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Finding alternative community-based learning delivery for parenting skills during COVID-19 for mothers with children aged 0–3 Years

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Parenting training has been considered crucial to improving child development. The Tanoto Foundation's parenting program intervention was started in 2021 when the COVID-19 pandemic impacted government policies in Indonesia. Preventive measures that limit mobility affect the sustainability of face-to-face parenting interventions. The study aimed to explore alternative intervention methods, such as face-to-face, blended, online with facilitators, and self-learning, for parenting skills learning during emergencies. A 1-year non-randomized quasi-field experiment using a mixed quantitative-qualitative approach was conducted to 762 participants. SIGAP Q, the HOME Inventory, and CREDI were used for quantitative measurements, while interviews and focused group discussions (FGDs) provided qualitative data. The quantitative data were analyzed using multiway ANOVA, and the qualitative data were analyzed using thematic analysis. The study found that all intervention modalities delivered positive outcomes. In contrast, face-to-face delivered the largest gain, followed by online with facilitators, blended learning, and online self-learning (a web-based learning management system). As an alternative, online with facilitators is the best for delivering parenting materials, followed by online self-learning (independent) modes of intervention. Blended and online models provide alternative models in emergency contexts. Implications are discussed in this article.

KEYWORDS

community-based parenting learning, mode of learning, early childhood, adult learner, web-based LMS

1 Introduction

The COVID-19 pandemic has created an unprecedented global emergency, particularly affecting new middle-income nations such as Indonesia. This country is expected to benefit from a demographic bonus, characterized by high population productivity and low dependency, from 2004 to 2030. However, before the pandemic, the country was already grappling with significant challenges, such as extreme poverty and high rates of stunting and malnutrition among children.

The Strategic Plan of the Health Sector 2020-2024 (Direktorat Jenderal Kefarmasian dan Alat Kesehatan, 2021), based on the 2018 Basic Health Survey [Kementerian Kesehatan RI, 2018], the life expectancy for Indonesians was 71.5 years (74 years for women and 69 for men). However, the Healthy Adjusted Life Expectancy (HALE) was only 62.65, indicating a loss of 8.85 years of quality of life due to illness, disability, and poor environmental conditions. Additionally, the document highlighted a prevalence of underweight children at 17.7% and stunting among Indonesian children under the age of 5 years at 30.8%, ranking Indonesia fifth highest in the world for stunting.

Soon after the COVID-19 pandemic, the Indonesian government responded with a number of policies, starting on March 1, 2020. One of these was the enforcement of stringent social distancing measures and strong recommendations to stay at home and avoid public spaces. Consequently, all public facilities, including market infrastructure, were closed. Schools, malls, entertainment venues, tourist attractions, places of worship, and public transportation activities were either temporarily suspended or severely restricted.

The government was aware that while the poverty alleviation programs had a positive effect, the state was still dealing with 9%−11% of the population living below or just below the poverty line, making them highly vulnerable. The National Economic Survey 2019 suggested that half of the households in this vulnerable population did not have savings (SMERU, 2021). To mitigate the catastrophic impacts of the pandemic, the government launched multi-sectoral programs, including social protection measures such as cash transfers and free healthcare, including medication, especially for COVID-19 patients. Additionally, the monetary and banking sectors provided financial support for family-based and micro-scale businesses (OECD, 2021; SMERU, 2021).

Global policies on social distancing and home isolation accelerated the development of digital technology to address emerging issues during the COVID-19 pandemic. This led to the rapid growth of digital platforms, significantly impacting homeschooling, local and global communication, job creation in digital marketplaces, global coordination, and telemedical cooperation, which ultimately contributed to ending the pandemic sooner than expected (OECD, 2020; Vargo et al., 2020; Zhao et al., 2021; Alghamdi et al., 2022).

Advances in communication applications during the pandemic helped keep people connected, maintaining social cohesion, and encouraging social inclusion for citizens with limited access to government social protection and basic services (Shin and Lin, 2021). Digital-based distant learning, developed to reach students who were otherwise deprived of education, was fully utilized as infrastructures were built to facilitate coordination to curb the virus. The Coordinating Ministry of Communication and Information (November 12, 2022) noted positive growth in Indonesia's digital economy (5.5% in 2021). By 2024, the government aims to establish digital connectivity in 12,000 districts across the country.

Early evaluation of the impacts of the COVID-19 pandemic revealed that family finances were the hardest hit due to massive unemployment and loss of family income (SMERU, 2021). Women were disproportionately affected compared to their male counterparts. More women-headed households reported lacking savings (56.7%) to cushion the impact of the crisis compared to men (50.6%). In addition, women were overwhelmed by added stressors, including providing psychosocial support for husbands or partners who lost their jobs and income, managing children who have to study at home, and, notably, finding additional sources of income (UNICEF, 2020; SMERU, 2021). Despite all these challenges, mothers were expected to manage children's behavior to mitigate the negative impacts of physical and psychological control, resolve parent–child conflicts, and moderate the negative impacts of controlling children's emotions and behavior (Marici, 2015).

Indonesia could not afford to lose any opportunities to improve its human resource development. Early childhood is a vital period during which rapid physical, social, and mental growth occurs. Appropriate nutritional intake and nurturing experiences at this time significantly affect children's cognitive, language, physical, motor, and socio-emotional development. Healthy development in these domains lays the foundation for future development and contributes to the child's overall quality of life (Morrison, 2009; Essa, 2011). As a country facing a "triple burden of malnutrition" among its children, Indonesia's future quality of human resources is seriously at stake (UNICEF, 2020; Dikhtyar et al., 2021).

For many years, the Indonesian government has been using various platforms to inform the public about preventing water- and blood-borne diseases, nutrition, and child-rearing practices. The most common method was face-to-face education for mothers or caregivers during clinical visits at POSYANDU (Pos Pelayanan Terpadu/Integrated Health Service organized in the neighborhood). With the growing use of smartphones, the government has also engaged the community through digital platforms. The COVID-19 pandemic highlighted the need for digital communication to inform the public and change their behavior. Digital technology was used to educate the public about the coronavirus and its variants, provide appropriate home care, and identify the most effective prevention methods. In addition, digital platforms were also used to inform and control citizens, ensuring adherence to public safety rules and regulations.

Parenting education is crucial for promoting child development and wellbeing, especially in the first 1,000 days of a child's life. Early brain development is the foundation for future development, and the fulfillment of nutrition and stimulation through parental care significantly influences children's brain development. Therefore, it is important for parents to understand appropriate parenting methods (Papalia and Martorell, 2021). The importance of addressing early childhood issues is also emphasized in the International Sustainable Development Goals (SDGs/TPB) agenda. The TPB agenda includes the issue of children as a global development target for 2030, aiming to ensure that all girls and boys have access to early childhood development, care, and good pre-primary education by 2030 so that they are ready to pursue basic education (Ministry of National Development Planning/Bappenas 2020, in the Central Statistics Agency).

This is especially important to address when families are living in extreme poverty. In the context of poverty, parenting policy recognizes the intricate relationships between structural factors and parental agency in delivering care for the best outcome for child wellbeing. Structural interventions focus on creating an

enabling environment and developing skills to address livelihood issues and access basic services such as health and education. In terms of parental agency, policies will be aimed at nurturing or improving parenting skills to enhance responsiveness, feeding practices, parent–child play and dialogues, marital stability, and psychosocial support (La Place and Corlyon, 2015). It is also important to note that parenting education is crucial for poor children's survival, as parents typically have the most direct and powerful influence on their wellbeing than any other caregivers (teachers, friends, or other caregivers). "While it is recognized that not all children are raised by their parents, nonetheless, all children require quality parenting," as observed by UNESCO (Evans, 2006; Baydar et al., 2014). This is even more crucial to mitigate the impacts of child marriage, in line with the amendment of Law No. 1 of 1974 on Marriage, which raised the legal age for girls to marry from 16 years old to 18 years old.

A review of parenting education by the World Bank (Tomlinson and Andina, 2015) showed that social protection programs combined with parenting education (like the Keluarga Harapan Program) are most effective in imparting knowledge on best practices in parenting and helping parents with daily tasks and responsibilities toward their children.

Traditional face-to-face methods of parenting education have serious limitations, particularly in resource-constrained environments. Limited resources result in limited participation. The UNICEF State of the World Children Indonesia (2020) reported that Indonesian law requires 20% of the budget to be allocated to the education sector. Unfortunately, in 2018, spending on education accounted for only 10% of total government expenditures. In social development, this situation is problematic for a middle-income country like Indonesia to address extreme poverty and related conditions, such as climate change.

Realizing the burden that women have to endure at home, the need for flexible, accessible, and scalable modes of delivering parenting education becomes increasingly evident (Jensen et al., 2021). This need became particularly evident during the COVID-19 pandemic, which disrupted conventional educational practices. As societies evolve, the methods through which parenting education is delivered must adapt to changing circumstances, especially with the emergence of digital technologies. This study investigates the feasibility of alternative modes of community-based parenting education in Indonesia, a country with diverse sociocultural contexts.

Several studies show that online education remains quite effective but requires the development of more mature self-regulation from the study participants (Bonk and Reynolds, 1997; Setyawati and Chelsea, 2021). Digital technology, which has been successfully utilized in distance learning, can greatly benefit marginalized populations who have been excluded from mainstream education. These populations include children with disabilities, children who migrate seasonally with their parents, girls who are culturally and geographically isolated, housewives who have added physical and psychological burdens because of their husband's lost income, and children who are always at home and need their mothers.

The Tanoto Foundation is an independent philanthropic organization in the field of education, which was founded on the belief that every person should have the opportunity to realize their full potential. The Tanoto Foundation's programs are based on the belief that quality education accelerates equal opportunity. Since its inception in 1981, the Tanoto Foundation has focused on developing educational facilities and various programs to advance Indonesian human resources from an early age, especially in the education sector. Since 2021, the Tanoto Foundation has been developing community units known as Rumah Anak Sigap (RAS), which serve as partners in implementing programs designed by experts who assist the Tanoto Foundation. One such initiative is the education advocacy program for mothers/primary caregivers to develop parenting skills. This program is expected to help the community prevent malnutrition and stunting in children, help parents provide cognitive and social stimulation for school readiness, and foster positive character development. Identifying the most effective intervention modalities will benefit this program.

To this end, the Tanoto Foundation commissioned a team of independent researchers from academic institutions, namely the Faculty of Psychology at Atma Jaya Catholic University of Indonesia and the Faculty of Psychology of Universitas YARSI, both located in Jakarta. The team was tasked with organizing a quasi-field experimentation study to test five modalities of delivering parenting information to mothers/primary caregivers: These modalities are as follows:

- Face-to-face (offline) education with home visits and visits to RAS.
- Blended education combining face-to-face and online sessions (web-based LMS).
- Fully online education with facilitators (web-based LMS-based and messaging app, WhatsApp).
- Fully online self-learning without facilitators (web-based LMS).
- The control group continues the existing parenting education without intervention (TAU).

  An LMS consultant redesigned the learning modules, which cover 10 topics, to be delivered online during the intervention period (see Table 1).

In light of the ongoing pandemic and the growing demand for remote learning solutions, our study holds significance for policymakers, educators, and researchers seeking to enhance the accessibility and impact of parenting education. By exploring the potential of digital platforms and alternative learning modalities, we aim to contribute to the development of innovative, adaptable, and effective parenting education programs that can withstand various challenges.

As highlighted by Tomlinson and Andina (2015, 2016), who have examined evidence in both developed and developing nations, parenting education programs yield positive impacts. These benefits include enhancing parents' sensitivity, reducing negative interactions with children, improving emotional abilities, responsiveness, and nurturing behaviors, helping parents be less intrusive and better able to foster children's independence, increasing immunization rates, improving child nutrition levels, boosting child height, and weight, as well as enhancing

TABLE 1 Titles of learning modules.

No.	Sub module title
1.	Building the Vision and Mission of the SIGAP Family
2.	Building a Warm Relationship with Children From Pregnancy to Toddlers
3.	Mother's Needs During Breastfeeding (Physical and Mental Needs): Breastfeeding Comfortably
4.	Feeding practices for Babies and Children)
5.	Age-appropriate Stimulation for Toddler Development
6.	Building Positive Communication Within the Family
7.	Non-Violence Communication in the Family
8.	Building Toddler's Behavior with Positive Discipline
9.	Playing And Storytelling With Toddlers And Practice Making Toys Out Of Materials At Home
10.	Protecting Toddlers from the Impact of Technology and Natural Disasters

children's emotional abilities, happiness, and secure attachments with caregivers.

To achieve the desired outcomes of the parenting education program, careful attention must be given to the design and delivery mechanisms of the intervention. Clear and explicit objectives should be set, considering factors like appropriate intensity and timing, relevant materials, community acceptability and support, and the involvement of trained facilitators (Tomlinson and Andina, 2015). Additionally, it is crucial to consider participants' characteristics and input behaviors, such as psychological maturity, education level, and digital literacy. Given the ongoing COVID-19 pandemic, it is important to explore various delivery modes, including digital platforms (Yoshikawa et al., 2020).

To address this issue, we conducted a comparative study in two distinct regions of Indonesia: Pandeglang and Jakarta. Pandeglang represents poor rural districts in Banten Province, while Jakarta represents poor urban inner-city districts. These regions were chosen based on their unique socioeconomic and cultural characteristics, allowing us to explore the adaptability of alternative parenting education methods across different contexts. By comparing the effectiveness and acceptability of various learning modalities, we aim to provide insights into designing effective parenting education programs.

The study is guided by "andragogy," emphasizing adult-focused learning principles (Knowles, 1984; El-Amin, 2020). Andragogy highlights the importance of learners' autonomy and self-directed learning, aligning well with the learning needs of adult participants. In andragogy, there are five assumptions for adult learners: (1) adults are goal-oriented, (2) adults are relevancy-oriented (problem-centered), meaning that they need to know why they are learning something, (3) adults are practical and problem-solvers, (4) adults have accumulated life experiences, and (5) adults are autonomous and self-directed.

Therefore, for the learning process to be successful, learning participants need to understand why they must learn the material. They need to learn experientially using a critical thinking approach, and teaching encourages participants' self-confidence. This is because adult learners have previous learning experiences and

tend to be practical. Participants should be able to engage in contextual analysis, role-playing, simulations, and self-assessments. Rogers (2001) explains that adult learners usually come to learning programs with various intentions. It is important to consider this and tailor the learning process accordingly. Adult learners are motivated to learn in their own way. Although motivation can be developed, intrinsic motivation will help people learn. Participants in the learning program may be encouraged to learn and persevere through extrinsic influences.

By integrating this approach with digital technology, we seek to design more learner-centric parenting education programs that cater to participants' diverse backgrounds and schedules. Shin and Lin (2021) compared online and offline learning for adult learners. If learning is organized offline, several challenges may arise (e.g., financial problems, lack of time to study, and lack of partner emotional support), dispositional (not believing that the institution can meet students' needs), and institutional (the institution does not have alternative times that suit students). Hence, online learning presents a potential alternative. However, this approach also comes with challenges that adult students may encounter. These challenges include time allocation, financial limitations, difficulties reconciling social and academic aspects, motivational hurdles, and technology-related obstacles (Bornstein et al., 2022; Britto et al., 2022). According to Dabbagh (2007), successful adult learners in online settings tend to possess certain characteristics. These characteristics include digital literacy, a positive self-concept, self-discipline, effective communication skills, interpersonal strengths, foundational knowledge of the subject matter, a commitment to collaborative learning, adept time management, and cognitive learning strategies.

However, to the best of our knowledge, no specific research has investigated effective learning methods that align with Indonesian culture in parenting education. Thus, this article aims to understand which learning modalities or interventions are more effective and may be proposed for further development to cope with similar disruptive situations in the future.

The research questions addressed in this study are as follows:

1. How do different learning modalities impact participants' knowledge acquisition and engagement in parenting education during an emergency such as a pandemic?

2. Are there variations in the effectiveness of learning modalities between the different regions of Pandeglang and Jakarta?

3. What are the perceptions (acceptability) of participants regarding the use of a learning management system (LMS) for parenting education in both regions?

2 Materials and methods

2.1 Research design

This research employed a quasi-experimental approach targeted at parents or caregivers to examine the effectiveness of four learning modalities: offline, blended, online with facilitators, and self-learning. One group served as a control group, receiving no specific intervention. Quasi-experiments are often used when it is impossible or unethical to randomly assign participants to groups, such as in studies of educational programs or

TABLE 2 Learning modalities and sites.

Learning modalities/sites	Face to face	Blended	Online with facilitator	Online self-learning	TAU
Pandeglang ($n = 447$)	Kadudampit ($n = 51$)	Palurahan ($n = 35$)	Koncang ($n = 48$)	Pakuluran ($n = 48$)	Sukacai ($n = 56$)
	Campaka ($n = 45$)	Saketi ($n = 42$)	Kadugadung ($n = 39$)	Kadumaneuh ($n = 39$)	Mandalawangi ($n = 44$)
Jakarta ($n = 315$)	-	Cipinang Besar Utara ($n = 45$)	Pademangan Barat ($n = 43$)	Menteng Dalam ($n = 38$)	Penjaringan ($n = 30$)
		Gandaria Selatan ($n = 45$)	Marunda ($n = 45$)	Harapan Mulya ($n = 37$)	Cipayung ($n = 32$)

social interventions. In some implementation science contexts, policymakers, or administrators may not be willing to have a subset of participating patients or sites randomized to a control condition, especially for high-profile or high-urgency clinical issues. Thus, a quasi-experimental design is used to conduct rigorous studies in these contexts, albeit with certain limitations (Miller et al., 2020). Quasi-experiments are a subtype of non-experiments that attempt to mimic randomized, true experiments in rigor and experimental structure but lack random assignment (Rogers and Révész, 2019). In a non-randomized quasi-field experiment, the researcher does not randomly assign participants to different groups (e.g., treatment and control groups). Instead, the groups are formed based on other criteria, such as pre-existing differences between the groups. The researcher then compares the outcomes between the groups to determine the effect of the independent variable.

2.2 Types of research

This study used mixed quantitative and qualitative methods with a convergent parallel design. The quantitative method was used to address research questions one and two, while the qualitative method was used to answer research question three. A convergence design is beneficial for studying a problem in its entirety and dimensions (Almeida, 2018). It uses two parallel phases: the quantitative approach is used to measure the properties and objective aspects of the problem, and the qualitative approach is applied to understand and describe the subjective aspect. The advantages of this design include its strong theoretical background and the ability to identify both the objective and subjective aspects of a problem.

2.3 Sample and recruitment of participants

Participants were recruited from 18 villages in Banten and Jakarta. The recruitment criteria for the intervention research included: being the primary caregiver of a baby or toddler aged 0–30 months without any special needs; belonging to low-to-middle income families with a salary/wage of <Rp 4,000,000 per month; having sufficient literacy skills in Bahasa Indonesia; consenting, agreeing, and committing to participating in all research activities for 13 months; residing at the research site; and having access to a smartphone and familiarity with the device. During the selection

process, participants were briefed about the study, its benefits, and risks, leading to informed consent.

The total number of participants recruited at the commencement of the research (baseline) was 1,146. During the intervention, 89 participants decided not to continue their participation, leaving 1,057 participants at the end of the program. In the final measurement (endline), 866 participants completed the assessment, and after data cleaning, the final number of participants included for analysis was 762. The reasons for dropping out included difficulty synchronizing with phases of the module due to childcare activities, moving to different sites, incomplete data, difficult time allocation for face-to-face meetings at predetermined venues, not meeting the inclusion criteria for analysis (child age), and gadget-related issues (many of which were resolved during project monitoring by field workers) (see Table 2).

2.4 Measurement instruments

Quantitative data were collected using three standardized questionnaires: SIGAP Q, the HOME Inventory, and the Caregiver Reported Early Development Instruments (CREDI). Qualitative data were collected through interviews and focus group discussions (FGDs). Three experts assessed content validity, while reliability was measured by calculating Cronbach's alpha and test-retest reliability.

The SIGAP parent survey consists of 48 questions designed by the Tanoto Foundation and adjusted by the research team. The questions are based on basic childcare knowledge following a literature review on parenting. The survey questions include binary response options (right or wrong) and have a reliability coefficient (Cronbach's alpha of 0.77). The HOME Inventory is an observation and interview tool used by enumerators during home visits to assess childcare management across various domains, including childcare organization, caregiver involvement, variation in caregiving, caregiving responsiveness, caregiving acceptance, and learning materials (Cronbach's alpha = 0.82). The CREDI assesses early childhood development milestones for children from birth to 3 years old, covering four domains: cognitive development, language development, motor development, and social-emotional development. Test-retest reliability was obtained as follows: cognitive development; $r_{(760)} = 0.60$, $p < 0.01$; language development; $r_{(760)} = 0.65$, $p < 0.01$; motor development; $r_{(760)} = 0.68$, $p < 0.01$; and social-emotional development; $r_{(760)} = 0.63$, $p < 0.01$ (see Table 3).

TABLE 3 Construct and domain of research instruments.

Construct and domains	Research instruments
Childcare knowledge	SIGAP Q Cronbach Alpha = 0.77
Childcare management Childcare organization	HOME VISITS AND OBSERVATION Cronbach Alpha = 0.82
Caregiver involvement	
Variations in caregiving	
Caregiving responsiveness	
Caregiving reception	
Learning materials	
Child development milestones Cognitive development	CREDI: development milestones test-retest validity child cognitive development; $r_{(760)} = 0.60$, $p < 0.01$
Language development	Child language development; $r_{(760)} = 0.65$, $p < 0.01$
Motor development	Child motor development; $r_{(760)} = 0.68$, $p < 0.01$
Social-emotional development	Child social-emotional development; $r_{(760)} = 0.63$, $p < 0.01$

The FGD guidance includes exploring the benefits and challenges encountered by participants and facilitators during intervention processes, their feelings and insights, the support provided, and any other concerns regarding the implementation of the intervention.

2.5 Research procedure

Selection of intervention research sites:

The selection of intervention research sites was conducted through 2 months of scoping visits (May–July 2021) to targeted sites in both Pandeglang and Jakarta. Selection was based on a number of inclusion criteria as follows:

1. **General criteria**

- Availability of public facilities such as public health centers (Puskesmas) or integrated health service centers (Posyandu).
- Availability of local volunteers and facilitators.
- Support from local leaders/authorities.
- Readiness to engage in all elements of the proposed project.
- Sufficiency of the estimated total number of parents with babies and toddlers (0–3 years old).

2. **Specific criteria**

- Availability of meeting or classroom venues (for face-to-face and hybrid or blended learning modalities) such as the Rumah Anak Sigap (RAS).
- Availability of digital communication technology infrastructures to support virtual modalities, including caregiver ownership of e-devices (smartphones or tablets).

- Accessible geographic locations, especially during the pandemic.

3. **Special inclusion criteria for selecting treatment as usual (TAU) control group**

- Ongoing government intervention.
- Ongoing usual intervention.
- History of previous engagements with the Tanoto Foundation.

During the scoping visit, the research team was seriously concerned with the high prevalence of COVID-19 infection and the increasing number of related deaths in Jakarta. Consequently, offline sessions were prohibited. Therefore, due to strong government restrictions, there was no Jakarta-based offline learning intervention model.

2.6 Recruitment and training of local facilitators

The recruitment process for local facilitators was divided into two mechanisms based on location. Facilitators were recruited directly under RAS management following the study protocol for research sites with access to RAS (Rumah Anak Sigap). For non-RAS sites, local government authorities coordinated the selection, screening, and recruitment of facilitators, including selecting the facilitator's coordinator. All facilitators were required to sign a consent form and a working agreement provided by the research team, commit to participating in the study for 14 months, and attend compulsory training.

The total number of recruited facilitators was 115, with 50 in Jakarta and 65 in Pandeglang. Capacity-building seminars were conducted to equip facilitators with essential knowledge on various topics, such as individual and group facilitating skills, research ethics, basic psychology, and disaster preparedness. Training sessions were also available for each module's topic during the research period, except for facilitators who supported online (self-learning) participants. This ensured that all facilitators were adequately prepared to implement the intervention research project.

Quantitative data were collected before (the baseline) and after (the endline) the intervention. Participants were asked to complete the SIGAP Q with paper and pencil, and then a trained enumerator interviewed them regarding the HOME Inventory and CREDI.

All participants signed informed consent forms during every data collection process. The informed consent form outlined voluntary involvement, data confidentiality, the risks and benefits of participation, data management, the duration of the intervention, and the recording and documentation of the process.

The ethical aspects of this study were evaluated and approved by the Research Ethics Commission of the Indonesian Catholic University, Atma Jaya, with approval number 06144/III/LPPM -PM 1.05 pm 10.10.05–PM.10.10.05/05.

2.7 Implementation processes

Prior to the commencement of the intervention, the Tanoto Foundation and the Intervention Research Design Team decided to divide 10 learning modules into three phases for each module, with each lasting 1 week. This approach provided a total of 3 weeks per learning module.

For the offline learning modality, all activities were conducted in face-to-face meetings, assisted by local facilitators who had been recruited and completed a series of capacity-building exercises. The blended modality involved a combination of activities:

- **Phase 1 (Week 1):** Full web-based LMS module learning.
- **Phase 2 (Week 2):** Face-to-face meetings with home visits by facilitators.
- **Phase 3 (Week 3):** Visits to RAS along with independent LMS work.

For both online modalities (with a facilitator and self-learning), there were no face-to-face meetings. The main difference between "with facilitator" and "self-learning" was the absence of a learning companion role by the facilitator in self-learning mode. Facilitators in the self-learning mode only functioned as communication bridges between research participants and the team, providing support for LMS-related technical problems experienced by participants.

2.8 Data analysis

The quantitative data were analyzed using descriptive statistics and inferential statistics (multiway ANOVA). This included central tendency, cross-tabulation, tests of significance such as analysis of variance followed by a *post-hoc* test, and Cohen's impact statistics.

Qualitative data obtained from the interviews and FGDs were organized according to thematic analysis. Emerging themes and patterns were identified, and connections between the data were interpreted. Then, we conducted data integration, which involved comparing and contrasting the findings from both types of data to gain a comprehensive understanding of the research questions (Yin, 2016).

3 Results

3.1 RQ-01: How do different learning modalities impact participants' knowledge acquisition and parenting education engagement during an emergency such as a pandemic?

Although all modalities generated learning experiences in all domains, participants were more familiar with offline modalities. Assessment of gain scores across modalities suggested that participants in the offline (face-to-face) modality performed best in learning outcomes on CHILDCARE KNOWLEDGE (SIGAP Q), followed by online assessment with a facilitator. Blended and online self-learning had similar gain scores, and the Treatment as Usual (TAU) modality showed the lowest gain score [$F_{(4,757)}$ = 6.51; $p < 0.01$]. For CHILDCARE MANAGEMENT (HOME), participants in offline modalities performed better than others in terms of responsiveness [$F_{(4,757)}$ = 3.46; $p < 0.05$]. Online with a facilitator and online self-learning demonstrated negative scores (see Table 4).

Analysis of the post-test confirmed that all modalities, on average, performed better than the control group (TAU), especially on knowledge about childcare [$F_{(4,757)}$ = 14.12, $p < 0.001$]. On HOME observation, participants showed differences in providing variations in caregiving [$F_{(4,757)}$ = 3.99, $p < 0.001$]. Further analysis, with the Games-Howell *post-hoc* test, found significant differences between TAU (M = 3.22, SD = 1.29), blended (M = 3.71, SD = 1.21), and self-learning (M = 3.66, SD = 1.22). We also found significant differences in how participants in different modalities provided children with learning materials [$F_{(4,757)}$ = 3.13, $p < 0.05$]. The Games-Howell *post-hoc* test found significant differences between online with a facilitator (M = 6.98, SD = 1.65), offline (M = 6.23, SD = 2.19), and TAU (M = 6.44, SD = 1.93) (see Table 5).

Considering the above analysis, we might conclude that offline intervention created a more conducive learning environment than other modalities. Although all modalities indicated positive development as expected, further analysis informed us that blended modalities had the smallest standard deviation across all modalities, which suggested a small deviation from the means or greater similarities of learning outcomes with other modalities. This was why the blended modality, which contains face-to-face elements, also performed relatively stable (never becoming the least or having negative results compared to other modalities). Many of the learning outcomes of TAU were consistently lower than those of other modalities.

3.2 RQ-02: Are there variations in the effectiveness of learning modalities between different regions, Pandeglang and Jakarta?

In all modalities, it was apparent that participants in Jakarta had better childcare knowledge than those in Pandeglang, especially evident in the TAU [$t_{(160)}$ = 5.01, $p < 0.001$, Cohen's d = 0.81], blended [$t_{(165)}$ = 4.92, $p < 0.001$, Cohen's d = 0.76], and self-learning modalities [$t_{(160)}$ = 4.52, $p < 0.001$, Cohen's d = 0.70]. No significant differences were found among the online facilitators.

In the TAU modality, Jakarta (M = 34.37, SD = 4.62) performed better than Pandeglang (M = 30.46, SD = 4.95). In the blended modality, Jakarta (M = 36.22, SD = 3.43) scored better than Pandeglang (M = 33.38, SD = 4.05), and also in self-learning, Jakarta (M = 35.68, SD = 3.60) scored better than Pandeglang (M = 32.83, SD = 4.43).

Regarding home observation, we found that Pandeglang scored better than Jakarta in all modalities for the organization of childcare. On the contrary, all modalities in Jakarta scored better than Pandeglang in the aspect of learning materials.

TABLE 4 Between-group analysis across gain scores.

Variables (gain = end - baseline scores)	F	Sig.	Offline		Blended		Online with facilator		Self-learning		TAU	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SIGAP parents' survey												
Childcare knowledge	6.51	0.00	4.89	5.26	3.27	4.78	3.46	5.62	3.27	5.38	1.54	5.42
HOME childcare observation												
Organization	2.54	0.04	0.71	1.31	0.54	1.32	0.74	1.38	0.41	1.35	0.36	1.18
Involvement	1.31	0.26	0.52	1.79	0.44	1.73	0.30	1.67	0.29	1.66	0.10	1.43
Variations	2.09	0.08	0.81	2.01	0.67	1.60	0.62	1.82	0.46	1.68	0.26	1.62
Responsiveness	3.46	0.01	0.63	2.13	0.10	1.84	−0.27	2.41	−0.09	2.24	0.31	2.06
Reception	0.40	0.81	−0.27	1.71	−0.18	1.83	−0.10	1.55	−0.31	1.73	−0.20	1.40
Learning materials	1.78	0.13	1.83	2.72	1.86	2.94	2.49	3.10	1.73	2.96	1.85	3.02
Development index (CREDI)												
Cognitive development	0.39	0.82	2.41	2.16	2.32	1.95	2.52	2.05	2.26	2.13	2.34	1.88
Language development	0.54	0.71	2.59	1.97	2.54	1.52	2.63	1.72	2.38	1.76	2.48	1.65
Motor development	0.62	0.65	2.98	2.36	2.84	2.00	3.11	2.07	2.95	2.24	3.17	2.01
Socio-emotional development	0.33	0.86	2.87	2.37	2.82	2.09	3.04	2.10	2.79	2.26	2.87	1.99

TABLE 5 Between-group analysis across endline scores.

Variables (endline scores)	F	Sig.	Offline		Blended		Online with Facil		Self-learning		TAU	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SIGAP parents' survey												
Childcare knowledge	14.12	0.00	34.56	4.48	34.91	3.98	35.16	3.81	34.15	4.30	31.96	5.18
HOME childcare observation												
Organization	2.86	0.02	5.57	0.68	5.32	0.78	5.41	0.81	5.25	0.86	5.33	0.77
Involvement	0.50	0.73	5.11	1.12	5.12	1.11	5.06	1.22	5.17	1.02	5.01	1.06
Variations	3.99	0.00	3.50	1.27	3.71	1.21	3.40	1.38	3.66	1.22	3.22	1.29
Responsiveness	1.17	0.32	8.76	1.66	9.02	1.51	8.67	1.82	8.78	1.69	8.91	1.43
Reception	0.96	0.43	5.56	1.23	5.54	1.36	5.63	1.02	5.46	1.16	5.70	0.99
Learning materials	3.13	0.01	6.23	2.19	6.77	1.73	6.98	1.65	6.63	2.08	6.44	1.93
Development index (CREDI)												
Cognitive development	1.72	0.14	51.29	1.11	51.37	1.24	51.08	1.23	51.13	1.31	51.09	1.17
Language development	2.35	0.05	51.94	1.46	52.00	1.69	51.57	1.68	51.66	1.76	51.57	1.63
Motor development	1.14	0.34	51.66	1.35	51.64	1.47	51.38	1.43	51.46	1.49	51.42	1.36
Socio-emotional development	1.84	0.12	51.71	1.34	51.83	1.46	51.46	1.39	51.55	1.58	51.49	1.41

In the organization of childcare, in the TAU modality, there were significant differences [$t_{(160)}$ = 3.30, $p < 0.001$, Cohen's d = 0.53] where Pandeglang scored better (M = 5.48, SD = 0.76) than Jakarta (M = 5.08, SD = 0.73). In the online with facilitators modality, there was a significant difference in childcare organization [$t_{(173)}$ = 3.30, $p < 0.001$, Cohen's d = 0.50], with Pandeglang scoring better (M = 5.61, SD = 0.65) than Jakarta (M = 5.22, SD = 0.90). This trend was also observed in the *self-learning* and blended modalities,

where Pandeglang scored better than Jakarta in the organization of childcare.

With regard to the learning materials, all modalities in Jakarta scored higher than those in Pandeglang. The TAU in Jakarta (M = 7.24, SD = 1.64) scored significantly higher [$t_{(160)}$ = 4.36, $p < 0.001$, Cohen's d = 0.70] on learning materials compared to Pandeglang (M = 5.95, SD = 1.95). Moreover, in the online with facilitators modality, there was a significant difference [$t_{(160)}$ = 3.18, $p < 0.001$, Cohen's d = 0.50] in the availability of learning

TABLE 6 Comparison of Jakarta and Pandeglang between group analysis across endline scores.

Variables (endline scores)	Offline		Blended		Online with Facil		Self-learning		TAU	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
JKT - PDG										
SIGAP parents' survey										
Childcare knowledge JKT	-	-	36,22	3,43	35,59	4,01	35,68	3,60	34,37	4,62
Childcare knowledge PDG	34,56	4,48	33,38	4,05	34,72	3,57	32,83	4,43	30,46	4,95
HOME All JKT	-	-	35,51	4,19	34,83	4,89	35,40	4,33	35,34	3,58
HOME All PDG	34,74	5,27	35,47	3,87	35,47	4,06	34,59	4,76	34,17	4,23
Organization JKT	-	-	5,18	0,86	5,22	0,90	5,08	0,80	5,08	0,73
Organization PDG	5,57	0,68	5,48	0,64	5,61	0,65	5,40	0,88	5,48	0,76
Involvement JKT	-	-	5,11	1,20	4,90	1,31	5,20	1,07	5,05	1,11
Involvement PDG	5,11	1,12	5,13	1,00	5,22	1,10	5,15	0,98	4,99	1,03
Variations JKT	-	-	3,68	1,17	3,64	1,41	3,85	1,22	3,48	1,30
Variations PDG	3,50	1,27	3,75	1,26	3,16	1,31	3,49	1,20	3,06	1,25
Responsiveness JKT	-	-	9,02	1,56	8,26	2,04	8,72	1,94	8,77	1,61
Responsiveness PDG	8,76	1,66	9,03	1,47	9,09	1,48	8,84	1,45	9,00	1,31
Reception JKT	-	-	5,48	1,42	5,59	0,95	5,37	1,02	5,71	0,82
Reception PDG	5,56	1,23	5,62	1,29	5,67	1,09	5,54	1,26	5,69	1,09
Learning materials JKT	-	-	7,04	1,72	7,23	1,43	7,17	1,84	7,24	1,64
Learning materials PDG	6,23	2,19	6,45	1,69	6,72	1,83	6,16	2,17	5,95	1,95
Development index (CREDI) JKT			51,95	2,10	51,72	2,03	51,98	2,40	51,47	1,87
Development index (CREDI) PDG	52,29	1,78	52,66	1,65	52,00	1,92	51,95	1,80	52,15	1,87
Cognitive dev JKT	-	-	51,21	1,30	50,95	1,22	51,16	1,45	50,87	1,06
Cognitive dev PDG	51,29	1,11	51,55	1,14	51,23	1,24	51,10	1,19	51,23	1,22
Language development JKT	-	-	51,75	1,84	51,47	1,79	51,76	1,97	51,18	1,58
Language development PDG	51,94	1,46	52,30	1,45	51,68	1,56	51,57	1,56	51,80	1,61
Motor development JKT	-	-	51,42	1,60	51,26	1,42	51,42	1,65	51,12	1,30
Motor development PDG	51,66	1,35	51,90	1,25	51,51	1,45	51,50	1,35	51,61	1,37
Socio-emotional development JKT	-	-	51,66	1,53	51,35	1,36	51,61	1,73	51,28	1,35
Socio-emotional development PDG	51,71	1,34	52,02	1,35	51,58	1,42	51,50	1,45	51,63	1,43

materials, which were more available in Jakarta (M = 7.17, SD = 1.84) than in Pandeglang (M = 6.16, SD = 2.17). Blended and self-learning modalities also showed similar results, with Jakarta scoring higher in the availability of learning materials than Pandeglang (see Table 6).

Participants in Jakarta had better childcare knowledge and access to learning materials than participants in Pandeglang. Meanwhile, participants in Pandeglang had better organization of childcare than participants in Jakarta. Participants in Jakarta could access better learning materials because the venues in the study sites were child learning centers newly established by the private sector called RPTRA. This facility lends out toys and learning materials to children in the community. Home observation scores, however, show that differences in organization between participants in Jakarta and Pandeglang may be due to the lack of alternative caregivers in Jakarta. The results also suggested that participants in both Pandeglang and Jakarta were relatively ready to engage in digitally mediated learning on parenting and child development issues.

3.3 RQ-03: What are participants' perceptions (acceptability) regarding using a learning management system (LMS) for parenting education in both regions?

The reception of the research program started during the scoping visit during the preparation phase of the study. Participants were recruited based on their willingness to engage in a 12-month

parenting education program. Acceptability refers to learners' positive attitudes after completing all the learning activities. FGDs were conducted with selected participants in different modalities during the midterm and final evaluations. With regard to the modules overall, we have the following remarks:

All participants appreciated the flexibility of the learning module on the digital platform, which was accessible (1) during the intervention period. This flexibility allowed them to revisit learning materials whenever needed.

In addition, they felt that online discussions, chat opportunities, and quizzes made studying online more fun and engaging (2) despite the poor internet signal faced by most participants. In line with the requirements of online learning for adult learners, the material was delivered in various formats, including infographics, audio, and video, which were well received by participants (3).

… More detailed. When taught (only) via Zoom, we only listen, and there are no practical exercises. However, in our module, we did not just listen; reading materials were made available (1). We can listen together, pass it on to husbands, and share with other friends who just gave birth. So it is not just for us. We also share it (the reading materials) with those who just gave birth, and they cannot accuse us of boasting because it is in line with information from scientific journals. So it is more convenient for us to share the link to our module (2)

..The most interesting form of material is infographics. Many participants said the infographics are easily understood and available in the LMS. The videos also helped participants to know what to do… But the audio is too long, needs to be cut to make it more interesting.… Overall is okay.. (3)

Although the module's contents (1–10) were deemed acceptable and useful, participants noted that some reading materials were heavily saturated with foreign technical terms, making both audio and reading materials difficult to comprehend. Materials were easier to understand when they contained examples related to their everyday experiences and were written in simple words or sentences. While the modules were very interesting, they may need to consider incorporating local-specific content to be more relevant to the participants (4).

… Initially, we found difficult words and concepts.. but after our feedback, the explanation is more digestible.. we prefer to use our own language, especially colloquial language … (4)

With regard to learning strategies, the participants felt that the time allotted for each activity could be adjusted to better suit the demands and time constraints of the participants. Although this issue had been resolved during the scoping visit, many participants might have encountered different obstacles that required adjustments in time allocation, especially for offline and blended modalities. In contrast, the online modality did not have time allocation issues, as the participants appreciated the time flexibility it offered. They could arrange their study time in a way that did not interfere with their daily roles at home (5).

..I may say that this online format fits with my schedule. I can arrange the time according to my available time. When we have to meet Offline, like this. I am not sure that I can always have the time (5)

..In the morning, my husband frequently asks me to prepare breakfast, tea, etc., which makes me busy, often until 11 am. I work on my LMS whenever my schedule allows (5)

Regarding the modalities, the participants appreciated but considered the offline format the best. They valued the offline format for its opportunity to maintain contact with neighbors ("silaturahmi") and for enabling them to share and discuss their experiences directly (6).

.. If online, sometimes we do not have the (internet) signal, and sometimes we do not have our mobile phone in hand (taken by our children). It is better to have an Offline like this one. We can know and greet our neighbors. We also learn better in Offline format. We can exchange our opinions about our child-rearing practices, and we can educate fellow participants… (6)

…If possible, we have our learning session not only at home. We can meet in smaller groups elsewhere. This is not like the present, where we learn only online. When we meet in person, we can share and ask direct questions. In online courses, participants may not know each other. If possible, we may have our own groups that meet occasionally to talk about learning materials (6)

Second, the role of assistants (facilitators) in online learning with facilitators and blended modalities is crucial; therefore, they should be well prepared to conduct their assignments with full awareness of their roles and responsibilities to avoid confusion. Facilitators who engaged in substantive and technical supervision were appreciated by the participants, as they helped participants feel that they were growing during the learning process. The participants were also motivated by the consistent support provided by facilitators to participate in the module's activities, which helped them resolve emerging problems (7).

..Most of the materials are readable. If I could not understand, well I come and visit the facilitator and asked questions.. always like that..(7)

.. I rely on my facilitator whenever I am stuck with my gadget. I borrow wifi from the facilitator, which helps me resolve my homework (7)

the facilitator is always helpful if I am stuck – usually, I send her my problem, and she helps me to resolve it (7)

When asked about future learning opportunities, most participants expressed their interest in participating because they recognized the importance of the materials in becoming better caregivers (8).

I may say it is useful to keep doing it. It helps mothers become understand (8)

... the scope of participation should be larger. I saw the benefits of learning the materials for my own child (now 3 years old). More mothers should be recruited and benefit from this intervention to acquire the latest information on parenting.. especially mothers who just gave birth to their baby to prevent baby blues syndrome.. a lot of women in the village get married but never have any preparations… (8)

They also felt the program was beneficial because it piqued their husband's interest in the platform, which stimulated their husband to help with childrearing (9).

.. my husband said that he is curious about listening to my story and wanted to try working on the learning materials (9)

I like the material about couples – husband and wife- to complement each other. Before I anticipated this learning course, my husband and I did not have much communication. But now we attend to each other more.. (9)

Thank God Almighty, my husband supports my participation wholeheartedly… (9)

In managing the intervention, the project was supported by trained facilitators and enumerators and the availability of safe spaces for learning, such as the SIGAP Learning Center (RAS). The results of the FGD involving cadres and local facilitators revealed that the cadres faced many difficulties when initially participating in the program and guiding the participants (10).

.. it takes time … sometimes more time spent in uploading photos, because the size does not fit and trimming the picture is not so easy.. (10)

.. dealing with a facilitator who is a lactating mother is cumbersome … it is difficult sometimes to fix time, especially when dealing with participants whose wifi signal is up and down… we received a lot of help requests.. sometimes I just said go find yourself a better place for wifi (10)

Taking their issues or needs to the field coordinator or the module manager was an important learning process. However, continuous education and training gradually improved the competency and readiness of the cadres to assist their participants (11).

.. Assist participants with relevant information, connect them with field facilitators when encountering learning problems … (11)

If we haven't had training, we can't answer like that, we don't know yet. Once we've had training, then we can answer about this and that… (11)

Training, workshops, and technical supervision for participants during the project implementation (12) also facilitated useful behavioral changes when utilizing the LMS with the help of cadres (13).

Participants often come to my house for help with Wifi or with the training materials in LMS … (12)

Providing information… if there are any obstacles or issues while we are learning with the LMS, we report it to the facilitator (12)

Everything is running smoothly for the [discussion] *forum* [in LMS]. *It has been discussed previously in the LMS. So, our questions for the facilitators are well understood, so we just need to fill that out..(13)*

[When participants were asked about behavior changes that occurred] *It really helps us personally if there is an LMS.. (13)*

Furthermore, some highlighted the need to improve internet infrastructure (14), support their children in offline and blended modalities, and sustain the facilitators' role (15).

… when the link can be opened, [it did] *not always immediately open. There might be a delay until the next day or two, but everything will definitely be done eventually. The main issues are the signal and the phone itself; that's how it needs to be improved (14)*

For matters concerning the children, we usually meet during the integrated health ser for matters concerning the vice center. Even when Tanoto is finished, let's not let it just disappear. At least take half an hour or 15 min to share with us because, you know, parenting requires it. Let's entrust it to capable cadres.. (15)

Web-based LMSs or apps developed for learning material are considered beneficial and relevant to their situation during the COVID-19 pandemic. Although many participants still preferred offline intervention for social-cultural and optimal outcomes, most participants in online modalities were able to appreciate the flexibility and achieve acceptable learning outcomes. To improve future digital platform interventions in parenting education, some improvements should be noted, especially in active learning strategies, locally based content, supporting infrastructures, and easy learning.

A number of notes should be considered, especially on foreign language terms, quizzes, and examples. Locally relevant examples (from daily events) may need to be enriched and stored in the Bank of Cases for alternative cases. Trained cadres and facilitators are crucial to the readiness of local participants.

4 Discussion

Indonesia needs to sustain its intervention programs to fight extreme poverty and stunting. Accepting parenting programs to mitigate the loss of quality human resources is critical to fighting poverty. Thus, such programs should be designed to adapt to emerging challenges to retain their benefits for improving the lives and wellbeing of developing children (Hoghughi, 2004; Yoshikawa et al., 2020; Bornstein et al., 2022). The traditional face-to-face approach to community-based education is difficult to sustain in an emergency, such as at the peak of the COVID-19 pandemic. Thus, providing solutions for community-based learning should be considered, including exploring the effectiveness of methods that allow online interactions, such as blended learning, as shown in this study.

This study revealed that imparting knowledge on parenting strategies virtually can be conducted through informal (center- or community-based) education. Although the offline (face-to-face) modality was not feasible at research sites in Jakarta, all computer-mediated modalities were accepted at all research sites, both in Pandeglang and Jakarta. Digital learning modalities have the potential to sustain parenting intervention into the future despite any difficult trajectories, such as in the COVID-19 pandemic situation. During the intervention program, local facilitators successfully developed problem-solving strategies to address various issues faced by participants, including technical-related matters and maintaining participants' motivation. Online learning also provided more room for time flexibility, with some participants studying after hours or early in the morning before baby care time starts. This is crucial, especially when the participants are caregivers or mothers. In this study, online learning had many advantages for participants as adult learners (Knowles, 1984; OECD, 2021; Shin and Lin, 2021). In addition, there is potential for greater inclusion in both rural and urban settings.

Both participants and facilitators acquired a better understanding and familiarization with ICT, with most of them adjusting to the early modules and gradually building their own learning strategies. Participants in the blended learning modality appreciated the center visits as they had the opportunity to go out and mingle with peers, providing them with some "me time," which was not available for pure online learning. Both facilitators and participants appreciated the quality of the module content and the various topics covered. The wide range of topics helped them nurture their children, including positive communication and emotions, which were rare in public health services.

Most of the intervention models were acceptable to their participants. During implementation, there were no serious

incidents when participants experienced severe difficulties accessing and learning the parenting module, except for poor internet signal. Module materials and learning activities are appropriate to the characteristics of adult learning participants. The materials are relevant to what is needed, and participants have autonomy in studying the material (Knowles, 1984; Shin and Lin, 2021). Activities such as discussion forums and quizzes increase participants' understanding and make learning easier (Nguyen, 2017).

Regarding supporting interventions such as module training for facilitators each month, among the three models with the Internet, the costliest variables will be venue and meals, transportation for participants and trainers, fees for resource persons and facilitators, and administrative management. All these are embedded in both blended and online learning with facilitator modalities as the program runs instead of the one-time cost of creating digital learning content.

However, blended learning meets the criteria related to learning material variation, participant time flexibility, and higher learning independence due to the demands of adult learning. Blended learning still provides space for participants to obtain support from facilitators regarding learning techniques and gadget usage. It also allows for offline discussions with other participants as needed in adult learning. Therefore, blended learning can be the most feasible alternative program in the near future when offline learning is impossible. Alternatively, we can resort to online learning with a facilitator. Participants should be familiarized with ICT in both modalities to enhance their learning experience.

It should be noted that local cadres (facilitators) play a crucial role as partners, technical and substantive advisors, and guardians of the learning process. Virtual learning not only provides more room for time flexibility, allowing participants to study during off-hours, but it also improves inclusiveness, especially for those with geographical challenges, and it provides preselected local issues and practices through digital documentaries. Despite limitations and the need for improvement, this program is suitable for implementation in Indonesia (Tomlinson and Andina, 2015).

5 Conclusion and recommendations

The study found that all intervention modalities delivered positive outcomes. In contrast, face-to-face learning delivered the largest gain, followed by online with facilitators, blended learning, and online self-learning (a web-based learning management system). As an alternative, online with facilitators is the best for delivering parenting materials, followed by online self-learning (independent) modes of intervention. Blended and online models provide alternative models during emergencies.

The following are our recommendations for future implementation:

- **Improve module and learning strategies**: enhance the relevance of the learning materials in blended and online learning with facilitator modalities. Make assignments and examples more user-friendly, and include local examples of practices and cases in the learning materials.

- **Consider a fully online modality**: when the learning module has been significantly improved (with a higher participation rate) and digital infrastructure is more accessible and less costly, consider designing a fully online modality.
- **Capacity building for local cadres or facilitators**: continue capacity building for local cadres or facilitators in conjunction with the design and content of the module. Utilize community centers to support such initiatives in the future.
- **Develop a bank of local cases and best practices**: create a living document that includes a constructed bank of local cases and best practices to aid in developing learning modules.

Regarding the limitations of this study, the duration of the intervention was relatively short (12 months), and the intervention design did not include a specific program for children that differentiated treatment through four intervention modalities. Therefore, the CREDI outcomes did not show differences related to child development across the four learning modalities. Future studies should consider a longer intervention period combined with treatments for both participants and children to observe the effects on parents and children more distinctly.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, upon reasonable request.

Ethics statement

Author contributions

WP: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. CS: Formal analysis, Writing – original draft, Writing – review & editing. YH: Formal analysis, Funding acquisition, Project administration, Resources, Writing – review & editing. KT: Formal analysis, Writing – original draft, Writing – review & editing. NA: Formal analysis, Project administration, Visualization, Writing – review & editing. EH: Writing – review & editing. FH: Writing – review & editing. I: Conceptualization, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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