value consensus in the neighborhood that may influence children development. For example, shared values of how to care for children, neighborhood collective activities, and collective protection against potential danger to children can help children to thrive. Studies supporting this mechanism document the relationship of social cohesion and community participation in the neighborhood. For example, the presence of educated and affluent persons in the neighborhood is linked to higher academic outcomes (McCoy et al., 2016). The perceived social cohesion in the community is significantly associated with lower levels of child abuse and neglect (Guterman et

al., 2009; Maguire-Jack & Showalter, 2016; McLeigh et al., 2018). Additionally, strong social organization is also linked to lower levels of maternal stress which is central to positive parenting (McCloskey & Pei, 2019). These studies suggest that community social organization, which is reflected through mutual trust, high social interaction, and sense of belonging (Forrest & Kearns, 2001), has a communal protective role in supporting healthy development in children.

Third, the *institutional model*, that views how neighborhood resources influence children development through access to resources that may provide a stimulating environment, such as parks, libraries, high quality child-care service, community centers and activities that are designed to support children development. For example, Anderson et al., (2018) find a relationship between the presence of youth-focused organizations and positive developmental outcomes for adolescence. This model is also used to explain the relationship between neighborhood socio-economic status and children's outcomes. For example, Dupéré et al., (2010) suggest that the presence of higher level of ECE quality in the neighborhood is associated with better children outcome. However, one study finds weak correlation between neighborhood SES and neighborhood resources, suggesting some targeted governmental efforts to place community based resources such as preschool or hospital in low-income neighborhood (Wei et al., 2021). More of this institutional framework theory related to the ECE center and neighborhood will be discussed in the following section.

Lastly, the *epidemic theory,* which argues that neighbor and peers' negative behaviors can have strong influence and easily be adopted by other children. Studies looking at this relationship are mostly focused on the peer effects in crimes and violence on youth and adolescence age groups (Burdick-Will, 2018; Rotger & Galster, 2019; Zimmerman & Messner, 2011).

These theories were summarized into two main categories, *structural theories* that focus on institutional and physical resources available within communities that support or impede children development and *relational theories,* that emphasize social processes, norms, interactions, and behaviors that influence the members of a community (McCoy et al., 2015). In this study I use three neighborhood characteristics that cover both structural and relational theories—village poverty, community participation, and community safety—to predict ECE quality and children's outcomes.

Neighborhood Characteristics and ECE Quality

Studies investigating the relationship between neighborhood and ECE are mostly framed within the education equity question of whether children based on their backgrounds such as socio-economic status, ethnicity, or context of living such as urban vs rural, have equal access to high-quality ECE. In the United States, evidence shows the distribution of ECE quality available in higher poverty and higher minority communities tend to be lower compared to other areas. Using neighborhood level data in the Boston area, McCormick et al., (2023) find that ECE centers' quality tend to be lower in the area with higher proportion of African-American and Hispanic communities compared to those in closer residential proximity of their white and Asian peers. Similarly, Bassok & Galdo, (2016) found that in Georgia, the state preschools located in the low-income and high-minority communities tend to be lower quality. This associative pattern, however, will be slightly different when publicly funded high quality ECE centers that specifically target low-income community exists. For example, the Head Start program in the United States is concentrated in low-income communities (Wei et al., 2021).

The documented disparities in ECE quality for cultural and ethnic minority children in the United States context, however, might not reflect the quality of ECE perceived by the local

community. Rosenthal (2003) argues that the commonly used proxy of developmentally appropriate practice to evaluate ECE center is largely based on Anglo-American cultures that might not be a desired educational goal for other communities, such as emphasis on individual independency compared to social harmony. Some studies use the adapted quality measures to truly reflect the quality of ECE based on the cultural values or norm within the society (Brinkman et al., 2017; Chen & Wolf, 2021).

By geographical rurality, a study in China (Hu et al., 2014) finds a huge gap of quality of ECE center in rural versus urban areas, with rural-private centers performing the lowest among all categories. ECE centers in rural areas received less funding and have limited facilities while serving a large proportion of low-income children. The similar gap of ECE quality in urban and rural areas is also evident in Africa where although the number of ECE centers is relatively equal, lower quality ECE programs are mostly located in rural areas (Mushoriwa, 2014).

Neighborhood Characteristics, ECE quality, and Children Outcomes

Most studies investigating the relationship of neighborhood, ECE quality, and student outcomes have established that the effect of neighborhood context on children's outcomes may be mediated by differences in ECE quality. In Shonkoff and Phillips (2000) framework, community ECE centers are one of the neighborhood's *institutional resources*, and such institutions may mediate the relationship between neighborhood characteristics and student outcomes. Using Multilevel Structural Equation Modeling (MSEM), one study found that neighborhood poverty is directly related to lower-level ECE quality and lower children's development outcomes, while an indirect relationship through an ECE quality indicator was only found between neighborhood poverty and children's socio-emotional skills (McCoy et al., 2015). In a rural setting in the Eastern United States, ECE quality partially explains the relationship

between neighborhood safety and children's receptive language outcome; in lower safety neighborhoods, collective socialization moderated the relationship between neighborhood and ECE program quality (De Marco & Vernon-Feagans, 2013). Another study also found the quality of childcare and home environment partially explained the association between neighborhood characteristics and children's outcomes (Dupéré et al., 2010).

While the possible pathway mechanism of neighborhood characteristics to children's outcomes via ECE quality is explained by previous studies, in this study, I am interested in examining the relationship between neighborhood characteristics and children's outcomes and whether this relationship differs based on the quality of the ECE center they attended.

Background and Context: The Indonesian Education System

The Indonesian administrative governmental system is divided into five levels: National, Provincial, District, Subdistrict, and Village. In relation to the primary, secondary and tertiary education systems, Indonesian Decree No. 23, Year 2014 states that post-secondary education is to be managed by the national government, junior secondary and senior secondary schools are managed by provincial government, while pre-primary and primary school are under the responsibility of the district or regency government. The goal of this shared responsibility is to give more autonomy for the local government to manage the operation of the education program, which was previously fully controlled by the national government. The autonomy granted to local governments is only for operation and human resource management responsibilities, such as principal and teacher program development programs, the supervision system, and allocation of subsidized operational funding (*Dana BOS*). Curriculum and accreditation of all levels of education programs remain under the authority of the national government. Indonesia

implements a national curriculum that must be applied in all public schools from kindergarten to high school (K-12).

Since 2015, Indonesia has adopted a 12-year compulsory education requirement (previously only 9 years) that covers elementary school (6 years), middle school / junior secondary (3 years) and senior secondary / high school (3 years). Although pre-primary education is yet to be included in the compulsory education as of the writing of this paper, ECE programs are acknowledged as an integral part of overall educational system in the national constitution (*UU Sisdiknas 2003*). The nomenclature of ECE programs is divided into formal (kindergarten) and non-formal (other non-kindergarten ECE programs such as playgroup and day care). In the year 2013, registered ECE centers received an annual budget of around $40 per child through the district education office to subsidize the operational cost of all registered ECE centers that provide service at least three days a week, for a total of 150 – 180 minutes per week (Adriany et al., 2019). Teacher salary or incentives expenses can be allocated using this funding up to a maximum of 50% of total funding. The remainder of the funding is to be spent on school operational expenses such as purchasing learning materials, water and electricity, and so on.

In the recently published ECE national guidance (MOEC, 2022), the role of the village government includes providing monetary support to finance teacher salaries, renovating or building new ECE classrooms, hosting teacher professional development programs, providing administrative and organizational support (such as documenting the number of 0–6-year-old children in the village), and encouraging parents to enroll their children in the ECE program, as well as providing other services such as parenting programs and health service programs for younger children. Village governments receive an annual Village Fund that is independently managed by village officials and communities. The main priority of the funding allocation is for

community development with an end goal of eradicating extreme poverty and providing basic humanitarian services, such health care and education access especially for young children. Although the main program structure is regulated by the village fund policies, the village government and community can independently decide their own programs and funding allocations based on their needs. Thus, the community plays a critical role in providing young children access to high-quality ECE in the village.

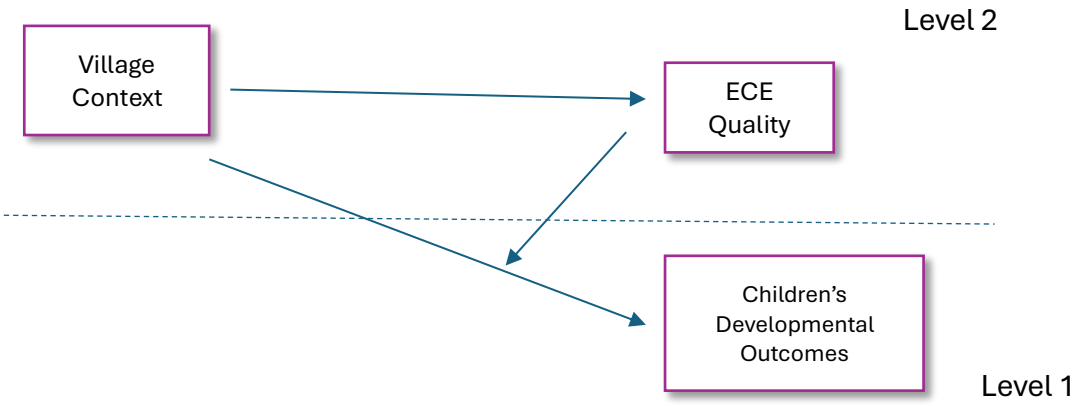
Starting in 2012, the national government has advanced the goal of "*One Village, One ECE Center*" to further expand the accessibility of ECE centers to reach young children in rural villages in Indonesia. Village governments were strongly encouraged to start new ECE centers and to provide continuous logistical and financial support. After a decade, although the number of ECE center in village is increasing, the goal to have at least one ECE center in each village has yet to be accomplished. In 2022, the ECE national directorate reported that 23,534 out of 83,794 villages (28 percent) in Indonesia still do not have an ECE center operating within the village (ECE directorate, 2023). Although there is no official report to support the claim, the Minister of Village Governments shared in a national seminar that village funds have been used to start and renovate 66,430 ECE centers from 2015 to 2021 (Mahrofi, 2022).

Current Study

This study builds on previous studies that have investigated the pathways in which neighborhood may influence children's outcomes via ECE quality. I will examine the association between village characteristics and ECE quality, and the association between neighborhood characteristics and children's developmental outcomes, as well as whether the latter relationship is moderated by the quality of ECE program attended by the child.

The framework of my research design is described in the following scheme:

Figure 4.1. Conceptual framework



Research Questions

1. What is the association between village characteristics (poverty, safety index, and community participation) and ECE quality?
2. What is the association between village characteristics (poverty, safety index, and community participation) and children's developmental outcomes? To the extent that village characteristics are related to children's developmental outcomes, is this relationship moderated by the quality of ECE program attended by the child?

Hypothesis

I expect to find poverty level to be negatively associated with ECE quality, in which, higher village poverty levels will be associated with lower ECE quality. On the contrary, I hypothesize village safety and village community participation will be positively associated with ECE quality and children's outcomes, in which, safer villages and ones where there is a higher degree of community participation in civic life will be associated with higher ECE quality. Further, if these relationships are non-zero, I hypothesize that ECE quality will buffer the negative impact of

village disadvantages. In other words, I expect that in villages with equivalent rates of poverty, safety, and community participation, children's outcomes will be better when they attend higher quality ECE programs (compared to those who attend lower quality ECE programs).

Method

Data

I draw my analytical sample for this study from the Early Childhood Education and Development (ECED) Impact Evaluation in Indonesia. The data was collected at the end of the ECED project in 2013 based on program implemented in 2009-2012. This project aimed to reach an estimated 738,000 children aged 0 to 6 years and their parents/caregivers living in 3,000 villages within 50 poor districts throughout Indonesia. Each village that was part of the project received a block grant of US$18,000 dispersed across three years for two ECE centers. The grant was meant to be managed by the village to achieve these intervention goals: (a) enhance and expand the existing ECE service; (b) increase the participation of children and families from low-income backgrounds; (c) improve the quality of the community program; and (d) comply with the essential health and safety standards (Pradhan et al., 2013). Hasan et al. (2013) explains the three main parts of the intervention. First, each village appointed one teacher and one child development worker (CDW). Second, these two village representatives received in total 200 hours professional development training with topics about "background of early child development and practical information on setting up and teaching in an ECED center, but not including an explicit curriculum manual" (Hasan et al., 2013, p. 113). A set of modules were shared with participants, but no step-by-step manual was given to the participants to encourage flexibility and autonomy in developing the center for each village. Third, each village wrote a

proposal with detail program and budget plan on how the funds were to be used for the 3-year implementation either to (1) establish new ECED services or (2) enhance the quality of existing service. 80 percent of the villages chose the first option.

The Impact evaluation of this project only involved 9 out of a total of 50 districts that received the grant. Within each district, 20 villages were randomly assigned to receive staggered implementation: early and late with an 11-month gap between the first and the second batch implementations. In addition, another 10 villages with matched characteristics were selected as the "never-treated" control group. Due to incompliance of the randomization process, some mitigation steps were taken with detailed recorded in the study protocol (Pradhan et al., 2013).

Several studies have been published in peer-review journals using the data obtained from this evaluation and have reported results such as the impact of the ECE project (Brinkman, Hasan, Jung, Kinnell, & Pradhan, 2017)), Quality of ECE (Brinkman et al., 2017), a comparison of ECE pathways (Nakajima et al., 2019), gender gaps in children outcomes (Nakajima et al., 2020), and the sustainability of ECE centers after the end of the project (Nakajima et al., 2021). The complete dataset collected in this evaluation is publicly available with permission from World Bank. I obtained the dataset by making a formal request to the World Bank database center (World Bank, 2019) and received approval to use their dataset to answer my own research questions. The details variables used in this study will be discussed in the measures section.

Analytical Sample

I present the summary statistics of village, ECE center and children characteristics in Table 4.1. The analytical sample of this study is 8,059 children who were enrolled in 580 ECE centers located in their residence villages ($N = 302$) during project endline data collection in 2013. The decision was made to only include children who live in the village where the ECE

center is located to examine the how the combination of village and center characteristics related to children's outcomes. This results in the exclusion of 323 children (out of 8,382 or 3.9 percent) who live outside of the village where their ECE center located. Overall, the mean of children's age is 4.71 years old with a SD of 1.06, and an equal proportion of female and male students. A small percentage of children in the sample (4 percent) were identified as having special needs.

As to the center and village characteristics, 93 percent of these centers are in rural areas with an average of 36 percent of low-income families. The mean of ECE quality is 2.92 (out of 7). Although this is considered minimal quality from the Early Childhood Environment Rating Scale, Revised (ECERS-R) scale threshold (which ranges from 1 = inadequate, 3 = minimal, 5 = good, to 7 = excellent), Brinkman et al., (2017) argue that most countries using ECERS, including China, UK, Canada and Sweden, scored below 5 point on average. This suggests that ECERS-R score sets quite high standards for the quality of the educational environment. I provide more details on the ECERS-R measure in the subsequent section.

Table 4.1. Summary Statistics of the Analytical Sample

Variable	
Village Characteristics	**N = 302**[1]
Rurality	282 / 302 (93%)
Village Poverty Rate	37 (16)
Population	4,270 (3,076)
ECE Center Characteristics	**N = 580**[1]
ECE Quality (ECERS-R Score)	2.92 (1.03)
Receiving government support	447 / 580 (77%)
Kindergarten (1=Yes)	274 / 580 (47%)
Islamic ECE (1=Yes)	56 / 580 (9.7%)
Type of ECE	
Islamic Kindergarten	52 / 580 (9.0%)
Islamic Preschool	4 / 580 (0.7%)
Kindergarten	222 / 580 (38%)
Non-project Playgroup	66 / 580 (11%)
Project Playgroup	236 / 580 (41%)
Children Characteristics	**N = 8,059**[1]
Age	4.71 (1.06)
Female	4,065 / 8,059 (50%)
Special Need status	323 / 8,059 (4.0%)
Mother Education	
Primary or less	3,387 / 8,059 (42%)
Junior Secondary	2,152 / 8,059 (27%)
Senior Secondary	1,971 / 8,059 (24%)
Post-secondary	549 / 8,059 (6.8%)
Children Developmental Outcomes	
Physical Health and well-being	8.10 (1.44)
Social Competence	6.77 (1.69)
Emotional Maturity	6.37 (1.37)
Language and Cognitive	6.69 (2.61)
Communication and General Knowledge	5.99 (2.05)

[1] Mean (SD) or Frequency (%)

Missing data

At the village-level, 10 villages (3.2%) are missing village poverty information, and 1 village (0.3%) is missing community safety indicator. I ran a MCAR test and confirmed that the missing pattern is indeed missing completely at random (p = 0.). I imputed these missing values with the mean value of villages in my sample. I dropped eight ECE (1.3%) centers that are missing all center-level variables. At the child-level, the missingness for my outcome variables (early developmental. Index) are 0.07% - 0.5%. I only include children with complete outcome values for each developmental domain in my model separately. Thus, the analytical sample for each developmental outcome estimations will be slightly different that presented in Table 4.1. Lastly, I imputed the missing child-level covariates: mother education (missingness = 1.3%) and child age (missingness = 0.16%) with the group mean.

Measures

Predictor Variables

All my predictor variables are collected by the village questionnaire. This questionnaire was designed to collect village-level information from the head of village or the other available respondents with leading roles in the village, such as the village secretary and the remaining head of departments.

Village Poverty. I construct village poverty rate based on the number of low-income family in the village divided by the total number of families in the village.

Community safety. The community safety variables are created using principal component analysis based on five items with 4-point Likert scale responses (1 = completely unsafe, 2=unsafe, 3=safe, 4 = completely safe). The five items asked in the questionnaire are:

- Do you think this village is a safe place for children to play outside?
- Do you think this village is a clean place for children to play outside?
- How safe is this village community from physical harm/threat (including domestic violent)?
- How safe is this village community from conflict/dispute?
- Currently, what is the safety level of community property ownership of this village?

Upon examining the items loading and eigenvalues, I decided to break the community participation into two variables. The first principal component has three larger item loadings: item 3 (How safe is this village community from physical harm/threat (including domestic violent)?), item 4 (How safe is this village community from conflict/dispute?) and item 5 (Currently, what is the safety level of community property ownership of this village?). I named this first component as Violence-Free village variable, in which higher scale indicates higher level of safety.

The second principal component has larger loading from the remaining two items: item 1 (Do you think this village is a safe place for children to play outside?) and item 2 (Do you think this village is a clean place for children to play outside?). I named the second component as Child-friendly village variable, in which higher scale indicates higher level of safety for children to play outside.

Community Participation. The community participation variables are created by taking the average scores of community participation in six community groups in the village: credit union group, mutual assistance group, youth group, Health and bereavement fund group, women group, and labor union group. The regularity of each group meetings was evaluated with 4-point Likert scale responses (1=Never conducted, 2= Conducted once

but no longer running, 3 = Running, not regular, 4= Currently regularly running). Initially, I tried to extract the main component using principal component analysis and there were three factors above 1 eigenvalue. However, upon checking the item loadings and in these three components, there were no evident substantive similarities between the items that loaded on each vector. Presumably, the lack of distinction of item loadings pattern is because the items asked for the regularity of meeting for six entirely different community groups and these six groups may behave differently within and between communities. In any case, I ultimately chose to use the average of score of community participation as intended in the questionnaire. Therefore, this variable reflects the average community participation in any community-based group in village and is not specific to community participation in ECE.

Thus, my analysis includes the following four question predictors: village poverty rate, violence-free village, child-friendly village, and community participation. I standardize all of my predictor variables to have a mean of zero and standard deviation of one for ease of comparison.

Outcome variables

The outcome variable for my first research question is ECE quality that was measured using the Early Childhood Environment Rating Scale, Revised (ECERS-R; Harms et al., 2005). ECERS-R has been widely used and translated internationally to measure the quality of preschool programs in at least 20 countries (Chen & Wolf, 2021). Clifford et al., (2010) reported that ECERS-R has good test-retest and interrater reliability with agreement within one point was reached on 92 percent of the items and the total interclass correlation was .915. There are 43 items in total that measure seven subscales: Space and Furnishings, Personal Care Routines,

Language-reasoning, Activities, Interaction, Program Structure, and Parents and staff. Similar to the other well-known ECE quality measures, ECERS-R was developed and tested in the developed and industrialized countries. Studies show that when it is used in developing countries, adaptation to local context is necessary to improve the predictive power and to match local classroom settings and quality standard (Chen & Wolf, 2021; Li et al., 2014).

The ECERS-R score used in this study follows the Brinkman et al., (2017) scoring system where the first rater's score is used as an instrument for the second rater's scores to correct for measurement error across raters. In addition to using the average total 43 items ECERS score, I will also run my analysis using only the average of 28 out of 43 items that align with Indonesian ECE quality regulation as suggested by Brinkman et al., (2017) . The subset of 28 items includes all 7 subscales of the original ECERS-R; however, there are some items within subscales that were not included. For example, for space and furnishing, only 3 out of 8 items are included, while for the parent and staff subscale only 3 out of 6 items were included. The detailed list of items included and excluded in the shorter, contextual version can be found in Brinkman et al., (2017).

The outcome variable for my second research question is the children's Early Development Index (EDI) score. EDI has been reported as a valid and reliable measurement with high internal consistency varies from 0.84 to 0.96, test-retest reliability varies from 0.82 - 0.94, and *Inter-rater reliability* at 0.53 – 0.80 (Janus & Offord, 2007) . EDI measures five developmental domains: Physical Health and Well-Being, Social Competence, Emotional Maturity, Language and Cognitive Development, and Communication Skill and General Knowledge in which each domain is scored from 1 (low) to 10 (high). During data collection, one teacher in each center filled out the EDI for all sample children who enrolled in that

center. For ease of comparison, I standardize all of my outcome variables to have a mean of zero and a standard deviation of 1.

Covariates

I include two village-level covariates: rurality and village population. I include three ECE-center level covariates: the type of service, kindergarten (coded 1) vs preschool (coded 0); whether Islamic school (coded 1, otherwise 0); and whether receiving governmental support (coded 1, otherwise 0). Finally, I include three child-level covariates: child age, child sex, and maternal education because these three variables are strongly associated with children's outcomes in the literature.

Analytical Strategy

Two different analytical strategies were applied for answering my two research questions. First, to examine the relationship between village characteristics and average ECE quality at the village level, I fit an ordinary least squares (OLS) regression in which I predict ECERS-R scores as a function of village poverty, safety index, and community participation and include my village- and center- level covariates. In this analysis, regular OLS regression, instead of multilevel regression, is utilized to answer my first question because all my predictors and outcomes are at the village level and each village only has a maximum of two ECE centers and most have only a single center.

To answer the second research question, since my outcome variable is at the individual child level nested in ECE center and village, I need to account for clustering dependency. Although it seems like I have three levels in my data (children nested in ECE center nested in village), I treated my data as two-level (children nested in village) because each village only has

one to two centers. Upon the inspection of design effect and ICC, all five children outcomes yielded quite similar results as presented in Table 4.2.

Table 4.2. *Design Effect and ICC*

Outcomes	Design Effect	Unconditional model ICC
Physical health & well-being	7.31	.24
Social competence	7.04	.23
Emotional maturity	6.93	.22
Language & cognitive	6.58	.21
Communication & general knowledge	6.53	.21

These results indicate nonindependence and autocorrelation in the multilevel data structure (Lai & Kwok, 2015). Therefore, the multilevel model should be used instead of the conventional OLS model. Next, since I am only interested in the average effect of predictors on outcomes across all villages and centers, I will use a multilevel model with random intercepts to account for cluster dependency.

I fit two-level random intercept models to estimate the relationship between child developmental outcomes and village characteristics, and then systematically introduce ECE quality and the interaction between neighborhood and ECE quality. I also include a set of child-level covariates to improve the precision of my estimation.

Specifically, the model specification for the second research question is:

Level 1

$$Y_{ij} = \gamma_{0j} + \gamma_{1j}A_{ij} + \gamma_{2j}S_{ij} + \gamma_{3j}ME_{ij} + \varepsilon_{ij}$$

Level 2

$$\gamma_{0j} = \gamma_{00} + \gamma_{01}Q_j + \gamma_{02}VP_j + \gamma_{03}S_j + \gamma_{04}CP_j + \gamma_{05}(Q_j * VP_j) + \gamma_{06}(Q_j * VS_j) + \gamma_{07}(Q_j * CP_j) + \boldsymbol{C}_{j+}U_{0j}$$

$$\gamma_{1j} = \gamma_{10}$$

$$\gamma_{2j} = \gamma_{20}$$

$$\gamma_{3j} = \gamma_{30}$$

where Y is the development outcome for student *i*, in village *j,* as a function of village level *j* characteristics, ECERS score, and the interaction between village characteristics and ECE Quality, adjusting for child-level covariates (Age, Sex, and Mother Education) in level 1 and center- and village- level covariates *C* (kindergarten, Islamic school, government support, rurality and population) in level 2. I allow for random variation for the intercept across villages U_{0j}, and child-level error term ε_{ij}.

I interpret γ_{01}Q as the estimated average relationship of ECE quality and students' outcome *i* in village *j*, $\gamma_{02}VP$ as the estimated average relationship between village poverty on students' outcome, and $\gamma_{03}S$ as the estimated average relationship between village safety on students' outcome, γ_{04}CP as the estimated average relationship between village community participation on students' outcome. γ_5 examines whether the relationship between village

poverty and students' outcome differs by the quality of the ECE center that the child attends. γ_6 examines whether the relationship between village safety and students' outcomes differs by the quality of the ECE center that the child attends. Finally, γ_7 examines whether the relationship between village community participation and students' outcomes differs by the quality of the ECE center that the child attends. In my taxonomy of results, some of these estimated coefficients will represent the unconditional relationship, whereas others will adjust for child characteristics or hold other community/center characteristics constant.

Results

Descriptive Statistics

The bivariate correlations among variables (Table 4.3) are in the expected direction and revealed relatively small correlations between village and center-level variables. The small correlation among my predictor variables indicates non-multicollinearity and thus the estimates are not likely to be biased or have inflated standard errors. At the child level, the correlations among children's developmental outcomes are moderate, with the strongest correlation emerging between emotional maturity and social competence as well as emotional maturity and communication & general knowledge outcomes. In terms of poverty level, the average village poverty rate is 37 percent with most of the villages within the range of 20%-50% of low-income families (Figure 4.2).

Figure 4.2. Histogram of Village Poverty Rate

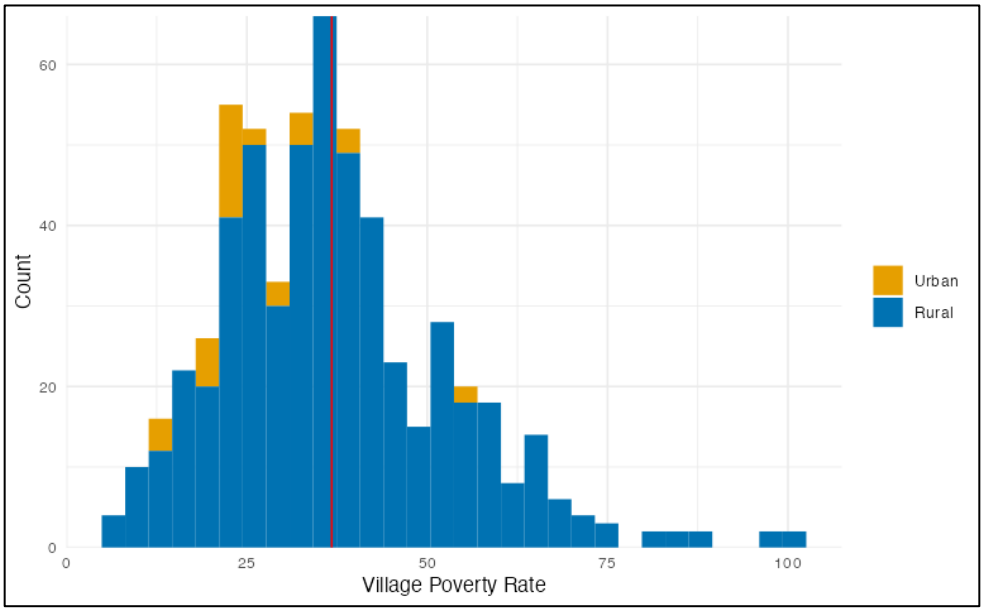


Table 4.3. Means, standard deviations, and correlation among primary variables.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
Village and Center Level											
1. Village Poverty	36.63	15.8									
2. Violence Free Village	-0.05	0.96	.03**								
3. Child Friendly Village	0.01	0.99	-.04**	.03**							
4. Community participation	3.63	0.33	-.01	.07**	.17**						
5. ECE Quality	2.92	1.04	-.11**	-.02*	.10**	17**					
Child level											
6. Physical health and well-being	8.10	1.44	-.00	.11**	.01	.10**	.07**				
7. Social Competence	6.78	1.69	-.02*	.05**	.01	.11**	.09**	.56**			
8. Emotional Maturity	6.37	1.37	.03**	.00	.03**	.10**	.10**	.48**	.66**		
9. Language and Cognitive	6.70	2.61	-.05**	.06**	-.03**	.13**	.06**	.53**	.59**	.46**	
10. Communication and General knowledge	6.00	2.06	-.05**	.04**	.01	.11**	.07**	.57**	.68**	.44**	.57**

* $p < .05$. **, $p < .01$.

Association between village characteristics and ECE quality

In Table 4.4, I report the estimated relationship between village characteristics and ECE quality. The conclusion generated using two versions of ECERS-R scores, the full items and contextual, is similar. For efficiency, I only report the results of my model using contextual ECERS-R score. I find that village poverty rate, child friendly village, and community participation variables are significantly associated with ECE center quality. The result remained robust after controlling for other predictors and covariates (Model 5). First, I find that one additional SD of village poverty is associated with a decline of ECE quality by 0.086 SD ($p < 0.05$). Then, one additional SD of child-friendly village indicator is associated with 0.06 SD ($p < 0.1$) of increased ECE quality. Lastly, one additional SD of community participation in village is associated with 0.128 SD ($p < 0.05$) of improved ECE quality.

Table 4.4. Estimated Relationship between Village characteristics and ECE Quality

	ECE Quality: Indonesian Contextualized ECERS-R				
	(1)	(2)	(3)	(4)	(5)
Village Poverty	-0.110***			-0.103***	-0.086**
	(0.04)			(0.039)	(0.04)
Violence Free Village		-0.021		-0.027	-0.006
		(0.032)		(0.032)	(0.033)
Child Friendly Village		0.094**		0.062*	0.060*
		(0.034)		(0.033)	(0.032)
Community Participation			0.174***	0.164***	0.128***
			(0.035)	(0.035)	(0.037)
Center Covariates					X
Village Covariates					X
Observations	580	580	580	580	580
R^2	0.012	0.009	0.031	0.047	0.112
F Statistic	7.144*** (df = 1; 578)	2.694* (df = 2; 577)	18.468*** (df = 1; 578)	7.063*** (df = 4; 575)	7.963*** (df = 9; 570)
Note:	*p<0.1; **p<0.05; ***p<0.01, *Cells report coefficients and associated heteroscedastic robust standard errors*				

Association between village characteristics, ECE quality, children's outcomes

Main Effects of Village and ECE center on children's outcomes

After modelling the relationship between village characteristics and ECE quality, I fit my two-level multilevel regression models to estimate the relationship between child developmental outcomes and village characteristics, and then systematically introduced ECE quality and the interaction between village characteristics and ECE quality. First, I report the main effects of each of predictor on children's outcomes when holding other predictors and covariates constant (model 8 in Table 4.4 – 4.8).

Village community participation and ECE quality stand out as the most consistent predictors across all children outcomes. Community participation is significantly associated with children's physical health and well-being in Table 4.4, model 8 (estimates =0.059, $p < 0.05$, 95% *CI* [0.00 0.12]), social competence in Table 4.5, model 8 (estimates = 0.072, p <0.05 [0.014, 0.130]), Language and cognitive outcome in Table 4.6, model 8 (estimates = 0.095, $p < 0.001$, , 95% *CI* [0.045, 0.145], and communication and general knowledge in Table 4.6, model 8 (estimates = 0.087, p < 0.01, 95% *CI* [0.030, 0.144]). Lastly, ECE quality is significantly associated with all children developmental outcomes: physical health and well-being in Table 4.4, model 8 (estimates = 0.036, p < 0.05, 95% *CI* [0.005, 0.067]), social competence in Table 4.5, model 8 (estimates = 0.036, $p < 0.05$, 95% *CI* [0.005, 0.067]), Emotional maturity in Table 4.6, model 8 (estimates = 0.083, $p < 0.001$, 95% *CI* [0.052, 0.114]), Language and cognitive in Table 4.7, model 8 (estimates = 0.061, $p <0.001$, 95% *CI* [0.032, 0.090]), and communication and general knowledge in Table 4.8, model 8 (estimates = 0.027, p < 0.1, 95% *CI* [−0.004, 0.057]).

The other two predictors (violence-free village and poverty rate) were only significantly associated with one children outcome and one predictor (child-friendly village variable) has no significant relationship with any children outcomes. Village poverty is significantly associated with emotional maturity in Table 4.6, model 8 (estimates = 0.068, $p < 0.05$, 95% *CI* [0.01, 0.11]), Violence free is significantly associated with physical health and well-being in Table 4.4, model 8 (estimates = 0.094, $p < 0.001$, 95% *CI* [0.04, 0.15]).

Interaction Effects of Village and ECE center on children's outcomes

I also test for the interaction effect between all my village predictors and ECE quality on children's outcomes to examine the role of ECE quality in potentially mitigating the adverse effects of village disadvantages. I report my findings in Table 4.4 – 4.8 with the most preferred model being model 8, where I account for all other predictors and covariates. Additionally, I also visualize the significant interaction effects in Figures 4.3 through 4.6 using *interactions* package (Long, 2021). The continuous moderator (ECE quality score) was projected in two lines, + 1 SD indicating high quality ECE which is about equal to 84th percentile (blue line) and – 1 SD indicating low quality ECE which is around 16th percentile (red line). The X and Y axis of these interaction plots are using standardized score with means of 0 and standard deviation of 1. The raw score of each developmental outcome ranges from 0-10 and the distribution of the outcomes can be found in appendix.

The interaction between village poverty and ECE quality is significantly associated with children's social competence in Table 4.5, model 8 (estimates = 0.041, $p < 0.01$, 95% *CI* [0.013, 0.070]), emotional maturity in Table 4.6, model 8 (estimates = 0.045, $p < 0.01$, 95% *CI* [0.016, 0.073]), and communication and general knowledge in Table 4.8, model 8 (estimates = 0.029, $p < 0.05$, 95% *CI* [0.000, 0.057]). The interaction plots show that the quality of ECE matters most

in villages with higher poverty villages. In wealthier villages, the differences in children's outcomes regardless of ECE quality are relatively smaller. Meanwhile, the gap of children outcomes who enrolled in different level of ECE quality becomes larger as the poverty rate in the villages increases.

Figure 4.3. Interactions between Village Poverty and ECE quality on Children Outcomes

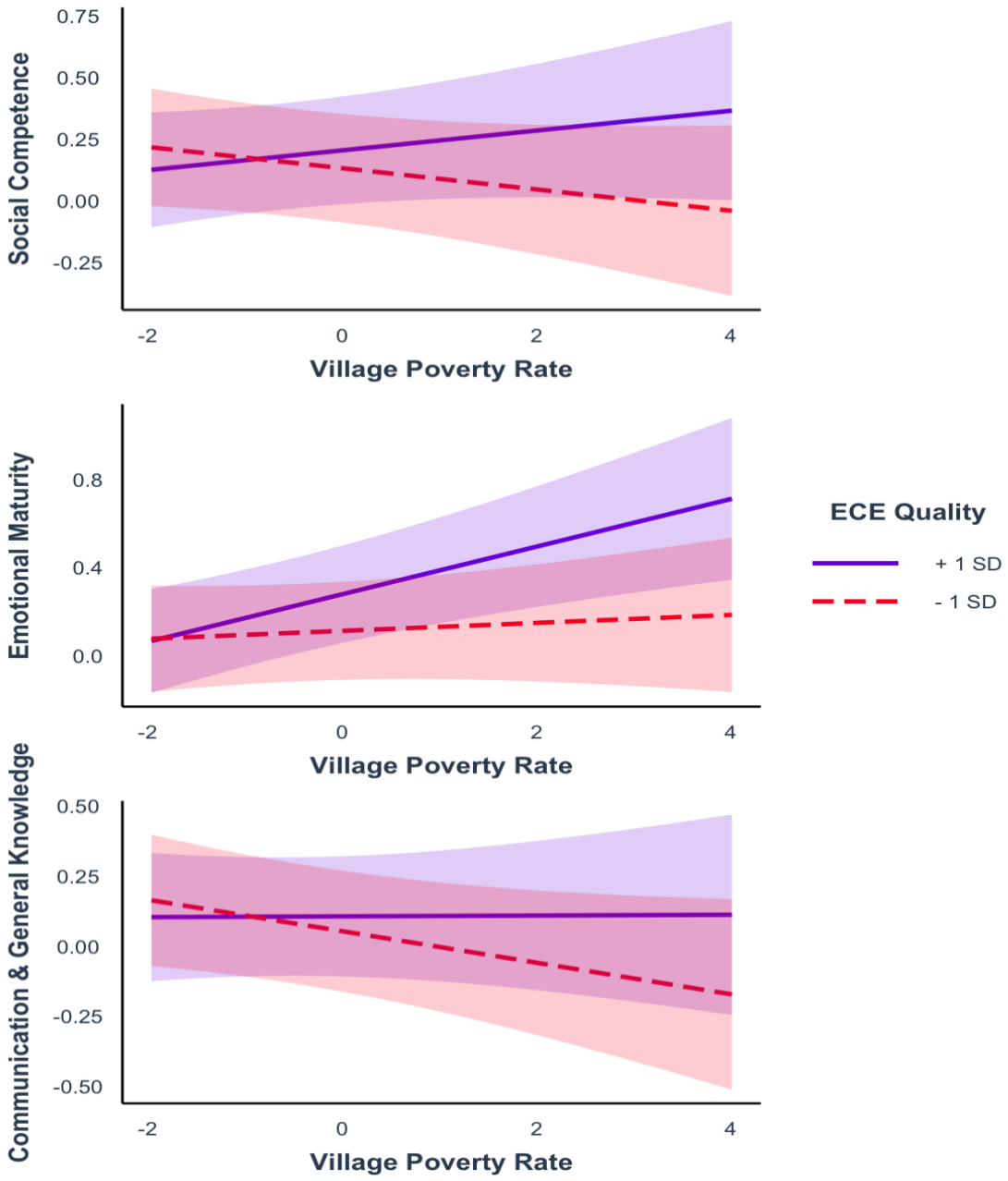
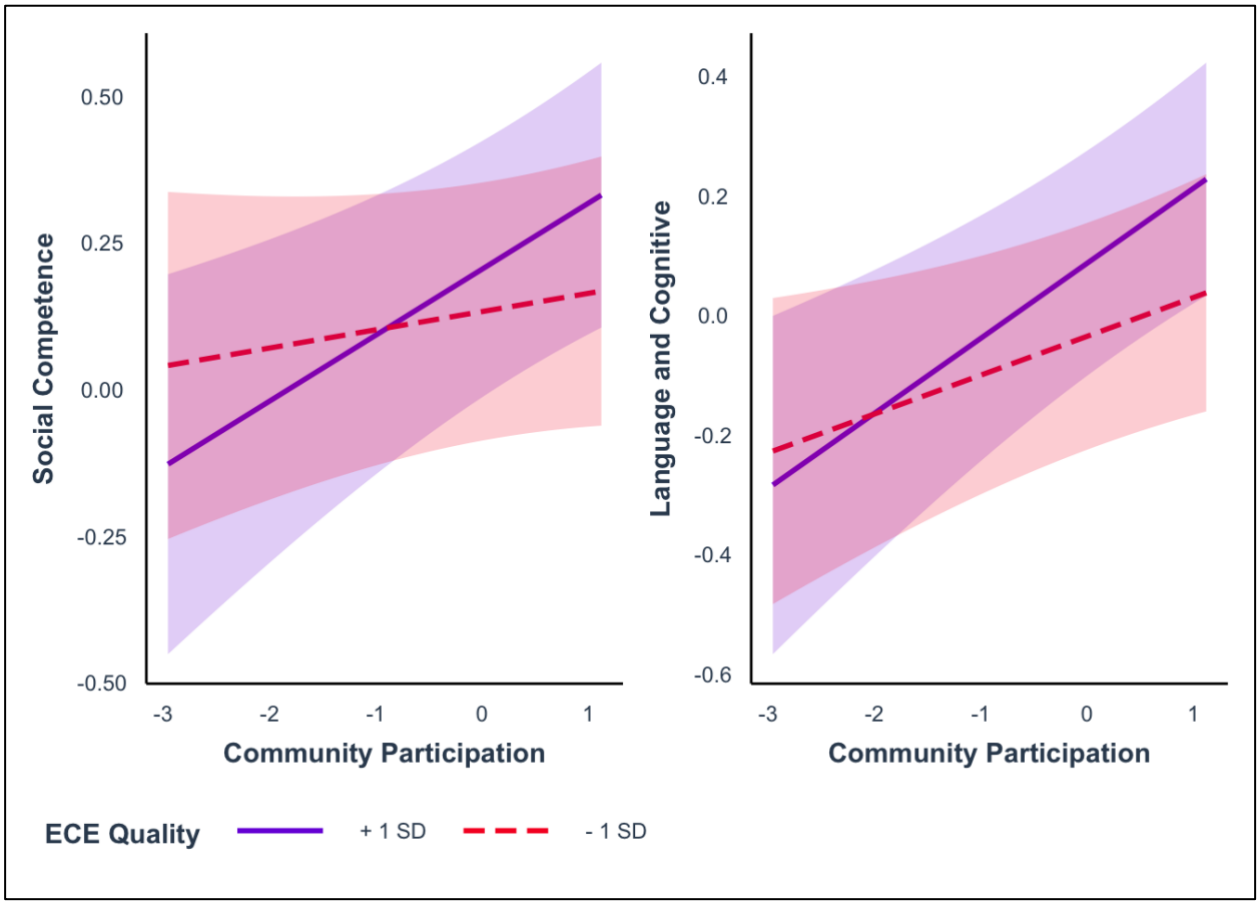
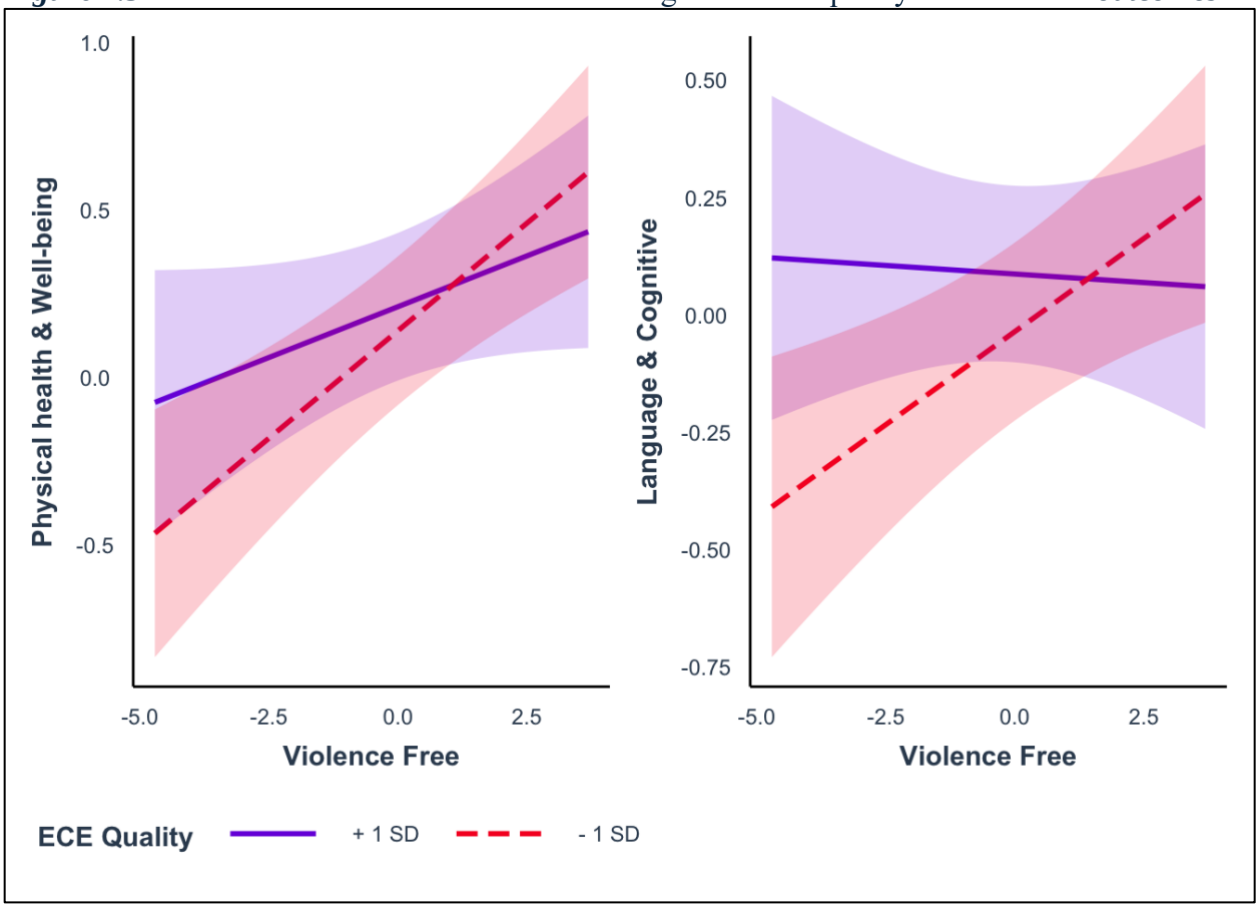


Figure 4.4 Interactions between Community Participation and ECE quality on children's outcomes



The interaction between community participation and ECE quality is significantly associated with children social competence in Table 4.5, model 8 (estimates = 0.041, $p < 0.05$, 95% *CI* [0.003, 0.078]) and marginally associated with language and cognitive outcomes in Table 4.7, model 8 (estimates = 0.030, $p < 0.1$, 95% *CI* [−0.004, 0.065]). The interaction plot shows that children relatively performed better in villages with high community participation and higher ECE quality can further intensify children's outcomes in these high community participation villages.

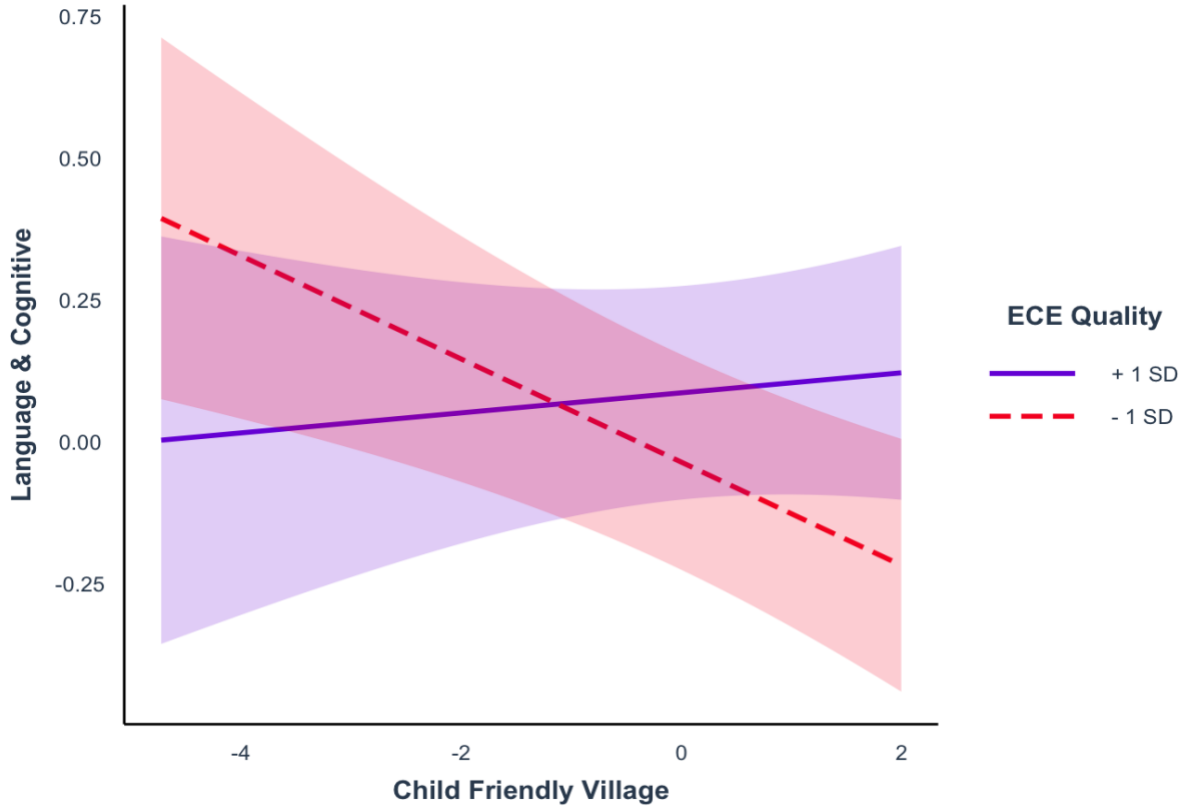
Figure 2.5 Interactions between Violence free village and ECE quality on children's outcomes



The interaction between Violence Free and ECE quality is marginally associated with children physical health and well-being in Table 4.4, model 8 (estimates = −0.034, $p < 0.1$, 95% *CI* [−0.072, 0.004]) and significantly associated with language and cognitive outcomes in Table 4.7, model 8(estimates = −0.043, $p < 0.05$, 95% *CI* [−0.078, −0.008]). The interaction plot shows that children relatively performed higher in violence-free villages or safer environment regardless of ECE quality. ECE quality is more important in high-violence villages where the children outcomes' gap based on the quality ECE they attended are larger compared to those in less violent villages. The buffering effect of ECE quality is evident in language and cognitive outcomes in which children enrolling in high quality ECE center in less safe village performed

slightly better than those in safer villages. Children in high violence villages and enrolled in lower quality ECE are those with the lowest developmental outcomes compared to their peers.

Figure 4.6 Interaction plot of relationship between Child Friendly free village and ECE quality on children's outcomes



Finally, the interaction between child-friendly village and ECE quality (Table 4.7 model 8) on children outcome is found for the language and cognitive outcome (estimates = 0.054, $p < 0.01$, 95% *CI* [0.018, 0.090]). Although, the main effect of child-friendly village and children's outcome is not significant, children in less child-friendly village tend to have higher language and cognitive outcomes. The interaction plot also captures that higher quality ECE can only have

meaningful impact for children outcome in villages with higher safety level of outdoor environment for children to play.

Table 4.5 *Estimated relationship between Village Characteristics, ECE Quality, and Physical Health and Well-Being*

	Children Developmental Outcome: Physical Health & Well Being							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village Poverty Rate	-0.001			0.005			0.001	0.018
	(0.031)			(0.031)			(0.030)	(0.029)
ECE Quality				0.026*	0.028*	0.024	0.022	0.036**
				(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Violence Free Village		0.116***			0.114***		0.109***	0.094***
		(0.030)			(0.030)		(0.030)	(0.028)
Child Friendly Village		0.009			0.008		-0.009	-0.003
		(0.030)			(0.030)		(0.030)	(0.028)
Community Participation			0.107***			0.110***	0.105***	0.059**
			(0.030)			(0.030)	(0.030)	(0.030)
Village Poverty * ECE quality				0.028*			0.028*	0.017
				(0.015)			(0.015)	(0.015)
Violence Free Village * ECE quality					-0.010		-0.013	-0.034*
					(0.020)		(0.020)	(0.019)
Child Friendly * ECE quality					0.010		0.005	0.008
					(0.020)		(0.020)	(0.020)
Community participation * ECE quality						0.028	0.031	0.022
						(0.020)	(0.020)	(0.019)
Student Covariates								X
Center Covariates								X
Village Covariates								X
Observations	8,053	8,053	8,053	8,053	8,053	8,053	8,053	8,053
Akaike Inf. Crit.	21,401.970	21,394.260	21,389.540	21,412.220	21,414.580	21,401.560	21,429.350	20,797.910
Bayesian Inf. Crit.	21,429.940	21,429.230	21,417.510	21,454.180	21,470.530	21,443.520	21,513.270	20,937.790
Note:	*p<0.1; **p<0.05; ***p<0.01, Cells report coefficients and associated standard errors							

Table 4.6 Estimated relationship between Village Characteristics, ECE Quality, and Social Competence

	Children Developmental Outcome: Social Emotional							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village Poverty Rate	-0.026			-0.016			-0.017	-0.001
	(0.030)			(0.029)			(0.029)	(0.028)
ECE Quality				0.042***	0.042***	0.042***	0.033**	0.036**
				(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Violence Free Village		0.047			0.047		0.041	0.032
		(0.029)			(0.029)		(0.029)	(0.028)
Child Friendly Village		0.019			0.022		0.001	0.006
		(0.030)			(0.029)		(0.029)	(0.028)
Community Participation			0.118***			0.124***	0.122***	0.072**
			(0.029)			(0.029)	(0.029)	(0.030)
Village Poverty * ECE quality				0.050***			0.049***	0.041***
				(0.015)			(0.015)	(0.015)
Violence Free Village * ECE quality					-0.003		-0.008	-0.024
					(0.020)		(0.020)	(0.019)
Child Friendly * ECE quality					0.038*		0.029	0.032
					(0.020)		(0.020)	(0.020)
Community participation * ECE quality						0.052***	0.050**	0.041**
						(0.019)	(0.020)	(0.019)
Student Covariates								X
Center Covariates								X
Village Covariates								X
Observations	8,024	8,024	8,024	8,024	8,024	8,024	8,024	8,024
Akaike Inf. Crit.	21,392.420	21,397.350	21,376.690	21,389.810	21,409.210	21,378.850	21,409.150	20,796.930
Bayesian Inf. Crit.	21,420.380	21,432.300	21,404.650	21,431.750	21,465.130	21,420.790	21,493.030	20,936.730

Note: *p<0.1; **p<0.05; ***p<0.01,
Cells report coefficients and associated standard errors

Table 4.7 Estimated relationship between Village Characteristics, ECE Quality, and Emotional Maturity

	Children Developmental Outcome: Emotional Maturity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village Poverty Rate	-0.026			0.049*			0.049*	0.063**
	(0.030)			(0.029)			(0.029)	(0.029)
ECE Quality				0.083***	0.083***	0.080***	0.075**	0.083***
				(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Violence Free Village		0.012			0.018		0.010	0.013
		(0.029)			(0.029)		(0.028)	(0.028)
Child Friendly Village		0.030			0.023		0.011	0.011
		(0.029)			(0.029)		(0.029)	(0.029)
Community Participation			0.105***			0.086***	0.085***	0.039
			(0.028)			(0.029)	(0.029)	(0.030)
Village Poverty * ECE quality				0.054***			0.053***	0.045***
				(0.015)			(0.015)	(0.015)
Violence Free Village * ECE quality					0.024		0.026	0.012
					(0.020)		(0.020)	(0.019)
Child Friendly * ECE quality					0.011		0.029	0.005
					(0.020)		(0.020)	(0.020)
Community participation * ECE quality						-0.015	0.013	-0.024
						(0.019)	(0.020)	(0.019)
Student Covariates								X
Center Covariates								X
Village Covariates								X
Observations	8,017	8,017	8,017	8,017	8,017	8,017	8,017	8,017
Akaike Inf. Crit.	21,426.590	21,433.990	21,414.650	21,401.260	21,428.200	21,404.880	21,433.810	20,792.330
Bayesian Inf. Crit.	21,454.550	21,468.930	21,442.610	21,443.200	21,484.120	21,446.820	21,517.680	20,932.110
Note:	*p<0.1; **p<0.05; ***p<0.01, Cells report coefficients and associated standard errors							

Table 4.8 Estimated relationship between Village Characteristics, ECE Quality, and Language and Cognitive

	Children Developmental Outcome:							
	Language and Cognitive							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village Poverty Rate	-0.045			-0.040			-0.045	-0.030
	(0.029)			(0.029)			(0.028)	(0.024)
ECE Quality				0.039**	0.036**	0.036**	0.026	0.061***
				(0.016)	(0.016)	(0.016)	(0.016)	(0.015)
Violence Free Village		0.072**			0.071**		0.065**	0.036
		(0.02)			(0.029)		(0.028)	(0.024)
Child Friendly Village		-0.029			-0.020		-0.046*	-0.037
		(0.029)			(0.029)		(0.029)	(0.024)
Community Participation			0.135***			0.143***	0.149***	0.095***
			(0.028)			(0.028)	(0.028)	(0.026)
Village Poverty * ECE quality				0.033**			0.031**	0.012
				(0.015)			(0.015)	(0.014)
Violence Free Village * ECE quality					-0.005		-0.010	-0.043**
					(0.020)		(0.020)	(0.018)
Child Friendly * ECE quality					0.064**		0.005	0.054***
					(0.020)		(0.020)	(0.018)
Community participation * ECE quality						0.058**	0.055**	0.030*
						(0.019)	(0.020)	(0.018)
Student Covariates								X
Center Covariates								X
Village Covariates								X
Observations	8,050	8,050	8,050	8,050	8,050	8,050	8,050	8,050
Akaike Inf. Crit.	21,467.790	21,475.150	21,454.600	21,475.310	21,496.230	21,467.090	21,501.920	20,877.050
Bayesian Inf. Crit.	21,495.760	21,510.110	21,482.580	21,517.270	21,552.170	21,509.050	21,585.850	21,016.920
Note:	*p<0.1; **p<0.05; ***p<0.01,							
	Cells report coefficients and associated standard errors							

Table 4.9 Estimated relationship between Village Characteristics, ECE Quality, and Communication and General Knowledge

	Children Developmental Outcome:							
	Communication and General Knowledge							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village Poverty Rate	-0.045			-0.038			-0.039	-0.027
	(0.029)			(0.029)			(0.028)	(0.028)
ECE Quality				0.019	0.024	0.019	0.014	0.027*
				(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Violence Free Village		0.038			0.042		0.037	0.012
		(0.029)			(0.029)		(0.028)	(0.027)
Child Friendly Village		0.019			0.018		-0.002	0.006
		(0.029)			(0.029)		(0.029)	(0.028)
Community Participation			0.112***			0.117***	0.115***	0.087***
			(0.028)			(0.028)	(0.029)	(0.029)
Village Poverty * ECE quality				0.041***			0.040***	0.029**
				(0.015)			(0.015)	(0.015)
Violence Free Village * ECE quality					0.016		0.014	-0.005
					(0.020)		(0.020)	(0.019)
Child Friendly * ECE quality					0.010		0.005	0.013
					(0.020)		(0.020)	(0.020)
Community participation * ECE quality						0.031	0.029	0.016
						(0.019)	(0.020)	(0.019)
Student Covariates								X
Center Covariates								X
Village Covariates								X
Observations	8,050	8,050	8,050	8,050	8,050	8,050	8,050	8,050
Akaike Inf. Crit.	21,467.790	21,475.150	21,454.600	21,475.310	21,496.230	21,467.090	21,501.920	20,877.050
Bayesian Inf. Crit.	21,495.760	21,510.110	21,482.580	21,517.270	21,552.170	21,509.050	21,585.850	21,016.920
Note:	*p<0.1; **p<0.05; ***p<0.01,							
	Cells report coefficients and associated standard errors							

Discussion

To the best of my knowledge, this study is among the first to examine the relationship between neighborhood characteristics, ECE quality, and children's outcomes in Indonesia. There are some important findings from this study that warrant future in-depth exploration. The first part of my study is to examine the relationship between village characteristics and ECE quality and the second part is to explore how the village level predictors and the joint combination these predictors and ECE quality relate to children's outcomes. I find that there are three significant village-level predictors of ECE Quality: village poverty, village safety (child-friendly indicator), and village community participation. I find that village poverty is negatively associated with ECE quality (β = -0.086, $p < 0.05$, 95%*CI* [−0.165, −0.006]). However, the magnitude of this estimation is very small, for example, when other variables are equal, in a village with 85% low-income family (+ 3 SD above the mean) the ECE quality is 0.3 point (out of 7) lower compared to ECE center in village with 37% low-income family (sample mean). This negative association between village poverty and with ECE quality is consistent with other studies (Bassok & Galdo, 2016; Cloney, Cleveland, et al., 2016; McCoy et al., 2015) and calls for further exploration on factors that may explain this reduced ECE quality pattern in higher poverty villages such as lower funding to support operational cost or teacher salary.

I find no evidence that village poverty is related to lower children's outcomes. This finding is in contrast to previous studies in mostly in United States context that find children in high poverty neighborhoods tend to perform lower than their peers in wealthier neighborhoods (Morrissey & Vinopal, 2018; Wolf et al., 2017). Instead, I find that children living in villages with a poverty rate one standard deviation above the mean score one standard deviation above the mean on an emotional maturity outcome (β= 0.068, $p < 0.05$, 95% *CI* [0.01, 0.11]).

Converting this estimation to the raw score, children in village with 53% of low-income family score 0.1 (out of 10) higher than those in village with 37% of low-income family. This finding highlights children's potential strength that can emerge by living in a difficult situation (McCoy et al., 2023). For example, instead of using deficit perspective of harmful effect of poverty on children, Ellis et al., (2022) use strength-based standpoint and argue that children can develop problem solving skills to adapt in limited resources or harsh situation. They called this as stress-adapted skills that is necessary and useful in later life. While none of the other outcomes are significantly associated with poverty rate, the inconsistency of the relationship direction I find in this study (negative estimation for social competence, language & cognitive, and communication & general knowledge outcomes and positive association for physical health & well-being and emotional maturity outcomes) imply that village poverty may relate to each children's outcome in different way. Future study can explore the potential mechanism on how each village characteristic associate with different children's developmental outcomes.

The other important and relatively stronger predictor of quality ECE and children's outcomes compare to my other predictors is community participation. I find that higher community participation is significantly associated with ECE quality ($\beta = 0.128$, $p < 0.01$, 95% *CI* [0.046, 0.211]). The magnitude of this estimation is also relatively small. To illustrate, ECE center in one SD higher community participation above the mean has 0.13 higher quality (maximum scale is 7). The community participation variable in this study does not specifically describe how the community as whole participates in the ECE center directly (e.g. family participation in children's activities at ECE center or community participation to support ECE program), rather, community participation is measured by the regularity with which various community groups in the villages, such as youth and women groups, gather and interact. The

regularity of group and communal-based activities serves as a measurement of the strength of the togetherness and relationships between the members of the community (Sampson et al., 1997). The social organization theory (Shonkoff & Phillips, 2000) explains that consensus in the neighborhood may influence children development through neighborhood collective activities that can help children thrive, and collective protection against potential danger to children. In the Indonesian context, a community-wide mutual consensus is central in the decision-making process for program priorities in the village. As I have explained earlier, the expenditure allocation of annual village fund is dependent on the community consolidation process that requires active participation of the community members. It is possible that the more active and involved the community, the more attention is given to programs that focus on the betterment of village as a whole, including the local ECE center.

I also find that ECE quality is a consistent predictor of differences in multiple child outcomes. Children attending an ECE center one standard deviation above the mean in quality have between 0.027 – 0.083 *SD* higher outcomes. Using the conversion suggested by von Hippel (2024), this effect is equivalent to 1 – 3 percentile above the average children outcomes (50^{th} percentile). This finding is consistent with previous studies that find ECE quality, especially process quality, is a strong predictor of children's outcomes (Bowne et al., 2017; OECD, 2018; Suchodoletz et al., 2023). This finding amplifies the importance of improving the quality of ECE alongside with the current national effort to expand the number of ECE center and children enrollment rate in rural Indonesia.

In addition, I also estimate the interaction terms between village characteristics and ECE quality on children's outcomes. I illustrate the difference of attending ECE center with +1 SD above the mean or equivalent to 84^{th} percentile (blue line) and center with – 1 SD below the

mean which is around 16th percentile (red line). The overall magnitude of my estimations linking village characteristics and children's outcomes is considered small ranging from 0.01 – 0.06 SD. However, this mirrors the magnitude of estimation found in other studies that are looking at neighborhood context and children's outcomes. For example, one meta-analysis found pooled effect size of 0.03 from 43 articles linking neighborhood disadvantages and children's behavioral outcome (Chang et al., 2016). Si

Interaction between village poverty and ECE quality on children outcomes show that ECE quality is more important in the poorer villages compared to the wealthier villages in three children's outcomes, social competence (β = 0.041, $p < 0.01$, 95% *CI* [0.013, 0.070]), emotional maturity (β= 0.045, $p < 0.01$, 95% *CI* [0.016, 0.073]), and communication and general knowledge (β= 0.029, $p < 0.05$, 95% *CI* [0.000, 0.057]). The gap of children outcomes based on the quality of ECE they attended are larger at the higher end of poverty rate. This finding can be explained by using the institutional model approach (Shonkoff & Phillips, 2000) in which children in wealthier villages presumably have other resources available in addition to ECE center (e.g. household resources, other public education facilities in villages) that can compensate for the lack of ECE quality to help stimulate children development. While in a high poverty village with limited resources, ECE centers become the primary and only space that children have the opportunity to receive necessary stimulation for their development. This evidence is supporting the effort to especially improve the quality of ECE program in the most socio-economically disadvantaged villages in Indonesia in a targeted manner.

The interaction terms between village community participation and ECE quality on children's outcomes are also significant but they have less of a protective role (Figure 4.4). In villages with higher community participation, higher ECE quality has the potential to further

intensify the already strong positive association between community association on children's social competence (β= 0.041, $p < 0.05$, 95% *CI* [0.003, 0.078]) and language and cognitive outcomes (β= 0.030, $p < 0.1$, 95% *CI* [−0.004, 0.065]). However, in lower community participation villages, the difference in the ECE quality is less likely reflected the differences in children's outcomes. Studies have found the positive association between community participation that reflect social cohesion and collective socialization (De Marco & Vernon-Feagans, 2013; Riina et al., 2014). Thus, Minh et al., (2017) describe that mutual trust and willingness to ensure common good of the community may explain this relationship. In addition, in higher community participation villages, children might have greater opportunity to socialize with other community members in the village that will influence their social and communication skill.

I also find significant interactions between village safety and ECE quality on children's language & cognitive outcome (β = 0.054, $p < 0.01$, 95% *CI* [0.018, 0.090]). Overall, although not statistically significant, children performed better in higher-safety villages regardless of the ECE quality (Figure 4.5). The buffering effect of ECE quality is evident in language and cognitive outcomes in which children enrolling in high quality ECE center in less safe village performed slightly better than those in safer villages, while children enrolling in lower quality ECE in less safety villages performed the lowest. The interaction between one indicator of village safety (child-friendly village) and ECE quality shows that higher quality ECE can only have meaningful impact for children outcome in villages with higher safety level of outdoor environment for children to play (Figure 4.6). This finding is consistent with other studies (De Marco & Vernon-Feagans, 2013; McCoy et al., 2023) that emphasize the importance on safe living environment for children to grow up in beyond the ECE quality. In the context of this

study, children spent most of their time in the community and relatively little time in the ECE center because of the short ECE service duration.

Overall, these findings are supportive of previous literature that studied the relationship of neighborhood context and children's outcomes. ECE quality has potential to protect children against the potential adversity of neighborhood disadvantage as observed in the village with high poverty villages and less safety villages. However, my study also sheds the light of the importance of cohesive and safe community environment for children to grow above and beyond ECE quality. Higher ECE quality can only have meaningful impact in relatively safety environment or strengthen the positive association that are already present in village with higher community participation. The fact that the majority of ECE centers in Indonesia only provide a short length of service (in oppose to full day service) means children still have larger majority of time spent at home and in the surrounding environment. It is important to ensure higher quality ECE center as well to improve overall village environment as a safe and friendly space for children to grow.

There are some policy implications of my findings. First, in the village level, my findings highlight the importance of positive village climate on children's developmental outcomes. I encourage village-level governments to implement programs and policy that can promote community participation and improve village safety. Second, my findings also suggest that ECE quality tends to be lower in high poverty villages, while I also observed the protective role ECE on children's outcomes in high-poverty and high-violence villages. Therefore, agencies whose main agenda is to improve ECE quality, such as ECE directorate, the Education Department, or child-focused NGOs, can map and prioritize their support and resources specifically in rural villages with high rate of poverty and violence. Lastly, programs that can increase community

participation should be used in promoting ECE quality in rural villages. Instead of only putting the burden of improving ECE quality on teachers' shoulder (such as teacher professional development, accreditation), policy makers should implement programming to encourage active participation of whole village to support ECE programs' teachers and staff providing ECE services for children.

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CHAPTER V

CONCLUSION

The overall goal of this dissertation is to understand factors that are associated with quality ECE that can guide and inform policymakers in their efforts to improve the quality of ECE programs, especially in rural and poor villages in Indonesia.

My findings indicate that access to high-quality ECE center in rural Indonesia is lower for children from higher rate of village poverty. I also find that in order to improve ECE quality in the rural villages, policymakers can prioritize equipping ECE centers with adequate educational and health and hygiene facilities, and ensure experienced teacher retainment.

My finding also highlights the important contribution of village characteristics to support the implementation of high quality ECE. I encourage village governments to improve local safety environment for children to grow as well as improve strong community participation.

My finding also contributes to guide a targeted initiative dedicated to improving ECE quality villages with higher poverty and higher violence as I find that meaningful difference in developmental outcomes for children attending high quality ECE compared to those attending low quality in these contexts.