

Toward the equitable expansion of early childhood education: Case study from Bhutan

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I, Lauren Pisani confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

For my thesis, I studied the effectiveness and potential scalability of an innovative approach to providing early childhood education to children living in rural communities in Bhutan. My research questions asked whether this approach, locally known as Care for Child Development Plus, was effective for improving children's early academic skills, whether the program produced outcomes that were comparable to those derived from classroom-based early childhood education services in the country, and whether communities recognized this approach as an acceptable alternative to classroom-based services for their children. My approach to answering these questions used a theory-based impact evaluation framework, and employed both qualitative and quantitative methods. My work built on a randomized control trial that was commissioned by Save the Children and the Ministry of Health in Bhutan. Specifically, I conducted key informant interviews with stakeholders at multiple levels and performed a comparison of the randomized control trial results to those from a previous evaluation of center-based early childhood education services in the country. Results of my analyses demonstrated that the Care for Child Development Plus program significantly improved children's literacy and numeracy skills as well as overall school readiness. The magnitude of children's learning gains were comparable to that of center-based early childhood education programs in the country, and the program was perceived to be valuable to participating parents and health workers. Results from this study contribute new evidence about an alternative approach to early childhood education programming at a time when national health and education systems are working toward expanding early childhood development coverage to marginalized communities in order to achieve targets set by the Sustainable Development Goals.

Impact Statement

Sustainable Development Goal 4.2 aims to, “ensure all girls and boys have access to quality early childhood development, care and preprimary education so that they are ready for primary education.” The early childhood period is a critical window for brain development and early childhood care and education programs are an important mechanism for improving children’s learning outcomes as they progress through the formal education system. Access to quality early childhood care and education programs is increasing but the expansion and quality associated with these services are uneven. Currently, only half of children living in low- and middle-income countries have access to early childhood education programs, and the majority of those who do are wealthy and live in urban areas. Governments and other organizations working to expand access to early childhood education require more immediate, effective alternative approaches to test in the communities they serve. My research offers evidence for one such approach that can be leveraged for remote communities in low- and middle-income countries.

Approximately 20 percent of children in Bhutan have access to classroom-based early childhood education services. This represents a substantial improvement in coverage since 2000, and the Ministry of Education has policies supporting the expansion of early childhood education to all children. However, it will take decades to reach all children with classroom-based early education services, especially for those living in remote mountainous regions. The home-based approach to delivering early literacy and mathematics instruction that I studied provides evidence that the existing health workers in Bhutan can effectively deliver early educational content to parents and their young children. My research also provides justification that this type of program is perceived as acceptable and valuable to the health workers and parents who were

involved. Providing young children in remote Bhutanese communities with stronger early learning inputs helps to prepare them for primary school and to fully realize their right to education.

My thesis also contributes to an under-studied area in the field of early childhood development because it lies at the intersection of two bodies of literature. There are numerous published studies on the effectiveness of cognitive stimulation programs delivered by health workers for children under the age of three. There is also a robust literature related to classroom-based early learning programs for 3 – 6 year old children. However, there are fewer studies of the impact of non-classroom based approaches to early education or of the potential effectiveness of these programs delivered by health workers for children over the age of three. My research expands on this literature base, and offers new evidence about an innovative approach for providing children in remote communities with previously unavailable early education inputs.

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1. Introduction

1.1 Research problem

For this thesis, I studied the effectiveness and potential scalability of an innovative approach to providing early childhood education (ECE) to children living in rural communities in Bhutan. The intervention under study, Care for Child Development Plus (CCD Plus), is a new program that combines aspects of existing approaches to early childhood development currently operating in Bhutan. The CCD Plus program delivered early literacy and numeracy content to 3 – 5 year old children living in rural communities where there are no ECE classes through the existing network of community health workers. The health workers trained parents on play-based activities that promote development of early literacy and numeracy skills, which can be carried out at home with minimal resources.

My first research question focused on whether this approach was effective for improving children's early learning skills. In addition, I asked whether the program produced outcomes that were comparable to those derived from classroom-based ECE services in the country, and whether communities recognize this approach as an acceptable alternative to classroom-based services for their children. My hypothesis was that if the effectiveness of the CCD Plus program was comparable to that of other types of ECE services in the country, and if key stakeholders like parents and health workers accepted the approach, then it may be possible to scale it to other rural communities in the country where young children are currently unable to access ECE services.

I used a theory-based impact evaluation framework, and employed a complementary mixed-methods design to answer my research questions. My work built

on a randomized control trial (RCT) that was commissioned by Save the Children and the Ministry of Health in Bhutan. To supplement results from the RCT, I conducted key informant interviews with multiple groups of stakeholders to investigate their perceptions of the appropriateness and effectiveness of the CCD Plus program. In addition, I performed a comparison of results from the RCT to results from a previous evaluation of center-based ECE interventions in Bhutan. This allowed me to develop a more comprehensive and contextualized understanding of how and why the CCD Plus program may or may not be an effective and sustainable approach to ECE in Bhutan. Results from this study contribute new evidence about non-classroom based ECE programming at a time when investment in early childhood development is on the rise and national health and education systems are attempting to expand coverage to more marginalized communities.

I was uniquely positioned to conduct this research due to my previous experiences working in Bhutan. I began supporting early childhood education programs in Bhutan through my position at Save the Children. I work as research and evaluation specialist within Save the Children in Bhutan and began supporting the Bhutan country office in 2015. Through this position, I advised Save the Children and the Ministry of Education in Bhutan on the design on the national ECD study in 2015, as well as the adaptation and administration of the International Development and Early Learning Assessment (IDELA) tool for the country. In addition, advised Save the Children and the Ministry of Health in Bhutan on the design of the CCD Plus evaluation in 2017. My relationships with Save the Children and government officials in Bhutan enabled me to receive approval to conduct secondary analysis of the previously collected quantitative data, and to conduct new key informant interviews for my thesis study.

1.2 Background

Conditions for children around the world have improved since the Millennium Development Goals (MDGs) were established in the year 2000, but the progress made during that period fell short of meeting all the established targets (UNESCO, 2015b). Health and nutrition services for young children improved, driving down the incidence of stunting and death in the first five years of life. By 2015, child mortality rates had dropped by 50 percent, but 6 million children under five were still dying from preventable diseases and one in four were stunted (UNESCO, 2015a, 2015b). Similarly, access to preprimary education services increased by nearly 67 percent, but still less than half of children living in low and middle-income countries (LMICs) had access to these services (UNESCO, 2015a; Yoshikawa & Kabay, 2015). Progress has been slowest for children from poorer and more rural areas; their health and education outcomes lag substantially behind those of their peers living in wealthier and more urban areas (Kaul & Sankar, 2009; UNESCO, 2015a; UNICEF, 2015; World Bank, 2013).

The MDGs included a target for reducing mortality for children under five, but did not include goals for any other aspects of early childhood development (ECD). In response to this omission, as well as increasing evidence from the scientific community about the importance of children's first years of life, a more holistic ECD target has been incorporated into the 2015 Sustainable Development Goals (SDGs). Specifically, SDG 4.2 asserts that, "by 2030 ensure that all girls and boys have access to quality early childhood development, care and preprimary education so that they are ready for primary education." This new target has motivated increased investment in care and education services for young children all over the world.

The holistic nature of SDG 4.2 represents consensus from the scientific community that children require adequate inputs from multiple sectors (i.e., health,

nutrition, safety, responsive caregiver and early learning) in order to achieve optimal development (Black et al., 2016). The health sector has been identified as a strategic starting point for integrated services because of the broad reach that health and nutrition services for pregnant women and young children have achieved across LMICs (Richter et al., 2016). Experts suggest that these relatively robust systems can now serve as platforms within which to integrate responsive caregiving, early learning, and child protection inputs for young children (Britto et al., 2018; Richter et al., 2016).

System-level support for integrated ECD policies is quickly being accepted internationally, but operationalization of these principles in LMICs is progressing more slowly. In 2014, 68 out of 215 LMICs had national multi-sectoral ECD policies, an increase from only seven in 2000. However, an analysis of national systems finds that less than half of these ECD policies have an institutional anchor and one-third lack any operational manuals or guidelines on the subject (Black et al., 2016). The integrated “Nurturing Care” framework launched in the 2015 Lancet publication on ECD (Black et al., 2016) was formally endorsed by UNICEF and World Health Organization (WHO) in 2018, but no guidance has been released to help governments realize this vision. In addition, substantial inequalities exist in health, nutrition, and education outcomes for young children from the most vulnerable backgrounds compared to their more advantaged peers; these are the children in the greatest need of ECD services, but also the least likely to receive them (Grantham-Mcgregor et al., 2007; Walker et al., 2011). National ECD systems will need to determine how to reach children with the highest levels of need.

In the remainder of this section, I will introduce the system-level support for ECD typically found in LMICs. I will then provide an overview of the ECD systems and context in Bhutan. Finally, I will detail recent research on ECE in Bhutan, and the two most

prominent program models for delivering ECD services to children in the country at the time my research began.

1.2.1 Early childhood care and education programs for young children globally

The terms early childhood development (ECD), early childhood education (ECE) and preprimary education (PPE) are often used interchangeably, but they have nuanced meanings. Early childhood development (ECD) is the broadest term and generally refers to physical and cognitive development for children aged 0 – 8 years. Early childhood education (ECE) refers to initiatives that intend to help children gain pre-academic skills relevant for their transition into primary school and focuses on children ages 3 – 6 years. Preprimary education (PPE) is defined as one year of formal schooling immediately preceding primary school when children are typically around 6 years old, although exact ages can vary depending on the age of primary school entry in a given country. Also, please note that throughout this paper when I refer to parents, this includes any primary caregiver of a child.

Health and nutrition services for 0 – 2 year old children have been steadily expanding and strengthening with increased international focus on reducing infant mortality, and services are now often available at national scale in the majority of LMICs (UNESCO, 2015a, 2015b). A widely used model of national service provision which is used to reach traditionally underserved communities in LMICs has been the expansion of community health workers (CHWs) (Nkonki et al., 2017; Perry et al., 2014). These positions are supported by governments across many LMICs and have driven decreases in infant mortality rates around the world (Schneider et al., 2016). A meta-analysis of publications focusing on CHWs over the past decade finds that while the largest growth area for these positions is maternal and child health, a minority of

publications (17 percent) focus on the success of initiatives operating across multiple programmatic areas (Schneider et al., 2016).

The new integrated ECD framework discussed above places the majority of its emphasis on pathways for adding early learning and child protection inputs on to existing health and nutrition services for children under two years old as these systems tend to be the most well developed in LMICs (Black et al., 2016; Britto et al., 2018). There is some evidence that CHWs can play a role in supporting improved stimulation and childcare practices for children under three years old) (Rahman et al., 2009; Vélez et al., 2014; Yousafzai et al., 2014). However, there is little evidence about whether CHWs can effectively deliver messages about cognitive stimulation or early education for children who are older than two years old.

Research has shown that early childhood interventions which provide both nutrition and cognitive stimulation inputs are more powerful for improving children's cognitive development than receiving nutritional inputs alone (Aboud & Yousafzai, 2015; Black et al., 2016; Grantham-Mcgregor et al., 2007; Walker et al., 2011). Further, studies that have compared the relative contributions of nutrition and stimulation interventions have found that stimulation has a stronger impact on children's cognitive development than nutritional supplementation (Attanasio et al., 2014; Walker et al., 2005; Yousafzai et al., 2014). The majority of these studies have focused on children under the age of three because the first 1,000 days of life have been identified as a particularly critical period for physical and cognitive development (Aboud & Yousafzai, 2015; Black et al., 2016). Specifically, inadequate nutrition, micronutrient supplementation and stimulation in the first 1,000 days of life is associated with physical and cognitive stunting later in life, as well as reduced educational attainment and wage earnings (Aboud & Yousafzai, 2015; Black et al., 2016).

Building on this evidence, the majority of the recent initiatives focused on integrating early learning for young children into health sector programs have focused on children under the age of three (Aboud & Yousafzai, 2015). Research has found that there is limited effectiveness of certain nutritional interventions after the first two years of life (e.g., iron and folic acid supplementation), but children under six are still highly vulnerable to malnutrition and disease (UNESCO, 2015b). In addition, the human brain continues to develop at its most rapid rates through the age of five (Thompson & Nelson, 2001). The period from age 3 – 5 is an especially critical period for the development of executive functioning and higher order problem solving (Center on the Developing Child at Harvard University, 2011; Thompson & Nelson, 2001; Weintraub et al., 2014).

Neither the health nor education sectors in LMICs offer consistent support for children aged 3 – 5 years, leaving children in this age group vulnerable to delays in their developmental trajectories (Grantham-McGregor et al., 2007; UNICEF, 2019). ECE enrollment rates have been rising in recent years, but education systems are largely focusing on a single year of preprimary education leading up to entry into primary school when children are approximately 5 – 6 years old (UNICEF, 2019). Less than half of children living in LMICs have access to preprimary services and access to these services is significantly more prevalent for wealthier children and those living in urban areas (Kaul & Sankar, 2009; UNESCO, 2015a; UNICEF, 2015; World Bank, 2013). There is also little discussion of integrating educational services with health or protection initiatives or examples of where multi-sectoral programs have been tried and tested with this age group (Black et al., 2016). Thus, there is a global ECD service gap for children aged 3 – 5 year old. Stronger support during this critical developmental period on a

large scale would have substantial impact not only on individual children’s cognitive development, but on the outcomes of society at large (Walker et al., 2011).

1.2.2 Context and ECD Systems in Bhutan

The Kingdom of Bhutan is a small, mountainous country in Asia (figure 1). The country is a democratic constitutional monarchy, which is ruled by King Jigme Khesar Namgyel Wangchuck. Bhutan is classified as Medium in the Human Development Index rankings, similar to India, Cambodia, and Lao PDR (United Nations Development Programme, 2014). The population density in Bhutan is 20.9 people per square kilometer of land, compared to 29.3 in Lao PDR, 89.3 in Cambodia and 445.4 in India (World Bank, 2019). These numbers reflect that the population of Bhutan is not densely settled; 59 percent of the population live in rural areas (National Statistics Bureau of Bhutan, 2019).

Figure 1. Map of Bhutan (CIA, 2019)



Bhutan has made strong progress toward reaching the health related MDGs for children, and it is estimated that the health system now reaches 94 percent of children under five years of age (Ministry of Health, 2019). As of 2016, under-5 mortality was

reported to be 32 per 1,000 live births in 2018 compared to 80 in 2000 (World Bank, 2019). However, two major health concerns that often appear later in childhood remain common; child stunting and anemia rates remain at 34 percent and 81 percent, respectively, for children under five. As in other LMICs, health outcomes are weaker for children living in rural areas and those from the poorest families (Atwood et al., 2014).

Support for ECE sits within the Department of Education in Bhutan and has been recognized as an integral component of the most recent sector strategy. Net enrollment ratios for primary education have reached 95 percent, but only 14 percent of students achieved at least a minimum proficiency score on the national civil service exam in 2017. There were multiple factors cited as related to this deficiency in students' knowledge acquisition, but one primary factor identified was the lack of early learning support provided to children before they enter primary school (Ministry of Education, 2018). The government has made policy commitments that support holistic early development for children, but implementation has been limited. Bhutan's Realizing Vision 2020: Education Sector Strategy states that, "All children aged 0-5 years will be supported to enhance their intellectual, emotional, and physical development through a program that enables them to grow in their familiar and natural environment" (Bhutan Department of Education, 2013). However, gross enrollment rates (GER) for preprimary education were reported to be 26 percent in 2017, and GER for ECE has reached 22 percent. Further, the Department of Education has faced considerable difficulty providing these services to children living in remote areas of the country. Due to budgetary constraints, the Department of Education will not consider supporting new ECE classrooms in villages that do not have at least 10 children of the appropriate age to attend (Ministry of Education, 2018).

Together, progress in the health and education sectors has improved children's chances of survival and access to education, but gaps remain in support for children's cognitive development. Pre-school aged children remain vulnerable and underserved because there is a service gap between the first two years of life, where health services are most active, and entry into primary school, where educational systems have broad coverage. This lack of systemic support is especially pronounced in rural communities. While the Ministry of Education is moving forward with initiatives to improve the quality of school-based preprimary and ECE programs, alternative solutions are needed to reach children in the numerous remote communities of Bhutan where school-based programs are not available.

1.3 ECD program models in Bhutan

The issue of providing ECE services to children living in remote areas of the country came to the fore due to findings from Bhutan's first national ECE study. In 2015, the Ministry of Education in Bhutan, in collaboration with Save the Children, executed an impact evaluation of all existing ECE programs in the country. At the time of the study, ECE services were being provided by a variety of entities and the MoE did not have a clear understanding of which approaches were the most effective for preparing children for primary school. Their goal was to complete an impact evaluation of all national ECE center programs in order to determine best practices and a way forward for ECE program expansion during the 2015 – 2020 Education Sector Strategy. Results of the national study precipitated multiple action points for the Ministry of Education in Bhutan. First, the MoE committed to investment in quality improvement of center-based ECE programs. Beyond evidence about the importance of quality in center-based programming, evidence from a national study highlighted the fact that children living in rural areas had significantly weaker school readiness skills than children living in urban

areas (Pisani et al., 2017). Results also displayed that caregiver behaviors have a strong relationship with children's school readiness. Taken together, these findings laid the groundwork for the Ministry of Education to seek alternative approach to providing ECE services to children living in rural areas.

1.3.1 Early Literacy and Math

The program identified by the Ministry of Education to support quality improvement in their center-based ECE programs following the 2015 national study was Save the Children's Early Literacy and Math (ELM) program. ELM was developed in 2012, and it is now implemented in 35 countries around the world, including Bhutan. ELM is an evidence-based approach that focuses on improving the instruction of emergent literacy and numeracy skills. The program can be delivered in either classroom-based or home-based modalities (i.e., ELM Center and ELM Home). The classroom-based programming focuses on improving teachers' abilities to deliver developmentally appropriate pre-literacy and numeracy instruction during daily activities, and the material development focuses on how to develop and use local materials in classrooms to support this instruction.

The home-based component focuses on training parents to engage in pre-literacy and numeracy activities at home, including how to use common household materials for these activities. The home-based programming is composed of group sessions with parents that are focused on learning different play-based activities that can be done with children on a day-to-day basis. For example, one session on early numeracy focuses on how parents can teach sorting and classification while cooking dinner or doing laundry. Sessions generally begin with facilitators asking parents to discuss successes and challenges experienced from trying to use techniques introduced in the previous sessions at home with their children, then a new topic is introduced and facilitators lead

parents through hands-on exercises with their children. Sessions are designed to be as practical as possible, and facilitators spend most of their time demonstrating and coaching parents through activities.

Both the ELM Center and ELM Home programs have been found to be effective for improving children's learning and development. A study from Bangladesh found that children who participated in the ELM Center program before entering primary school displayed significantly stronger speaking, writing, and mathematics skills in first and second grade compared to children who did not attend a preprimary program (Aboud & Hossain, 2011). In addition, a randomized control trial of the ELM Center program found it to be significantly more effective in improving children's literacy and numeracy skills than the standard government preprimary curriculum in Ethiopia (Dowd et al., 2016). Finally, a study of the ELM Home program found it to be as impactful as the standard classroom-based government preprimary curriculum for improving children early literacy and math skills in Ethiopia (Borisova et al., 2017a). That is, there were no significant differences between the learning growth of children attending government classes and those who were not enrolled in preprimary, but whose parents attended the ELM Home sessions.

1.3.2 Care for Child Development

The Care for Child Development (CCD) program, is a holistic ECD package for children aged 0-5 that was developed by UNICEF in partnership with the World Health Organization (WHO) in 2002. CCD components that focus on the issues of integrated management of childhood illnesses, infant and young child feeding, maternal and newborn health care, cognitive stimulation, and responsive caregiving. The CCD program implementation guidance has evolved over time, but the most recent version of the program is designed as a counseling program to be delivered during home visits by

health workers operating out of health units or hospitals in LMICs. The level of intensity is suggested as three home visits per family at intervals that correspond with other recommended visits for children under the age of three (Lucas et al., 2018).

A 2015 study of the CCD program found that it was currently being implemented in 23 sites across 19 countries by various service providers including community health workers, social workers, child protection professionals, and pediatricians (Lucas et al., 2018). CCD was first introduced in Bhutan in 2014, and is delivered by health workers, specifically those focusing on maternal and child health (Ministry of Health, 2013). Despite the broad use of the CCD program, empirical evidence of its effectiveness for improving child's cognitive development is relatively limited. The literature review in Chapter 2 will provide more details on this topic.

1.3.3 Care for Child Development Plus

As noted earlier, the Royal Government of Bhutan has begun investing in ECD and testing different solutions for meeting the needs of children in the country. The CCD program has been adopted by the Ministry of Health as an effort to address the children's multi-dimensional development needs, and is operational through basic health units across the country. The ELM Home program was been implemented and tested by Save the Children, in partnership with the Ministry of Education. In response to the national ECD study conducted in 2015, the Ministry of Education sought new partnerships in order to better serve young children living in rural communities. In 2016, the Ministries of Education and Health agreed to partner on a new program designed to reach preschool aged children living in remote areas. To do so, they merged the CCD and ELM models into one approach, locally known as Care for Child Development Plus (CCD Plus).

Health workers operating in rural communities delivered CCD Plus to parents of children aged 3 – 5 using a group session format. The CCD Plus sessions followed the ELM at Home curriculum, which contains seven sessions focused on early literacy and mathematics, and two additional sessions related to health and nutrition topics were added using material adapted from the CCD program (9 sessions total). The sessions were designed to be implemented once per month, and last approximately 90 minutes. Parents were encouraged to bring their children to the sessions so they could practice the games and activities together, with support from the group facilitators. Both Health Assistants and village health workers asked to attend all sessions to help deliver content to parents and manage children. Parents received a booklet with take-home cards to remind them about the activities they learned and a book bank was available at all sessions to enable parents to borrow books to read with their children. Figures 2 and 3 display examples of the CCD Plus take home cards in Dzongkha and English.

Figure 2. CCD Plus Take Home Card: Learning about Books (Dzongkha)



Figure 3. CCD Plus Take Home Card: Let's Count (English)



All sessions followed the same structure and focused on increasing caregivers' confidence and understanding of how they can support their children's early literacy and math skills at home, including teaching a series of simple games and activities they can engage in with children during their daily routine. Sessions began with health workers welcoming families and leading a group song or game. Then parents would share their experiences using the games introduced in the previous session at home with their children. After this, one facilitator would take the children away to another area to play with available materials, and the remaining health worker would introduce the caregivers to the topic of that session and associated activities. The health worker would introduce the new games and practice them with the group of parents. Following this, children were brought back and parents would practice the new games with them. The sessions ended with one of the health workers reading a storybook aloud to parents and children, families borrowing books from the book bank, agreeing on the next time the group would meet, and singing a goodbye song.

1.4 Rationale

Both the CCD program and ELM at Home have strong theoretical underpinnings, but also substantial shortcomings that limit their potential effectiveness or feasibility for use at scale to improve school readiness for 3-6 year old children. The CCD program is delivered by health professionals and is designed for use during routine health visits. Delivery through routine health visits reduces additional resources and other costs associated with the program, making it more conducive to use at scale. However, the standard CCD program does not offer guidance on active outreach to communities nor any curriculum for more enduring and in-depth engagement with families. Rather, the materials are structured for single face-to-face meetings with caregivers and children within health centers. So at best, exposure to the program is limited to a few additional minutes during routine health visits. At worst, a parent cannot or does not take their children for recommended health visits, or the health provider forgets or does not have time to address CCD content during their meeting. In addition, after age two when children require fewer health visits, there is limited contact between families and health workers and thus limited possibility that the CCD plus program would substantially benefit the cognitive development of 3-6 year old children.

In contrast, the ELM at Home program specifically targets 3-6 year olds and actively brings pre-academic services to a community. However, similar to other resource intensive programs implemented by International Non-governmental Organizations (INGOs), the sustainability of ELM at Home is limited if the professionals delivering services are not incorporated into existing government systems. A program like this is most relevant in areas where school or center-based ECE services are limited which makes it unlikely that teachers or other Ministry of Education professionals would be available to deliver this service. Therefore, for sustainability, other professionals in

the community would be required to deliver the service in order for it to become a scalable solution to improve cognitive development for children in those communities.

In theory, the CCD Plus program combines the components of CCD and ELM Home that are most conducive to an effective, scalable program, but this model has never been empirically tested. Therefore, my thesis examined both the effectiveness and potential scalability of this approach. A non-traditional ECE program would only be considered a relevant solution if it produces comparable learning and development outcomes compared to traditional school-based programs. My thesis addressed this issue by testing the effect of the CCD Plus program on children's learning and development with data from a RCT. To understand whether the magnitude of the effect is similar to that of center-based programs in the country I also compared these data to results of the national ECD study.

In addition to appropriate quality of services, a successful non-classroom based ECE program would also need to generate strong demand from the groups being served. As a community-based approach to ECE, the CCD Plus program is only viable beyond the pilot phase if community members accept it as an alternative to formal classroom-based services and continue to invest time and energy into the initiative (Britto et al., 2018). To address this issue, my thesis study sought to understand community members' interest and willingness to invest in this approach. Specifically, I interviewed parents, health workers, and Ministry of Health officials about their perceptions of the CCD Plus program and the relevance of such an initiative in their communities.

1.5 My contribution

Various alternative approaches to ECE have been proven effective in small-scale pilots, but less is known about which approaches are feasible on a large scale, and whether these approaches would be accepted as ECE alternatives by parents and communities (P. Engle, Fernald, et al., 2011; van Ravens, 2015; World Bank, 2013). Data collected through quantitative impact evaluations are often inadequate to answer questions about how and why new initiatives are or are not found to be effective, and whether they are scalable or sustainable (Britto et al., 2018; White, 2009). Of particular relevance to this topic is the cultural acceptance and perceived sustainability of an alternative approach to ECE. Even if a program is found to be effective during a pilot period, will families and communities accept it as something they want for their children? This study uses a theory-based evaluation framework and employs both quantitative and qualitative methods in order to develop a comprehensive understanding of program effects and perceived sustainability of an alternative ECE approach for 3 – 5 year old children within rural Bhutanese communities (Creswell, 2009; Greene et al., 2010; White, 2009).

This study also contributes to existing literature about integrated ECD services in LMICs. Research in the international ECD field has concluded that appropriate health, stimulation and protection services are required for children to achieve optimal development, and suggests that the field should focus on multi-sectoral programs in order to deliver these services effectively (Black et al., 2016). Many of the new integrated ECD initiatives focus on combining cognitive stimulation into health sector initiatives for children under three, as the health sector has built a strong foundation of programs to support children in their first 1,000 days of life (Black et al., 2016; Chang et

al., 2015; Yousafzai et al., 2014). The program under study is one of the first integrated ECD programs for 3 – 5 year olds to be rigorously tested in a LMIC.

1.6 Research questions

This study aims to take a holistic approach to determining overall program effectiveness and uses a mixed methods design to answer all research questions. In summary, my thesis addresses the following questions:

1. What is the impact of the CCD Plus program on children’s school readiness?
 - a. What is the quantitative impact of the CCD Plus program on children’s cognitive development?
 - b. Does the CCD Plus program have the same impact on all children and families?
 - c. What are the perceived changes in children’s school readiness from caregiver and health workers’ points of view?
2. Does the CCD Plus program have the potential to be a scalable alternative to classroom-based ECE services within Bhutan?
 - a. How do children’s learning outcomes compare to those from classroom-based ECE programs in the country?
 - b. Is the CCD Plus program accepted as an alternative to classroom-based ECE services by caregivers?
 - c. Do health workers and caregivers perceive the CCD Plus program as sustainable within their communities?

My first broad research question relates to the impact of the CCD Plus program on children’s school readiness. More specifically, I estimated impact of the program on children’s development and learning in five domains measured by the IDELA: motor,

literacy, numeracy, social-emotional, and spiritual, moral and cultural development, using multilevel multivariate regression analyses. These results are complemented by information from interviews with health workers and parents detailing their perspectives on the perceived effects of the CCD Plus program on children. To investigate heterogeneous program effects, I used multilevel multivariate regression analyses with interactions for background factors related to equity in the Bhutanese context (i.e., household poverty and maternal literacy). Again, I supplemented the quantitative results with qualitative data from interviews with health workers and parents.

In my second research question, I asked about the potential scalability of a program where health service providers are being asked to deliver a parenting program focused on improving ECE for 3-5 year old children in rural communities. Information about topics related to acceptance of the program as a preschool alternative for children as well as implementation benefits and challenges, including threats to sustainability were elicited during interviews with health workers and parents. In addition, I compare quantitative impact evaluation results of the CCD Plus program from this study with data from a national ECE study conducted in 2015 to determine how the impact of this alternative ECE approach compares with that of standard center-based ECE programming. A full discussion of my analytic techniques is presented in Chapter 3.

1.7 Methodology overview

My research contributes to the global literature by investigating the impact of a non-center based approach to ECE for children living in rural communities, through a cross-sectoral collaboration with the health sector. I employed a mixed-methods approach in order to inform not only the discussion about the potential impact of an integrated ECE parenting program on child development, but also the perceived acceptability and scalability from the perspectives of implementers and parents. Due to

the novelty of this program approach and its reliance on local community members, evidence focused on community perceptions is especially important. In addition, the qualitative data may help identify reasons why the CCD Plus program is or is not found to be effective in this context. I use Ecological Systems Theory to ground my research, and my methodology is drawn from the literature on theory-based impact evaluations. I offer an introduction here and discuss both of these topics in more detail in Chapters 2 and 3.

Ecological Systems Theory provides a framework for the multiple spheres, or systems, that influence children's developmental trajectories (Bronfenbrenner, 1977). This theory proposes that influences from the policy level down to individual caregiver relationships all have an effect on the environment within which a child develops, but that the actors most proximal to the child exert the strongest influence. I felt that this theory provided an appropriate framework to conceptualize the multiple layers of influence that the CCD Plus program was engaging with in order to improve learning opportunities for young children living in remote Bhutanese villages.

A mixed-methods approach, and specifically literature related to theory-based impact evaluations, guided my methodological design. RCTs are often touted as the "gold standard" for impact evaluations because they provide an unbiased estimate of the treatment effect in a given context. However, they have also been criticized for their lack of information about factors related to how or why a treatment effect may have been found, as well as for their lack of external validity (Deaton & Cartwright, 2018). These criticisms do not contend that RCTs are irrelevant for building scientific knowledge, but rather suggest that best practice is to use RCTs alongside other methods which include conceptual and theoretical considerations. Theory-based impact evaluations represent one popular method for integrating RCTs into a broader evaluation design. A theory-

based evaluation is designed to investigate not only the unbiased treatment effect, but also the underlying assumptions within the causal chain of the evaluation in order to produce results that speak to impact and also factors influencing the success or failure of an intervention (White, 2009).

1.8 Organization of thesis

In chapter 2, I present the literature review with empirical and theoretical justification for this study. In chapter 3, I present my methodological approaches and analysis techniques. In chapter 4, I present results of my analyses related to the impact of the CCD Plus program on children's cognitive development. In addition, I present results related to the potential scalability of the CCD Plus program to other communities in Bhutan. In chapter 5, I discuss the relevance of this approach in the Bhutanese context, and within the global literature of ECE programs available in LMICs. Finally, in chapter 6, I summarize the main contributions of this work and suggest recommendations for future study.

2. Literature review

In this chapter I review the theoretical and empirical evidence related to my research questions. There is a wide range of literature related to parent-focused programs for young children, and I have structured this literature review to focus on subsets of this knowledge base that are most relevant to my research questions. First, I discuss Ecological Systems Theory and its application to ECD programs for young children. Then I present global evidence related to ECD, with a specific focus on educationally focused programs for 3 – 5 year olds. Within this literature review, I highlight the tension between the approach taken by health systems and cognitive stimulation programs designed for children younger than three which rely heavily on parents as the primary agents of change, and ECE programs designed for children older than three years, which are associated with education systems and rely almost exclusively on classroom-based approaches. I will not address literature related to parent-focused programs that do not have children's cognitive development as a stated outcome (e.g., programs that aim to change parents' behaviors related to their children's nutrition).

2.1 Ecological systems theory

Early childhood development in an international context is a complex theoretical area because it sits at the intersection of many fields, such as psychology (both developmental and cross-cultural), sociology, education, and economics. The theory that is most compelling in this area is Urie Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1977). Bronfenbrenner proposes that there are multiple spheres of influence, or systems, which radiate out from a child and influence their development. The people and contexts most proximal to the child are thought to have the most direct

influence on her/his developmental trajectory, but all actors have a relationship with the child's development in some way, as well as with one another.

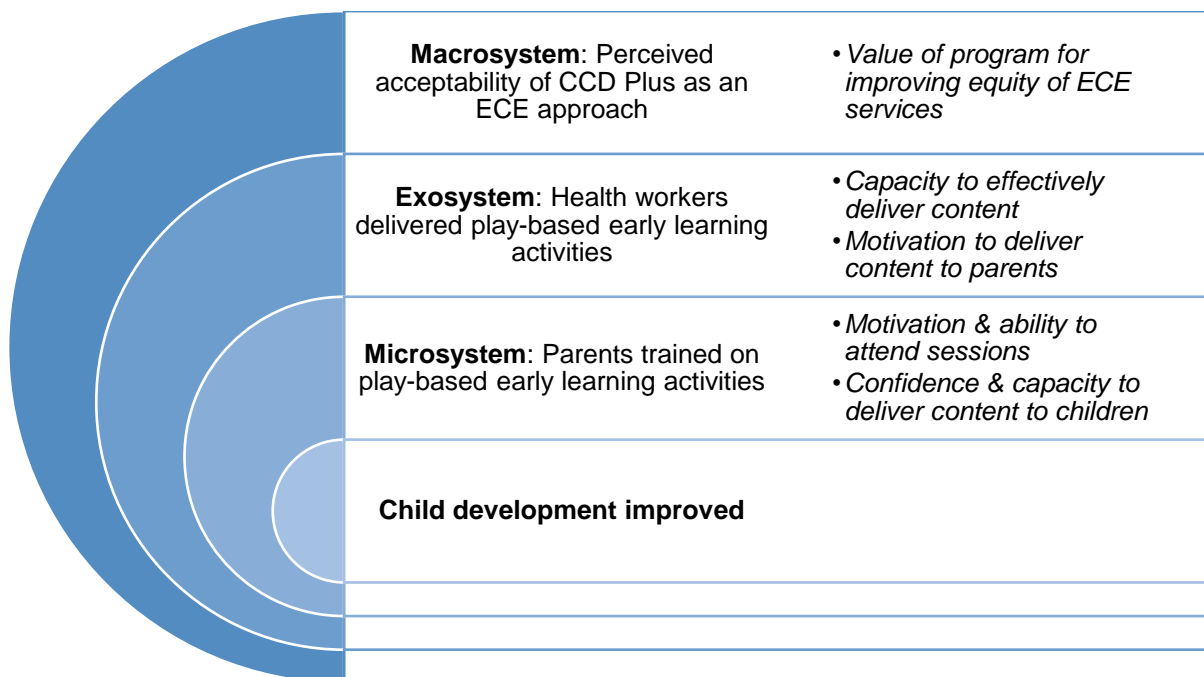
Bronfenbrenner was an American academic, but his theory works well across cultures. Ecological Systems Theory does not assign values or specific behaviors to children or the people surrounding them, rather it attempts to explain the relationships between actors and how they influence one another. Therefore, this theory applied in an international context allows for the conceptualization of child development that builds on developmental psychological theories of child development and also incorporates space for sociological theories of cultural and societal influences on child development (e.g., Piaget, Vygotsky). Bronfenbrenner's microsystem is the closest level of influence on the child and incorporates actors like parents, schools and peers. Beyond the microsystem, the exosystem incorporates local community influences on child development, the macrosystem includes attitudes of the broader culture, the chronosystem acknowledges the influence of a particular time period on child development, and the mesosystem represents the relationship between these spheres of influence.

The combination of the conditions in each of these spheres creates the environment within which a child develops. In some cases, the relationships are synergistic and help to create conditions conducive to optimal child development. In other cases, some of the spheres are stronger than others, resulting in inequities for young children. For example, if national policy does not support pro-family and pro-female policies like universal childcare and appropriate maternity leave (macrosystem), then the only people who can access these services are those who are employed by private organizations that support these policies or those who are wealthy enough to purchase them privately. These macrosystem deficits generally mean that children from poorer families who cannot access these services are at higher risk for receiving low

quality early developmental inputs. However, this macrosystem deficit can be counteracted by additional microsystem or exosystem supports. For example in many multi-generational families grandparents provide reliable, responsive childcare while a child's parents work (microsystem). Alternatively, programs like Head Start in the United States were created to provide high quality early childhood care and education services in high-need communities (exosystem).

In the context of Bhutan, national policies support optimal development for all young children in the country, but actions to realize these policies have not yet been put into practice. Therefore, children living in remote communities who typically cannot access center-based ECE services and whose parents typically spend their days farming or herding are at high risk of not receiving adequate early developmental supports. In this study, I investigated how the CCD Plus program could strengthen young Bhutanese children's microsystems and exosystems. Within the microsystems, I asked whether the program changed parents' interactions with their children, and whether these changes influenced children's cognitive development. At the exosystem level, I investigated whether health workers were perceived as acceptable actors to deliver ECE messages in rural communities. My questions about the potential scalability and national adoption of the CCD Plus program considered the possible changes to macrosystem conditions for the early education of young children in the country. Figure 2 displays my theory of change in the Ecological Systems Theory framework.

Figure 4. Theory of change using Ecological Systems Theory



Parenting programs are especially relevant within the framework of Ecological Systems Theory because the most influential actors within the microsystem for young children are their primary caregivers, and strong parental inputs can offset weaker support from other spheres. For example, in the case of this study, I am investigating whether stronger early learning inputs at home and from health workers could offset the lack of institutional support from teachers/schools in the microsystem and actionable policy in the macrosystem. In an effort to reach caregivers of young children, parenting programs can also strengthen other microsystem or exosystem conditions in children's lives. For example, programs delivered by health workers necessarily build capacity of the health workers and health systems in their communities. Programs operating at large scale may also influence the macrosystem policies and norms encompassing cognitive development for young children.

2.2 Long-term effects of ECD interventions

Extensive literature has documented the positive benefits of programs designed to improve the cognitive and psychosocial development of young children. Of note are

the Perry Preschool and Abecedarian studies conducted in the United States which demonstrated the positive long-term effects that high quality early childhood care and education programs can have on children's later educational achievement, economic opportunities, health, and other life outcomes (García et al., 2017; Schweinhart et al., 2005). Both the Perry Preschool and the Abecedarian programs incorporated both institutional and at-home interventions. Children were provided with high-quality full-time child care or education services (education in the case of Perry in which children were 3-5 years old; child care and then education for Abecedarian in which children were 0 – 5 years). Parents were also viewed as important to the success of the programs and were incorporated either through regular home visits (Perry), or group meetings (Abecedarian).

While the Perry Preschool and Abecedarian studies are often cited as evidence for the need to invest in high-quality ECD around the world, this evidence base has also been criticized as largely inapplicable in LMICs. These programs were very intensive and required human and material resources that are not widely available in LMICs. Rigorous longitudinal studies of ECD programs have been conducted in LMICs, but few have both used a randomized design and followed children into later stages of life in order to test the long-term impacts of ECD in lower resource settings. One of the most earliest and most well know studies is a randomized control trial conducted in Jamaica which followed participants from early childhood into adulthood and found that a home-based intervention for children aged 0 – 2 years was effective for improving cognitive development (Walker et al., 2005).

The intervention in Jamaica included weekly home visits from trained health workers over the course of two years, and focused on parents at the agents of change. The evaluation followed four cohorts of children from infancy to age 20. The study arms

included three groups of stunted children who received programs of either micronutrient supplementation, psychosocial stimulation or both nutrition and stimulation, and a group of non-stunted children. Short-term results found that the stunted children in the psychosocial stimulation arms achieved stronger cognitive development than children who received only nutritional inputs, to the point that there were no differences between the cognitive development between these children and their non-stunted peers (Walker et al., 2005). Long-term outcomes found that, on average, stunted children who received psychosocial stimulation earned 25 percent more income than stunted children who did not receive stimulation. In addition, these children achieved the same average level of earnings as the non-stunted comparison group, further confirming that the stimulation intervention enabled the stunted children to “catch up” with their non-stunted peers (Gertler et al., 2014).

Evidence from the Jamaica study helped spur increased investment in the first three years of life in LMICs through interventions that largely focus on parents as the primary agents of change. Within the first three years of life, parents are often recognized as a child’s first teacher, and numerous short-term evaluations have shown that more responsive caregiving and psychosocial stimulation are associated with improved cognitive outcomes for children in contexts around the world (Black et al., 2016; Grantham-McGregor et al., 2007; Walker et al., 2005, 2011; Yousafzai et al., 2014). However, there is a tension in the literature as children approach the age of three. After this point, there is very limited evidence about whether parents can serve as early teachers or the primary agents of change vis-à-vis their children’s cognitive development. Rather, the literature is focused almost entirely on the impacts of classroom or school-based programs for 3 – 5 year old children. This is especially

problematic for LMICs as the early educational institutions that are common in HIC are very limited in these contexts.

2.3 Global evidence for parent-focused ECD interventions

A meta-analysis of ECD parenting programs conducted in 2015 identified six evaluations that demonstrated significant impact on children's cognitive development (Britto et al., 2015; Jin et al., 2007; Yousafzai et al., 2014). However, only one program from Turkey focused on cognitive development for children over the age of three, and this program combined the parent-focused program with a summer preschool intervention (Bekman et al., 2004; Britto et al., 2015). Similar to the program in Turkey, a meta-analysis of ECE programs for 3-5 year olds in LMICs conducted in 2016 investigated parent-focused ECE programs that were an add-on to center-based services. These researchers found that providing parents with opportunities to practice new activities with their children during programming time was associated with greater impacts on children's pre-academic skills, but all interventions in question were using parenting education as a supplement to center-based services (Grindal et al., 2016). A recent study of ECE centers in Malawi also found that adding a group-based parenting program on top of the standard government supported ECE centers resulted in significantly higher cognitive and social-emotional development at 18- and 36-months post-intervention (Özler et al., 2016).

There is a small body of evidence to suggest that home-based early education programs can be as effective as center-based interventions in low resource contexts. A study of low-income families in Turkey investigated the short and long-term effectiveness of educational ECE classes, custodial ECE care, and home-based ECE care, and all treatments arms had two intervention conditions: one with a mother training program and one without. Analyses found no long-term effects of the ECE treatment

arms, but rather found that across ECE arms, training mothers in early literacy, numeracy and responsive caregiving had significant effects on primary school enrollment, cognitive skills and social-emotional development at the end of primary school (Kagitcibasi et al., 2001). Further, studies from Cambodia and Ethiopia have found ECE parenting groups to be equally as effective for improving children's literacy, numeracy and social-emotional development as locally available center-based ECE programs (Borisova et al., 2017a; Rao et al., 2012).

These studies suggest that quality is a key element when considering alternative ECE approaches in LMICs. There are two elements of quality which are relevant in this context: the first is the quality of the home-based program itself, and the second is the quality of the alternative options. The evaluation from Cambodia states that the home-based program was perceived to be lower quality than the two center-based options, and that the community-led centers were generally understood to be lower quality than the state-run programs. The home-based program was delivered by village mothers who receive a 2-day training, and the sessions generally focused on nutrition, well-being and developmental stages. The community-based preschools held classes for two-hours per day for approximated 24-36 weeks per year, and were led by a community member who receives 10-16 days of training from an NGO. Communities supported these preschools, including finding a location for the classes, paying teacher salaries, and providing learning materials. State-run programs were typically attached to primary schools and staffed by teachers who completed a two-year professional training course after completing Grade 12. These classrooms contained age-appropriate learning and play materials, and children attended three-hours per day for 38-weeks per year (Rao et al., 2012). Thus, the study from Cambodia found that a fairly basic home-based program

can be as effective as a relatively low quality center-based program, but less effective than the high quality state-run program.

The papers from Turkey and Ethiopia described the two home-based programs under study as being specifically focused on enhancing pre-literacy and pre-numeracy skills. In both programs, trained paraprofessionals from local communities worked with parents and demonstrated activities designed to develop different aspects of emergent literacy and numeracy. Both projects leveraged active learning techniques to teach parents, as well as regular monitoring and supervision of implementation (Borisova et al., 2017b; Kagitcibasi et al., 2001). These two studies demonstrate that high quality home-based ECE programs focused on enhancing children's academic skills can have significant short and long-term impacts on children's school readiness and primary school performance.

In summary, the results of these studies demonstrated that home-based ECE programs can produce comparable learning outcomes to those of locally available classroom-based ECE programs in LMICs. In the case of Ethiopia and Turkey, the home-based programs were effective because they were high quality and well implemented. In the case of Cambodia, the home-based program was more basic, but the alternative option for most families, community-based ECE, was relatively low quality. Authors of the Cambodia evaluation suggested that the home-base program was effective because it was perceived as highly acceptable by community members and fathers, grandparents and other adults in the community engaged in the activities and games with children thereby increasing the 'dose' of the intervention (Rao et al., 2012).

2.4 Quality in ECD parenting programs

There is wide variation in the format of ECD parenting programs compared to more institutionalized, classroom-based ECD programs (Kaminski et al., 2008). Parent-focused ECD programs are delivered in many different formats (e.g., home visits, clinical visits, group sessions, etc.) by multiple types of actors ranging from medical doctors to community volunteers. However, at the core of these programs, the focus is on encouraging long-term behavior change in the caregivers of young children.

Meta-analyses of parent-focused ECD interventions with various goals (e.g., responsive caregiving, children's physical and cognitive development, reducing problem behavior in children, etc.) conducted on studies from predominantly high-income countries (HICs) have identified common factors contributing to program effectiveness. These studies demonstrated that the implementer of the program is a critical component. Programs delivered by paid professionals rather than volunteers were more effective, and positive relationships between parents and workers promoted positive outcomes (Brookes et al., 2006; Korfmacher et al., 2007; Moran & Ghate, 2005). These studies also found that having active strategies to promote caregiver behavior change (e.g., feedback, coaching, role play, and videotaped interactions) and having components of coaching for parents produces stronger outcomes (Kaminski et al., 2008; Teepe et al., 2019).

A 2011 systematic review of programs in LMICs with rigorous evaluation data found similar results regarding components of successful parenting programs. The study by Engle et al. analyzed 15 studies focused on parenting support for children's development and learning, which were delivered through a variety of modalities: home visits, primary health care visits, group sessions with caregivers, primary health care and nutritional services, or a combination of these techniques. Seven programs focused

on working with parents only, and eight incorporated parents and children together. Within this group of parenting programs, 11 out of 15 were found to have substantial positive effects on child development, and programs that incorporated both parents and children were found to be more effective than those that worked with parents only (P. L. Engle et al., 2011). The most effective models were those with systematic training methods for the workers, a structured and evidence-based curriculum, and opportunities for parental practice with children that incorporated opportunities for feedback from a trainer. The studies reviewed did not demonstrate a significant relationship between the intensity of the program (i.e., number and frequency of touch points) and child outcomes, but did suggest that in some instances program effects were larger for younger children and those from poorer families (P. L. Engle et al., 2011).

2.5 ECD parenting programs at scale

It is also relevant to this study to consider the evidence about parenting programs that have been successfully taken to scale. While reviewing the studies referenced above, I identified four parenting programs with components that focused on improving children's cognitive development which have been implemented at scale. Two of these programs (from Kyrgyzstan, Tajikistan) implemented adaptations of the CCD program through national health systems and demonstrated significant impact on child development (Britto et al., 2015; P. Engle, Fernald, et al., 2011). Evaluations incorporated into program roll-out identified impact on children's cognitive development for beneficiaries under the age of three in both countries. The program in Tajikistan included 3-5 year old children, but did not find significant effects of the program on these children. A discussion of the results within this report suggests that the difference between outcomes for children under three and those older than three was due to the reduced number of health visits typical of the older age group. Children aged 0-2 had

more scheduled touch points with the health systems than 3-5 year olds and therefore caregivers had more opportunities to receive input from health providers in the earlier years (P. Engle, Najimudinova, et al., 2011).

In summary, the literature I reviewed suggests that evidence to support a non-center based ECE program with information about effectiveness and scalability would be a contribution to the field. There is a substantial literature base which indicates the effectiveness of home-based cognitive stimulation programs for children under three, and also evidence to indicate that engaging parents in children's early education can make these programs more effective. There is limited evidence about the effectiveness of fully non-center based ECE programs that rely on parents as the primary teachers of 3 – 5 year old children, but the evidence that I found suggests that these programs can be as effective as classroom-based services in LMICs. However, none of these studies investigated community members' perceived acceptability of the program, or the health system as the potential implementing body.

3. Methodology

In this chapter, I begin by reviewing the research approach and study design. Then, I describe the quantitative and qualitative tools used, data collection methods, and analyses conducted. I provide details about the data collection procedures for the quantitative data sets even though these activities were not undertaken specifically for my thesis study because I believe they are relevant to fully understanding the strengths and limitations of these data in my subsequent analyses. Further details about the tools used in this study are included in Appendix A.

3.1 Mixed Methods Approach

The methodology most commonly used in program evaluations conducted by the World Bank and associated international implementing organizations is quantitative impact evaluations, such as randomized control trials (RCTs). RCTs are often considered the most rigorous method for evaluating the impact of an intervention because, if executed properly, they provide an unbiased estimate of causal effects. However, they have also been criticized for lacking adequate contextualization and information about how or why a particular program did or did not produce its hypothesized effects (Deaton & Cartwright, 2018; Greene et al., 2010; Pritchett & Sandefur, 2013; White, 2009). While RCTs provide an unbiased estimate of treatment effect within a given context, the data are not without other biases that reduce the internal and external validity of the findings. Selection of a sample and the error associated introduces bias related to that particular context. That is, selection of a specific sample in Country A happens for a variety of reasons related to the program in question and the evaluators undertaking the research (among other influences), which introduces a structural bias and idiosyncratic error that are unique to that study. Thus, the probability of finding the exact same sample conditions in Country B

and the likelihood of truly replicating the study from Country A in Country B is extremely unlikely (Pritchett & Sandefur, 2013).

These criticisms do not contend that RCTs are irrelevant for building scientific knowledge, but rather suggest that best practice is to use RCTs alongside other methods which include conceptual and theoretical considerations (Deaton & Cartwright, 2018). This call for consideration of local context during evidence generation is also represented in global evaluation guidance such as the Development Assistance Criteria (DAC) for Evaluation Development Assistance (OECD, 1991, 2010). The DAC evaluation guidelines also call for consideration of sustainability as a central consideration of any evaluation.

One popular manifestation of this idea is a theory-based impact evaluation, which is a methodology that tests the underlying assumptions within the causal chain of an impact evaluation and incorporates data from multiple sources for more robust reliability of the findings (White, 2009). This is the methodology I chose to employ for my thesis. Specifically, I designed a qualitative study to complement the planned RCT, with the aim of better understanding whether the CCD Plus approach was perceived as an acceptable alternative to center-based ECE programs in the target communities.

For my evaluation, I used a complementary mixed-methods study design. A complementary mixed-methods design is one in which different methods of inquiry are used to investigate overlapping but distinct components of an issue, with the aim of producing a more nuanced understanding of the topic (Greene, 2007; Greene et al., 1989). A complementary design is distinct from a design that aims to achieve triangulation in important ways. Triangulation is used to build corroboration or consensus about a certain issue by using multiple methods of inquiry. In contrast, a complementary design is used to elaborate or clarify the results of one method of inquiry with another, which

could lead to convergent or divergent conclusions. The phenomena under investigation in a complementary design are typically overlapping or closely related but not identical (Greene, 2007; Greene et al., 1989). For example, with triangulation a researcher may aim to determine a student's level of skill in mathematics using school records as well as a direct assessment of mathematical ability, whereas a complementary study may compare data from a direct assessment of a student's mathematical ability with their self-reported confidence in their mathematical ability.

A complementary mixed-methods design was appropriate to achieve my goals for this study. In essence, I wanted to understand not only whether the impact of the CCD Plus program was significant within the study sample, but also whether it was meaningful in the context of ECE programming in Bhutan. In order to achieve a more contextualized understanding of the effectiveness of the program, it was critical that I adopt a design that incorporated multiple data sources and inquiry paradigms. Supplementing data from the CCD Plus RCT with information from other assessments as well as perceptions from the communities within which the program operated served to test underlying assumptions about how the program worked and to improve the overall relevance of this study.

3.1.1 Theory-based impact evaluation

In his description of a theory-based impact evaluation, White (2009) outlines six key principles of a successful theory-based impact evaluation: 1) aligning the evaluation with the program theory, 2) understanding local context, 3) anticipating heterogeneity of results, 4) incorporating a rigorous impact evaluation, 5) conducting rigorous factual analysis, and 6) using mixed methods. I addressed each of these components in my thesis study in the following ways:

1. In order to align this evaluation with the CCD Plus program theory, I first created a detailed theory of change. I have incorporated data from all relevant stakeholders: various levels of health workers who oversee and implement the program, parents receiving the services, and young children whose optimal development are ultimately the target of the intervention. The causal chain for the CCD Plus program flows from health workers to parents to children, and the assumptions underlying each link in this chain must be unpacked in order to fully understand program effectiveness. For example, in order for health workers to be effective in their delivery of program messages, they must have received adequate training, find the time to deliver program content to parents, and have the motivation to work effectively with parents and their young children. Further, in order for classroom lessons to translate into behavioral change with parents, they must make time to attend the parenting sessions, adequately understand the information they are receiving, feel confident using the new practices at home, and find the time to engage in more activities with their children. Key information interview questions address all of these topics.
2. Prior to designing the qualitative interview tools, I reviewed the CCD Plus implementation guides and had a series of meetings with the Bhutanese program implementers in order to gain an understanding of the local context and the types of heterogeneity that could be expected in the program results. For example, the program implementers expressed that there were important distinctions between the different cadres of health workers stationed in rural communities who could deliver the CCD Plus program. Specifically, Health Assistants (HAs) are paid Ministry of Health staff who operate out of Basic Health Units (BHUs) in rural communities, and they generally have upper secondary degrees or higher. In

contrast, village health workers (VHWs) are unpaid local community members who receive training from BHUs but are often illiterate or have completed only basic levels of education. One of the pressing questions for the roll-out of the CCD Plus program was whether to rely on HAs or VHWs for service delivery. HAs are more highly trained but have ancillary responsibilities and are often located at BHUs rather than in rural communities, whereas VHWs are available and present in local communities but have substantially less professional experience. Program implementers agreed that HAs and VHWs should share program implementation responsibilities and questions were incorporated into the qualitative assessment that asked about which group of health workers was perceived as more appropriate for larger scale service delivery.

3. Secondary analysis of data from a rigorous impact evaluation was incorporated into this study through a collaboration with ongoing work by the CCD Plus program implementers. Save the Children and the Ministry of Health in Bhutan collaborated on program design and implementation in 2017, and agreed to test the pilot program's effectiveness through a randomized control trial (RCT). All villages within the target districts (n=49) were randomly assigned to the treatment and control groups prior to the start of the program, and then a sample of 38 villages were selected at random for participation in the study. Twelve parent-child dyads from each village were interviewed at the pre-test and the post-test was designed to interview the same families. The evaluation was designed to measure children's literacy, numeracy, social-emotional and motor skills before and after receiving the intervention, as well as to test changes in caregivers' reported behaviors with their children.

4. With respect to factual analysis, a number of considerations are included in this study. The CCD Plus program is conceptualized as an ECE service that is suitable for families living in the most rural areas of Bhutan. Thus, an evaluation must take care to test the assumption that the neediest families are in fact, receiving and benefitting from services. This consideration is accounted for within both my quantitative and qualitative analyses.
5. Quantitative analyses tested for heterogeneous program impact related to the most prevalent dimensions of inequality in the target communities: maternal education and relative poverty of the family. Qualitative interviews elicited information from health workers and parents about issues related to inequality of access, uptake and impact.
6. Finally, related to using mixed methodologies, I designed all research questions to be answered through both quantitative and qualitative analysis. While the rigorous quantitative evaluation is an important component of a theory-based impact evaluation, it is inadequate to fully understand the theory of change for this program. I designed a qualitative study to complement the ongoing RCT and create a more holistic study of program effectiveness and potential viability of this approach as an alternative to formal ECE in the country. Details of the qualitative methodology will be presented later in this chapter.

3.2 Research approach

My first outcome of interest is whether the CCD Plus program is effective in improving parenting practices and children's learning and development after a nine-month intervention period. In addition to overall effectiveness, I also ask whether the program is equally effective for all children. This is especially relevant to the context in Bhutan given that the CCD Plus program is being tested in the hopes of improving the

equitability of ECE services for 3-5 year olds in rural communities. In order for the CCD Plus program to be considered a scalable option, it must be effective for even the neediest families and children. In order to meaningfully improve the equity of early education services, the CCD Plus program would need to help children living in rural communities achieve learning outcomes that are comparable to those achieved by children living in communities where they can access center-based ECE services.

I continue by asking whether the CCD Plus program is perceived as an acceptable approach to ECE in the local context. That is, in order for the program to be viable beyond the pilot stage, health workers must see the value in the initiative for the communities they serve, and feel that the activities do not detract from their other ongoing responsibilities. In addition, parents must see the value in spending their time attending the group meetings, and perceive adequate value of the activities for their children.

I use quantitative and qualitative methods in a complementarity design to address these topics, with each outcome explored using mixed-methods. Within this thesis study, I used three distinct data sources. Specifically, I conducted secondary data analysis of the data set that was collected by Save the Children and the Bhutanese Ministry of Health for the 2017 RCT of the CCD Plus pilot program (n= 304). To supplement this data, I conducted key informant interviews with stakeholders from the CCD Plus program in 2017, and this constitutes the qualitative data in my study. The qualitative data includes key informant interviews with 55 parents, health workers, and Ministry of Health representatives from each of the districts participating in the 2017 CCD Plus pilot program. Finally, I conducted secondary data analysis of data from the 2015 Bhutanese National ECD Study (n=1,337), which were collected by Save the Children and Bhutanese Ministry of Education.

The question of program impact is answered quantitatively with data from the 2017 RCT, which included both child and caregiver-level outcomes. I used multilevel multivariate regression analyses to determine the magnitude and significance of the effect of the CCD Plus program on children's learning and development and on caregiver behavior change. To answer the question of heterogeneity of impact, I interacted the treatment variable with equity variables collected through the caregiver questionnaire (i.e, family economic resources and maternal literacy). Finally, to understand the impact of the CCD Plus program in the context of other ECE programming in Bhutan, I compared the magnitude of the change in children's learning and development to the magnitude of change derived from existing center-based ECE programming in the country, using data from a national study of ECE programs conducted in 2015.

I examined synergistic or divergent views about the impact of the program from key stakeholders through thematic analysis of key informant interviews. I coded transcripts from interviews with district health officers, health assistants, community health volunteers and children's caregivers that focused on their views of the impact of the program on themselves and on children. To investigate potential heterogeneous program impacts through my qualitative analysis, I coded participants' responses for issues of program impact related to poverty and parental education. The question of whether CCD Plus was perceived as an acceptable alternative to center-based ECE was posed to all of these stakeholders as well. Interviewees were also asked for their perspectives about whether the program would be continued in their communities, and whether they felt it would be valuable in other communities in the country.

3.2.1 Generalizability

An important consideration with mixed-methods research is the generalizability of the results to other contexts. The combination of quantitative and qualitative data is designed to allow researchers to delve deeper into the effects of an intervention, and the mechanisms by which change is occurring in target locations. In this case, both the quantitative and qualitative data were collected from purposively selected districts of Bhutan that met the criteria of having low ECE center coverage. This suggests that these communities are different from other districts with greater ECE center coverage in substantial ways. In Bhutan, ECE centers are generally established by the Ministry of Education or civil society/INGOs so this could indicate that areas without these programs are harder to access for geographic or political reasons. Therefore, the results of this study may not be applicable to other areas of Bhutan where there is stronger government and civil society presence. However, with national ECE coverage at 22 percent in 2017 when this study was conducted, it can be assumed that more districts are similar to the communities in this study than are in a different. In addition, large disparities in ECE access exist within most LMICs so information from marginalized communities in Bhutan could be relevant to similar communities in other countries. However, additional research in such communities in other countries would need to be conducted in order to confirm or reject this hypothesis.

3.3 Quantitative Methodology

In this section, I present the measures, data collection procedures, sample details, and analysis approaches for my two quantitative data sets: the 2015 National ECD Study, and the CCD Plus impact evaluation. I provide additional details about the CCD Plus

impact evaluation sample because this information is not yet published, whereas the details of the 2015 National ECD study were published by Pisani et al. (2017).

3.3.1 Measures

The International Development and Early Learning Assessment (IDELA) was used to measure children's learning and development before and after implementation of the CCD Plus pilot program. The same tool was also used as the primary outcome measure in Bhutan's National ECD Study. IDELA is a direct child assessment developed by Save the Children to measure school readiness skills in children aged 3.5 – 6 years (Pisani et al., 2018). The core IDELA tool contains 22 items in four domains: motor development, emergent literacy, emergent numeracy, and social-emotional development. Additional, optional items in other domains can also be added. A study conducted by New York University using exploratory and confirmatory bi-factor analyses to assess the structure of the core tool found that the items were organized into the hypothesized domains and confirmed the construct validity of the tool in Ethiopia (Wolf et al., 2017). Subsequent construct validity tests have concluded that this structure holds in four additional LMIC contexts (Halpin et al., 2018).

Using a direct child assessment improves the objectivity of the findings in this study compared to use of a parent-reported measure (Wysocki, 2015). Multiple factors influence parents' ability to respond accurately to questions about their children's development, and disadvantaged parents (e.g., poorer, less educated) are at greater risk of misreporting information about their children's development (Feldman et al., 2000; Roberts et al., 1999). Children's skills or that of their peers also impact parents' perspectives; parents are more accurate reporters of children's language skills when they have either very poor or exceptional skills, and are less accurate when children have average abilities (Bennetts et al., 2016). In addition, parents may not have a

nuanced understanding of their children’s skills or may have different perspectives about which abilities are most salient depending on cultural or contextual factors.

To date, the IDELA tool has been used in over 70 countries by Save the Children and over 60 different partner organizations. IDELA was first used in Bhutan in 2015 for the National ECD Study. At this time, the tool was reviewed and adapted by ECD experts in Bhutan, including representatives from the Ministry of Education and UNICEF (Pisani et al., 2017). During the tool review process, IDELA items were compared against Bhutan’s Early Learning Development Standards (ELDS) and experts agreed that additional items should be added to capture children’s spiritual, moral and cultural development. Other items in the assessment remained consistent with the standard global tool. Figure 3 provides an overview of IDELA items. Please refer to Appendix A for the full tool.

Figure 5. IDELA items and domains

Motor Development	Emergent Literacy	Emergent Numeracy	Social-emotional Development
Hopping on one foot	Print awareness	Measurement and comparison	Peer relations
Copying a shape	Expressive vocabulary	Classification/Sorting	Emotional awareness
Drawing a human figure	Letter identification	Number identification	Empathy
Folding Paper	Emergent writing	Shape identification	Perspective taking
	Initial sound discrimination	One-to-one correspondence	Self-awareness
	Listening comprehension	Simple operations	Conflict resolution
		Simple problem solving	
Executive function: Short-term memory and inhibitory control			
Approaches to Learning: Persistence, motivation and engagement			
Health and Hygiene			
Moral, spiritual, cultural Development (adapted for use in Bhutan only)			

Bhutanese adaptations of the IDELA Home Environment Tool were used to measure changes in parenting practices in the 2015 National ECD Study and in the evaluation of the CCD Plus pilot program. This questionnaire aligns with the multi-sectoral nurturing care framework presented in the 2016 Lancet Series on early childhood development and includes questions related to health, nutrition, safety and security, responsive caregiving and early learning (Black et al., 2016). The questionnaire includes detailed questions about parent-child interactions including stimulation/play activities, discipline practices, child care/neglect behaviors and feeding/nutritional practices. Finally, the questionnaire also includes demographic information like levels of parental education, family size, and household wealth (figure 4). Please refer to Appendix B for the full tool.

Figure 6. IDELA Home Environment tool

Section	Description
1. General family information	Parental age, parental literacy, parental education, languages spoken at home, number of children at home
2. Health and hygiene	Sex of child, child age, height of child, weight of child, child weight at birth, child immunization record, recent child illness, hand washing habits, teeth brushing habits, child dietary diversity
3. Home learning environment	Types of reading materials at home, types of toys at home
4. Parenting practices and support for learning and development	Adults in the home engaging with children to promote learning and development
5. Child care and protection	Harsh discipline activities, children left alone or in the care of another young child
6. Socioeconomic status	Housing materials, access to potable water, access to hygienic toilet, objects/appliances owned, land/animals owned
7. Disability status	Known or suspected disability status of child

3.3.2 Data collection

3.3.2.1 NATIONAL STUDY

A baseline assessment of children's learning and development was undertaken at the beginning of the school year (March 2015), and a follow-up assessment with the same children was conducted at the end of the school year (November 2015). At baseline, 24 university graduates (21 females and three males) with previous data collection experience were hired for the baseline data collection. The graduates underwent six days of intensive training, which included field testing of the data collection tools, techniques in interviewing young children, procedures for random selection of classrooms and children, requesting assent and consent from children and adults, and Save the Children's Child Safeguarding Policy. The assessors undertook similar training prior to endline data collection. Fourteen of the same people were hired to collect endline data, in addition to four additional people with previous data collection experience. Assessors were trained by Save the Children staff who had been trained as IDELA master trainers. For additional details, refer to Pisani et al. (2017).

3.3.2.2 CCD PLUS EVALUATION

The quantitative pre-test was completed in March 2017 prior to the CCD Plus training, and the post-test assessment took place in October 2017. The quantitative data collections were scheduled around the beginning and end of the CCD Plus program cycle and also the school year in Bhutan. As this program could potentially serve as an alternative to center-based ECE, the Ministry of Education in Bhutan wanted to capture the learning gains achieved by children after approximately one school year (March – October in Bhutan). Also, the full CCD Plus program consists of 12 sessions that are intended to be delivered bi-weekly so assessment timeframe also matches the

intervention period. Finally, funding for the pilot phase of the program only extended until the end of the 2017 calendar year so all project and evaluation activities had to be completed during this time.

Assessors were trained by Save the Children staff who had experience using the IDELA tools. Twelve assessors were trained to administer the child and caregiver questions. The training lasted five days and included both in-office and field practice with the tools. In addition, assessors worked in language groups to standardize their use of local language terms throughout the assessments. For example, assessors agreed on the most appropriate and child-friendly term for the feeling of sadness with the Khengha language. This agreement was required because Khengha is a largely unwritten language so written translations were not possible.

Data collection lasted approximately two weeks. Assessors were divided into teams of four, each of which traveled to a different study district. Each team was accompanied and supervised by a Save the Children staff member. The data were recorded on tablets using KoBo Toolbox software¹ which prevented assessors from skipping questions or inputting implausible values. All data were uploaded to a central cloud account managed by the local data collection manager when the tablets were connected to the internet.

3.3.2.3 LIMITATIONS

A limitation of using a direct child assessment with young children in Bhutan was the difficulty with translation of the tool into all mother tongues. This was an issue in both the 2015 and 2017 data collections. Some languages spoken by children living in the remote villages included in this study are rare and do not have a consistent written form.

¹ <https://www.kobotoolbox.org/>

Therefore written translation of the tool into these languages was impossible, which increased the possibility of assessor error. In order to help mitigate this issue, assessors speaking all mother tongues represented by children in the sample were hired and oral translation of the tool into all necessary languages was practiced during the assessor training.

3.3.3 Analytic approach

I used multilevel modeling in all impact analyses. Multilevel modeling is an adaptation of multiple linear regression techniques, designed to improve model fit when the data in question are hierarchically structured. In social sciences, data structures are often viewed as hierarchical because information is gathered about individuals who are clustered within larger units, and the conditions or groups within which the individuals are operating are often under review (Goldstein, 2011; Raudenbush & Bryk, 2002). For example, in education, children are grouped within classes, which are grouped within schools, and social scientists are often investigating how the classroom or school conditions are influencing children's learning outcomes. These groups are also seen in health care services where patients are grouped within hospitals, or geographically where individuals live in particular regions that share governance and other resources.

Multilevel modeling is a technique best suited to data in which individuals are clustered or grouped because it accounts for the violation of the assumption of independence between individuals as well as the assumption of uncorrelated residuals which exist in simple linear regressions (Raudenbush & Bryk, 2002). The risk of failing to account for group effects is that standard errors are underestimated, and p-values are artificially reduced (Goldstein, 2011). Multilevel modeling produces a more nuanced estimate of explanatory relationships, especially when there are group-level variables with potential relevance in the model.

Multilevel modeling is appropriate for both quantitative datasets in this study by typical social science conventions. In the 2015 National ECD Study, the majority of children were grouped within classrooms, and individual level variables as well as classroom-level variables were collected. Children’s learning and development was directly correlated to their enrollment in a particular classroom, therefore violating the assumption of independence of individuals and uncorrelated residuals that exists in a linear regressions. Similarly, in the CCD Plus evaluation the program materials were delivered to parents through group sessions organized in their village. Therefore, any changes in their knowledge and behavior, and the potential resulting changes in their children’s learning and developed are inherently correlated.

To answer the question of quantitative impact of the CCD Plus program on children’s cognitive development, I controlled for baseline IDELA scores and used inverse probability weighting (IPW) to correct for differential attrition between the control and intervention group (Wooldridge, 2010). A discussion of study attrition and creation of IPWs is discussed in detail in the following section. To answer the question of the heterogeneity of program impact, I built on the original impact calculations by adding interactions between the treatment variable and equity variables (i.e., maternal literacy and family wealth assets). I ran separate models for each equity dimension. The two equations used for multilevel analyses of intervention impact are as follows:

Equation 1. CCD Plus evaluation: Overall program impact

$$y_{ij} = \beta_0_j + \beta_1 t_{ij} + \beta_2 x_{ij} + \beta_3 x_{ij} + r_{ij}$$

Equation 2. CCD Plus evaluation: Heterogeneous program impact

$$y_{ij} = \beta_0_j + \beta_1 t_{ij} + \beta_2 x_{ij} + \beta_3 x_{ij} + \beta_4 x_{ij} + \beta_1 t_{ij} * \beta_4 x_{ij} + r_{ij}$$

where

- y_{ij} = IDELA post-test scores for individual i in cluster j
- β_0_j = Level 1 constant term
- $\beta_1 t_{ij}$ = Assignment to treatment for individual i in cluster j
- $\beta_2 x_{ij}$ = Child age in months for individual i in cluster j
- $\beta_3 x_{ij}$ = IDELA pre-test scores for individual i in cluster j
- $\beta_4 x_{ij}$ = Represents a variable for equity, either maternal literacy (1=literate 0=illiterate), or a standardized index of relative family wealth
- r_{ij} = Level 1 random effect

To answer the question of whether the CCD Plus program produced comparable learning gains to that of center-based ECE programs in Bhutan, I compared the magnitude of the impact found for the CCD Plus evaluation with the estimates of learning growth from the 2015 National ECD study. This study sampled all ECE services providers in the country, including the Ministry of Education, INGOs, CSOs, corporate actors and private groups. In addition, the study incorporated a sample of children with no access to ECE services. This allowed me to calculate the average effectiveness of a typical ECE class in the country. Specifically, I estimated the average learning gains for children enrolled in any kind of ECE program (i.e., the combined average of all classroom-based ECE services captured in the study) to those of children with no access to ECE. I then compared this effect size estimate to the results of the CCD Plus evaluation. In this way, I was able to compare the learning and development gains associated with one year of center-based ECE programming in Bhutan to that of one year of ECE programming through the CCD Plus program.

The model specifications for the National Study analyses were very similar to those used for the CCD Plus evaluation data. The covariates in both analyses were child age, baseline IDELA scores, and assignment to treatment (CCD Plus in one case,

and any ECE center in the other). The CCD Plus analyses were clustered at the community level, and the national study was clustered at the center level, although in almost all cases there was only one ECE center in the community. The most substantial difference between the models in the two datasets was that I weighted the CCD Plus estimates to account for attrition, and did not make any attrition adjustments in the national study estimates. I did not make attrition adjustments for the National Study sample because attrition was relatively low and even across study groups (Pisani et al., 2017).

CRITIQUES OF MULTILEVEL MODELING

While multilevel modeling is a common technique in psychology and education research, it is not frequently used in other disciplines like economics (Antonakis et al., 2019; McNeish et al., 2017). There is general consensus that the variance shared between individuals within 'clusters' should be modeled when estimating program effects, but there is debate about how best to derive these estimates. Economists generally argue that multilevel modeling is not the most parsimonious method, and that other techniques such as using cluster-robust standard errors are preferable (McNeish et al., 2017). This argument centers around the idea that the modeling of random effects used in multilevel equations introduces a new assumption that could also introduce endogeneity between predictor and outcome variables (Antonakis et al., 2019). Specifically, in a multilevel model with two levels, Level 1 represents the individual-level equation where the dependent variable depends linearly on the predictor variables, and Level 2 represents the characteristics, including slopes and intercepts, of the clusters within which individuals are grouped (Raudenbush & Bryk, 2002). The Level 1 equation contains an error term that is unobserved and assumed to be uncorrelated with the predictor and outcome variables. Similarly, the Level 2 equation contains an unobserved

term that represents the variance between slopes and intercepts of the clusters. Introducing a second unobserved term at Level 2 introduces the new assumption that the unobserved terms at Level 1 and 2 are independent of one another. Economists argue that this additional assumption (known as the random effects assumption) is inefficient, and increases the likelihood of misspecification of the model (Antonakis et al., 2019; McNeish et al., 2017).

Multilevel models operate with many of the same assumptions as other types of linear models, but the introduction of random effects in these models add distinct assumptions and considerations. If assumptions related to the random effects are violated, standard errors and point estimates can be biased. Research on the use of multilevel models found that studies with small samples (fewer than 120), and those with discrete outcome variable were the most sensitive to misspecification of random effects or their covariance structure, whereas those with large samples and continuous outcomes were robust to these issues (McNeish et al., 2017). The outcomes of my models are continuous and the study sample is not small so the results of my analyses are likely robust to any issues related to random effect specification.

As a robustness check, I ran the same impact analyses using multivariate regression with cluster robust standard errors, and the results remained largely the same (see Appendix D). The point estimates and standard errors vary slightly, but these analyses also demonstrate that the C4CD Plus program had significant impact on children's literacy, numeracy and overall school readiness skills. One difference between the two sets of analyses is that there is not a significant difference between treatment and control groups in social-emotional development in the cluster robust model, although the magnitude and the of the relationship is very similar ($\beta= 0.30$ in the cluster robust model and $\beta=0.34$ in the multilevel model).

3.3.4 Quantitative samples

3.3.4.1 NATIONAL STUDY

The sample included 1,189 children and parents from 120 sites across nine districts in Bhutan (table 1). Three districts from each region were chosen based on the prevalence and diversity of ECE programming in each district, and then centers and children were randomly sampled. To understand the impact of various types of ECE program models across the country a sample of each of the different types of ECE centers was chosen (i.e., local Community Service Organizations (CSO), INGOs, Private entities, and Corporate groups). In addition, a sample of parent-focused ECE programs delivered by non-formal education centers (NFE parenting) and a comparison group of children who had no access to any ECE programming were included. Only new enrollees at the selected ECE centres were selected for the assessment. If a selected ECE classroom had more than 15 new enrollees, a random selection of 15 children was chosen for the study (Pisani et al., 2017).

The same children were targeted for the endline data collection. Attrition analyses found that 14 percent of children from the baseline study were missing at the time of the final data collection. This proportion of missing children fell within the assumed attrition range and therefore did not compromise the original power calculations for the study. There were no significant differences between children present at the endline study and those who were missing along measurable background or learning characteristics (Pisani et al., 2017).

Table 1. 2015 National ECD Study sample

District	CSO	INGO	Private	Corporate	NFE Parenting	No ECD	Total
Total sites	14	37	20	8	20	20	119
Total children	125	393	206	87	169	209	1,189

3.3.4.2 CCD PLUS EVALUATION

The quantitative evaluation of the CCD Plus pilot program was a cluster randomized control trial (RCT). Using information from the Ministries of Education and Health, four Dzongkhags (districts) were purposefully selected for the study sample based on their low ECE coverage rates, existence of community health workers, and representation across national geographic regions. Program assignment was randomly allocated at the gewog level (health worker service area blocks), and all families with children aged 3-5 living in the selected gewogs were eligible for inclusion in the program. For budgetary reasons, not all villages could be included in the study so a sample of villages were randomly selected for inclusion into the study. All families with 3 – 5 year old children within villages selected for the study were invited to participate. If a family had more than one child in the target age range, the older child was sampled for the study.

Power calculations under a cluster randomization design require consideration of how individuals are grouped and how similar individuals within clusters are to one another. The degree of similarity between individuals in a cluster is commonly measured using the intraclass correlation coefficient (ICC). The ICC represents the loss of variance obtained from individuals in sample due to their commonality with other individuals in a cluster, and thus has an inverse relationship with overall sample size; higher ICC, or similarity between

individuals, increases the sample needed to achieve target levels of power for a given effect size.

Information from the 2015 national ECD study, which also used the International Development and Early Learning Assessment (IDELA) tool to measure child development, was used during sample size calculations. Power calculations used a 95 percent confidence level and 80 percent power, which are considered standard levels in the field of education research. The 2015 national ECD study found a baseline-endline correlation of $r = 0.53$ for children's learning and development skills as measured by the total IDELA score. The total IDELA score is a composite measure derived from the sum of the motor, social-emotional, literacy and numeracy subdomains. Data from the national ECD study displayed a $\rho = 0.25$ ICC for children's learning and development within ECE classrooms, but lower intracluster correlations of children's learning have been observed for children within the same villages in studies of non-center based ECE programs in other countries using the IDELA tool ($\rho = 0.05 - 0.10$). Therefore, an intra-cluster correlation coefficient of $\rho = 0.07$ was used in sample size calculations to account for clustering of families within villages. Village size within the chosen districts varied between communities, but the average size was 12 eligible families per village, and so a cluster size of 12 was used in the calculations.

Finally, the threshold of $r = 0.35$ minimum detectable effect (MDE) was used in the sample size calculation. This threshold was chosen for a number of reasons. The child development measure being used has been found to be highly sensitive to both center and non-center based ECE programming, and given the potential scale of the program following the pilot program, we wanted statistical significance of the results to also identify a meaningful effect on children's development (Dowd, Borisova, Amente & Yenew, 2016; Borisova, Pisani, Dowd, Lin & 2017). Data from the previous national ECD study in Bhutan

found that the IDELA effect size related one year of enrollment in any type of ECD center (varying quality within this group) was $r = 0.60$ standard deviations so a $r = 0.35$ MDE would represent over half a school year of learning through this alternative approach. Given these assumptions, sample size calculations recommended including 15 clusters and 180 caregiver-child dyads per arm (30 clusters and 360 children dyads total).

Ultimately 35 of the 49 total villages in the four districts were randomly selected for the study: 16 control and 19 intervention. Three control villages had to be excluded from the study due to a lack of available health workers in those villages, which was not known at the time of sampling. In addition, due to the limited population in many rural villages of Bhutan, some selected villages contained less than 12 eligible families. Therefore at baseline, the RCT study sample included 304 caregiver-child dyads: 122 control and 182 intervention. While the recommended minimum number of clusters was achieved, the suggested sample size for children was not reached in control communities. Therefore the ability of the analysis to find impact of the program was reduced.

SAMPLE CHARACTERISTICS

My analysis of balance between study groups at baseline no statistical differences between the two groups on almost all variables for both children and caregivers. The differences identified for caregivers were that those in the control reported more instances of yelling, hitting and overall negative discipline behaviors than caregivers in the intervention group ($p < 0.01$ overall). The only significant difference identified for children was that those in the control group displayed stronger social-emotional development than their peers in the intervention group ($p < 0.05$). There were no significant differences found for other measured child (i.e., age, gender, weight,

immunization records, language spoken, child development outcomes) or caregiver/household characteristics (i.e., parental age, parental literacy, family wealth, family health practices, food diversity, home learning materials, home learning and discipline activities).

Baseline data displayed that on average, mothers were 31 years old, and fathers were 34 (table 2). Approximately half of mothers were reported to be literate, along with 64 percent of fathers. It was most common for both mothers and fathers to have completed less than primary education. Twenty-nine percent of families spoke Dzongkha, the national language, and the majority of parents spoke other local languages. One caregiver responded to a home environment survey for each child, and primary caregivers were targeted for questioning.

Caregivers were asked details about their homes and possessions in order to create a measure of relative wealth in the target communities. I created two composite wealth variables in order to test their utility in the impact analyses presented later. One wealth variable is a simple sum of domestic possessions caregivers report owning (excludes land and livestock). On average, caregivers report owning 3.2 out of 9 common possessions. The other composite wealth index was created through a factor analysis of all wealth variables. Several variables were excluded from the factor analysis because they display variation less than 90/10 in the sample population: electricity, power tiller, microwave, computer, washing machine, and land. The factor analysis used a varimax rotation in order to produce orthogonal vectors, and found three wealth factors with loadings greater than 1, and one with loadings greater than 2. A scree plot displays leveling off after the first factor, and only the first factor contains more than two variables with loadings greater than 0.45. Therefore, the first factor was used to predict the family wealth index that is included in the table below (table 6). There are no

significant differences between the control and intervention groups in terms of ownership of any individual assets or in the composite wealth variables.

Caregivers were also asked about health conditions and practices in their homes. Although not a core outcome of the CCD Plus project, pro-health messages were delivered during four parenting sessions, and household health conditions substantially influence children's development so they are relevant covariates in this study. Caregivers report washing their hands 2.8 times per day, most commonly before eating. Caregivers reported that children received 2.6 types of food in a day, most commonly eggs, fats (oils/fats/butter) and fish. This suggests that many children are not receiving the recommend daily diversity of foods, typically four or more, but the nutrition they are receiving is largely protein and fat (WHO, 2008). There were no significant differences between the health and hygiene practice of families in the intervention and control groups.

Table 2. CCD Plus RCT Baseline: Caregiver demographic characteristics

Variable	Control (N=122)		Intervention (N=182)		Significant difference (p-value)
	Mean	Std. Dev.	Mean	Std. Dev.	
Mother age	31.09	7.050	30.59	6.138	0.6383
Mother is literate	53.3%	0.501	48.4%	0.501	0.4544
Father age	33.50	6.568	35.10	8.413	0.1240
Father is literate	68.3%	0.467	61.0%	0.489	0.2421
Parents are married	81.1%	0.393	88.5%	0.320	0.2228
Number of children in home	2.58	1.476	2.88	1.502	0.2267
Languages spoken in the home					
Dzongkha	36.1%	0.482	24.7%	0.433	0.3549
English	0.8%	0.091	0.5%	0.074	0.7971
Khengkha	27.0%	0.446	36.3%	0.482	0.6225
Kurtoepkha	13.9%	0.348	29.7%	0.458	0.2914
Lhotshamkha	27.0%	0.446	23.1%	0.422	0.8038
Sharchopkha	7.4%	0.262	20.9%	0.408	0.1761
Other	10.7%	0.310	6.0%	0.239	0.5475
Number of appliances in the home	3.25	1.888	3.10	1.770	0.7476
Family wealth index (standardized)	0.03	1.057	-0.05	0.954	0.7406
Number of handwashing activities per day (0-8)	2.72	1.031	2.80	1.134	0.7239
Number of types of food given to child per day (0-13)	2.86	0.990	2.38	1.064	0.0715

Note: Standard errors clustered at the village level

Other relevant covariates for this study relate to children’s home learning environments. This construct can be conceptualized as being composed of both materials available for children and practices that encourage development and learning (Dowd et al., 2017; Hess & Hallaway, 1984). On average, caregivers reported having 2.2 types of reading materials in their home, most commonly religious books (table 3). Twenty-six percent of parents reported having storybooks appropriate for children. Caregivers report having approximately four types of toys in the home for children to play with, most commonly objects found outside the home or store-bought toys. There were no significant differences between the types of reading materials and toys owned by families in the intervention and control groups.

Caregivers report engaging in 3.8 out of 9 learning or play activities with their children in the past week, most commonly taking the child outside. Practices like reading to children or telling them stories were uncommon (16 percent and 25 percent reporting these practices in the past week, respectively). On average, 78 percent of caregivers reported spanking their child in the past week, 50 percent reported yelling at their child and 20 percent reported hitting their child. These data demonstrated that disciplining a child through spanking is a more common practice than any learning or play activity. There were no significant differences between the home learning activities of families in the intervention and control groups. However, caregivers in control communities reported engaging in significantly more harsh disciplinary behaviors with their children than caregivers in intervention communities.

Table 3. CCD Plus RCT Baseline: Home learning environments characteristics

	Control (N=122)		Intervention (N=182)		Significant difference (p-value)
	Mean	Std. Dev.	Mean	Std. Dev.	
No. reading material types (0-7)	1.83	1.742	2.33	1.635	0.0750
No. toy types (0-9)	4.05	1.505	4.04	1.349	0.9992
Total home learning activities in the past week (0-9)	4.21	2.484	3.61	2.492	0.3480
Reading	16.5%	0.373	15.6%	0.364	0.6461
Storytelling	28.4%	0.453	27.4%	0.448	0.9517
Singing	57.8%	0.496	50.4%	0.502	0.2311
Taking outside	77.1%	0.422	69.6%	0.462	0.3577
Playing	54.1%	0.501	54.8%	0.500	0.6515
Drawing	28.4%	0.453	22.2%	0.417	0.4140
Teaching new things	58.7%	0.495	41.5%	0.495	0.0865
Teaching letters	52.3%	0.502	36.3%	0.483	0.1444
Teaching numbers	47.7%	0.502	43.0%	0.497	0.5203
Total negative discipline in the past week (0-3)	1.90	0.816	1.30	0.883	0.0065
Hitting	25.7%	0.439	20.0%	0.401	0.3511
Yelling	73.4%	0.444	37.0%	0.485	0.0133
Spanking	90.8%	0.290	73.3%	0.444	0.0034

Note: Standard errors clustered at the village level

At baseline, children’s ages ranged from 31 – 71 months with an average age of 50 months (approximately four years), and 51 percent of the sample are girls (table 4). On average, 98 percent of caregivers brought health cards to the interview, 17.6 percent were low weight at birth (<2.5kg), and 87 percent of children had complete immunization records. Children in the sample spoke a variety of languages, most commonly Khengkha. At baseline, children in the intervention and control groups displayed equivalent early learning and development skills in all domains except social-emotional development.

Table 4. CCD Plus RCT Baseline: Child characteristics and IDELA scores

	Control (N=122)		Intervention (N=182)		Significant difference (p-value)
	Mean	Std. Dev.	Mean	Std. Dev.	
Average child age (months)	50.45	8.425	49.76	9.488	0.6249
Child is female	50.0%	0.502	52.2%	0.501	0.7588
Child weight (kg)	14.00	4.380	13.01	2.922	0.1283
Low birth weight (<2.5 kgs)	18.9%	0.393	14.8%	0.356	0.3719
Health card seen at interview	99.2%	0.091	96.2%	0.193	0.2705
Immunizations complete	92.6%	0.263	83.4%	0.373	0.3120
Language child is most comfortable speaking:					
Dzongkha	26.2%	0.442	4.9%	0.217	0.0553
Khengkha	24.6%	0.432	34.1%	0.475	0.5993
Kurtoepkha	13.1%	0.339	25.3%	0.436	0.3922
Lhotshamkha	24.6%	0.432	19.2%	0.395	0.7296
Shar chopkha	4.9%	0.217	14.8%	0.356	0.1827
Other	6.6%	0.249	1.6%	0.128	0.3176
Child development outcomes (standardized)					
Motor	0.12	1.147	-0.07	0.906	0.1749
Literacy	0.20	1.016	-0.10	0.987	0.1733
Numeracy	0.15	0.986	-0.08	1.012	0.1062
Social-emotional	0.25	1.125	-0.15	0.888	0.0158
Cultural	0.13	0.973	-0.09	1.007	0.2236
Total IDELA	0.21	1.038	-0.12	0.963	0.0592

Note: Standard errors clustered at the village level

Children’s learning and development and caregivers parenting practices were measured longitudinally, with the same families interviewed at the pre- and post-test for both the intervention and control groups. The same versions of both the IDELA and IDELA Home Environment Tools were used at both points in time. Attrition rates between the pre- and post-test are discussed in the next section.

ATTRITION

Data for the quantitative post-test were collected in November 2017 and display an overall attrition rate of 19.7 percent. To analyze factors related to attrition, I ran logit regressions with all variables from the baseline caregiver and child surveys. Results of these analyses found that none of the child development domains significantly predict

attrition, but five of the caregiver variables were found to significantly predict attrition. Specifically, caregivers who reported hitting their child in the past week and those with higher total harsh discipline practices were less likely to be missing at the post-test; more homemade toys in the home, hand washing after disposing of garbage, and being a member of the intervention group were positively associated with attrition. With the number of tests run using caregiver variables ($n=108$), probability suggests that 5 percent or 5.4 tests would display a significant relationship just by chance, which is what is observed in these data. However, the differential attrition between the intervention and control group warranted additional investigation.

To further investigate the differential attrition between the control and intervention groups I examined differences between the two groups in relation to attrition. Again using logit regressions, I predicted attrition with caregiver and child variables, controlling for study group assignment, and then tested the interaction between group assignment and background variables where significant relationships were found. Three variables were found to significantly predict attrition alongside study group assignment (i.e., caregivers who reported hitting their child in the past week, hand washing after disposing of garbage, and feeding children fruit and vegetables yesterday) but none displayed a significant interaction with study group assignment. Thus, there were no measured characteristics that differed significantly between the control and intervention groups with relation to post-test attrition.

I used inverse probability weighting (IPW) to account for the missing data in my subsequent analyses of program effects. Inverse probability weighting is a well-known method to account for missing data, but use of this method is predicated on the condition that good predictors of selection are present, and that selection is exogenous, conditional on observed predictors (Wooldridge, 2010). These conditions are satisfied

by the robust caregiver and child outcomes measured at baseline in this study (150 variables in total), and the lack of disparity in predictors of attrition between the control and intervention groups.

As a robustness check, I also used multiple imputation to account for the missing cases. Multiple imputation is a method by which a number of imputed data sets are created and data estimates and standard errors from each imputed data set are combined with estimates of uncertainty derived from variability in the estimates across the data sets (Little & Rubin, 2014). Results of the impact analyses were consistent across the two methods of analysis (see Appendix E). In addition, results of my impact analyses yielded the same conclusions when neither weighting nor multiple imputation were used (Appendix E).

To create IPWs, I first used a logit regression to predict the probability of being present at the post-test controlling for the five variables identified as significantly predicting attrition as well as the additional variable identified as significantly predicting attrition alongside study group, and study group assignment (see table 5). Using this model, study group assignment no longer significantly predicted attrition. Using the predicted probability from this regression (p_i), I then created weights such that:

Equation 3. CCD Plus RCT: Attrition weighting

$$\Pr(\text{present at post-test}) = (1/p_i) \text{ and } \Pr(\text{missing at post-test}) = 1/(1 - p_i).$$

I used this weight to account for potential attrition bias in analyses of program impact presented in the next chapter.

Table 5. CCD Plus RCT: Predicted presence at post-test

VARIABLES	(1) Present at post-test
Intervention group	-0.842 (0.449)
Number of harsh discipline behaviors in past week	0.503 (0.342)
Caregiver hit child in past week	0.283 (0.593)
No. homemade toys in home	-0.556 (0.386)
Caregiver washes hands after disposing of garbage	-1.071** (0.409)
Child ate fruits/vegetables yesterday	-0.884 (0.509)
Constant	1.812** (0.624)
Observations	303

Note: Clustered robust standard errors in parentheses

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

3.3.5 Limitations

One of the primary limitations of the quantitative portion of this study is that the sample may be underpowered to detect the desired minimum effect. This increases the risk of type II error and suggests that potential effects of the program may be undetected by impact analyses. This risk is increased due to the attrition that occurred between the pre- and post-test. As noted above, steps were taken to account for potential attrition biases, but it is not possible to recover the loss in sample size.

In addition, the loss of three villages from the CCD Plus sampling frame could have compromised the representativeness of the sample. Thirty-five villages were originally sampled, but three villages were dropped from the control group before data collection began. These villages were excluded because they did not have Health Assistants assigned at the time when the programming was beginning. The lack of an

available Health Assistant suggests that these communities could be more remote or disadvantaged than other villages. Consequently, the control group sample could be more advantaged than the population it is meant to represent.

3.4 Qualitative methodology

In this section, I present the tools, data collection procedures, sample details, and analysis approaches for my qualitative data set. The qualitative data were collected specifically for my thesis, and the tools I created had not been used in Bhutan or in any other context prior to my thesis study. The primary goal of the qualitative component of this study was to expand on the quantitative results and explore the commonalities or tensions between the quantitative findings and the lived experiences of the caregivers and health workers most involved in the C4CD Plus program.

3.4.1 Measures

The qualitative tools were developed with the goal of understanding why the CCD Plus approach was or was not successful in rural communities in Bhutan, as well as whether this approach could potentially be delivered by the national health system on a larger scale. I developed three different semi-structured interview guides to elicit information from different cadres of stakeholders. Semi-structured interviews were well suited to my research goals as they ensure a standardized set of topics are covered with multiple interviewers and interviewees, but also allow flexibility for probing that elicits unique insights to emerge from individual interviews (Adams, 2015). Each guide included questions and prompts that were specific to a cadre of respondent and each interview lasted approximately 30-45 minutes.

Although the specific prompts varied between the different interview guides, the topics explored in each guide are very similar, in order to allow for the consistent

coverage of themes across stakeholders. All guides asked about the perceived importance of the messages shared during CCD Plus sessions, lessons learned or perceived behavioral changes associated with the sessions, challenges faced with the CCD Plus sessions, desire to continue the program in target areas, and perceived relevance in other areas of the country. Caregivers were asked about topics including what they remembered of the sessions, ability to attend sessions regularly, acceptability of the games/activities introduced, use of the techniques discussed with their children, and changes in their children. Community health volunteers were asked about their experience teaching caregivers about early stimulation, balancing this work with other responsibilities, and the potential contribution of the program to the education of children in target communities. Similarly DHOs and Health Assistants were asked about their perception of the program, and alignment of the CCD Plus program with other ongoing initiatives within the Ministry of Health. Please refer to Appendix C for the full tools.

3.4.2 Data collection

I trained the site PI on the interview guides through three training sessions conducted via Skype, and he then trained six qualified local staff using similar methodology (approximately two days of training). The other interviewers had previous experience working on data collection projects with Save the Children or other similar organizations in Bhutan. Importantly, they also spoke the local languages used by caregivers and health workers in the target villages. I remained in close communication with the site PI via email and Skype throughout the interviewer training and data collection process in order to monitor progress and manage challenges and barriers. The interview guide was refined throughout the data collection in an iterative process that allowed interviewers to better capture themes across interviews.

Interviews with health workers and caregivers took place in October 2017, and were administered in partnership with Save the Children and the Ministry of Health in Bhutan. To reduce time and financial burden of the data collection, and minimize travel complications for the participating families, the qualitative data collection was undertaken concurrently with the quantitative data collection (CCD Plus evaluation post-test). With the long travel distances between remote villages of Bhutan, it was not possible to return to individual communities numerous times. This improved the efficiency of the data collection, but also added burden to the data collection days. Different assessors were used for the qualitative and quantitative data collections to reduce burden on the assessors and promote fidelity of data collection. However, data collection monitors reported that undertaking the qualitative interviews concurrently the quantitative data collection caused some confusion and caregivers showed signs of fatigue when answering interview questions. Interviews with Health Assistants and DHOs occurred on the days leading up to or after the caregiver and community health volunteer interviews.

Data were collected using paper and pencil transcription, and assessors were instructed to record participants' responses word for word. Assessors were purposefully assigned to different regions to ensure assessors spoke the local language of the area. This allowed assessors to interview respondents in whatever language the respondent was most comfortable speaking. The most common language spoken in Haa is Dzongkha (national language), but communities in other districts more commonly speak local languages like Khengkha (Zhemgang), Lhotshamkha (Tsirang), and Kurtoep (Lhuentse).

3.4.3 Analytic approach

In order to elicit information about the CCD Plus sessions from multiple points of view, multiple groups of stakeholders were interviewed. Ministry of Health staff

overseeing the program (DHOs), health workers delivering the parenting sessions (HAs and VHWs), and caregivers from each district were invited to participate in the interviews. Incorporating data from multiple stakeholders increases validity by facilitating the generation of a wide variety of themes. Demonstrating that the same themes appear across sources also improves reliability and decrease the potential for researcher bias (Denzin & Denzin, 1978; Renz et al., 2018). In addition to improving reliability and validity of this investigation, it is important to include perspectives from all three groups in order to capture a holistic picture of the potential scalability of the CCD Plus program. Caregivers of young children are critical to the success of a parenting program, and support from local and Ministry-level health workers is also necessary for continued investment and prioritization of such a program.

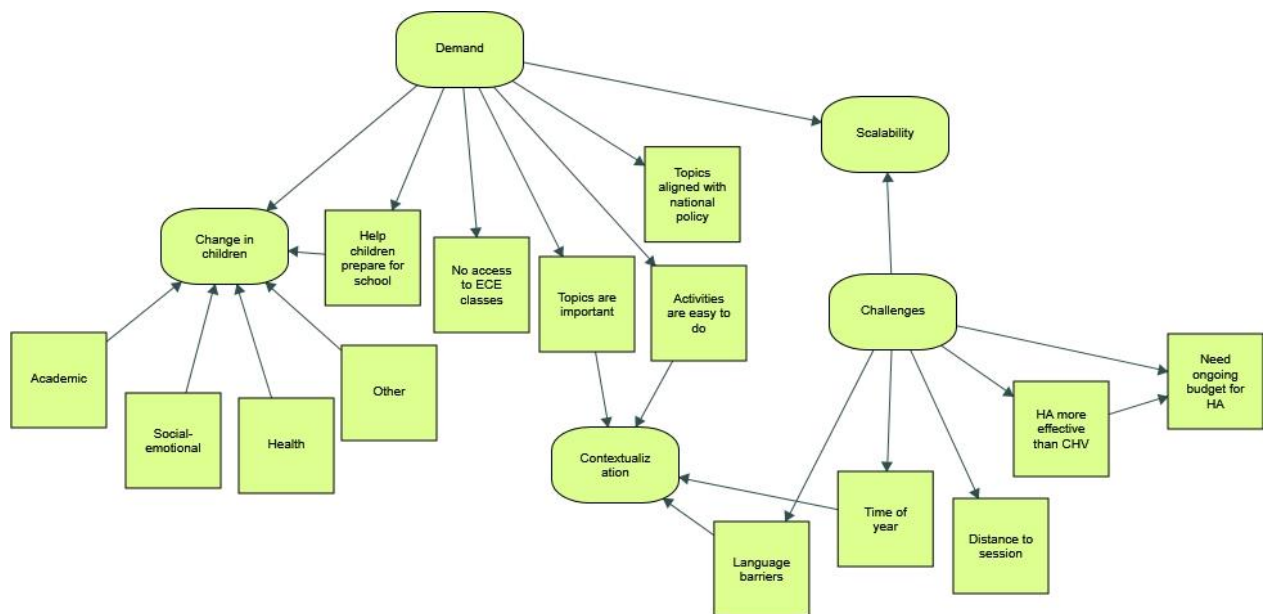
Analysis of the qualitative data was conducted using thematic coding. I used an inductive method, which allowed for the emergence of themes without preconceived hypotheses. This was an appropriate approach for these data for a number of reasons. This was the first time health workers in Bhutan had been trained to implement early education related content so there was no prior research or information with which to draw hypotheses about their possible views on this exercise. In addition, my semi-structured interview guides used the same root questions for to all respondents in a specific cadre but probing allowed for new themes and information to become incorporated into the data. Therefore, an analysis technique that allowed for themes to emerge organically from the data served to open the analysis to the new points of view from additional stakeholders.

Although I used an inductive analysis technique to allow themes to emerge from the data itself, it must be acknowledged that a researcher cannot totally free themselves from preconceived ideas or expectations of the data (Braun & Clarke, 2006). The

themes I identified were undoubtedly influenced by my previous interactions with the CCD Plus program as a staff member of Save the Children, and by my experience as a researcher in the global ECD field. To the extent possible, I allowed themes to emerge on their own, and I kept close track of whether and how often different themes emerged from each of the stakeholder groups. I identified key themes as those ideas or opinions that emerged consistently across or within stakeholder groups. After my coding was complete, I worked to relate the ideas that had emerged to findings from other studies in order to identify similarities and differences between the results of this study to the existing literature base. Although I was cannot be a completely neutral observer in this case, allowing themes to emerge organically from interview transcripts improved the relatability and validity of my analyses.

My process of thematic analysis followed an iterative process, as described in Braun & Clarke (2006). I first transcribed the data from the original paper transcriptions into a digital format and familiarized myself with the content. I then input the data into NVivo 12 software and began creating an initial coding scheme. I developed one codebook to encompass all groups of stakeholders, as opposed to developing separate codebooks for each group because I was interested in the synergies and tensions between the opinions of the groups. Following a thorough initial coding of the entire data set, I began searching for and reviewing possible themes. I created an initial thematic map, and then refined and more formally named my themes (figure 5). Finally, I reported on the themes and their meaning for the CCD Plus project and within the context of Bhutan.

Figure 7. Thematic coding map



3.4.4 Qualitative sample

The qualitative sample was purposively chosen from across all four districts represented in the quantitative evaluation. There are substantial cultural and infrastructure differences between districts within Bhutan, and therefore it was important to include perspectives from all participating geographic regions in this study. The District Health Officer (DHO) from each district was invited for an interview, and officials from three out of four districts participated (table 6). Health Assistants from each BHU sampled for the quantitative evaluation were invited to participate, and eight out of 19 HAs were interviewed. Finally, within each target village, community health volunteers (VHWs) and caregivers were invited to participate. The qualitative samples in this study were roughly proportional to the size of the quantitative samples from these districts: Lhuentse and Zhemgang contained the largest samples, followed by Tsirang, and finally Haa had the smallest sample.

Table 6. Qualitative study sample

Position	District			
	Tsirang	Lhuentse	Zhemgang	Haa
District Health Officer	1	1	1	0
Health Assistant	2	4	1	1
Community Health Volunteer	4	5	2	0
Caregiver	7	15	10	1

3.4.5 Limitations

An important limitation of the qualitative portion of this study is potential interviewer bias. Many respondents did not speak English so it was necessary for interviews to be conducted by local language speakers. It was possible to hire some independent assessors to collect qualitative data, but it was also necessary for Save the Children and Ministry of Health staff to conduct some of the interviews. Given that both parties were responsible for program design and delivery, it is possible that their perspectives could have influenced the interviews. In addition, respondents could have biased their responses when speaking to representatives of the organizations that were providing a service to their communities.

3.5 Ethical considerations

When speaking directly with children and families living in disadvantaged areas, it is critical to consider the ethical nature of all components of a study from instrument design to data collection procedures and reporting of results. It is strongly discouraged to undertake any study in Bhutan without the consent of the appropriate government agencies. This study received approval from the Ministry of Health as well as the National Statistics Bureau of Bhutan. In addition, I received approval from the IRB at UCL (UCL data protection number: Z6364106) as well as Save the Children's Ethics

Review Committee. The RCT was also registered with ISRCTN (15805004) to promote transparency of the research.

This study was designed to document changes in parenting practices and child development outcomes related to a parenting education program delivered by health workers. Quantitative and qualitative tools included questions about participants' experiences with and perspectives about the CCD Plus program, and children's knowledge of early literacy, numeracy, social-emotional and motor skills. No sensitive information related to political affiliations or disease status was collected.

Data collectors were trained on appropriate conduct with children using Save the Children's Child Safeguarding training, and data collection was overseen by Save the Children and Ministry of Health staff. Both parental consent and child assent were obtained before children were interviewed. All participation was voluntary, and participants did not receive any remuneration for their involvement. Families in both the control and intervention areas continued to receive standard services from health workers, and were not denied any health-related care in relation to this study.

I also took care to protect participants' identity when reporting results of the study. For the quantitative data, all results were reported in aggregate and no individual or identifying information has been shared. All qualitative data was reported anonymously so that no quotations or viewpoints can be attributed back to any individual. I have shared the results of this study with stakeholders at Save the Children and within the Ministry of Health in Bhutan. I do not have access to the local communities who participated in the study, but the quantitative results were published in the national public newspaper and on state-sponsored television. All data are stored on

my password protected computer, and all identifiable information will be destroyed after this thesis is completed.

4. Results

4.1 *What is the impact of the CCD Plus program on children's school readiness?*

To answer this research question I first analyzed results from the quantitative impact evaluation of the CCD Plus program to determine the treatment effect on children in the intervention group. I then investigated whether the program produced the same results for all children and families. First, I analyzed variations in CCD Plus impact on children's development related to a child's mother's education level and their family's relative wealth status. I supplemented this analysis with an investigation of the impact of the program on caregivers, and any variations in this impact related to maternal education and family wealth.

To complement my quantitative investigation, I analyzed interview transcripts from health workers and caregivers related to the changes they observed in children after participating in the CCD Plus program. I analyzed health worker transcriptions for their observations on possible changes in caregivers' behavior related to children's early learning. Similar to my quantitative analyses, I investigated interview responses for any perceived differences in program uptake or impact related to parental education levels and/or poverty.

4.1.1 Quantitative results

4.1.1.1 IMPACT ON CHILD DEVELOPMENT AND LEARNING

As described earlier, multilevel multivariate regression analyses were used to estimate the quantitative impact of the CCD Plus program on children's cognitive development. These models included assignment to treatment, as well as control variables for relevant baseline characteristics, such as baseline IDELA scores. All models were weighted to adjust for attrition, as specified in the previous chapter.

Results display a significant positive impact of the CCD Plus program on children’s literacy, numeracy, social-emotional, and overall learning and development (i.e., total IDELA score), with effect sizes ranging from 0.34 standard deviations (SDs) for the social-emotional domain to 0.73 SDs in emergent numeracy (table 7). On average, the CCD Plus program had a significant 0.60 SD impact on children’s overall learning and development. No significant effects were found in the domains of motor or cultural development, although the coefficients were positive and small in size ($d = 0.14 - 0.24$).

Table 7. Impact of CCD Plus on child development (standardized IDELA scores)

	(1)	(2)	(3)	(4)	(5)	(6)
	Motor	Literacy	Numeracy	Social-emotional	Culture	IDELA
Intervention	0.236 (0.153)	0.654*** (0.137)	0.733*** (0.163)	0.342* (0.174)	0.137 (0.136)	0.599*** (0.158)
Child age (month)	0.0273*** (0.00605)	0.0144* (0.00601)	0.0195** (0.00689)	0.0111 (0.00845)	0.0264*** (0.00649)	0.0127* (0.00607)
Motor (baseline)	0.435*** (0.0716)					
Literacy (baseline)		0.507*** (0.0524)				
Numeracy (baseline)			0.318*** (0.0695)			
Social-emotional (baseline)				0.431*** (0.0761)		
Culture (baseline)					0.353*** (0.0631)	
IDELA (baseline)						0.566*** (0.0648)
Constant	-1.453*** (0.321)	-1.047*** (0.308)	-1.353*** (0.358)	-0.728 (0.438)	-1.371*** (0.314)	-0.926** (0.313)
Observations	235	235	235	235	235	235
Number of groups	31	31	31	31	31	31

Note: Standard errors in parentheses. ~p<0.0.1 *p<0.05, **p<0.01, ***p<0.001

Next, I fit models for the relationships between maternal literacy and family wealth, and child development outcomes to investigate possible heterogeneous program effects. My process for these analyses was to model the relationship between maternal literacy and the treatment variable, and family wealth and the treatment variable separately to determine whether there were differential treatment effects on children's development related to either condition. If significant interactions between the treatment variable and either variables were found, I would have pursued further analyses to determine whether there was any relationship between maternal literacy, family wealth and treatment effect together.

Results of these models demonstrated limited evidence of differential relationships between maternal literacy or family wealth and changes in child development for children in the treatment and control groups. Maternal literacy did not significantly predict changes in children's learning and development in any domain, and there were no significant interactions effects between maternal literacy and treatment status (table 8). These results suggest that the CCD Plus program was equally effective for children with literate and illiterate mothers.

Family wealth significantly positively predicted three out of six outcomes (Literacy, Culture, and total IDELA). In addition, there were a significant negative interaction term for treatment status and family wealth in the Culture domain (table 9). This suggests that poorer children in the treatment group improved more in the domain of Cultural, moral, and spiritual development compared to children in the control group. These results demonstrate that the CCD Plus program was equally effective regardless of the relative wealth of a child's family, and suggest that more disadvantaged children gained more in some domains of development.

Table 8. Impact of CCD Plus on child development, controlling for maternal literacy

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Motor	Literacy	Numeracy	Social-emotional	Culture	IDELA
Intervention	0.134 (0.199)	0.588*** (0.176)	0.734*** (0.211)	0.460* (0.210)	0.162 (0.193)	0.570** (0.199)
Child age (months)	0.0266*** (0.00617)	0.0142* (0.00620)	0.0195** (0.00741)	0.0115 (0.00862)	0.0273*** (0.00652)	0.0119 (0.00643)
Mother is literate	-0.177 (0.142)	-0.0974 (0.126)	-0.00736 (0.126)	0.169 (0.132)	0.101 (0.152)	-0.101 (0.119)
Intervention*Mother is literate	0.208 (0.224)	0.148 (0.169)	-0.00577 (0.198)	-0.254 (0.180)	-0.0665 (0.223)	0.0695 (0.176)
Motor (baseline)	0.442*** (0.0721)					
Literacy (baseline)		0.518*** (0.0510)				
Numeracy (baseline)			0.318*** (0.0750)			
Social-emotional (baseline)				0.420*** (0.0769)		
Culture (baseline)					0.346*** (0.0625)	
IDELA (baseline)						0.573*** (0.0697)
Constant	-1.329*** (0.347)	-0.993** (0.335)	-1.347** (0.411)	-0.825 (0.463)	-1.461*** (0.335)	-0.838* (0.353)
Observations	233	233	233	233	233	233
Number of groups	31	31	31	31	31	31

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Table 9. Impact of CCD Plus on child development, controlling for family wealth

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Motor	Literacy	Numeracy	Social-emotional	Culture	IDELA
Intervention	0.220 (0.159)	0.641*** (0.131)	0.728*** (0.164)	0.338 (0.178)	0.148 (0.118)	0.592*** (0.163)
Child age (months)	0.0260*** (0.00614)	0.0107* (0.00545)	0.0198** (0.00683)	0.0123 (0.00887)	0.0261*** (0.00633)	0.0127* (0.00618)
Family wealth index (std)	0.0780 (0.0630)	0.122* (0.0538)	0.142 (0.0769)	0.175 (0.100)	0.223*** (0.0599)	0.129* (0.0632)
Intervention*Family wealth index (std)	-0.0255 (0.0831)	-0.0997 (0.0864)	-0.155 (0.106)	-0.210 (0.122)	-0.280*** (0.0679)	-0.128 (0.0792)
Motor (baseline)	0.422*** (0.0763)					
Literacy (baseline)		0.530*** (0.0599)				
Numeracy (baseline)			0.328*** (0.0738)			
Social-emotional (baseline)				0.409*** (0.0795)		
Culture (baseline)					0.350*** (0.0665)	
IDELA (baseline)						0.552*** (0.0706)
Constant	-1.407*** (0.321)	-0.870** (0.283)	-1.361*** (0.355)	-0.818 (0.458)	-1.406*** (0.318)	-0.945** (0.317)
Observations	223	223	223	223	223	223
Number of groups	31	31	31	31	31	31

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

4.1.1.2 IMPACT ON CAREGIVER BEHAVIORS RELATED TO ECE

In the CCD Plus theory of change, caregivers are the primary drivers of change in children's learning and development. Thus, I wanted to understand whether there was impact of the program on children's home learning environments (i.e., learning materials in the home and learning related activities between children and adults), and whether there were differential effects of the program related to caregiver or family characteristics. Although not the main outcome of interest, changes in a child's home learning environment are important to consider as a mediator of program impact on children. The results of these analyses could potentially corroborate results of the impact analyses for child level outcomes, or alternatively could suggest divergent outcomes.

Within these analyses, I investigated changes in resources in the home and behaviors promoted by the CCD Plus program that support children's literacy and numeracy development. Similar to the analyses of child outcomes, multilevel multivariate regression analyses were first used to investigate whether the CCD Plus program had a measurable impact on children's home learning environments. Similar to the initial impact models, these estimations take into account relevant baseline variables and use attrition weighting. I then investigated whether there were heterogeneous program effects related to mothers' literacy levels or relative family wealth.

Results of the impact analyses display significant positive impact of the CCD Plus program on children's home learning environments. I find significant impact on the variety of reading materials and toys in the home, as well as the variety of home learning activities that caregivers engage in with their children (table 10). The home environment questionnaire I developed asked detailed questions about home learning

activities, which allowed me to investigate whether behavior change occurred within mothers, fathers or other caregivers in the home. A disaggregation of caregiver behavior change found that only mothers displayed a significant increase in learning and play activities with their children. There were no significant effects of the program on the diversity of learning and play activities among fathers or other caregivers.

Table 10. Impact of CCD Plus on learning materials and learning activities in the home

	(1)	(2)	(3)	(4)	(5)	(6)
	No. Reading material types	No. toy types	No. home learning activities	No. home learning activities - Mother	No. home learning activities - Father	No. home learning activities - Other caregiver
Intervention	0.875*** (3.40)	0.645* (2.22)	1.056* (2.27)	1.191** (2.71)	-0.0530 (-0.13)	-0.266 (-0.83)
Child age (months)	0.00463 (0.60)	-0.0213~ (-1.78)	-0.0130 (-0.77)	-0.00739 (-0.44)	0.0173 (1.30)	-0.00631 (-0.42)
No. reading material types (baseline)	0.278*** (3.59)					
No. toy types (baseline)		0.363*** (5.49)				
No. home learning activities			0.198*** (3.53)			
No. home learning activities - Mother				0.326*** (4.34)		
No. home learning activities - Father					0.356*** (3.76)	
No. home learning activities - Other caregiver						0.151* (2.34)
Constant	1.296** (2.89)	4.328*** (7.05)	4.257*** (4.70)	2.286* (2.46)	0.314 (0.42)	1.835* (2.27)
Observations	235	235	235	235	235	235

Note: Standard errors in parentheses; ~p<0.0.1 *p<0.05, **p<0.01, ***p<0.001

Further investigation of heterogeneous program effects demonstrated very limited evidence of differences in program impact on home learning environment variables related to maternal literacy or family wealth. Maternal literacy and family wealth status each significantly predicted changes in one of six outcome variables (number of home learning activities for mothers and number of home learning activities for other caregivers, respectively) (table 11). In addition, neither variable had any significant interactions with the treatment variable (table 12 and table 13). Taken together this suggests that there were no differential effects of the CCD Plus program on caregiver behavior change or children's home learning environments related to maternal literacy or family wealth.

Table 11. Impact of CCD Plus on learning materials and learning activities in the home controlling for equity variables

	(1)	(2)	(3)	(4)	(5)	(6)
	No. reading material types	No. toy types	No. home learning activities	No. home learning activities – Mother	No. home learning activities - Father	No. home learning activities - Other caregiver
Intervention	0.745** (2.72)	0.611* (2.03)	1.113* (2.51)	1.103* (2.45)	-0.00308 (-0.01)	-0.0825 (-0.24)
Mother is literate	0.116 (0.46)	0.0713 (0.32)	0.391 (1.37)	0.664* (2.56)	-0.246 (-0.84)	-0.105 (-0.36)
Family wealth index (std)	0.146 (1.29)	0.130 (0.93)	0.229 (1.52)	0.0883 (0.56)	-0.0527 (-0.41)	0.278* (2.04)
Child age (months)	0.0005 (0.06)	-0.0241~ (-1.85)	-0.0120 (-0.69)	-0.00639 (-0.43)	0.0168 (1.32)	-0.00701 (-0.50)
No. reading material types (baseline)	0.251** (3.00)					
No. toy types (baseline)		0.350*** (4.31)				
No. home learning activities			0.196*** (3.61)			
No. home learning activities - Mother				0.293*** (3.96)		
No. home learning activities - Father					0.326*** (3.38)	
No. home learning activities - Other caregiver						0.133* (2.07)
Constant	1.600** (3.12)	4.517*** (6.61)	3.896*** (4.13)	1.931* (2.34)	0.505 (0.66)	1.773* (2.34)
Observations	221	221	221	221	221	221

Note: Standard errors in parentheses; ~p<0.0.1 *p<0.05, **p<0.01, ***p<0.001

Table 12. Impact of CCD Plus on learning materials and learning activities in the home with interaction for maternal literacy

	No. reading material types	No. toy types	No. home learning activities	No. home learning activities – Mother	No. home learning activities - Father	No. home learning activities - Other caregiver
Intervention	1.201*** (3.91)	0.618~ (1.83)	1.403* (2.42)	1.040* (2.09)	0.369 (0.79)	0.132 (0.32)
Mother is literate	0.633~ (1.77)	0.134 (0.49)	0.900* (2.27)	0.571~ (1.77)	0.306 (0.62)	0.382 (0.80)
Intervention*Mother is literate	-0.667 (-1.44)	0.0235 (0.07)	-0.705 (-1.30)	0.180 (0.36)	-0.850 (-1.47)	-0.726 (-1.26)
Child age (months)	0.00616 (0.79)	-0.0207~ (-1.68)	-0.00898 (-0.52)	-0.00419 (-0.25)	0.0150 (1.17)	-0.00628 (-0.42)
No. reading material types (baseline)	0.294*** (3.43)					
No. toy types (baseline)		0.347*** (4.65)				
No. home learning activities			0.201*** (3.56)			
No. home learning activities - Mother				0.274*** (3.50)		
No. home learning activities - Father					0.357*** (3.82)	
No. home learning activities - Other caregiver						0.179* (2.50)
Constant	0.874~ (1.69)	4.307*** (7.31)	3.599*** (3.81)	2.024* (2.07)	0.288 (0.39)	1.575~ (1.72)
Observations	233	233	233	233	233	233

Note: Standard errors in parentheses; ~p<0.0.1 *p<0.05, **p<0.01, ***p<0.001

Table 13. Impact of CCD Plus on learning materials and learning activities in the home with interaction for family wealth

	No. reading material types	No. toy types	No. home learning activities	No. home learning activities – Mother	No. home learning activities - Father	No. home learning activities - Other caregiver
Intervention	0.761** (2.92)	0.629* (2.09)	1.120* (2.46)	1.177** (2.73)	0.0319 (0.08)	-0.135 (-0.38)
Family wealth index (std)	0.240 (1.30)	0.117 (0.54)	0.430* (2.30)	0.274 (1.20)	0.114 (0.74)	0.0652 (0.39)
Intervention*Family wealth index (std)	-0.143 (-0.65)	0.0627 (0.23)	-0.299 (-1.08)	-0.195 (-0.60)	-0.322 (-1.39)	0.303 (1.18)
Child age (months)	-0.000891 (-0.12)	-0.0244* (-1.96)	-0.0162 (-0.96)	-0.0108 (-0.72)	0.0192 (1.50)	-0.00640 (-0.45)
No. reading material types (baseline)	0.233** (2.95)					
No. toy types (baseline)		0.357*** (4.87)				
No. home learning activities			0.189*** (3.45)			
No. home learning activities - Mother				0.332*** (4.82)		
No. home learning activities - Father					0.326*** (3.36)	
No. home learning activities - Other caregiver						0.115* (1.97)
Constant	1.754*** (3.87)	4.522*** (6.59)	4.325*** (4.65)	2.316** (2.83)	0.222 (0.29)	1.765* (2.31)
Observations	223	223	223	223	223	223

Note: Standard errors in parentheses; ~p<0.0.1 *p<0.05, **p<0.01, ***p<0.001

4.2.1 Qualitative results

4.2.1.1 CHANGES IN CHILD DEVELOPMENT

Stakeholders reported positive changes in their children's school readiness in a number of different domains, and overall felt that the program was effective. A District Health Officer commented, *"Within a short period of time, children are found to be much educated."* Parents tended to report a variety of different types of skills when explaining the development they observed in their children. For example, a parent from Lhuentse stated, *"Yes, my child is now at least ready to go to school in terms of language, respect, counting, identifying numbers..."* The most common domain of development described was academic skills, followed by social-emotional development, then other general or cultural skills (e.g., colors, fine motor skills, greeting people, etc.), and finally health knowledge (table 12). The CCD Plus program content focuses primarily on teaching pre-literacy and numeracy skills, and four sessions related to health topics were added to align with the ongoing CCD programming through the Ministry of Health in Bhutan. Social-emotional development was not directly addressed by the program but emerged prominently from caregivers' and health workers' interview responses.

Table 14. Frequency of responses related to changes in children's development

Changes in children	Number of references
Academic skills (literacy and numeracy)	18
Social-emotional development	16
Other (fine motor, singing songs, colors, etc.)	5
Health and hygiene	4

The academic skill development reported by parents was well aligned with CCD Plus program content, and supported changes observed through the quantitative

evaluation. Pre-literacy skills identified include writing, how to handle books, expressive language, and knowledge of the alphabet and simple words. Respondents also discussed pre-numeracy skills like simple measurement, sorting, shape identification, counting, and identifying numbers.

Related to health, the most commonly identified skill that children developed was hand washing, and other topics mentioned included healthy food and teeth brushing. These topics are also well aligned with the content of CCD Plus sessions that focused on health. A parent from Zhemgang noted,

“Yes, they teach us lessons related to health such as handwashing and giving nutritious food to child which is very important for my child's development. Before I was not aware of handwashing steps but now I am.”

Comments suggested that messages around hand washing were particularly well received by children and parents.

Many stakeholders also noted advancement in children's social-emotional development, including skills like making friends, interacting with peers, and enhanced confidence. Caregivers often noted that their children seemed more assertive and outgoing. A caregiver from Lhuentse stated, *“They gain confidence, develop exposure, and learn to socialize.”* Another caregiver from Tsirang noted, *“Children know how to sort, counting; they also mingle with other children and get a lot of confidence.”* Social-emotional development was not a stated goal of the program but lesson plans do incorporate small and large group activities for children and parents, which may have provided children with opportunities to interact with their peers that are not otherwise common for children living in remote communities before they enter formal schooling.

Other changes in children that were highlighted by respondents included things like fine motor skills (e.g., drawing or coloring), knowledge of colors, greetings, respect,

and gaining interest in learning. Appropriate greetings and respect for all beings are important cultural competencies in Bhutanese society. These skills are not present in the standard ELM curriculum, but were incorporated during the local adaptation process, in addition to things like local songs and stories. It is likely that stakeholders believing that their children were gaining culturally valued skills, in addition to academic and health competencies, helped them accept the program as appropriate for their children. This demonstrates that appropriate local adaptation of global approaches is critical for the success of this type of approach.

4.2.1.2 CHANGES IN CAREGIVER BEHAVIORS RELATED TO ECE

One of the main changes in caregivers that was noted by multiple stakeholders was increased knowledge about how young children learn. Parents gave examples of playing games and singing songs with their children, and described becoming aware of the importance of play for learning. For example, a parent from Lhuentse stated,

“Our children play all the time but we also tend to stop them thinking that they dirty the place. But now we have realized that it is important to let children play. If we attempt to answer their questions as it makes children learn and hence develop.”

Another parent from Lhuentse commented,

“We know what to teach children through play. For example we teach songs we have learned during the sessions. We also could teach counting with any materials that are available around in the environment.”

These responses were corroborated by comments from health workers, who also mentioned the emphasis of play in the sessions. A community health volunteer from Tsirang commented that, *“all the sessions were through play.”* When asked whether they believed that the sessions changed the way that parents interacted with their children, a community health worker from Lhuentse reported, *“Yes, I have visited some homes and realized that they've practiced at home. Now children are more open, and*

they [parents] know that beating children is not good.” This theme is well aligned with the CCD Plus curriculum and suggests parents were internalizing the messages about strategies for engaging and teach their young children.

The majority of stakeholders reported believing that parents could be effective teachers for their young children. Parents commonly reported gaining confidence that they could teach their children school readiness skills. A parent from Tsirang stated, *“I gained a lot of confidence because these are small things I can do with my children so that they can be prepared for school.”* The majority of health workers also reported feeling that parents were capable of being effective early teachers for their children. A District Health Officer stated, *“Yes parents are the best teachers; caregivers can teach children so ECCD centers not required.”*

While the majority of stakeholders reported believing that parents could be effective teachers for their young children, some did express reservations. Most parents reported feeling confident that they could teach their children at home, but a few expressed concerns about being able to remember the lessons taught during parenting sessions because they were uneducated. For example, a parent from Zhemgang stated, *“I am not literate so it becomes difficult for me recollect.”* In addition, some health workers also reported feeling worried about parents’ motivation and ability to dedicate appropriate time to teaching their children. A Health Assistant from Lhuentse commented,

“Though the project gives them an opportunity to teach their children at home but since all the parents have to depend on agriculture works, I guess they don’t get enough time to sit with their children.”

Despite these hesitations, a number of caregivers gave examples of how they believed they could overcome challenges presented by their illiteracy or farming

schedules. A parent from Haa noted, *“We as uneducated parents could not recollect the session we learnt, but with help from VHW and HAs we overcome some of our challenges.”* Another parent stated, *“We can also tell stories from pictures even if we cannot read.”* Health workers’ responses echoed these themes, and the majority also reported believing that all parents could meaningfully carryout ECE activities with their childre. A Health Assistant from Zhemgang stated,

“The C4CD Plus pilot project is very useful because the activities as games are very simple and parents, also illiterate [parents], can practice with their children at home during follow of their daily route works.”

Illiteracy and an agrarian lifestyle were the closest themes to maternal education and poverty that emerged from stakeholders related to potential inequities in program effectiveness. Stakeholders presented these factors as potentially influencing the ability of caregivers to serve as effective teachers for their children but no interviewees reported feeling that the program could not work for these groups. Most often stakeholders presented examples how the program could work with these groups, or how caregivers from these groups overcame their challenges in order to participate in the program.

The overwhelming feeling shared by all groups of stakeholders was that parents were eager and able to try to teach their children school readiness skills at home, even if they were not the perfect teachers. This sentiment was well summarized by a parent from Lhuentse who said, *“We have understood how to teach our children. Even if we are not educated we can learn something, if not all. We feel that we have changed for the better.”*

4.2 Does the CCD Plus program have the potential to be a scalable alternative to classroom-based ECE services within Bhutan?

In this section I investigate whether the CCD Plus program is a potentially scalable ECE model within Bhutan. First, I compared quantitative impact results from the CCD Plus pilot evaluation and the 2015 national study of ECE in Bhutan to determine whether the learning and development gains displayed by children were comparable to those exhibited by children enrolled in classroom-based ECE services. Then, using interview transcripts from health workers and children's caregivers, I analyzed whether these community members perceived the CCD Plus program to be an acceptable alternative to traditional classroom-based ECE services. I investigated interview responses further to determine whether health workers and caregivers perceive the program to be sustainable in their communities.

4.2.1 How do children's learning outcomes compare to those from classroom-based ECE programs in the country?

Bhutan's 2015 National ECD Study used a random sample of established ECE centers across all service providers in the country, including the Ministry of Education, INGOs, CSOs, corporate actors and private groups. In addition, the study incorporated a sample of children with no access to ECE services. This allowed for an analysis of the effectiveness of the existing center-based ECE programs compared to not having access to any type of classroom based-ECE services. For my thesis study, I conducted a secondary analysis of this data, and estimated the effect size of the learning gains for children in an 'average' ECE center in 2015 (i.e., the combined average of all classroom-based ECE services captured in the 2015 national study) relative to the learning gains of children with no access to ECE. I then compared this to the treatment effect sizes from the 2017 CCD Plus trial.

One limitation of this analysis is that the districts included in the national study and those in the CCD Plus study do not overlap, except for in the district of Zhemgang. There were none or very limited center-based ECE programs for children in the CCD Plus districts so most were not included in the national study, and for the same reason these were the districts purposefully targeted for the CCD Plus program. So the districts from the two studies are fundamentally different at least in their access to early learning programs, but likely in other economic and social factors as well. In addition, the studies took place at two different points in time: 2015 and 2017. Therefore the differences presented here are descriptive, but nonetheless I believe they provide important insight into how the magnitude of learning gains from a non-center based program compares to that of center-based services in the same country.

Children in the two samples are comparable in terms of age, and as expected, data suggest that children in the CCD Plus sample are more disadvantaged, on average, than those in the National ECD Study sample (table 15). Children in both samples are 50 months old on average, and slightly more children in the CCD Plus sample are girls compared to the National ECD Study sample. More children in the National ECD Study sample speak Dzongkha at home, and more mothers are literate compared to the CCD Plus sample. Parents in the National ECD Study sample report engaging in more home learning activities with their children and having more common appliances in their homes (e.g., radio, television) compared to parents in the CCD Plus sample. Finally, children in the National ECD Study had stronger Total IDELA scores at baseline compared to children in the CCD Plus sample.

Table 15. Summary of sample characteristics

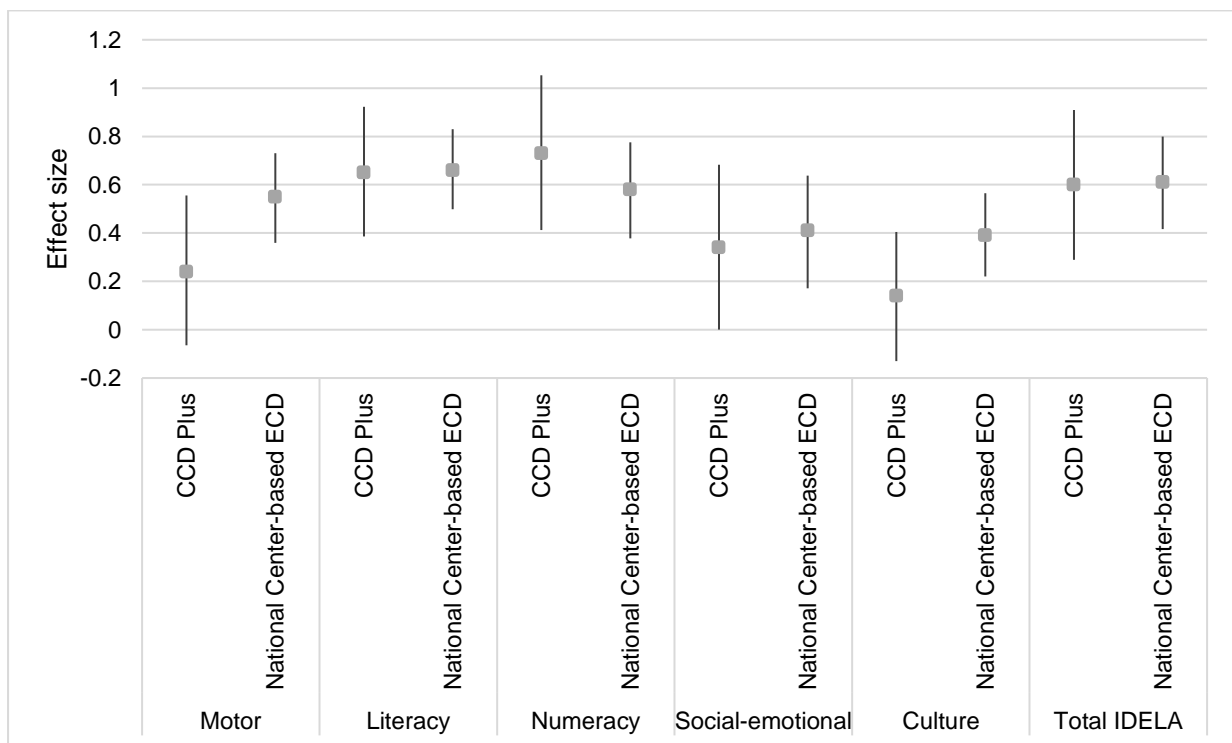
	CCD Plus (N=244)		National ECD Study (n=1,189)	
	Mean	Std. Dev.	Mean	Std. Dev.
Average child age (months)	50.3	9.120	50.5	8.493
Child is female	51.6%	0.501	49.8%	0.500
Child speaks Dzongkha	27.9%	0.449	46.4%	0.499
Mother age	31.1	6.655	30.0	5.938
Mother is literate	49.6%	0.501	61.7%	0.486
Number of reading materials at home	2.11	1.699	2.68	2.100
Number of home learning activities	3.88	2.501	6.58	2.397
Number of home appliances	3.22	1.812	4.53	2.270
Total IDELA (baseline)	16.8%	0.121	22.0%	0.154

Results from multilevel multivariate regression analyses demonstrate that the CCD Plus program produced almost exactly the same average impact on overall child development (i.e., Total IDELA score) as center-based programs (0.60 compared to 0.61 standard deviations) (table 16). The CCD Plus program produced relatively larger average learning gains in the domains of literacy and numeracy, and smaller gains in the areas of cultural, motor and social-emotional development compared to center-based ECE programs in Bhutan. The confidence intervals around the predicted effect sizes in all domains overlap between the two intervention modalities (figure 6). This finding suggests that the CCD Plus program produced the same magnitude of change in children’s learning and development as the average center-based ECE program in Bhutan.

Table 16. Treatment effect size from CCD Plus and national center-based programming

	CCD Plus (n=234)		National Center-based ECE (n=1,055)	
	Effect size	Confidence Interval	Effect size	Confidence Interval
Motor	0.24	-0.064-0.556	0.55	0.359-0.731
Literacy	0.65	0.386-0.923	0.66	0.498-0.830
Numeracy	0.73	0.413-1.053	0.58	0.378-0.775
Social-emotional	0.34	0.001-0.683	0.41	0.171-0.638
Culture	0.14	-0.130-0.404	0.39	0.221-0.565
Total IDELA	0.60	0.289-0.910	0.61	0.417-0.800

Figure 8. Treatment effect with confidence interval, by trial and developmental domain



4.2.2 Is the CCD Plus program accepted as an alternative to classroom-based ECE services by caregivers?

When asked for their perspectives about the CCD Plus program as an ECE service for their children, the majority of caregivers and health workers reported feeling that the CCD Plus program was an acceptable alternative to ECE classes and that parents could act as teachers for their young children. A Health Assistant from Zhemgang stated, *“I feel parents are the best teachers in such tender age of their lives. So this kind of program is really good.”* This sentiment was echoed by the majority of health workers and parents.

Stakeholders reported believing that the topics addressed in the CCD Plus program were valuable for children and caregivers in their communities. A Health Assistant from Tsirang commented, *“I found all the topics were important for children to understand and parents too. It is not only child health topics. It covered topics which they need in school.”* Similarly, a community health volunteer from Lhuentse stated, *“It is important for parents to learn as it will develop their children's learning and development.”* No themes emerged related to the program being inappropriate or unwanted by any group of stakeholders.

In terms of considering the program an alternative to classroom-based ECE services, caregivers and health workers also typically responded that CCD Plus was acceptable as a pre-academic program. A caregiver from Lhuentse stated, *“We do not have ECCD centers in our area and this program has helped us learn how to teach and play and make our children ready for schooling.”* Another caregiver from Zhemgang commented, *“Yes it will benefit children. When the children go for school they will be ready. If they are taught at home, they will equally participate at school.”* In addition, a community health volunteer from Lhuentse said, *“It is very important because if we do*

not support our children at home we cannot make them take interest in learning. It will help children learn better in school.”

There were some stakeholders whose responses suggested that although the CCD Plus program was appreciated, it was not as good as a center-based program. The primary hesitation centered around their own capacity to teach children academic skills. One parent from Zhemgang noted, *“Whatever I learned is important to children. Parents appreciate becoming teachers at home but teachers will have to reteach children in school.”* Some caregivers also noted that being illiterate was a challenge and that because of this they had trouble remembering everything they were taught during the parenting sessions. There were also responses from a small group of health workers which presented uncertainty that parents could deliver the activities at home faithfully. A Health Assistant from Lhuentse noted,

“ECCD is not only the solution that prepares children for schooling, I think it can be also done by the parents at home...through my journey conducting C4CD plus² I learned that parents really can do this at home because some parents are really innovative and creative and intelligent. I am not saying all parents can do it but most of them really can.”

In addition to being accepted generally as a pre-academic program, some interviewees also noted that a program like CCD Plus improves equity of ECE services provided for children living in rural communities. A District Health Officer articulated this sentiment saying,

“It is a very good project since it is taking care of those children who are generally deprived of such opportunities because of their nature of settlement, and the parents hardly knew the importance of Care for Child development. Really it gives an equal opportunities for all the children to learn the basic things and then get ready for school.”

² Note that UNICEF’s Care for Child Development program typically uses the acronym CCD but in Bhutan it is referred to as C4CD, and therefore CCD Plus is known as C4CD Plus.

In summary, the CCD Plus program is perceived as highly acceptable and beneficial for children in target communities. Caregiver and health workers found the program content and the idea of parents acting as teachers as acceptable in their communities. A minority of stakeholders voiced reservations about how capable parents were to effectively teach ECE content to their children, and skepticism about whether they could be as effective as classroom teachers. However, the more prevalent themes that emerged were around acceptance, appreciation, and continued interest in the program.

4.2.3 Do health workers and caregivers perceive the CCD Plus program as sustainable within their communities?

When asked about the perceived sustainability of the CCD Plus program in their communities, health workers and caregivers discussed a number of different topics that fell into two main themes. Many respondents spoke about demand for such a program from rural communities, and a small number addressed demand from the system-level. Responses related to the contextualization of the program for target communities were also very common, and highlighted both strengths and challenges of the program. Insights about contextualization related to the timing, location, and human resources most appropriate for the program in the future.

4.2.3.1 DEMAND

Caregivers and health workers reported strong demand for a program like CCD Plus in their communities. Participants from all three stakeholder groups agreed that sessions should be offered in their communities in the future, and also in other areas of Bhutan. A Health Assistant from Haa stated,

“Despite their heavy and tiresome farm work, parents showed keen interest to take part in pilot program and parents and children learned some essential parenting skills and pre-schooling skills.”

Similarly, a parent from Haa noted, *“It should be organized for growing kids in the future. It's very beneficial for kids and the sessions planned by the program are very good and informative.”*

At the system level, health workers reported that the CCD Plus program was well aligned with MoH policies and ongoing programming. A Health Assistant from Haa commented,

“MOH has already incorporated C4CD in all health centers and we have been practicing it. Yet C4CD Plus pilot project has further helped us deliver our C4CD program through simple games and learning activities.”

These stakeholders suggested that rather from distracting from their existing responsibilities, the CCD Plus program actually enhanced delivery of other child health related activities. A Health Assistant from Lhuentse stated,

“The project really didn't hinder delivery of other similar programs as such. It helped me in conducting the C4CD sessions we do anyway. It gave more ideas on to deal with the children and to recognize delays. It helped the games where I could also use in the C4CD sessions.”

In addition, health workers reported feeling like the program was filling an unmet need in communities they served. A Health Assistant from Zhemgang noted, *“I have always felt the necessity of such a program and was always guilty that we health workers failed to help these children under 5 years. So personally I feel my question is answered.”*

Despite this alignment with existing MoH programs and policy, health workers also noted that they did not know of any plans for ongoing funding to the CCD Plus program, and that this would be required in order to continue operating these activities. For example, a Health Assistant said, *“Yes I would like to continue the program but it can't be done only during the chaotic season. The challenges are time and resource*

only.” Time and resources are two major components of sustainability which would need to be addressed in order for the program to continue, but responses like this suggest that there is at least robust demand for such a program from the stakeholders would be implementing the service.

4.2.3.2 CONTEXTUALIZATION

Within the theme of contextualization, interviewees identified both strengths and weaknesses of the pilot phase programming. As noted previously, caregivers and health workers reported that the content of the program was acceptable and appropriate for their communities. Although there were no responses related to changes to lesson content from caregivers or health workers, it is possible that stakeholders felt uncomfortable voicing disagreements with the program content to interviewers associated with the program. It is also possible that they were not familiar enough with ECE content that they felt confident suggesting alternative approaches of topics. However, respondents did suggest changes related to the timing, location and other components of the sessions.

The season chosen for the pilot program was summer, which is monsoon and high harvest season in the target communities. Caregivers commonly reported difficulty attending the parenting sessions on top of their farming responsibilities and these comments were echoed by health workers. Respondents suggested that in the future, the program should be held in the winter/dry season when caregivers have more free time. A District Health Officer noted, “*This program was conducted during the busy working season of the parents. In the future, such program has to be conducted in the months of November – March.*” When asked if the program should be offered in the

future, a parent from Tsirang stated, *“Yes, as it will benefit both parents and child, but the sessions should be conducted during winter seasons.”*

The theme around using the appropriate season for the program was represented across respondents from all districts, but a theme related to challenges with the location of the session only appeared for a smaller group of caregivers and health workers from Lhuentse. Stakeholders in this district reported that they needed to travel long distances to attend the sessions, and it was problematic. A parent from Lhuentse commented, *“Due to the long walking distance we did face a problem attending the sessions one time.”* Similarly, a village health worker said, *“If it had been at my own Chiwog (village), I would have done better. The session site is far; I felt difficulty.”* Further investigation is needed to understand why the group locations chosen for Lhuentse were more difficult to reach than locations in other districts.

Caregivers only raised comments about the language used during the CCD Plus sessions. Two comments made general reference to the fact that activities would be better if they were delivered in local language. A parent from Zhemgang stated,

“Yes, the sessions are very important for us so I think the person who delivered the speech should speak in the language which most of the people are comfortable so it will be easy for them to teach child at home.”

In addition, there were also two responses that made specific mention of the Khengkha language. One parent was thankful that their Health Assistant spoke Khengkha during their sessions, and another described difficulty understanding topics taught in her sessions because they were not delivered in Khengkha. These differing perspectives suggest that use of language was inconsistent between communities. Language mismatches between health workers and community members would be important to address in future CCD Plus programming, and also suggest that there are existing

issues in the health systems related to serving communities with speak the Khengkha language.

Finally, stakeholders also commented on the alignment of program curriculum with workforce capacity. When asked whether Health Assistants or village health workers would be better placed to deliver CCD Plus sessions in the future, most respondents felt that Health Assistants would deliver better quality sessions. A Health Assistant from Lhuentse stated, *“Health Assistants must deliver this session as they have better teaching skills than VHWs. Moreover, most of the VHWs are uneducated and they cannot ensure quality of teaching.”* Similarly, a Health Assistant from Zhemgang said, *“I personally think Health Assistants because many VHWs are not educated and are not confident to deliver the program.”* In their responses, parents were not always clear about whether they were commenting on the practices of a Health Assistant or a village health worker, but the majority of the comments that did specify, suggested that Health Assistants were delivering the sessions most of the time, and that parents were satisfied with their work. For example, a parent from Lhuentse noted,

“HA conducted most of the sessions. He did well because if we don't understand he took his time to explain again and again. We wish him to conduct such sessions in the future is such programs are conducted.”

While no village health worker stated that Health Assistants are better suited to deliver the program, a number of these respondents noted that more training would be beneficial for them. A village health worker from Lhuentse noted,

“We would appreciate if we can get a similar training at least once a year. This will help us learn more about the program and build our own capacity. Attending just once is not enough.”

Taken together, these responses suggest that while Health Assistants' time is more expensive and limited by other responsibilities than village health workers, they deliver a

higher quality program than village health workers alone. It may be possible for village health workers to take over session delivery in the future, but additional training and supervision would be needed.

5. Discussion

My thesis combined secondary data analysis of the existing quantitative evidence on ECE programs in Bhutan with new qualitative data in order to provide a more comprehensive understanding of whether a non-classroom based ECE program is a potential solution to inequities in access and learning for young children living in rural communities. Through this complementary mixed-methods approach I was able to contribute to important gaps in the existing literature related to the equity and potential scalability of a non-classroom based approach to ECE.

Incorporating qualitative data allowed me conduct factual analysis related to program implementation, and to better understand community reactions to the CCD Plus program. As defined by White (2009), factual analysis allows for investigation of different aspects of the causal chain. In this case, data from key informants allowed me to study whether the CCD Plus messages were adequately delivered by health workers to parents in different communities, whether parents were then engaging in these activities with the young children in their homes, and whether community members perceived value of the program for their children.

The qualitative component of my study also allowed me to understand the acceptability and demand for such a program in the Bhutanese context. Appropriate contextualization of any global intervention brought to a new context is critical to investigate as a responsible development practice, but also to understand whether the approach has the potential to be sustainable or scalable in a given context. Regardless of the quantitative impact of the program, a community-led initiative such as CCD Plus, could only be viable beyond a pilot phase if local stakeholders find value in the activity.

Using a complementary mixed-method design also enabled me to investigate synergies and divergences between data from the two modalities of investigation. The most substantial convergence that appeared between the qualitative and quantitative results relates to the impact of the program on parents' home learning activities with their children, and children's school readiness. Both analyses demonstrated that there was substantial positive impact of the program on caregiving behaviors related to ECE and on children's cognitive development. These results were further supported by a number of themes that emerged from key informant interviews related to the high quality of program delivery, active attendance from parents, and confidence that parents understood and could act as teachers for their children.

An important divergence between the two analyses relates to the effectiveness of the CCD Plus program compared to a center-based ECE program. Quantitative results suggested that children whose parents participated in the CCD Plus sessions made equivalent gains in overall school readiness compared to children who attend center-based ECE programs. In contrast, the qualitative results demonstrated that stakeholders felt that the program was acceptable as a pre-academic service, but that center-based programs would be more effective in preparing their children for formal schooling. Health workers and parents were aware that the children in their communities were missing out on important learning opportunities that other children had access to, so they were eager to participate in CCD Plus. However, they voiced skepticism about the ability of parents to be as effective as the teachers working in classroom-based ECE programs. This tension will be important to address in any future planning or implementation of the CCD Plus program.

5.1 Impact

The results from this study complement findings from previous research on ECD programs in LMICs. Through a systematic review of 105 studies of ECD programs Britto et al. (2015) found that both center and home-based programs can have significant impact on children's cognitive outcomes. Their findings indicate that the modality of effective service delivery is flexible, and that rather than focusing on infrastructure, a key component of successful programs is the active engagement of caregivers and children during program delivery (Bekman et al., 2004; Britto et al., 2015; Eickmann et al., 2003; Kagitcibasi et al., 2001; Sharma & Nagar, 2009). The CCD Plus curriculum integrated hands-on activities with caregivers and children into each session, which could be a key component of why this program has been proven to be so impactful on caregiver behavior change and children's development.

The results of the CCD Plus trial demonstrate a large effect of the program despite a relatively light touch intervention. This could have occurred for a number of reasons. One likely contributor is the fact that the children in this sample were living in highly disadvantaged communities and demonstrated very limited school readiness skills as baseline. On average, children in the CCD Plus sample achieved 16.8 percent correct on the total IDELA score at baseline. This is a low score overall, and is also substantially lower than the baseline skills demonstrated by children in the 2015 National ECD Study (22 percent correct, on average). Thus children in the CCD Plus sample had more skills to gain than children in more advantaged communities within Bhutan or elsewhere. Another example of a study that demonstrates large effects on learning for children in highly marginalized communities comes from Burde and Linden (2013). These authors studied an intervention that focused on building community schools for girls living in rural Afghanistan and found that girls' test scores increased

0.65 standard deviations on average, or 1.28 standard deviations for those who attended the new schools. Girls gained substantially more than boys from the intervention in part because they were so much more disadvantaged at the baseline (Burde & Linden, 2013).

The domains of development where the largest impacts were found are aligned with the CCD Plus curriculum materials. This gives the results additional face validity, and also suggests a weakness of the intervention. Children in the intervention arm demonstrated the largest gains in the domains of literacy and numeracy, which were the focus of the majority of the CCD Plus sessions, and these gains were similar in magnitude to the learning growth demonstrated by children attending ECE classes in the 2015 National Study. In contrast, children in the CCD Plus trial demonstrated relatively smaller gains in the areas of social-emotional and motor development (0.34 and 0.24 standard deviations, respectively), and development in these areas was weaker than that demonstrated by children attending ECE classes in the 2015 National Study. The gap between the two modalities was especially large in motor development, with the CCD Plus trial demonstrating an impact of 0.24 standard deviations compared to 0.55 standard deviations in the 2015 National Study. So while the gains in overall learning and development were statistically similar across the two studies, domain-specific results suggests that more focus on social-emotional and motor development is needed within the CCD Plus program in order to support children's holistic development in a similar way as a formal classroom setting.

The results of my study are most comparable with the Rao et al. (2011) study, which used a similar methodology to investigate the effectiveness of different ECE conditions on children's learning and development in Southeast Asia. In the Rao et al. (2011) study, researchers were unable to randomly assign children to treatment

conditions, but rather randomly selected children from the different treatment conditions that existed in the country and conducted a longitudinal study over the course a school year to determine the extent to which children receiving different types of pre-academic inputs were able to gain these skills. This is very similar to the design used in the 2015 National ECD Study in Bhutan which I used as the reference point against which to compare the impact of the CCD Plus trial. Similar to the results of my research, the Rao et al. (2011) study also found that a home-based ECE program had comparable impact on children's development to that of the locally available center-based programs in Cambodia. The findings of these two studies can be taken two ways: either the quality of the center-based programs in Cambodia and Bhutan are so poor that relatively light-touch home-based early learning services can produce comparable results or home-based early learning services effectively engage parents and caregivers of young children to the point that they provide strong enough inputs to approximate what is learned in a local ECE classroom.

The need for better quality ECE services in LMICs has been widely reported (UNICEF, 2019), but it's possible that the average quality of ECE services in some countries is enough to improve children's learning and development in a substantial way. Results from the 2015 National ECD Study in Bhutan demonstrated that children who attended an 'average' ECE class had significantly stronger skills than children who did not have access to these classes (Pisani et al., 2017). Similarly Rao et al. found that community-based ECE centers produced significantly greater learning gains than not receiving any ECE inputs. Therefore, these results suggest that these services operate with enough quality to improve children's development compared to receiving no early learning inputs. Rao et al. posit that while the quality of home-based and community preschools in the Southeast Asia region are typically considered low by Western

standards, they are in fact robust enough to improve children's learning and development (Rao et al., 2011). There is no international standard for the specific characteristics an early education program must have or minimum quality standards they must meet in order to be beneficial to children's development but further research on this topic would be greatly beneficial as center-based ECE services continue to be expanded globally.

The implications of home-based ECE services producing meaningful learning gains for preschool-aged children in LMICs, brings us back to a key tension in the ECD literature. As noted earlier, parents are often described as a children's first teacher and numerous evaluations have shown that more responsive caregiving and psychosocial stimulation are associated with improved cognitive outcomes for children aged 0 – 3 years (Black et al., 2016). However, after the age of three the literature is focused almost entirely on the impacts of classroom or school-based programs for 3 – 5 year old children and there is far less discussion of how parents can act as teachers after children in this age range. Given the high plasticity of children's brains through the age of five, neuroscience supports the hypothesis that parents and other caregivers can serve as important educators throughout the early childhood period, especially if the alternative is no ECE inputs at all. The 3 – 5 year old age range is especially important for higher cognitive functioning (Thompson & Nelson, 2001), suggesting that interventions like CCD Plus which focus on early literacy and mathematics are especially critical for children's future success in school and in life.

5.2 Demand

Qualitative findings from this study align with the recent analyses by Britto et al. (2018) around the state of the ECD field for implementing multisectoral programs at scale. These authors suggest that demand is a critical component to understanding

larger scale uptake and sustainability of a program. Related to sustainability, demand can be considered at multiple levels, including demand from intended beneficiaries, and also demand from the associated system representatives and policies. They argue also that appropriate contextualization of the approach for the intended populations must be thoroughly considered (Britto et al., 2018).

Demand for the CCD Plus program was undoubtedly vocalized by caregivers living in rural communities, and this could have helped to drive the success of the program. Caregivers were aware that their children were missing out on important learning opportunities because they could not attend formal ECE classes, and reported being happy that their children were receiving pre-academic inputs before entering primary school. Stakeholder interviews demonstrated that caregivers went to great lengths to attend parenting sessions even though they were held during the busy harvest season. Caregivers and health workers also expressed broad acceptance of the idea of parents as teachers, and appreciation for the program. Caregivers reported feeling comfortable with the activities presented by the CCD Plus program, and welcoming the opportunity to act as teachers to their own children. Health workers also believed that the majority of caregivers showed strong uptake of the program activities. A minority of stakeholders expressed hesitation about the program because they felt that caregivers could not provide children with the same caliber of input as a teacher in a formal ECE center, but the majority of caregivers and health workers felt that they were contributing meaningfully to young children's development with lessons they learned from the CCD Plus program.

A number of issues about contextualization of the CCD Plus warrant further consideration. A deeper investigation into acceptability of program messages would be beneficial, as well as research into any unintended consequences of the program. No

information that I gathered suggested there were issues with the content of the program, but it's possibility that the methods I used were not appropriate to eliciting this type of information. It was interesting to note, however, that caregivers reported that children were gaining skills ins culturally valued domains like respect. This suggests that at least some aspects of the program content were well adapted to the context.

In contrast, clear themes emerged related to the contextualization of the logistics of program delivery. The most prevalent theme discussed by health workers and caregivers was that in the future, sessions should not be held in the summer months when the chance of monsoons are high and many caregivers are occupied with harvesting responsibilities. Instead they suggested that the winter would be a more appropriate time to hold sessions. Revising the delivery timing will be critical for sustainability and should be considered separately in each district of the country, as geography varies widely within the country. Other issues related to contextualization included location of the sessions, and local language use by health workers. These themes were somewhat more localized, but would also need to be addressed in future programming.

5.3 Scalability

Findings that emerge from my qualitative analyses in this study can also be interpreted in light of recent thinking put forward about paths to national implementation of integrated ECD programs and key aspects of successful small-scale programs. In a recent publication from the New York Academy of Sciences, Nores and Fernandez (2018) suggested eight key dimensions to consider for system level integration of health and education programs including: strong collaborative and/or centralized leadership, vertical alignment, horizontal alignment, evidence-based programs and policies, integrated program monitoring, investment in early childhood workforce, continuous

improvement cycles, and partnerships (Nores & Fernandez, 2018). Further, an analysis of successful pilot programs funded by Grand Challenges Canada's Saving Brains initiative suggest that key 'signals' of successful small-scale programs include evidence of impact on caregivers and children, optimization of human resources, and existence of strong collaborative partnerships (Radner et al., 2018).

Based on this literature, one of the most promising aspects of the CCD Plus program is the engagement and ownership of the Ministry of Health (MoH) from the inception of the project. MoH officials from the national, district and local levels agreed to commit staff and resources to the project, including for program oversight and monitoring. This displays both collaborative partnerships between government and INGO, and vertical alignment within the country. One critical partner who was largely missing from early engagement around this project is the Ministry of Education (MoE). The MoE was invited to engage in the pilot program development and study design but remained largely disengaged. This could lead to difficulties in having the CCD Plus fully endorsed as an early education program within the country.

Results of this study suggested important considerations related to investment in the ECE workforce and optimization of human resources. While the most economical group to engage for future implementation would be village health workers, the results of this study suggest that the sessions were more effectively delivered by Health Assistants rather than by village health workers. In addition, considering the frameworks published by Nores and Fernandez (2018) and Rader et al, (2018), Health Assistants would be the more optimal choice for investment and optimization of the workforce. Health Assistants are salaried employees of the MoH who receive standard government supported training and supervisions services, whereas village health workers are volunteers who receive minimal investment from the system. Adequate resources would

need to be invested to continue using Health Assistants as the primary implementers of the CCD Plus program, but it would likely be the best long-term investment for the MoH if they made the commitment to take the program to scale.

One alternative or supplement to having Health Assistants lead the CCD Plus program in the future could be to offer further training to village health workers over time and eventually transition more responsibilities to them as they became more comfortable with the content. Health Assistants could still be involved as part-time facilitators and/or supervisors, but empowering village health workers to take on more responsibility could improve the regularity within which the program is delivered to families. A detailed strategy for supportive supervision and sharing of responsibilities between Health Assistants and village health workers would be needed to achieve optimal professional development and maintenance of program quality. In addition, there could be high turn-over rates with village health workers because they are volunteers so development of a standard pre-service CCD Plus training module would be beneficial. Demand for more training was clearly articulated by village health workers within this study so engagement from workers does not seem like it would be a substantial barrier.

Another important consideration for workforce investment is the cost of providing these services on a larger scale. I was not able to incorporate a costing analysis into this study and that is a substantial limitation of this work. However, relatively speaking, the CCD Plus program is cheaper to implement than a traditional center-based ECE program simply due to the lack of infrastructure required. Costs to scale and maintain this program would primarily be around training, monitoring/supervision, and transportation for facilitators. Focusing on Health Assistants for future programming

would be more expensive than village health workers, but as discussed above, this investment may be necessary to maintain the quality of the program.

Given the multi-sectoral nature of the CCD Plus program and the contributions it would be making to the system of ECE services in Bhutan, it could be appropriate to consider a scalable model that utilized resources from both the MoH and MoE. The MoH would be well placed to fund salaries and per diem expenses for health workers delivering the program, but the MoE could potentially pay for other costs related to training and materials. Engagement of the MoE in material development would also help improve comparability between the two modalities for supporting children's holistic development. This study identified that motor development was a weakness of the CCD Plus program, and development of these skills is largely related to having age-appropriate manipulatives for children to practice and play with. If the MoE provided appropriate materials for fine motor development, it could help children receiving the non-center based services achieve similar motor skills to children attending ECD classrooms. The logistics of this type of funding model would no doubt be complicated but it would promote ownership of the program across the relevant government ministries, and would serve as a clear example of strong multi-sectoral ownership of an innovative approach to achieving universal ECE coverage.

6. Summary and conclusion

Half of the preschool-aged children living in LMICs lack access to educational services, and program expansion favors more advantaged children (UNICEF, 2019). Given the slow pace of system-level change, more innovative intermediate solutions are necessary in order to provide marginalized children with the support they need to achieve optimal development and fully realize their right to education. The results of my study demonstrate promising evidence for one approach to providing ECE services to children living in rural communities.

In this study, I leveraged multiple data sources to conduct a theory-based impact evaluation of a home-based ECE program in Bhutan. I used data from a randomized control trial of the CCD Plus program to answer questions about how effective a non-classroom based program was for improving children's school readiness. I then used data from a previous national study of ECD services in Bhutan, and data from key informant interviews collected for this study to move beyond a standard impact evaluation, and contextualize the CCD Plus impact results. I used the national ECD study data to understand how gains in achievement that resulted from the CCD Plus program compared with outcomes produced by center-based programs available in the country, and therefore sought to understand whether equity in learning outcomes could be achieved through the implementation of this approach. I used the qualitative data to investigate how local stakeholders perceived the benefits and challenges of CCD Plus, and whether the program could potentially continue to be delivered in these communities and other similar communities in the country through the existing health care system.

The results of my study contribute to the literature by providing an example of a successful home-based education program delivered by community health workers for children older than three years of age. The literature on integrated ECD programs that leverage parents' as the key influencers of children's cognitive development are predominantly from programs for children under the age of three, whereas the literature on ECD programs for children over three focuses almost exclusively on classroom-based programs. In this study, I found that parents can also serve as effective teachers for preschool-aged children. In addition, this study establishes that the health system can be effectively leveraged to deliver educational content in a way that aligns with existing national ECD policies and resources.

My analysis of the comparability of this non-center based approach with that of the existing center-based ECE services in Bhutan is a critical component of this study, and should be replicated elsewhere if new ECE approaches are being tested. When advocating for alternative services for disadvantaged groups of children, care must be taken to determine whether the inputs are contextually appropriate and effective. In many cases, children in underserved areas require additional inputs compared to their more advantaged peers in order to achieve the same outcomes. Therefore, any alternative approaches leveraged for these children should be proven to be at least as effective as the services received by others in order to be considered for further investment.

Finally, interviews with parents and health workers revealed that ECE services were in high demand in these communities. Stakeholders were keenly aware that their children were missing out on educational opportunities because there were no ECE classrooms available in their communities, and welcomed the opportunity to act as teachers and improve their children's school readiness. They held formal, classroom-

based ECE services in the highest regard, but believed that the enrichment they could offer was beneficial as well. They clearly articulated that they felt it was worth the effort to offer and attend the CCD Plus sessions in addition to their existing responsibilities, suggesting that a home-based ECE program delivered by the MoH could be sustainable in rural communities in Bhutan as an intermediate solution to providing classroom-based services for all children.

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**International Development
and Early Learning
Assessment
Assessor's Guide
January 2015**

Instructions: This packet will allow you to assess the development and early learning of young children (ages 3.5-6.5 years). Please pay careful attention to the instructions, and read all questions to children exactly as they appear. You will see two forms of type:

Bold type in boxes indicates things you, the assessor, must say to the child out loud. Please read this type aloud to the child completely and exactly as it appears. This is important to ensure that the data will be collected in a standardized manner across all children.

Italic type indicates instructions for you. Do not read these instructions aloud to the child.

If you are using the “text version” of the assessment, set up the book with the assessor instructions facing you and the other side of the text facing the child. You will need to explain to the child that sometimes they will see a picture, but sometimes their side will be blank and you will demonstrate the activity. If you are using the regular paper version of the assessment, make sure your stimuli (picture cards etc.) are prepared in advanced and easily accessible.

Before beginning any assessment, it is important to establish a relaxed and playful rapport with the child. Ask him/her a few questions about subjects of interest to them. Introduce your self-etc. As much as possible, help the child see the assessment as a game rather than a serious test. Also, ensure that you begin the assessment by recording the student’s name, sex, date of assessment, etc, on the score sheet.

Throughout the assessment, offer neutral encouragement to the child. Say things like, ‘*You are working very hard - keep it up!*’ Give encouragement in between questions, rather than in the middle of questions. Be patient! Do not give hints to questions or make facial expressions while the child is completing tasks.

Observe how the child is doing and offer breaks as needed throughout. Technically there is no “time limit” to complete the assessment although some questions are timed to help move through the items at a regular pace.

Greeting

Hello,

My name is _____ . I work with the MoE in the evaluation of our early childhood program supported by Save the Children.

We are here to learn about how children, like you, learn things and if they know how to play some games. We are going to play some games and do activities together. I will show you different materials I have with me and will also ask you some questions about stories, pictures, letters, numbers and other things. I will also ask you to show me how you do some things, like drawing.

Some activities will be easy for you and others may be harder. Don't worry if you cannot do some things. We just want you to try.

You can stop and take a break if you need to. Just let me know. If you decide at any point that you'd like to stop, or that you don't want to do one particular activity, that's okay too.

Do you understand? Do you have any questions? Are you ready to start?

Background questions

This information is to be completed before the assessment begins with the child. These questions should not be asked to the child. The specific items in this section can be decided on by each project team, but at minimum we recommend:

Assessor name or code	
ECD Center/School ID	
Child ID	
Child's full name	
Child sex	
Child's age	
Date of Assessment	
Time at start	
Time at end of the assessment	

Item 1. Personal awareness (socio-emotional)

Materials: None

Ask the child the following questions one at a time.

scoring

Can you tell me your full name?	Correct	Incorrect	No response
Can you tell me how old you are?	Correct	Incorrect	No response
Are you a boy or a girl?	Correct	Incorrect	No response
Please tell me the name of one person who takes care of you	Correct	Incorrect	No response
Can you tell me the name of the / town (urban)/village (rural) that you live in?	Correct	Incorrect	No response
Can you tell me the name of the country that you live in?	Correct	Incorrect	No response

Item 2. comparison by Size and length (Emergent math)

Materials: Picture Cards with circles and sticks

Now I will show you some pictures and ask you some questions. Look at this picture. Can you show me the biggest circle?

Wait for child to respond and then ask:

Can you show me the smallest circle?

Then show the child the picture with the sticks and ask:

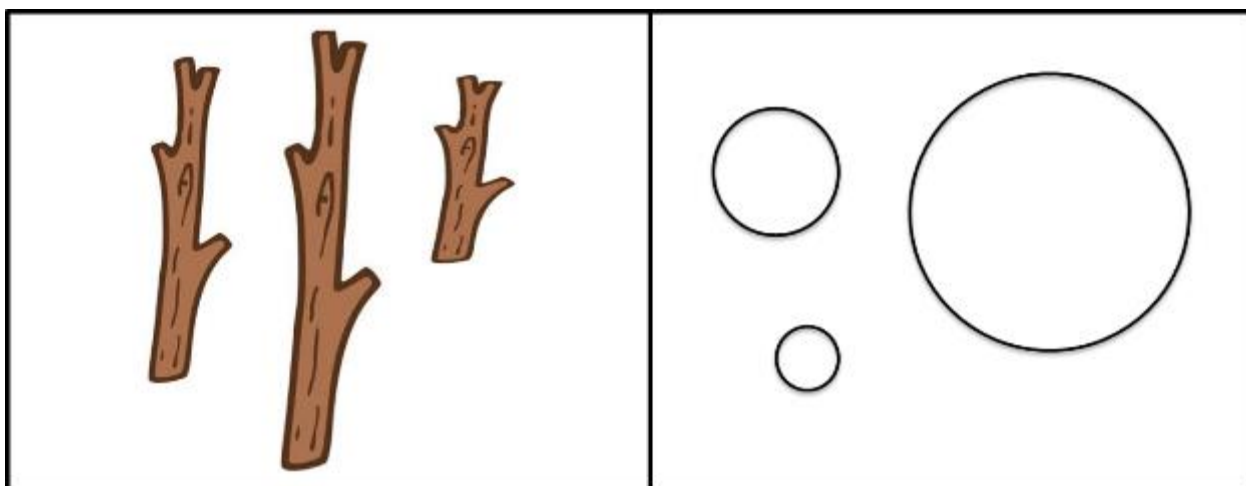
Now look at this picture. Can you show me the longest stick?

Wait for child to answer and ask:

Can you show me the shortest stick?

Scoring

Child identifies biggest circle	Correct	Incorrect	No response
Child identifies smallest circle	Correct	Incorrect	No response
Child identifies longest stick	Correct	Incorrect	No response
Child identifies shortest stick	Correct	Incorrect	No response



Item 3. Sorting and classification (Emergent mAth)

Materials: Picture cards of stars (Chilies) and circles (Tomatoes) (two red chilies and one green chili, two green tomatoes and one red tomato)

Place the picture cards in front of the child in a random order and say:

We're going to play a game where we group pictures together that are similar. Look at these pictures and try to arrange them into groups with others that are alike.

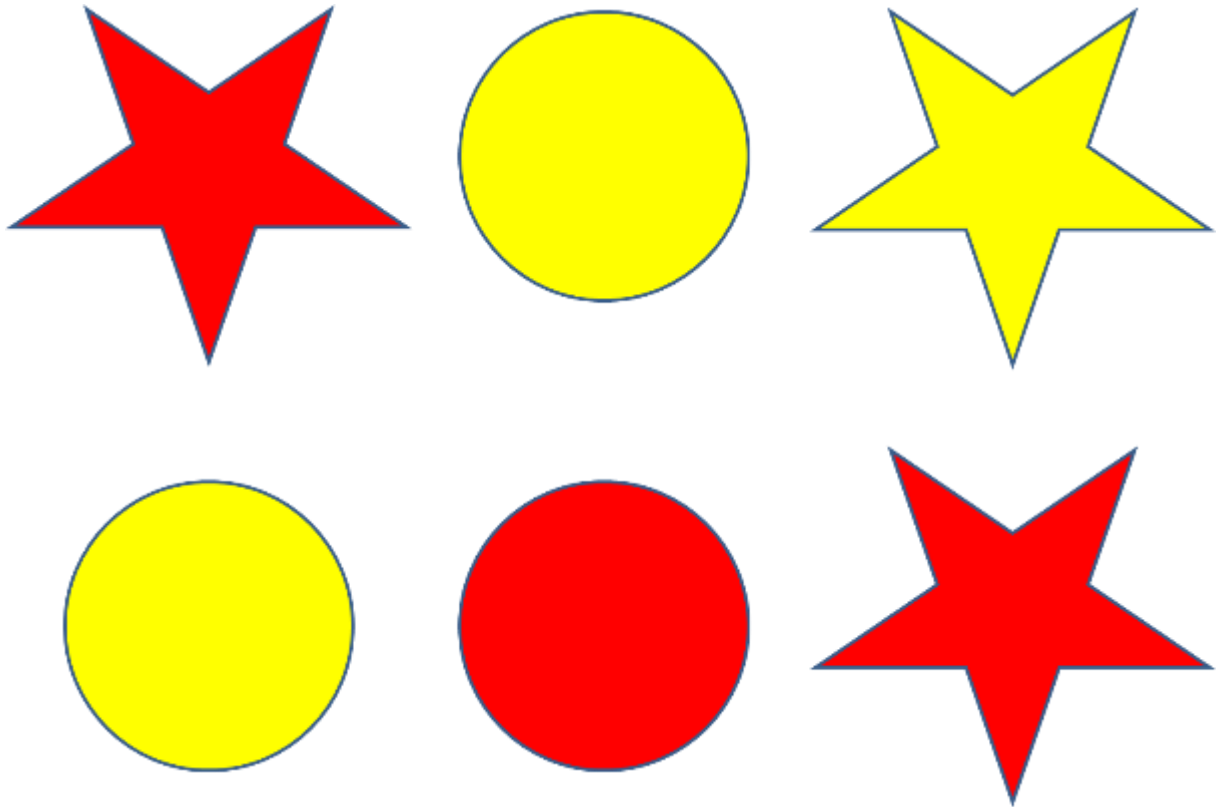
Once the child has completed sorting by one criterion say,

Ok. Look at the cards and try to remember how you sorted them. Now we will put the cards back together and try to find another/different way to group these cards?

Be patient and wait as the child tries to examine how to arrange the cards.

Scoring

Child sorts cards by first criterion	Correct	Incorrect	No response
Child sorts cards by second criterion	Correct	Incorrect	No response



Item 4. Shape identification (Emergent mAth)

Materials: A laminated page with pictures of 6 shapes used in this test (4 shapes + 2 distractors)

Place the laminated page with shapes in front of the child and say:

I have some pictures to show you. These are pictures of different shapes. Look at these pictures and show me:

Where is the circle?

Continue like this down the list:

Where is the rectangle?

Where is the triangle?

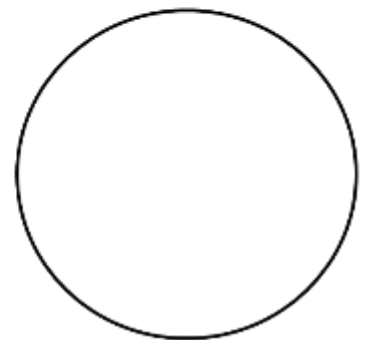
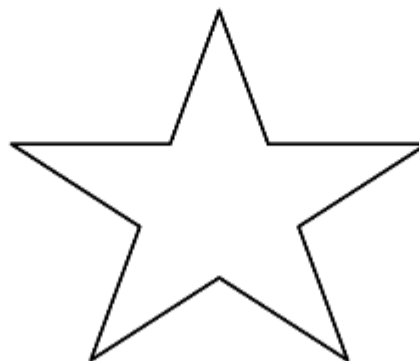
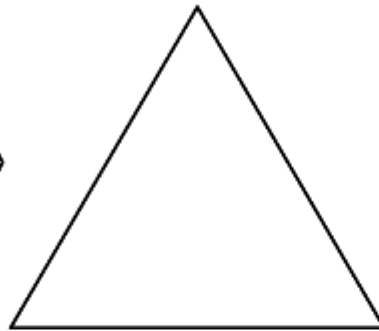
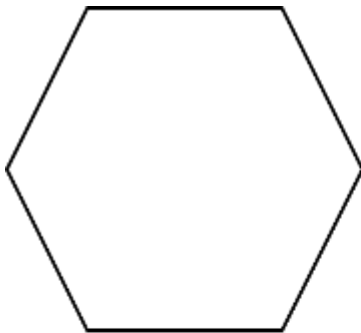
Where is the square?

Can you point to something /an object that is shaped like a circle?

Scoring

Child identifies circle	Correct	Incorrect	No response
Child identifies rectangle	Correct	Incorrect	No response
Child identifies triangle	Correct	Incorrect	No response
Child identifies square	Correct	Incorrect	No response

Child identifies circle in the environment	Correct	Incorrect	No response
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Item 5. Number id (Emergent mAth)

Materials: Number chart of numbers from 1-20

Let's look at some numbers now. I will point to some numbers and I want you to tell me if you know what numbers they are. It's OK if you don't know all of them.

Show the child a copy of the numbers chart. Using another sheet of paper cover all rows of the table except Rows 1 so that it doesn't distract the children. Begin with the first number in the first row by pointing and asking the child

Ok, let's begin. What number is this?

If the child gets stuck for more than 5 seconds, mark as incorrect, point to the next number and encourage the child to continue.

Continue to show number by number, moving your finger across the row until you complete Rows 1 and 2. As the child identifies each number, mark with an X those identified incorrectly. Count all the numbers child identified correctly in Rows 1 and 2. If the child has only identified 3 or fewer numbers correctly, STOP and move on to the next item. If the child identifies 4 or more numbers correctly, move to Rows 3 and 4 saying,

Nice work, let's look at a few more numbers now. I wonder which ones you know.

Ask the child to continue identifying the numbers as done in Rows 1 and 2 and continue marking incorrect answers.

2	4	10	5	7
9	6	8	3	1
13	17	14	19	16
15	18	11	12	20

Item 6. number sense- One-to-one correspondence (Emergent mAth)

Materials: 20 small items (e.g. stones/blocks/beads etc.)

Arrange the 20 objects randomly in front of the child.

Now we are going to play with << name of item >>. There are a lot of << name of item >> here. Please give me 3 << name of item >>?

Be patient while child arranges the objects. When child finishes, re-arrange the 20 objects randomly.

Thanks. Now, can you please give me 8 << name of item >>?

Be patient while child arranges the objects. When child finishes, re-arrange the 20 objects randomly.

If the child cannot give you 3 or 8 objects, STOP and move on to the next item.

If they can give you 3 or 8 items, re-arrange the 20 objects randomly again and say

Nice work. Can you please give me 15 << name of item >>?

While you administer this item observe how persistent /engaged the child is in trying to answer the questions, and score according to the scoring rubric.

Scoring

One to One correspondence			
Child identifies 3 items	Correct	Incorrect	No response

Child identifies 8 items	Correct	Incorrect	No response
Child identifies 15 items	Correct	Incorrect	No response
Persistence / Engagement			
Child stays concentrated on the task at hand; not easily distracted	Yes	No	No response
Child is motivated to complete task; does not want to stop the task.	Yes	No	No response

Item 7. addition and subtraction (Emergent math)

Materials: Rocks/blocks used in previous item, Picture cards with bikes and apples

I have another game with << name of item >>. Here I have 3 << name of item >>.

Lay out 3 <<name of items >>

Now my friend gives me 2 more << name of item >>

Lay these out near the first objects but leaving a little space between the two groups.

How many <<name of item >> do I have in total?

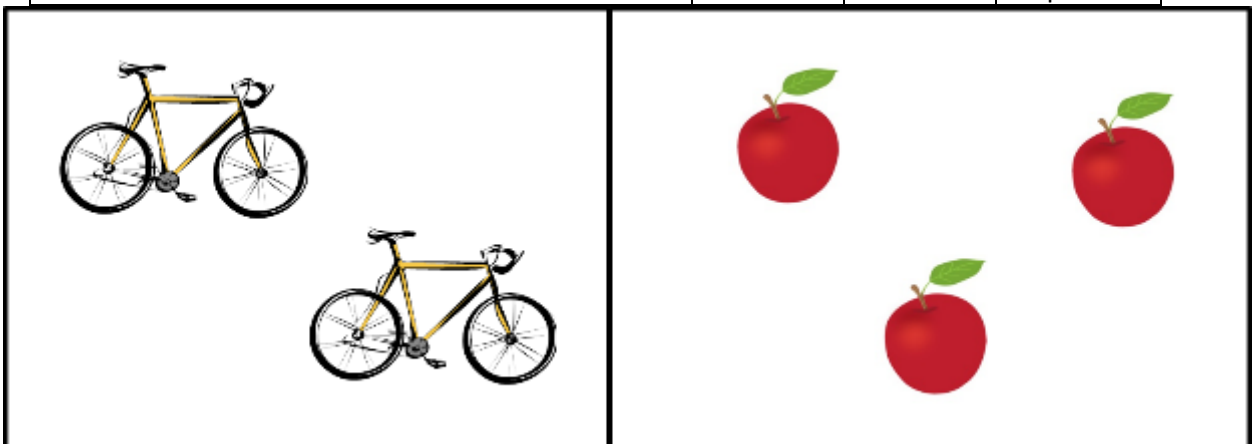
Wait for the child to count and score response. Then show the picture with the bikes and say

Let's try another one. Here are 2 bicycles, if you put 2 more bikes in the picture how many would there be?

Ok. Now I have another picture. Here are 3 apples. If you took one away how many apples would be left?

Scoring

Child adds 3 and 2	Correct	Incorrect	No response
Child adds 2 and 2	Correct	Incorrect	No response
Child subtracts 1 from 3	Correct	Incorrect	No response



Item 8. Puzzle completion (Emergent math)

Time Estimate: 2 minutes 

Materials: 4 piece jigsaw puzzle (laminated and standardized, cut appropriately). Include a picture of the puzzle for the child to see.

Show the picture of the puzzle to child and say,

We are going to have some fun with this puzzle. This is a picture of what you are going to try to make with these pieces.

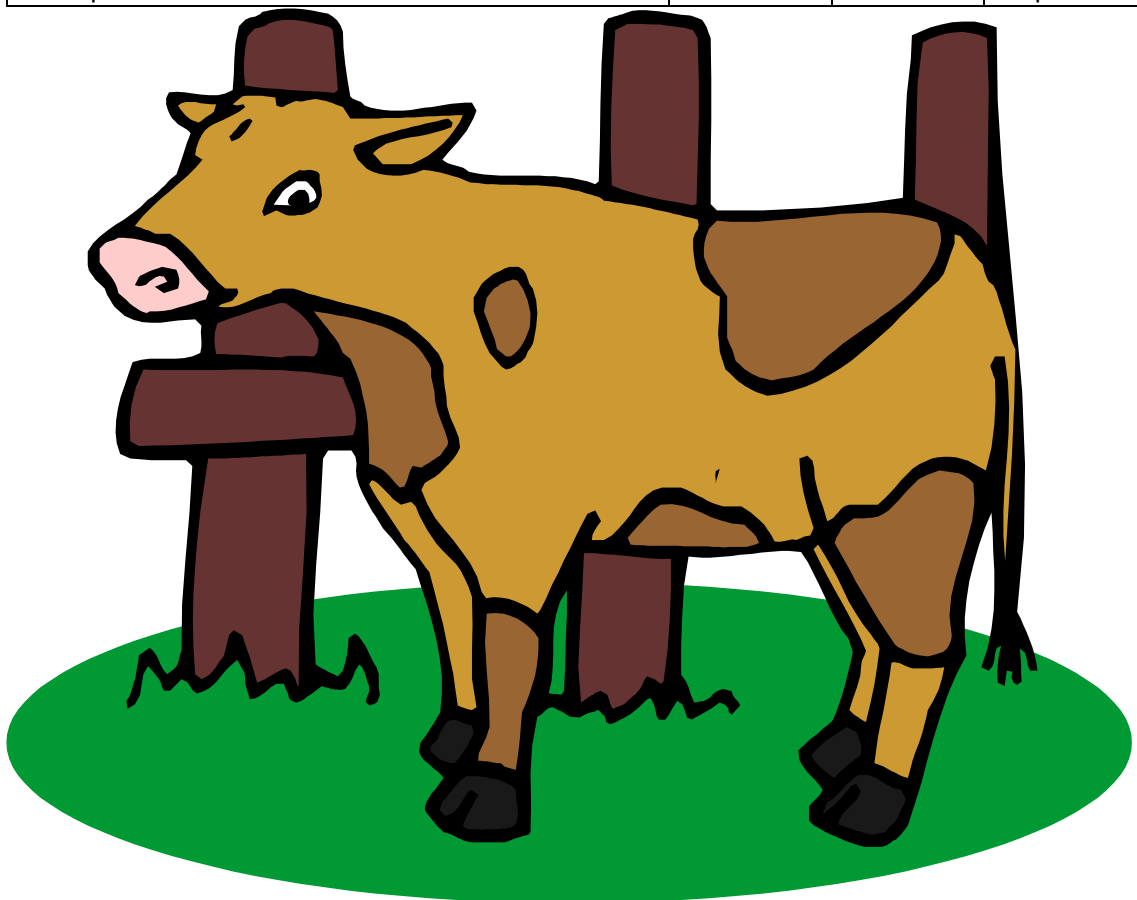
Show the child the puzzle pieces in a random order and say,

Can you try to join the pieces together to make this picture? Let me know when you are done.

While you administer this item observe how persistent /engaged the child is in trying to answer the questions, and score according to the scoring rubric.

Scoring

Puzzle completion			
Number of puzzle pieces fit together (0, 2, 3, 4)			No response
Persistence / Engagement			
Child stays concentrated on the task at hand; not easily distracted	Yes	No	No response
Child is motivated to complete task; does not want to stop the task.	Yes	No	No response



Item 9. Friends (Socio- Emotional)

Materials: Nothing

Can you tell me the names of some of your friends you like to play with?

You can prompt ONCE by saying,

Can you think of any other friends?

Scoring

Number of friends named (0-10)		No response
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Item 10. emotional awareness/regulation (socio-emotional)

Materials: None

Now I have some questions about feelings. Think for a moment and tell me what makes you feel sad or want to cry?

If needed ask clarifying question to understand better child's response. Then ask:

What do you do to feel better when you are feeling sad?

Continue and ask:

What else do you do to feel better when you are feeling sad?

Mark whether the child gives an appropriate response and say:

Now tell me what kinds of things make you feel happy?"

Appropriate answers for regulating emotions: talking/being with friend/adult, playing with something, seeking an adult to help, think of something that makes me smile, punch s pillow, take a deep breath etc.

Scoring

Child identifies something that makes them sad	Appropriate response	Inappropriate response	No response
Child gives one response on dealing with sad feeling	Appropriate response	Inappropriate response	No response
Child gives another response on dealing with sad feeling	Appropriate response	Inappropriate response	No response
Child identifies something that makes them happy	Appropriate response	Inappropriate response	No response

Item 11. Empathy /perspective taking (socio-emotional)

Materials: Picture card of a girl crying

Show the picture card and say,

Now let's look at this picture. Imagine this girl is a friend and she fell down and is hurt. How do you think she is feeling right now?

Then ask,

What would you do to help her feel better?

Prompt ONCE by saying,

Is there anything else you would do?

Acceptable answers

Child crying – upset, in pain, sad, scared or other culturally acceptable answer

Helps in distress – asks how she is doing, hug her, tell her she will be OK, find out if she needs medicine, play with her, hold her hand, get an adult to help her or other acceptable answer

Scoring

Child identifies that friend is feeling sad/hurt/upset	Correct	Incorrect	No response
Child gives one response for how to make friend feel better	Appropriate response	Inappropriate response	No response
Child gives second response for how to make friend feel better	Appropriate response	Inappropriate response	No response



Item 12. Sharing/solving conflict (socio-emotional)

Materials: Nothing

Now I will ask you to imagine a situation. Imagine you are playing with a toy you like and another child wants to play with the same toy, but there is only one toy. What would you do in this situation?

Prompt ONCE by saying,

Is there anything else you would do?

Appropriate answer: talk to the child and ask him to wait, take turns, share, get another toy, play together with the toy, or other culturally acceptable answer

Inappropriate response: push the child away, run away with the toy, tell him it's mine and he can't have it;

Scoring

Child gives one response for how to solve conflict	Appropriate response	Inappropriate response	No response
Child gives second response for how to solve conflict	Appropriate response	Inappropriate response	No response
Child gives third response for how to solve conflict	Appropriate response	Inappropriate response	No response

Item 14. Oral vocabulary (Emergent literacy)

Materials: No Material

Now let's try a word game. Imagine you are going to the shop. Can you name some things /foods you can eat that you can buy from the shop? Try to name as many things as you can think of and I will keep count of them.

Record the number of items the child lists until the child has listed 10 items. If the child is stuck at 2 or 3 items, you can PROMPT ONCE by saying,

Can you think of any others?

When the child cannot think of more items, move on to the next question and say:

Now, I want to know what animals you are familiar with. Can you tell me the names of some animals that you know, animals you may have seen outside your home or in the community? Try to name as many animals as you can think of and I will keep count again.

You can PROMPT ONCE by saying

Can you think of any others?

When the child cannot think of more items, move on to the next item.

Scoring

Number of shop items named (0-10)		No response
Number of animals named (0-10)		No response

Item 15. Print awareness (emergent literacy)

Materials for Item: Age appropriate book for 3-5 year olds

Hand the book to the child upside down, with the cover facing up toward the child.

We are going to look at a book and I need your help. If you were going to read this book, can you show me how you would open it so you can read it?

Turn to the first page of the story.

Can you show me where I should start reading?

Open on the next page and point to the first word on that page

If I start to read here, on the first word, where do I continue reading? Show me with your finger.

Give the child a moment or two to look through the book if he/she wants before we move on to the next question.

Scoring

Child opens the book appropriately (turns book so words are no longer upside down)	Correct	Incorrect	No response
Child points to text on the page (can be the full sentence, the first word, the whole text)	Correct	Incorrect	No response
Child shows direction of text	Correct	Incorrect	No response

Item 16. Letter identification (emergent literacy)

Materials: High frequency and medium frequency letter sheet adapted in country

We will play an alphabet letter game now. I will point to some letters and I want you to tell me what letters they are. It's OK if you don't know all of them. Just do your best.

Show the child a copy of the letter chart. Using another sheet of paper cover all rows of the table except Rows 1 so that it doesn't distract the children. Begin with the first letter in the first row, by pointing and asking the child

What letter is this?

Continue to show letter by letter, moving your finger across the row until you complete Rows 1 and 2. If the child gets stuck for more than 5 seconds, mark it as incorrect, point to the next letter and encourage the child to continue.

Continue to show letter by letter, moving your finger across the row until you complete Rows 1 and 2. As the child identifies each letter, mark those identified incorrectly. Count all the letters child identified correctly in Rows 1 and 2. If the child has only identified 3 or fewer letters correctly, STOP and move on to the next item. if the child identifies 4 or more letters correctly, move to Rows 3 and 4 saying,

Let's look at some more letters now. I wonder which ones you know.

Ask the child to continue identifying the letters as done in Rows 1 and 2 and continue marking incorrect answers.

E	T	A	N	I
O	S	H	R	D
L	C	U	M	F
G	W	B	Y	P

Item 17. FIRST LETTER SOUNDS (emergent literacy)

Now we will play a listening game. This one is about the sounds in words. The word “Hat” starts with /h/ (Say the sound, not the letter name). Now listen to the words I say and tell me which one starts with the same sound, the sound/h/ (Say the sound, not the letter name)
Hand, ball, or light?

If the child gives an incorrect response, say: Hand starts with /h/ just like hat.

Assessment:

Now we are going to continue playing this game. Are you ready?

Repeat the list of words ONCE per question if needed and mark child’s response.

The word ‘Star’ starts with /s/. Now listen to the words I say and tell me which one starts with the same sound /s/
Cow Doll Sun

Good. Now tree starts with /t/. Listen to the words I say and tell me which one starts with the same sound, the sound /t/
Game Toy Cat

Great! Now door /d/. Listen to the words I say and tell me which one starts with the same sound, the sound /d/
Dog Key Girl

Scoring

Child identifies /s/ word pair	Correct	Incorrect	No response
Child identifies /t/ word pair	Correct	Incorrect	No response
Child identifies /d/ word pair	Correct	Incorrect	No response

Item 18. Emergent writing (emergent literacy)

Time Estimate: 2 minutes 

Materials: One blank page, pencil or pen

We're going to play and write. Can you try to write your name here in any way you know? Don't worry of you can't do it well, just try your best.

Limit this section to 2 minutes from when the child begins writing. If the child does not write for a minute after your suggestion, stop and say,

We're going to move on to our next game now.

While you administer this item where the child is asked to write, you should also take note of how the child holds the pencil. The child should hold the pencil with a mature grip.

Scoring

Writing level (0-4)		No response
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Item 19. Oral comprehension (emergent literacy)

Materials: Story below which can be adapted to the local context if needed.

Now I am going to tell you an interesting story. After I have told you the story I will ask you some questions. Listen carefully, okay?

Read out the story slowly, clearly and fluently.

The Mouse and the Cat

Once upon a time there was a fat cat. He always wore a red hat. Once when he was sleeping, a small mouse came silently and stole the hat. The cat woke up to see his hat gone, got very angry and started chasing the mouse. After a while, the mouse was trapped under a table and could not find any way to escape. So the mouse said to the cat, "Please don't eat me, cat. If you spare my life I will return your hat." So, after getting back his hat the cat said, "Please don't touch my hat again" and he went back to sleep in a happy mood.

Now I am going to ask you some questions about the story.

Ask each question slowly and clearly. Each question may be repeated ONCE if needed.

While you administer this item observe how persistent /engaged the child is in trying to answer the questions, and score according to the scoring rubric.

Scoring

Comprehension			
"Who stole the cat's hat?" (the mouse)	Correct	Incorrect	No response
"Can you tell me the color of the hat?" (red)	Correct	Incorrect	No response
"Why did the cat chase the mouse?" (because the mouse took/stole its hat)	Correct	Incorrect	No response
"Where did the mouse get trapped ?" (under the table)	Correct	Incorrect	No response

"Why did the cat decide not to eat the mouse?" (because the mouse gave back the hat)	Correct	Incorrect	No response
Persistence /Engagement			
Child stays concentrated on the task at hand; not easily distracted	Yes	No	No response
Child is motivated to complete task; does not want to stop the task.	Yes	No	No response

Item 20. Copying a shape (Fine Motor)

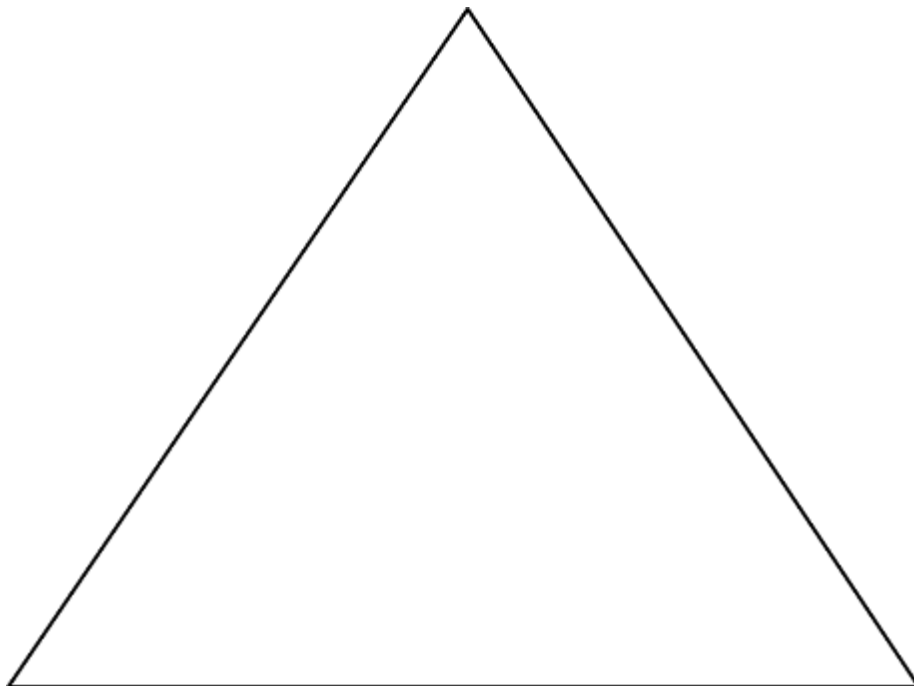
Materials: Pencil and Paper, Picture card with a triangle

Show the child the picture of a triangle and say:

Let's do some drawing! Someone drew this picture. Can you try to draw the same picture on your piece of paper? Just try your best.

Scoring

Number of closed corners, no gaps (0, 1,2, 3)			No response
Resembles closely the picture (diagonal, relatively straight lines)	Yes	No	No response



Item 21. Drawing a person (Fine motor)

Time Estimate: 2 minutes 

Materials: Pencil, Paper

Give the pencil and paper to the child.

I have another drawing game for you. I would like you to draw a picture of a girl or a boy standing up. Can you please draw that for me?

Limit this section to 2 minutes from when the child begins drawing. If the child does not draw for a minute after your suggestion, stop and say:

We're going to move on to our next activity now.

While you administer this item observe how persistent /engaged the child is in trying to answer the question, and score according to the scoring rubric.

Scoring

Drawing a person			
Child draws a head	Correct	Incorrect	No response
Child draws a trunk/body	Correct	Incorrect	No response
Child draws arms	Correct	Incorrect	No response
Child draws legs	Correct	Incorrect	No response
Child draws 1 facial feature	Correct	Incorrect	No response
Child draws 2 facial feature	Correct	Incorrect	No response
Child draws hands	Correct	Incorrect	No response
Child draws feet	Correct	Incorrect	No response
Persistence / Engagement			
Child stays concentrated on the task at hand; not easily distracted	Yes	No	No response
Child is motivated to complete task; does not want to stop the task.	Yes	No	No response

Item 22. Folding paper (fine motor)

Materials: A 20 x 20 cm. piece of paper

Now let's play a folding game! Together we will make a fun shape. I will give you a sheet of paper and I will take one piece too. Watch closely what I am doing and try to fold your piece of paper just as I do, step by step. Please follow me step by step and try to do it carefully.

Follow the steps below as you demonstrate.. Be patient and give time to the child to follow each step. One prompt for each step is allowed. If the child stops/hesitates/gives up in the middle, then move on to the next item.

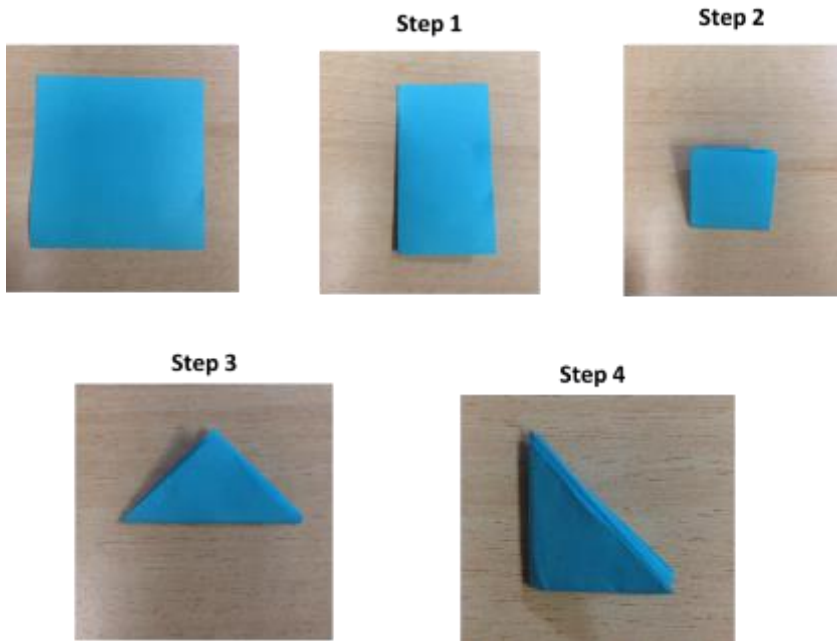
Step 1: Fold down the middle (vertically)

Step 2: Fold down the middle again (horizontally)

Step 3: Fold in half diagonally

Step 4: Fold in half diagonally again

For a step to be scored as correct, there should be no more than a 1 cm difference between the various folds



While you administer this item observe how persistent the child is trying to answer the questions, and score accordingly.

Scoring

Folding			
Number of steps child folded precisely /correctly (within 1 cm) (0-4)			No response
Persistence / Engagement			
Child stays concentrated on the task at hand; not easily distracted	Yes	No	No response
Child is motivated to complete task; does not want to stop the task.	Yes	No	No response

Item 23. Hopping (Gross motor)

Materials: None

We are going to play a game. I want you to stand on any one foot that you prefer and hop forward, and hop forward again, like this –

Demonstrate hopping 10 steps in a straight line

Try to hop as many steps as you can and I will count the number of steps you hopped.

Count the number of steps hopped by the child continuously in one go. Maximum 10 steps.

Scoring

Number of steps hopped		No response
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Item 24. Knowledge about the national flag (Spiritual, Moral & Cultural)

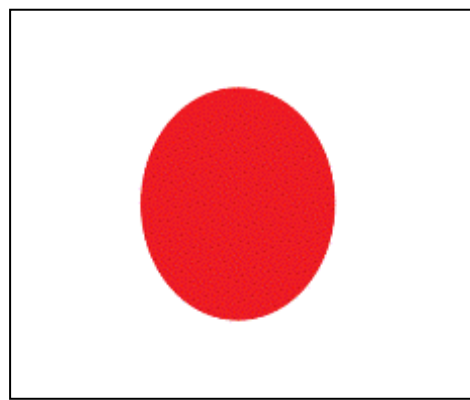
Materials:

Laminated Picture card with pictures of flags of four different countries

Show the child the pictures of flags of four different countries and say:

Now let's look at these pictures.

Then ask, Can you show me the (our) flag of Bhutan?



Scoring

Child identifies the flag	Correct	Incorrect	No response
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Item 25. Compassion (Spiritual, Moral & Cultural)

Materials:

Picture card of a dog being kicked by a boy

Show the picture card to the child and say, "A boy is kicking this dog. Do you think he should do this?"

Wait for the child to respond, and then ask “Why?”



Scoring

Child answers that the dog should not be kicked	Correct	Incorrect	No response
Child gives one valid reason for not kicking the dog	Appropriate response	Inappropriate response	No response

Item 27. Conscious of the ENVIRONMENT (Spiritual, Moral & Cultural)

Materials:

Picture card showing littering of the environment by a girl

Show the Picture card showing littering of the environment by a girl to the child and say, “**This girl has thrown the wai wai covers, empty juice bottles and paper (rubbish) beside the road after eating. Do you think she should do this?**”

Wait for the child to respond, and then ask, “Why?”



Scoring:

Child answers that the rubbish should not be thrown beside the road.	Correct	Incorrect	No response
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Child gives one valid reason for not throwing the rubbish beside the road.	Appropriate response	Inappropriate response	No response
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HEALTH AND HYGIENE

ITEM 26: HAND WASHING

Materials: none

When are good times to wash your hands?

Wait for child to respond and ask again, Are there any other times when it is good to wash your hands?

What do you need to wash your hands properly?

Wait for child to respond and ask again, Are there any other things you think you would need to wash your hands?

Can you tell me why hand washing is important?

SCORING:

Number of different responses given by child (example: before eating, after going to the toilet, after playing)			No response
Child responded that water is needed to wash hands properly	Correct	Incorrect	No response
Child responded that soap is needed to wash hands properly	Correct	Incorrect	No response
Child provided one correct example of why hand washing is important (example: removes dirt or germs, prevents illness, keeps you healthy, or a response that fits closely)	Correct	Incorrect	No response

ITEM 27: HAND WASHING STEPS

Materials:

Picture Card showing Seven Hand Washing Steps for Enumerators reference.

Now we will talk about hand washing. Can you demonstrate to me how would you wash your hands? Wait for the child to respond. Observe and count how many steps the child could demonstrate.

Scoring

Steps of hand washing

Number of steps child demonstrated correctly (0-7)	/7	No response
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ITEM 28: BRUSHING TEETH

Materials: None

When in the day is it good to brush your teeth?

Wait for child to respond and ask again, Are there any other time you think it is good to brush teeth?

Wait for the child to respond, and then ask, "Can you tell me why is brushing your teeth important?"

SCORING:

Child responded that it is good to brush teeth in the morning	Correct	Incorrect	No response
Child responded that it is good to brush teeth before bedtime	Correct	Incorrect	No response
Child provided one correct example of why brushing teeth is important (example: removes sugar, prevents cavities or teeth decay, keeps teeth healthy, or a response that fits closely)	Correct	Incorrect	No response

ITEM 29: HEALTHY AND UNHEALTHY FOOD

Materials: 6 picture cards of vegetables, fruits, chips and soft drinks and one picture card of balanced diet. PLEASE NOTE: Pictures may need to be adapted based on specific cultural context



Show each picture card to the child one at a time and ask:

Is this food good for you?

Show the picture of balanced diet and ask: Why is eating healthy food good for you?

SCORING:

Number of correct responses given by child (Fizzy drinks, chips & chocolate – No. Milk, Vegetables and fruits - Yes)	/6	No response
Child provided one correct responses (example: helps my body become big/tall, healthy, not fall sick, no need to go to hospital/take medicines/take injections, become strong).	Correct/Incorrect	No response

Thank the child for their patience and contributions and congratulate them on their effort. Ask if they have any questions or if there is anything else they want to say. If a child wants to draw let them do that while you check your score sheet.

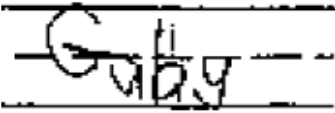

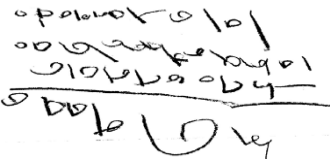

Overall observation of child

Based on your observation of the child throughout the assessment, answer the following questions as carefully as possible.

scoring

	Almost never	Sometimes	Often	Almost always
Did the child pay attention to the instructions and demonstrations throughout the assessment?	1	2	3	4
Did child show confidence when completing activities; did not show hesitation.	1	2	3	4
Did the child stay concentrated and on task during the activities and was not easily distracted? ;	1	2	3	4
Was child careful and diligent on tasks? Was child interested in accuracy?	1	2	3	4
Did child show pleasure in accomplishing specific tasks?	1	2	3	4
Was child motivated to complete tasks? Did not give up quickly and did not want to stop the task?	1	2	3	4
Was the child interested and curious about the tasks throughout the assessment?	1	2	3	4

Appendix A. Scoring rubric for writing

Writing level		
Level 4: Wrote name		4 points
Level 3: Wrote letters		3 points
Level 2: Scribbled with order of forms like letters		2 points
Level 1: Wrote a design or scribbles without order		1 point
Level 0: Didn't write anything		0 points

Appendix B

Date of Interview: _____ / _____ / 2017
Assessor's name: _____
Child ID _____
District: _____
Community _____

QUESTIONNAIRE FOR CAREGIVERS

Instructions:

Thank you for your time. My name is _____, and I work for Save the Children in the evaluation of our early childhood program. The goal of this evaluation is to improve the education that is being provided to your child. Your answers to the following questions will help us greatly in reaching this purpose. All of your answers are confidential. Again, thank you for your time.

PART 1: General Family Information

1. What is your child's name?	
2. What is the sex of your child?	<input type="checkbox"/> Girl <input type="checkbox"/> Boy
3. Date of Birth of child:	Year _____ Month _____ Day: _____
3. How old is your child?	Years _____ Months _____
5. What is your full name?	
6. How are you related to the child?	<input type="checkbox"/> Mother (1) <input type="checkbox"/> Father (2) <input type="checkbox"/> Grandparent (3) <input type="checkbox"/> Older brother/sister (4) <input type="checkbox"/> Other caregiver (5) Specify (5A): _____
7. Who is the primary caregiver of the child? (an adult who assumes the most responsibility in caring for the health and well-being of the child)	<input type="checkbox"/> Mother (1) <input type="checkbox"/> Father (2) <input type="checkbox"/> Grandparent (3) <input type="checkbox"/> Older brother/sister (4) <input type="checkbox"/> Other caregiver (5) Specify (5A): _____
7. What is the mother's full name?	
2. What is the mother's age?	
3. What is the highest level of education that the mother has completed?	<input type="checkbox"/> None (0) <input type="checkbox"/> Preschool (1) <input type="checkbox"/> Primary (2) <input type="checkbox"/> Secondary (3) <input type="checkbox"/> Higher education (4) <input type="checkbox"/> Don't know (5) <input type="checkbox"/> Others Specify (6) _____
4. Can the mother read?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) <input type="checkbox"/> Don't know (9)
5. What is the father's full name?	
6. What is the father's age?	
7. What is the highest level of education that the father has completed?	<input type="checkbox"/> None (0) <input type="checkbox"/> Preschool (1) <input type="checkbox"/> Primary (2) <input type="checkbox"/> Secondary (3) <input type="checkbox"/> Higher education (4) <input type="checkbox"/> Don't know (5) <input type="checkbox"/> Others Specify (6) _____

8. Mother's Marital Status	<input type="checkbox"/> Single (0) <input type="checkbox"/> Married(1) <input type="checkbox"/> Widower(2) <input type="checkbox"/> Divorced (3) <input type="checkbox"/> Others Specify (4)_____
8. Can the father read?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) <input type="checkbox"/> Don't know (9)
9. What is the number of children in the family?	
7. What languages are spoken at home?	Language 1: _____ Language 2: _____ Language 3: _____ Language 4: _____
8. What language does your child feel most comfortable speaking and understanding?	Language 1: _____

PART 2: Health and Hygiene

Request the parents to provide the child's health card and record the following: Child's birthdate:/...../..... 1.2. Child's height recorded last:Cms Date of last record:...../...../..... 1.3. Child's weight recorded last:kgs Date of last record:/...../..... 1.4. Child's weight at birth:kgs.....gms 1.5. Immunization completed as appropriate for the age of child: Yes / No 1.7. Any deviation from normal development recorded in the growth chart: Yes / No If yes, copy it from the record?	
When do you wash your hands? (do not read options to parents; check as many as apply)	<input type="checkbox"/> Before eating <input type="checkbox"/> Before cooking/preparing food <input type="checkbox"/> Before feeding children <input type="checkbox"/> After defecation <input type="checkbox"/> After cleaning a child's bottom <input type="checkbox"/> After cooking/eating <input type="checkbox"/> After cleaning the house/compound/cattle <input type="checkbox"/> After disposing garbage <input type="checkbox"/> Others (Specify)
When do you brush your teeth? (do not read options to parents; check as many as apply)	<input type="checkbox"/> Morning <input type="checkbox"/> Evening/Before bed time <input type="checkbox"/> After meals <input type="checkbox"/> Other (Specify)
In the past 2 weeks, has (child) had any difficulty or rapid breathing with cough?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) <input type="checkbox"/> Don't know (999)
In the past 2 weeks, has (child) had any fever?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) <input type="checkbox"/> Don't know (999)

<p>In the past 2 weeks, has (child) had any diarrhea?</p>	<p><input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) <input type="checkbox"/> Don't know (999)</p>
<p>Please tell me about the food that (child) ate yesterday. (do not read options to parents; check as many as apply)</p>	<p><input type="checkbox"/> Porridge, bread, rice, noodles, or other foods made from grains <input type="checkbox"/> Pumpkin, carrots, squash, or sweet potatoes that are yellow or orange inside (other vitamin A rich vegetables) <input type="checkbox"/> Potatoes, white yams, or sweet potato, wild potato (shing joktang), tapioca or any other foods made from roots. <input type="checkbox"/> Any dark green leafy vegetables <input type="checkbox"/> Ripe mangoes, ripe papayas, or (other local vitamin A-rich fruits) <input type="checkbox"/> Any other fruits or vegetables <input type="checkbox"/> Liver, kidney, heart, or other organ meats <input type="checkbox"/> Any meat, such as beef, pork, mutton, chicken etc <input type="checkbox"/> Eggs <input type="checkbox"/> Fresh or dried fish <input type="checkbox"/> Any foods made from beans, peas, lentils, nuts, or seeds <input type="checkbox"/> Cheese, yogurt, or other milk products <input type="checkbox"/> Any oil, fats, or butter, or foods made with any of these <input type="checkbox"/> Any sugary foods such as chocolates, sweets, candies, pastries, cakes, or biscuits <input type="checkbox"/> Spices such as chilies, prickly ash (thingey), herbs (coriander, mint etc.) sauce <input type="checkbox"/> Any other (specify)</p>
<p>How many times (usually) do you feed your child/children in a day? <i>(Feeding refers to meals and snacks for the child in a day)</i></p>	<p><input type="checkbox"/> Two times a day <input type="checkbox"/> Three times a day <input type="checkbox"/> Four times a day <input type="checkbox"/> Five times a day <input type="checkbox"/> Six times a day <input type="checkbox"/> Other (specify) _____</p>
<p>What do you do when your child falls ill?</p>	<p><input type="checkbox"/> Take child to BHU (1) <input type="checkbox"/> Consult a local healer (2) <input type="checkbox"/> Consult an astrologer (3) <input type="checkbox"/> Consult an elderly person (4) <input type="checkbox"/> Conduct puja (5) <input type="checkbox"/> Other specify (6) _____</p>
<p>What do you do when your child does not show age appropriate development?</p>	<p><input type="checkbox"/> Take child to BHU (1)</p>

	<input type="checkbox"/> Consult a local healer (2) <input type="checkbox"/> Consult an elderly person (3) <input type="checkbox"/> Consult an astrologer (4) <input type="checkbox"/> Conduct puja (5) <input type="checkbox"/> Other specify (6) _____ _____
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PART 3: Home Environment / Parenting Practices

1. Do you have any of the following types of other reading materials at home?			
	<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (0)	<input type="checkbox"/> Don't know (9)
Storybooks / picture books for young children?			
If yes, how many books?			
b. Textbooks?			
c. Magazines?			
d. Newspapers?			
e. Religious books?			
f. Coloring books?			
g. Comics?			
2. I am interested in learning about the things that your child plays with when s/he is at home. Does she play with:			
a. Homemade toys, such as stuffed dolls, cars, or other toys made at home?			
b. Toys from a shop or manufactured toys?			
c. Household objects, such as bowls, cups or pots?			
d. Objects found outside, such as sticks, rocks, animal shells or leaves?			
e. Does your child have any drawing or writing materials?			
f. Does child have any puzzles (even a two piece puzzle counts)?			
g. Does your child have any two or three piece toys that require hand-eye coordination?			
h. Does child have toys that teach about colors, sizes or shapes?			
i. Does child have toys or games that help teach about numbers/counting?			
j. Others			

3. In the past 3 days, did you or any other family member older than 15 years engage in these activities with <<insert child's name>>? Note: ask "Who?" if the answer is "yes". – tick as many as appropriate	Yes(1)	No(0)	Mother (2)	Father (3)	Other caregiver (4)
a. Read books or look at pictures books with child?					
b. Tell stories to the child?					
c. Sing songs to or with the child, including lullabies?					
d. Take the child outside the home? For example, to the market, visit relatives.					
e. Play with the child any simple games?					
f. Name objects or draw things to or with the child?					
g. Show or teach your child something new, like teach a new word, or teach how to do something?					
h. Teach alphabet or encourage to learn letters to the child?					
i. Play a counting game or teach numbers to the child?					
j. Hug or show affection to your child?					
k. Spank your child for misbehaving?					
l. Hit your child for misbehaving?					
m. Criticize or yell at your child?					
4. I would like to know about how your child spends his/her day.					
a. On a regular day, how many hours does the mother spend time talking, walking, and/or playing with the child?					
b. On a regular day, how many hours does the father spend time talking, walking, and/or playing with the child?					
On a regular day, how many hours the child spend in the care of another child who is less than 10 years old?					
On a regular day, how many hours does the child spend alone?					

PART 4: Socio-economic background

1. What kind of roof does your house have?	<input type="checkbox"/> Cement	<input type="checkbox"/> Iron sheets
	<input type="checkbox"/> Thatch	<input type="checkbox"/> Other

2. What kind of walls does your house have?	<input type="checkbox"/> Mud	<input type="checkbox"/> Wood/thatch
	<input type="checkbox"/> Bricks	<input type="checkbox"/> Other

<p>What is the main source of drinking water for members of your household?</p>	<input type="checkbox"/> Cement Piped water Piped into dwelling (1) Piped into compound (2) Piped to neighbor (3) Public tap (4) Dug well Protected well (5) Unprotected well (6) Water from spring Protected spring (7) Unprotected spring (8) Rainwater collection (9) Tanker-truck (10) Cart with small tank / drum (11) Surface water (river, stream, dam, lake, Pond, canal, irrigation channel). (12) Bottled water (13) Other Specify _____ (14)
<p>What kind of toilet facility do members of your household usually use?</p>	Flush / Pour flush Flush to piped sewer system Flush to septic tank (without soak pit) Flush to septic tank (with soak pit) Flush to pit (latrine) Flush to somewhere else Flush to unknown place / Not sure /DK where Pit latrine Ventilated Improved Pit latrine (VIP) Pit latrine with slab Pit latrine without slab / Open pit Long drop latrine Composting toilet Bucket No facility, Bush, Field Other

3. Does your house have a:	<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (0)	<input type="checkbox"/> Don't know (9)
a. Bedroom?			
b. Kitchen?			
c. Living room?			

d. Washroom?			
e. Inside toilet?			

4. Does your home have:	<input type="checkbox"/> Yes (1)	<input type="checkbox"/> No (0)	<input type="checkbox"/> Don't know (9)
a. Radio?			
b. Television?			
c. Refrigerator?			
d. Bicycle?			
e. Motorcycle?			
f. Mobile phone?			
g. Electricity?			
h. Land for crops?			
i. Livestock, family animals, or poultry?			

5a. Does child <i>do household chores or work outside the household</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No
5b. How much time (in minutes) does (CHILD) spend doing chores or work each day?	_____ hours

Part 6: Disability

Do you suspect or know that the child has any disabilities?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0) → <i>If No, skip to question 3.</i>
If so, what type?	<input type="checkbox"/> Communication/language (1) <input type="checkbox"/> Cognitive (2) <input type="checkbox"/> Sensory integration/attention (3) <input type="checkbox"/> Physical (4) <input type="checkbox"/> Visual (5) <input type="checkbox"/> Auditory (6) <input type="checkbox"/> Other (7)
Are you worried about any aspect of your child's intellectual or social development or skills?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0)
Are you worried about any aspect of your child's physical development or growth?	<input type="checkbox"/> Yes (1) <input type="checkbox"/> No (0)

Appendix C

CCD Plus DHO and HA Key Informant Interviews

Date: _____

District: _____

Interviewer name(s): _____

Interviewee name: _____

Greeting

Thank you for agreeing to meet with us and for taking the time to come here today. Your presence and participation are very much appreciated. We are going to talk about the CCD parenting education program that you have participated in. The Ministry of Health is considering expanding the same program to other districts in Bhutan and would like to learn more about your experiences in this pilot phase of the program. There are no right or wrong answers, and you can feel free to be honest. Your responses will be anonymous and used to make the program more effective for other families in Bhutan.

Questions for DHOs

1. Let us recollect about the C4CD Plus group sessions. Can we think of what we did? What were some of the activities? How did you find it?
2. What is your opinion about helping children at home to be prepared for school? Do you think you are confident to help children learn some of the skills that you learned through the training sessions? How/Why?
3. Do you think these parenting sessions will have impact on children's development? Why or why not?
4. Do you feel the messages shared in the parenting sessions are as important as messages about child health topics? Why or why not?
5. Do you think there were challenges? If so, what were the challenges? How can we overcome them?
6. Can you recollect which were the most easy and difficult sessions? Which sessions were the easiest and which were the difficult?
7. Can you recollect which sessions were the most interesting sessions? Why?
8. On a scale from 1 to 10 (1= not important at all, 10=very important) how important do you think the messages about early learning at home are for parents to learn? Why?
9. Do you think the parenting sessions should be offered to parents in other areas of Bhutan? Why or why not?
10. Do you think such sessions should be organized in the future? How can we improve our program delivery?
11. What is your opinion of the persons who delivered the sessions (HA v. CHW)? Why?

CCD Plus VHW Key Informant Interviews

Date: _____

District: _____

Interviewer name(s): _____

Participant name: _____

Participant position:

- Midwife
- Public Health Nurse
- Enrolled Nurse
- Community Health Nurse
- Community Health Officer
- Community Health Volunteer

Greeting

Thank you for agreeing to meet with us and for taking the time to come here today. Your presence and participation are very much appreciated. We are going to talk about the CCD parenting education program that you have participated in. The Ministry of Health is considering expanding the same program to other districts in Bhutan and would like to learn more about your experiences in this pilot phase of the program. There are no right or wrong answers, and you can feel free to be honest. Your responses will be anonymous and used to make the program more effective for other families in Bhutan.

Questions for CHWs

Training & mentoring

1. Was the training you received for the CCD Plus program helpful for your understanding of how to deliver the parenting sessions?
 - a. What were the strengths of the training?
 - b. What could be done to make the training more helpful?
2. Did you receive any mentoring or feedback on your delivery of the CCD Plus program during the past 6 months?
 - a. Was the feedback helpful for improving your delivery of the program?
 - b. Were there any negative aspects of the monitoring you received?
 - c. What other support do you think could have helped you?

Parenting session workload

3. Were you able to find time to lead all 12 of the parenting sessions held during the past six months? Why or why not?
4. On a scale from 1 to 10 (1 being very easy and 10 being very difficult) how easy or difficult was it to lead the parenting sessions? Why? What would have made it easier?

Parenting session participation

5. How many parents typically attended the parenting sessions?
 - a. What was the make-up of the group (example: men or women, younger or older parents, grandparents or other family, etc.)?
6. Did you hear about any barriers to parents attending the sessions? If so, what were they?
7. Did all parents actively participate in the activities and discussions the same amount or did some participate more than others?
 - a. Who were the most active participants? Who were the least active?

Parenting session importance

8. On a scale from 1 to 10 (1 being not important at all and 10 being very important) how important do you think the messages about early learning at home are for parents to learn? Why?
9. Do you feel that the messages shared in the parenting sessions are as important as messages about child health topics? Why or why not?
10. Do you believe that the sessions changed the way that parents interacted with their children? Why or why not?
11. Do you think these parenting sessions will have an impact on children's development? Why or why not?
12. Do you think the parenting sessions should be offered to parents in other areas of Bhutan? Why or why not?

CCD Plus Parent Key Informant Interviews

Date: _____

District: _____

Interviewer: _____

Participant name: _____

Greeting

Thank you for agreeing to meet with us and for taking the time to come here today. Your presence and participation are very much appreciated. We are going to talk about the CCD parenting education program that you have participated in. The Ministry of Health is considering expanding the same program to other districts in Bhutan and would like to learn more about your experiences in this pilot phase of the program. There are no right or wrong answers, and you can feel free to be honest. Your responses will be anonymous and used to make the program more effective for other families in Bhutan.

Questions for Parents

1. Let us recollect about the C4CD Plus group sessions. Can we think of what we did? What were some of the activities? How did you find it?
2. What is your opinion about helping children at home to be prepared for school? Do you think you are confident to help children learn some of the skills that you learned through the sessions? How? Why?
3. Do you think these parenting sessions will have impact on children's development? why or why not?
4. Do you feel the messages shared in the parenting sessions are as important as messages about child health topics? Why or why not?
5. Do you think there were challenges? If so, what were the challenges? How can we overcome it?
6. Can you recollect which were the most easy and difficult sessions? Which sessions were the easiest and which were the difficult?

Can you recollect which sessions were the interesting sessions? Why?

7. On a scale from 1 to 10 (1 not important at all and 10=very important) how important do you think the messages about early learning at home are for parents to learn? Why?

8. Do you think the parenting sessions should be offered to parents in other areas of Bhutan? Why or why not?

9. Do you think such sessions should be organized in the future? How can we improve our program delivery?

10. What is your opinion of the persons who delivered the sessions? How? Why do they think so?

Appendix D

Table D1. CCD Plus Impact analysis using cluster robust standard errors

VARIABLES	(1) Motor	(2) Literacy	(3) Numeracy	(4) Social- emotional	(5) Culture	(6) IDELA
Intervention	0.188 (0.153)	0.703*** (0.134)	0.706*** (0.173)	0.304 (0.169)	0.124 (0.131)	0.554** (0.159)
Child age (month)	0.0327*** (0.00672)	0.0145* (0.00619)	0.0247** (0.00726)	0.0138 (0.00872)	0.0290*** (0.00629)	0.0179* (0.00724)
Motor (baseline)	0.422*** (0.0713)					
Literacy (baseline)		0.578*** (0.0579)				
Numeracy (baseline)			0.320*** (0.0844)			
Social-emotional (baseline)				0.433*** (0.0707)		
Culture (baseline)					0.380*** (0.0623)	
IDELA (baseline)						0.576*** (0.0678)
Constant	-1.735*** (0.369)	-1.091** (0.314)	-1.617*** (0.383)	-0.866 (0.454)	-1.511*** (0.300)	-1.196** (0.382)
Observations	235	235	235	235	235	235
R-squared	0.403	0.466	0.305	0.246	0.308	0.485
Adjusted R-squared	0.396	0.459	0.296	0.236	0.299	0.478

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

Appendix E

Table E1. Comparison between CCD Plus impact models using different methods to account for attrition

VARIABLES	(1) Unweighted Model	(2) IPW Model	(3) Imputed Model
Intervention	0.571*** (0.156)	0.599*** (0.158)	0.491** -3.12
Child age (month)	0.0139* (0.00566)	0.0127* (0.00607)	0.0144 -1.93
IDELA (baseline)	0.555*** (0.0511)	0.566*** (0.0648)	0.485*** -7.11
Constant	-0.985** (0.303)	-0.926** (0.313)	-0.986* (-2.46)
Observations	236	235	294

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05

