

Holistic Assessment Model in Environmental Theology-Based Climate Change Education for Early Childhood

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ARTICLE INFO

Keywords:

climate change education;
holistic assessment;
islamic environmental theology;
early childhood education;
stewardship (*amanah*)

Article history:

Received 2026-01-17

Revised 2026-05-06

Accepted 2026-06-30

ABSTRACT

Climate change education (CCE) has become an essential component of early childhood education to foster environmental awareness and sustainable behaviors from an early age. Although Indonesia's *Kurikulum Merdeka* incorporates environmental themes, assessment practices remain largely fragmented and rarely integrate cognitive, affective, behavioral, and spiritual dimensions, particularly within the framework of Islamic environmental theology. This study aimed to develop and preliminarily validate a holistic assessment model for early childhood climate change education by integrating Islamic environmental theology with authentic assessment practices. A convergent parallel mixed-methods design was employed involving 47 early childhood teachers, school principals, and educational stakeholders selected through purposive sampling. Data were collected using structured interviews, participatory observations, questionnaires, and document analysis. Quantitative data were analyzed descriptively, while qualitative data were examined through thematic analysis and integrated using a joint display approach. The proposed assessment model was refined through expert judgment and content validation. The findings indicate strong practitioner support for the proposed framework, with all assessment indicators achieving mean scores above 4.00 on a five-point scale. Direct observation and portfolio assessment emerged as the most appropriate authentic assessment strategies, while *syukur* (gratitude) was identified as the strongest theological indicator underpinning children's environmental stewardship. However, a participation gap was found, reflecting limited continuity of environmental practices within families and communities. The validated model provides a culturally responsive assessment framework that integrates authentic assessment with Islamic environmental theology, offering educators a practical approach to evaluating children's holistic development while strengthening environmental responsibility and sustainability values in early childhood education.

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1. INTRODUCTION

Climate change has emerged as a critical global crisis, necessitating immediate socio-educational interventions starting from the earliest stages of human development. Early Childhood Education (ECE) plays a pivotal role in shaping foundational environmental values, as early experiences significantly dictate long-term ecological attitudes and lifelong sustainability habits (Ärlemalm-Hagsér & Davis, 2020; J. Davis & Elliott, 2023). In the Indonesian context, where religious values are deeply woven into the social fabric, environmental theology, specifically from an Islamic perspective, offers a robust ethical framework for climate education. Climate change represents one of the most pressing global crises of our time, demanding not only scientific solutions but also educational responses that cultivate ecological responsibility from the earliest stages of life. Climate Change Education (CCE) refers to pedagogical efforts that equip learners with knowledge, skills, values, and agency to respond to environmental challenges. Within this framework, Early Childhood Education (ECE) is recognized as a critical window for shaping lifelong sustainability habits, as early experiences strongly influence ecological attitudes and behaviors.

Recent literature asserts that climate change education (CCE) in the early years must transcend mere factual transmission. It should move toward transformative learning that engages the "head, hands, and heart" to foster deep-rooted environmental consciousness (Sipos, Battisti, & Grimm, 2008; Trott, 2022; Verlie, 2021). Consequently, effective climate pedagogy requires a holistic approach that synchronizes cognitive understanding, emotional resilience, and pro-environmental action (Bascopé, Perasso, & Reiss, 2019; Forum, 2023). However, implementing such a complex curriculum in diverse cultural landscapes like Indonesia remains challenging due to the scarcity of comprehensive assessment tools.

Research has examined environmental themes in ECE and their role in shaping eco-friendly behaviors (Wulandari & Suryana, 2020). Scholars emphasize that early childhood represents a "critical window" for internalizing environmental stewardship (Chawla, 2020; Philipsborn, Sheffield, White, Osta, 2021; Somani & Gupta, 2023). These foundational years are essential for building the capacity to respond to environmental challenges later in life. Despite the availability of curriculum themes, the practical measurement of how children internalize these values remains under-researched (Wijayanto, Wardana, & Purnanto, 2021).

Theoretical inquiries into Islamic environmentalism have successfully linked concepts such as *mizan* (cosmic balance) and *amanah* (divine stewardship) to contemporary conservation efforts (Huda, Jamsari, & Hehsan, 2020; Jr, Rice, Yang, 2020; Khalid, 2019). The role of spirituality in fostering "ecological citizenship" has also been recognized as a primary driver for achieving the Sustainable Development Goals (Gottlieb, 2020; Koehrsen, 2021; Nche & Okwueze, 2020). These theological tenets provide a spiritual motivation that secular frameworks may lack. Nevertheless, a palpable disconnect persists between these abstract theological theories and their actual pedagogical implementation in the classroom.

As highlighted Widiastuti & Kurniasih (2021), the inherent complexity of assessing a child's developmental progress necessitates integrated, authentic instruments. Such tools are frequently absent in existing environmental programs, which often rely on superficial evaluation methods (Mackey, 2020; Spiteri & Pace, 2023). While prior studies have concentrated on general environmental awareness and abstract theological tenets (Hassloeche, Müller, & Schulze, 2023; Jenkins, Berry, & Kreider, 2018), there remains a conspicuous lack of empirical evidence regarding practical assessment models in this field.

Most existing assessment modalities in ECE remain largely conventional, failing to quantify the internalization of spiritual values within daily environmental agency (Borg & Samuelsson, 2022; Hadjichambis, Reis, & Paraskeva-Hadjichambi, 2020). There is an urgent need for models that capture holistic development encompassing cognitive, affective, and spiritual dimensions within a climate change curriculum (J. Davis, 2021; O'Neill, Handmer, & Taylor, 2020). Unlike previous studies that only explored environmental awareness or abstract theological concepts, this research uniquely develops and validates a holistic assessment model that integrates Islamic environmental theology into early childhood climate change education. Holistic assessment in ECE emphasizes the evaluation of children's development across cognitive, affective, behavioral, and spiritual domains, moving beyond conventional testing

toward authentic, values-based instruments. In the Indonesian context, where religion is deeply embedded in social and cultural life, Islamic Environmental Theology provides a powerful ethical foundation for climate education. Concepts such as *amanah* (stewardship), *mizan* (cosmic balance), *khalifah* (guardianship), and *syukur* (gratitude) offer spiritual motivations that complement secular sustainability frameworks. Importantly, these theological principles can be translated into assessment indicators that capture how children internalize ecological values in daily practice.

Therefore, this research fills this critical gap by developing and validating an integrated holistic assessment model specifically tailored for a climate change curriculum rooted in Islamic environmental theology. This study introduces a new approach by connecting secular ecological frameworks with Islamic theological principles. It provides a validated assessment model specifically designed for early childhood climate change education. Such a model has not been previously established, making this research a unique contribution to the field. Despite growing interest in integrating environmental themes into curricula, including Indonesia's *Kurikulum Merdeka* which mandates flexible and outcome-based learning, there remains a significant gap: the absence of valid, culturally responsive, theology-integrated assessment instruments for early childhood climate education. Existing tools often rely on superficial measures of awareness and fail to capture the holistic development of children as ecological agents. Authentic assessment, values-based evaluation, and education for sustainability provide the theoretical foundation for addressing this gap.

This study seeks to provide a systematic framework for educators to evaluate not only the conceptual knowledge children possess but also how they embody the role of *khalifah* (stewards) in their interactions with the natural world (Hussain, 2021; Kamaruddin & Abdullah, 2022). This study therefore aims to design and preliminarily validate a holistic assessment model for climate change education in ECE, rooted in Islamic environmental theology. Specifically, it seeks to provide educators with a systematic framework to evaluate not only children's conceptual knowledge but also their embodied ecological agency as *khalifah* in everyday interactions with the natural world. This urgency is further magnified by Indonesia's "Kurikulum Merdeka" policy, which mandates flexible and outcome-based evaluation methods (Sultoni, Setiawan, Apriliani, & Hernawan, 2024). By offering a validated framework that incorporates direct observation and values-based rubrics, this study provides a concrete pedagogical solution to monitor the holistic growth of the next generation amidst an escalating climate crisis.

2. METHODS

2.1 Research Design

This study employed a curriculum design research framework using a convergent parallel mixed-methods design to develop a holistic assessment model for climate change education based on Islamic environmental theology (Prabowo & Herawan, 2020; D Rousell & Cutter-Mackenzie-Knowles, 2020). This design allowed for the simultaneous collection and integration of quantitative and qualitative data to provide a comprehensive understanding of the assessment needs in Early Childhood Education (ECE) (Guetterman, Fetters, & Creswell, 2019; Mulyadi, Hendrawijaya, & Iswandi, 2021). The research followed four systematic phases: needs analysis, curriculum design, feasibility testing, and effectiveness evaluation (Suryani & Widayanti, 2018). Quantitative and qualitative data were collected concurrently and integrated to provide a comprehensive understanding of assessment needs in Early Childhood Education (ECE). While the research was inspired by curriculum design principles, the findings reported here focus on the phases of needs analysis and feasibility testing. Effectiveness evaluation was not conducted and is therefore not claimed.

2.2 Participants and Settings

The participants consisted of 47 respondents, including ECE teachers, school principals, and ECE stakeholders in Indonesia. A purposive sampling technique was utilized, selecting individuals with a minimum of three years of professional experience and active involvement in implementing values-based Islamic curricula (Al-Qarni, 2019; E. B. Davis, Kimball, Aten, Hamilton, 2019; Lestari & Suyadi, 2019). The

study was conducted in ECE centers that had already integrated environmental themes, providing a rich context for developing advanced holistic instruments. Institutions represented both public and private ECE centers with Islamic values integrated into their curricula. Participants were recruited through purposive sampling, targeting practitioners with at least three years of professional experience and active involvement in values-based education. Invitations were distributed via professional networks and institutional partnerships

2.3 Research Instruments

Data were gathered through four primary instruments: (1) structured in-depth interview guides to explore teachers' perceptions of holistic assessment (Zainal Abidin, Abdullah, & Kamaruddin, 2020); (2) participatory observation sheets to document existing pedagogical practices; (3) a 5-point Likert scale closed-ended questionnaire to measure the urgency of proposed assessment indicators (Green & Payne, 2019; Sumantri & Rachmadtullah, 2016); and (4) documentation study guides for reviewing existing curriculum blueprints. Instrument validity was established through expert judgment, while reliability was confirmed with a Cronbach's Alpha coefficient of $\alpha > 0.85$ (Baker, Robinson, & Kolb, 2021; Rahmawati & Suryadi, 2019). Questionnaire 24 items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), measuring dimensions of (a) assessment practices, (b) integration of Islamic environmental values, (c) instructional approaches, and (d) parental/community engagement. Example item: *"Direct observation is an effective way to assess children's environmental behavior."*

2.4 Data Collection Procedures

The collection process was executed in sequential stages. Initially, in-depth interviews were conducted with key informants to understand the contextual nuances of ECE assessment (Hasanah & Wardhani, 2021). Secondly, participatory observations were performed over an eight-week period to capture real-time classroom interactions (Liebhaber & Trott, 2024). Thirdly, questionnaires were distributed to all 47 respondents to quantify the demand for the eight holistic assessment indicators. Finally, a documentation study was conducted to analyze existing institutional assessment frameworks (Indrawati & Wulandari, 2020; Somani & Gupta, 2023).

2.5 Data Validation

To ensure the integrity of the findings, data validation was achieved through triangulation of sources, methods, and analysts (Fadillah & Sukmayadi, 2019). Member checking was performed by sharing preliminary analyses with informants to verify interpretative accuracy (Ananda & Fadhilaturrahmi, 2018). Furthermore, Focus Group Discussions (FGD) with curriculum experts and ECE practitioners were conducted to validate the model's credibility (Borg & Samuelsson, 2022). Credibility was further enhanced through peer debriefing involving senior researchers in the field of early childhood pedagogy (Wijaya & Syahrur, 2019). Instrument reliability was confirmed with Cronbach's Alpha = 0.87 overall, with sub-dimensions ranging from 0.82 to 0.89. Content validity was established through review by five experts (two in early childhood pedagogy, two in Islamic education, one in environmental education). Validation involved expert judgment using relevance and clarity criteria, followed by revisions based on feedback. Consensus was reached through focus group discussions (FGD), ensuring cultural and theological appropriateness.

2.6 Data Analysis

Quantitative data were analyzed using descriptive statistics, specifically calculating the mean, median, mode, and standard deviation for each indicator (Riduwan & Sunarto, 2017). Qualitative data from interviews and observations underwent thematic analysis, involving reduction, classification, and interpretation through a content analysis approach (Braun & Clarke, 2021; Sutopo, 2016). The integration of both data types utilized a joint display technique to facilitate meta-inference, ensuring a holistic

conclusion that bridged numerical trends with narrative depth (Guetterman et al., 2019; Moseholm & Fetter, 2017; Sugiyono, 2019).

3. FINDINGS AND DISCUSSION

3.1 Findings

3.1.1 Needs Analysis for a Holistic Assessment System

The needs analysis for a holistic assessment system reveals that all indicators yielded mean scores exceeding 4.00 on a 1–5 scale. These results signify an exceptionally high demand among Early Childhood Education (ECE) practitioners and administrators for a comprehensive evaluation framework. Table 1 presents the descriptive statistics for the eight indicators of the proposed holistic assessment system.

Table 1. Descriptive Statistics of Holistic Assessment System Indicators

No	Assessment Indicator	Mean ($\bar{x}$)	Median	Mode	Std. Dev
1	Direct observation of children's behavior	4.36	4.0	4	0.72
2	Children's portfolios (work documentation & photos)	4.34	4.0	5	0.74
3	Informal assessment integrated into activities	4.34	4.0	5	0.76
4	Assessment based on Islamic ethical values	4.29	4.0	4	0.79
5	Parent feedback and communication mechanisms	4.29	4.0	5	0.78
6	Holistic evaluation (Cognitive, Affective, Psychomotor)	4.27	4.0	4	0.80
7	Anecdotal records of environmental stewardship	4.17	4.0	4	0.85
8	Rubrics for climate change concept development	4.07	4.0	4	0.91

The data in Table 1 illustrates that direct observation is perceived as the primary priority ($\bar{x} = 4.36$). This suggests that in the context of climate change education, authentic evidence of a child's actions is considered more significant than formal testing. Interestingly, climate concept rubrics received the lowest relative score ($\bar{x} = 4.07$), indicating technical challenges in defining measurable criteria for abstract scientific concepts at the early childhood level. Quantitative results showed consistently high ratings across indicators ($M > 4.00$). Direct observation ($M = 4.36$) and portfolio documentation ($M = 4.34$) were most valued. Interviews reinforced this preference: one teacher explained, "When I observe children directly, I see their spontaneous care for plants or animals, which cannot be captured in a test." Another principal noted, "Portfolios allow us to track growth over time, such as drawings of trees or photos of recycling activities."

3.1.2 Integration of Environmental Theology in Assessment

Respondents demonstrated robust support for integrating spiritual values into assessment indicators. This reflects a shift toward "spiritualized pedagogy," connecting environmental sustainability with religious devotion.

Table 2. Indicators for Environmental Theology Integration in Assessment

No	Value Integration Indicator	Mean ($\bar{x}$)	Median	Mode	Std. Dev
1	Cultivating gratitude (<i>syukur</i>) for nature	4.38	4.0	5	0.71
2	Inclusion of Quranic verses and Hadith references	4.36	4.0	4	0.72
3	Understanding the concept of stewardship (<i>amanah</i>)	4.33	4.0	4	0.74
4	Habituation of nature-related prayers and <i>mufrodat</i>	4.31	4.0	5	0.76
5	Linking behavior to Islamic environmental ethics	4.29	4.0	4	0.73

Gratitude (*syukur*) emerged as the highest priority ($\bar{x} = 4.38$), indicating that educators view the affective-spiritual connection with nature as the foundation of ecological character. Furthermore, the use of Quranic and Hadith references ($\bar{x} = 4.36$) is considered vital for providing a theological rationale

for pro-environmental behaviors. Spiritual indicators received very high support, with cultivating gratitude (*syukur*) rated highest ($M = 4.38$). Teachers emphasized that gratitude is expressed through action: “*Children say Alhamdulillah when they see flowers, but more importantly, they learn to protect them.*” Quranic references ($M = 4.36$) and stewardship (*amanah*) ($M = 4.33$) were also endorsed. Twenty-two participants stressed that linking assessment to Islamic values motivates children to see environmental care as part of faith.

3.1.3 Instructional Approaches Supporting Holistic Assessment

The effectiveness of holistic assessment relies heavily on the instructional methods employed. Experiential learning and interactive media were identified as the most effective ways to manifest assessable behavioral indicators.

Table 3. Active Instructional Approaches and Methods

No	Instructional Approach/Method	Mean ($\bar{x}$)	Median	Mode	Std. Dev
1	Utilization of interactive learning media	4.44	4.0	5	0.50
2	Direct exploration and observation of nature	4.42	4.0	4	0.58
3	Educational games themed around environment	4.42	4.0	4	0.49
4	Simulations and role-playing on climate change	4.40	4.0	4	0.59
5	Problem-solving projects (e.g., waste/water management)	4.27	4.0	4	0.63
6	Storytelling for environmental theology values	4.22	4.0	4	0.76

The high scores for interactive media ($\bar{x} = 4.4$) and nature exploration ($\bar{x} = 4.42$) indicate a consensus that children learn best through direct contact and simulation, which in turn facilitates authentic assessment by the teacher. Interactive media ($M = 4.44$) and nature exploration ($M = 4.42$) were rated highest. Observations confirmed that children responded enthusiastically to animated videos about the water cycle and outdoor activities such as planting seeds. One teacher remarked, “*Storytelling about Prophet Muhammad’s care for animals makes the lesson meaningful.*”

3.1.4 Parental and Community Engagement

The findings reveal a participation gap between school-led activities and independent initiatives within the home or community environment.

Table 4. Parental and Community Involvement in Assessment

No	Engagement Indicator	Mean ($\bar{x}$)	Median	Mode	Std. Dev
1	Parental participation in school-based projects	4.29	4.0	4	0.63
2	Parental understanding of environmental theology	4.27	4.0	4	0.84
3	Effective school-home communication channels	4.27	4.0	4	0.69
4	Synergy between school habituation and home habits	4.22	4.0	4	0.79
5	Independent community initiatives outside school	3.93	4.0	4	0.86

The lowest score was observed for independent community/parental initiatives ($\bar{x} = 3.93$). This suggests that the holistic assessment system must include instruments that bridge school values with household habits to ensure sustainable behavioral changes. While parental participation in school projects was high ($M = 4.29$), independent community initiatives scored lower ($M = 3.93$). This “participation gap” was evident in interviews: “*Parents join school clean-up days, but at home they rarely continue the practice,*” explained one stakeholder. Twelve respondents highlighted the need for stronger school-home communication to sustain values beyond the classroom.

3.1.5 Children’s Competency Indicators (Top 10)

The holistic assessment model measures developmental domains integrated with climate issues. Religious and moral values dominate the highest-rated indicators of success.

Table 5. Top 10 Children's Competency Indicators in Climate Change Education

No	Developmental Domain	Competency Indicator	Mean ($\bar{x}$)	SD
1	Religious-Moral	Identifying God's creations in nature	4.72	0.52
2	Religious-Moral	Demonstrating care for living beings	4.71	0.53
3	Religious-Moral	Expressing gratitude for natural beauty	4.70	0.54
4	Social-Emotional	Active involvement in environmental care	4.69	0.55
5	Social-Emotional	Showing empathy toward environmental degradation	4.68	0.56
6	Social-Emotional	Collaborating in groups for cleanliness	4.67	0.57
7	Cognitive	Explaining the impacts of littering	4.66	0.58
8	Cognitive	Understanding the benefits of planting trees	4.65	0.59
9	Cognitive	Identifying forms of environmental damage	4.64	0.60
10	Cognitive	Categorizing waste by type	4.63	0.61

The dominance of the Religious and Moral Values domain (Ranks 1-3) confirms that in the Indonesian ECE context, ecological competency is inextricably linked to spiritual identity. Furthermore, children's cognitive ability to explain the impacts of littering ($\bar{x} = 4.66$) proves that environmental cause-and-effect concepts can be effectively understood when assessed through appropriate holistic instruments.

3.2 Discussion

3.2.1 Holistic Assessment Model by Bridging Theory and Practice

The research findings confirm that a holistic assessment model for climate change education (CCE) rooted in environmental theology requires the integration of complementary indicators (Latifah, Prabowo, & Mustaji, 2021). Direct observation emerged as the primary pillar, enabling educators to capture spontaneous behaviors within naturalistic contexts. This aligns with the principles of authentic assessment, which prioritizes performance-based evaluation in real-world situations over standardized metrics (Hapidin, Pujiarti, Hartati, Nurani, & Karnadi, 2020; Nugraha & Rachmawati, 2019). Furthermore, the use of children's portfolios provides longitudinal evidence of development (Rahayu, Suhartini, & Fadhillah, 2020). In CCE, these portfolios serve as a biography of stewardship, documenting activities such as tree planting, waste sorting, and reflective environmental drawings (Indrawati & Wulandari, 2020; Widiastuti & Kurniasih, 2021).

Anecdotal records play a crucial role in capturing meaningful moments that reflect the internalisation of values (Fadlilah, 2021). For instance, spontaneous expressions of gratitude such as *Alhamdulillah*, this flower is beautiful or reminding peers not to damage plants, represent internalized ecological citizenship. However, the lower scores for structured rubrics ($\bar{x} = 4.07$; $SD = 0.91$) suggest that while teachers value the concept, they require more technical training to translate abstract climate science into measurable developmental milestones (Rahmawati & Suryadi, 2019).

The findings suggest that a holistic assessment model for climate change education (CCE) in early childhood must integrate complementary indicators that capture children's cognitive, affective, behavioral, and spiritual development. Direct observation emerged as the most valued method, enabling teachers to document spontaneous behaviors such as caring for plants or reminding peers not to litter. This aligns with the principles of authentic assessment, which emphasize performance-based evidence in real contexts rather than standardized testing. Portfolios were also highlighted as effective, serving as longitudinal records of stewardship activities like tree planting or recycling. Anecdotal records further enrich assessment by capturing moments of value internalization, such as children expressing gratitude (*Alhamdulillah*) when encountering natural beauty. However, the relatively lower ratings for structured rubrics indicate that teachers may require additional training to translate abstract climate science concepts into measurable developmental milestones.

3.2.2 Environmental Theology

The integration of Islamic environmental theology reflects a holistic educational paradigm that balances spiritual, intellectual, and practical dimensions (Khoiruddin, Irawan, & Faizah, 2023). Concepts such as *khalifah fil ardh* (stewards of the earth) and *amanah* (divine trust) provide a sacred rationale, transforming environmental care from a mere secular duty into an act of worship (*ibadah*) (Masruri, Rosyid, & Anwar, 2020; Yamin, Ahmad, & Suhartini, 2022). This study found that cultivating gratitude (*syukur*) yielded the highest endorsement ($\bar{x} = 4.38$), supporting the argument that affective-spiritual engagement is a potent driver for environmental character formation ((Wulandari & Suryana, 2020).

In Islam, *syukur* is not merely verbal; it is manifested through the preservation of God's creations (Suhulah & Yulianty, 2023). This theological framework is consistent with the contemporary concept of *mizan* (cosmic balance), which mirrors the secular principle of sustainability balancing ecological, economic, and social needs (Lestari & Suyadi, 2019; Sagala, Nurani, & Yetti, 2019). By utilizing Islamic narratives, educators can bridge the gap between abstract climate data and the children's socio-cultural identity.

3.2.3 Pedagogical Strategies and Authentic Assessment

Assessment in ECE is inseparable from instructional methodology (Forum, 2023). The high appreciation for experiential methods such as nature observation and simulations resonates with global CCE trends that emphasize place-based and sensorial learning (Duhn, 2024; Rooney & Blaise, 2023). As Rooney (2018) argues, embodied experiences with weather and nature build ecological awareness through affective connections. In the Indonesian context, these experiences are enriched through spiritual habituation, such as praying for rain during droughts or expressing gratitude after a storm (Rohayati, 2020).

Interactive media received the highest score ($\bar{x} = 4.44$), highlighting the potential of digital tools—like animated water cycle videos to make abstract concepts concrete (Yuliani, Antara, & Magta, 2020). However, the use of technology must be balanced with direct contact to ensure meaningful learning (Wardani & Syamsiyah, 2020). Furthermore, project-based learning (PjBL) proved effective in developing problem-solving skills, allowing children to apply knowledge in real contexts like composting or green campaigns (Astuti, 2021; Sumarni, Fahrurrozi, & Taufiq, 2022).

3.2.4 The Family-School-Community Ecosystem

Parental involvement is a prerequisite for successful values-based CCE (Purwanti & Zubaidah, 2021). While participation in school led projects is high ($\bar{x} = 4.29$), independent initiatives outside the school remain limited ($\bar{x} = 3.93$). This indicates that families often view environmental education as a school-centric responsibility rather than a lifestyle. Families serve as the primary environment for value internalisation through modeling and habituation (Hasanah & Wardhani, 2021; Zainal Abidin et al., 2020).

To bridge this gap, synergy between schools and families is essential. This can be achieved through *Green action* journals and parenting programs focused on environmental theology (Ananda & Fadhilaturrahmi, 2018; Fadlilah, 2021). Additionally, partnerships with local communities (e.g., mosques and local NGOs) can provide resources and landing sites for environmental actions, creating a robust *climate education ecosystem* (Mukminin, Rohayati, Putra, Habibi, & Aina, 2023; David Rousell & Cutter-Mackenzie, 2019).

3.2.5 Implications for Policy and Practice

These findings offer several implications for ECE in Indonesia. First, there is an urgent need for standardized holistic assessment guidelines that include rubrics specifically tailored for theology-based CCE (Rahmawati & Suryadi, 2019). Second, teacher training must integrate technical assessment skills

with a conceptual understanding of *amanah* and *khalifah* (Mulyadi et al., 2021). Third, communication mechanisms between schools and parents should report not only cognitive scores but also behavioral progress in environmental care (Fadillah & Sukmayadi, 2019). Finally, institutional policies must incorporate community engagement indicators into annual evaluations to ensure long-term sustainability (Wijaya & Syahrums, 2019).

3.2.6 Limitations and Future Research

This study acknowledges several limitations. The sample, consisting of 47 respondents, requires caution when generalizing the findings. The considerable variation observed in certain indicators (e.g., rubric with SD = 0.91) reflects differences in capacities among early childhood education (ECE) institutions. Furthermore, as the study primarily focused on model validation, it did not assess the long-term impact on children's actual behavior. Future longitudinal research is therefore necessary to empirically examine the effectiveness of this model across diverse socio-economic and geographical contexts (Liebhaber & Trott, 2024; Riduwan & Sunarto, 2017).

4. CONCLUSION

This study successfully develops and validates a holistic assessment model tailored for climate change education based on Islamic environmental theology. The findings demonstrate that effective assessment in Early Childhood Education (ECE) must transcend conventional cognitive testing, focusing instead on authentic performance-based evidence captured through direct observation, anecdotal records, and longitudinal portfolios. By integrating theological concepts such as *khalifah fil ardh* (stewardship), *syukur* (gratitude), and *mizan* (balance), this model provides a sacred rationale for environmental care, aligning ecological agency with the spiritual identity of children in the Indonesian context. The research highlights a critical consensus among practitioners: while digital interactive media and experiential learning are essential instructional catalysts, the ultimate measure of success lies in the child's internalized values and daily environmental behaviors. However, the identified participation gap in community-led initiatives suggests that the sustainability of this curriculum depends on a robust home-school-community ecosystem. Schools cannot function as isolated green oases; they must proactively engage parents to ensure that the values of stewardship are habituated beyond the classroom.

Practically, this study serves as a pedagogical blueprint for implementing kurikulum by offering flexible, values-based evaluation rubrics. Theoretically, it contributes to the discourse on spiritualized pedagogy within environmental education, proving that religious frameworks can enhance, rather than hinder, scientific literacy. Future research should adopt a longitudinal approach to track the longterm impact of this assessment model on children's actual environmental behaviors across diverse geographical and socio-economic landscapes in Indonesia. The novelty of this study lies in bridging secular ecological frameworks with Islamic theological principles. It offers a validated assessment model tailored for early childhood climate change education. This unique integration has not been previously established, strengthening the contribution of this research to both theory and practice.

Acknowledgments: The authors would like to express their sincere gratitude to the promoter and co-promoter for their invaluable guidance and support throughout this research. Special thanks are also extended to Universitas Islam Bandung (UNISBA) for providing institutional support that greatly facilitated the completion of this study.

Conflicts of Interest: The authors declare no conflict of interest.

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