



## Constructing an Integrative *Adiwiyata* Madrasah Model for Environmental Education and SDGs from an Islamic Eco-Theological Perspective

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### Abstract

#### Keywords:

*Adiwiyata*  
Madrasah;  
Integrative  
Model;  
Environmental  
Education; ESD;  
SDGs

This study aims to construct an integrative model of *Adiwiyata*-based environmental education that is systemically connected to the framework of *Education for Sustainable Development* (ESD) and the *Sustainable Development Goals* (SDGs) within the context of madrasah learning. The study employs a qualitative approach with a case study design in a madrasah implementing the *Adiwiyata* program. Data were collected through in-depth interviews, participatory observation, documentation, and *Focus Group Discussions* (FGD), and were analyzed using interactive analysis techniques, including data reduction, data display, and conclusion drawing. The results indicate that the developed integrative model consists of four main components: school policy, an integrated green curriculum, environment-based participatory activities, and the strengthening of eco-friendly facilities, all of which are synergized with the three pillars of ESD (environmental, social, and economic). The implementation of this model has been proven to enhance students' environmental literacy, ecological awareness, and sustainable behavior through the integration of intracurricular, cocurricular, and extracurricular learning. In addition, the roles of the madrasah principal and teachers as agents of change are key factors in the successful implementation of the model. The study concludes that the construction of an integrative *Adiwiyata*-ESD model based on the SDGs makes a significant contribution to strengthening sustainable environmental education in madrasahs and is relevant as an innovative framework for educational transformation toward sustainable development.

### Abstrak:

#### Kata Kunci:

*Madrasah Adiwiyata*;  
*Model Integratif*;  
*Pendidikan*  
*Lingkungan*; ESD;  
SDGs

*Penelitian ini bertujuan untuk mengkonstruksi model integratif pendidikan lingkungan berbasis Adiwiyata yang terhubung secara sistemik dengan kerangka Education for Sustainable Development (ESD) dan Sustainable Development Goals (SDGs) dalam konteks pembelajaran madrasah. Penelitian menggunakan pendekatan kualitatif dengan desain studi kasus pada madrasah yang*

*mengimplementasikan program Adiwiyata. Data dikumpulkan melalui wawancara mendalam, observasi partisipatif, dokumentasi, serta Focus Group Discussion (FGD), dan dianalisis menggunakan teknik analisis interaktif yang meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa model integratif yang dikembangkan mencakup empat komponen utama, yaitu kebijakan sekolah, kurikulum hijau terintegrasi, kegiatan partisipatif berbasis lingkungan, dan penguatan fasilitas ramah lingkungan yang disinergikan dengan tiga pilar ESD (lingkungan, sosial, ekonomi). Implementasi model ini terbukti mampu meningkatkan literasi lingkungan, kesadaran ekologis, serta perilaku berkelanjutan peserta didik melalui integrasi pembelajaran intrakurikuler, kokurikuler, dan ekstrakurikuler. Selain itu, peran kepala madrasah dan guru sebagai agen perubahan menjadi faktor kunci keberhasilan implementasi model. Kesimpulan penelitian menegaskan bahwa konstruksi model integratif Adiwiyata-ESD berbasis SDGs memberikan kontribusi signifikan dalam penguatan pendidikan lingkungan berkelanjutan di madrasah serta relevan sebagai kerangka inovatif untuk transformasi pendidikan menuju pembangunan berkelanjutan.*

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## 1. Introduction

*Education for Sustainable Development (ESD)* has evolved into a central paradigm in transforming global education systems toward environmental, social, and economic sustainability.<sup>1</sup> ESD is not merely understood as the transfer of knowledge, but as a transformative process that shapes learners' critical awareness, values, and capacity for action in addressing complex global challenges.<sup>2</sup> In this context, education functions as a strategic instrument to develop a generation that not only understands sustainability issues but is also capable of actively participating in creating sustainable solutions at both local and global levels.<sup>3</sup> Environmental literacy represents a key dimension of ESD, integrating cognitive, affective, and behavioral aspects of learners in relation to environmental issues.<sup>4</sup> Moreover, 21st-century competencies such as critical

<sup>1</sup> Scott Strachan, Louise Logan, and Stephen Marshall, 'Vertically Integrated Projects for Sustainable Development: Achieving Transformational Action by Embedding Research-Based ESD in Curricula', 2022, 63, doi:10.3390/environsciproc2022015063; Philip Vaughter, Fumiko Noguchi, and Shengru Li, 'Minding the GAP: An Overview of Five Years of Education for Sustainable Development (ESD) Projects Under the Global Action Programme (GAP) Within Regional Centres of Expertise (RCEs) on ESD', *Frontiers in Sustainability* 3 (2022), doi:10.3389/frsus.2022.978938; Xinqun Yuan et al., 'Sustainable Development Goals (SDGs) Priorities of Senior High School Students and Global Public: Recommendations for Implementing Education for Sustainable Development (ESD)', *Education Research International* 2022 (2022): 1–14, doi:10.1155/2022/2555168.

<sup>2</sup> I W. Karmana, 'Review Literatur: Studi Tingkat Pemahaman Education Sustainable Development (ESD) Pada Siswa SMA', *Biocaster Jurnal Kajian Biologi* 2, no. 3 (2022): 121–25, doi:10.36312/bjkb.v2i3.89; Rina Wijayanti et al., 'Analisis Bahan Ajar Fisika Berdasarkan Perspektif Education for Sustainable Development', *Jurnal Kependidikan Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan Pengajaran Dan Pembelajaran* 7, no. 2 (2021): 340, doi:10.33394/jk.v7i2.2985.

<sup>3</sup> Via Alissa, 'Kesadaran Peserta Didik Dalam Penerapan Green School Untuk Mendukung ESD (Education for Sustainable Development)', *Eduteach Jurnal Edukasi Dan Teknologi Pembelajaran* 3, no. 2 (2022): 51–60, doi:10.37859/eduteach.v3i2.3805; Yahya Hanafi et al., 'Analisis Kebutuhan Pengembangan Instrumen Literasi Lingkungan Untuk Mahasiswa Pendidikan Biologi FKIP Universitas Ahmad Dahlan', *Jurnal Eksakta Pendidikan (Jep)* 5, no. 2 (2021): 174–80, doi:10.24036/jep/vol5-iss2/604.

<sup>4</sup> Ismail Ismail and Muhammad A. Parinduri, 'Implementasi Mata Pelajaran Pendidikan Agama Untuk

thinking, creativity, collaboration, and communication are integral components of the ESD framework in shaping learners who are adaptive to change.<sup>5</sup> Therefore, ESD requires a holistic and contextual learning approach that connects knowledge with real-life practices. This indicates that the implementation of ESD necessitates systemic support from various educational stakeholders. Consequently, the integration of ESD into formal education systems becomes an unavoidable necessity in achieving sustainable development goals.

In the Indonesian context, the implementation of *Education for Sustainable Development* (ESD) finds its relevance through the *Adiwiyata* program, which has been developed as a national policy in environmental education.<sup>6</sup> This program is designed to encourage schools to become environmentally cultured learning environments through the strengthening of policies, curriculum, participatory activities, and environmentally friendly facilities.<sup>7</sup> *Adiwiyata* functions as an incubator for ESD implementation at the school level, as it provides a concrete operational framework for integrating sustainability values into educational practices.<sup>8</sup> Through this approach, schools are not only places of learning but also serve as living laboratories where students can directly experience sustainable practices.<sup>9</sup> Furthermore, *Adiwiyata* promotes the development of an environmentally responsible school culture through routine activities such as waste management, greening initiatives, and energy conservation.<sup>10</sup> However, the implementation of *Adiwiyata* across schools demonstrates varying levels of effectiveness, particularly in integrating sustainability concepts into the learning process.<sup>11</sup> This indicates that although *Adiwiyata* has structurally provided an adequate framework, substantively it still requires strengthening in pedagogical and curricular aspects.<sup>12</sup> Therefore, the integration of *Adiwiyata* with the ESD framework is essential to ensure that environmental education is not merely symbolic, but truly transformative.

Furthermore, the integration of *Adiwiyata* and *Education for Sustainable Development* (ESD) requires the development of innovative and contextual

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Pendidikan Berkelanjutan Pada Sekolah Menengah Umum', *Journal of Education Humaniora and Social Sciences (Jehss)* 6, no. 1 (2023): 371–78, doi:10.34007/jehss.v6i1.1883.

<sup>5</sup> Hanafi et al., 'Analisis Kebutuhan Pengembangan Instrumen Literasi Lingkungan Untuk Mahasiswa Pendidikan Biologi FKIP Universitas Ahmad Dahlan'; Wijayanti et al., 'Analisis Bahan Ajar Fisika Berdasarkan Perspektif Education for Sustainable Development'.

<sup>6</sup> Mirza Desfandi, Enok Maryani, and Disman Disman, 'Building Ecoliteracy Through Adiwiyata Program (Study at Adiwiyata School in Banda Aceh)', *Indonesian Journal of Geography* 49, no. 1 (28 July 2017): 51, doi:10.22146/ijg.11230; HANIPAH APRILIANI, Gandhi Pawitan, and Pius Suratman, 'Systematic Literature Review: Analisis Collaborative Governance Dalam Program Adiwiyata Sekolah', *Jurnal Ilmiah Pendidikan Lingkungan Dan Pembangunan* 24, no. 02 (2024): 36–54, doi:10.21009/plpb.v24i02.32857.

<sup>7</sup> Oot Hotimah, Suchyanto Suchyanto, and Samadi Samadi, 'Implementation a Caring and Environmentally Cultured School in Jakarta', *Social Humanities and Educational Studies (Shes) Conference Series* 5, no. 4 (2022): 101, doi:10.20961/shes.v5i4.68976.

<sup>8</sup> Ismail and Parinduri, 'Implementasi Mata Pelajaran Pendidikan Agama Untuk Pendidikan Berkelanjutan Pada Sekolah Menengah Umum'.

<sup>9</sup> Azaz Akbar and A M. Ali, 'Peran Sekolah Dalam Upaya Pelestarian Greend Child Sebagai Upaya Pelestarian Lingkungan Hidup', *Sang Pencerah Jurnal Ilmiah Universitas Muhammadiyah Buton* 7, no. 3 (2021): 321–27, doi:10.35326/pencerah.v7i3.1181.

<sup>10</sup> A. E. F. Hasan, Suarti Suarti, and Ummul Hasanah, 'Implementasi Konsep Adiwiyata Dalam Pembelajaran Fisika Sman 10 Bulukumba', *Al-Khazini Jurnal Pendidikan Fisika* 1, no. 2 (2021): 155–62, doi:10.24252/al-khazini.v1i2.24250.

<sup>11</sup> Hotimah, Suchyanto, and Samadi, 'Implementation a Caring and Environmentally Cultured School in Jakarta'.

<sup>12</sup> Ahmad Yusam Thobroni and Dewi Masyithoh, 'Pendidikan Islam Berbasis Adiwiyata Di MAN 1 Mojokerto: Implementasi Dan Normativitas Qur'ani', *TADRIS: Jurnal Pendidikan Islam* 15, no. 2 (4 January 2021): 266–82, doi:10.19105/tjpi.v15i2.3625.

learning models capable of bridging theory and practice. Various pedagogical approaches, such as experiential learning, *ecopedagog*, and outdoor learning, have been identified as effective strategies in strengthening the implementation of ESD-based environmental education.<sup>13</sup> The experiential learning approach enables students to learn through direct experiences that are relevant to their environment, thereby enhancing their understanding and engagement with sustainability issues.<sup>14</sup> Meanwhile, *ecopedagog* emphasizes the importance of critical awareness of the relationship between humans and the environment, encouraging students to become agents of change within society.<sup>15</sup> Outdoor learning also provides contextual and authentic learning experiences that can enhance students' affective connection to the environment.<sup>16</sup> In addition, the use of ESD-based learning media, such as e-modules and electronic student worksheets (e-LKPD), has shown potential in improving students' environmental literacy.<sup>17</sup> Therefore, the development of an integrative learning model becomes a key factor in optimizing the implementation of *Adiwiyata* within the ESD framework.

However, the implementation of *Adiwiyata*-based environmental education within the ESD framework is not without structural and cultural challenges. One of the primary challenges is the limited understanding among teachers regarding ESD concepts, along with the lack of systematic training to integrate sustainability values into the learning process.<sup>18</sup> In addition, constraints in facilities and resources also hinder the implementation of environmental programs in schools.<sup>19</sup> In some cases, environmental activities remain routine in nature without deep reflection that connects these activities to sustainability concepts.<sup>20</sup> This indicates a gap between practice and the ideal goals of ESD-based environmental education. On the other hand, school leadership support plays a crucial role in determining the success of *Adiwiyata* program implementation.<sup>21</sup> School principals act as agents of change who guide school policies and culture toward sustainability.<sup>22</sup> Therefore,

<sup>13</sup> Sri Wahyuni, 'Manajemen Sekolah Adiwiyata Nasional Dalam Menanamkan Karakter Kewirausahaan Siswa', *Media Manajemen Pendidikan* 4, no. 1 (2021): 92–103, doi:10.30738/mmp.v4i1.8923; Jenny K. Matitaputty et al., 'Implementasi Education for Sustainable Development (Esd) Melalui Ekopedagogi Dalam Pembelajaran Di SMP Negeri 8 Ambon', *Budimas Jurnal Pengabdian Masyarakat* 4, no. 1 (2022), doi:10.29040/budimas.v4i1.3532; Aminah Zuhriyah, 'Urgensi Penerapan Outdoor Learning Dalam Praktik Pendidikan Lingkungan', *Edukatif Jurnal Ilmu Pendidikan* 3, no. 6 (2021): 5170–82, doi:10.31004/edukatif.v3i6.1662.

<sup>14</sup> Lilik Wahyuni and Sugeng Riyanto, 'Model Sekolah Adiwiyata Melalui Program Asistensi Mengajar Berbasis Pembelajaran Experiential', *Jurnal Paedagogy* 9, no. 4 (2022): 616, doi:10.33394/jp.v9i4.5673.

<sup>15</sup> Matitaputty et al., 'Implementasi Education for Sustainable Development (Esd) Melalui Ekopedagogi Dalam Pembelajaran Di SMP Negeri 8 Ambon'.

<sup>16</sup> Zuhriyah, 'Urgensi Penerapan Outdoor Learning Dalam Praktik Pendidikan Lingkungan'.

<sup>17</sup> Ida N. Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim', *Social Humanities and Educational Studies (Shes) Conference Series* 5, no. 4 (2022): 367, doi:10.20961/shes.v5i4.69111; Nadia N. Saffanah and Ghulam Hamdu, 'Analisis Rubrik Penilaian Keterampilan Berpikir Kritis Berbasis ESD Di Kelas Tinggi Sekolah Dasar', *Judika (Jurnal Pendidikan Unsika)* 10, no. 1 (2022): 1–15, doi:10.35706/judika.v10i1.5344.

<sup>18</sup> Rahmah Z. Munawaroh et al., 'Penanaman Nilai Karakter Peduli Lingkungan Melalui Mata Kuliah Pendidikan Lingkungan Hidup Pada Mahasiswa PGMI', *Instructional Development Journal* 5, no. 1 (2022): 33, doi:10.24014/idx.v5i1.19102.

<sup>19</sup> Hotimah, Suchyanto, and Samadi, 'Implementation a Caring and Environmentally Cultured School in Jakarta'.

<sup>20</sup> Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim'.

<sup>21</sup> Wahyuni and Riyanto, 'Model Sekolah Adiwiyata Melalui Program Asistensi Mengajar Berbasis Pembelajaran Experiential'; Putri R. D. Kusumawati, Roma Aristiyanto, and Ila K. Muflikhah, 'Pengembangan E-Modul Berbasis Pendidikan Lingkungan Berkelanjutan Dalam Pembelajaran Ipa', *Lensa (Lentera Sains) Jurnal Pendidikan Ipa* 13, no. 2 (2023): 149–55, doi:10.24929/lensa.v13i2.366.

<sup>22</sup> Alissa, 'Kesadaran Peserta Didik Dalam Penerapan Green School Untuk Mendukung ESD

strengthening teacher capacity and school leadership becomes a crucial aspect in developing effective environmental education models.

From an Islamic perspective, environmental education in madrasahs should be grounded not only in ecological knowledge and sustainability competencies but also in an ethical and theological understanding of the relationship between human beings, God, and nature. The Islamic worldview conceptualizes nature as part of God's creation (*khalq Allāh*) and human beings as *khalīfah* (stewards) entrusted with the responsibility to maintain the balance of creation. This stewardship is inseparable from the principle of *amānah*, which implies that environmental resources constitute a trust for which human beings are morally accountable. The Qur'anic concept of *mīzān* further emphasizes the maintenance of balance and warns against actions that disturb ecological equilibrium, while the prohibition of *fasād fi al-arḍ* provides an ethical basis for rejecting environmental destruction. Similarly, the principle of avoiding *isrāf* establishes a normative foundation for responsible consumption and the prevention of excessive exploitation of natural resources. These principles indicate that environmental responsibility in Islam is not merely a contemporary educational concern but is embedded within a broader moral framework concerning human accountability and the preservation of creation. Therefore, Islamic environmental ethics can provide an important philosophical foundation for strengthening environmental education in madrasahs by transforming ecological awareness from cognitive understanding into a religiously meaningful moral commitment.

The Islamic perspective also introduces an important distinction between environmental education as an instrumental educational program and environmental education as a process of moral and spiritual formation. Within Islamic *ecothology*, the natural environment is understood as containing signs (*āyāt*) of God's existence and wisdom, meaning that interaction with nature can become a dimension of religious learning and spiritual reflection. Such an understanding challenges an exclusively anthropocentric conception of environmental sustainability in which nature is protected primarily because of its utility to human welfare. Instead, an Islamic ecological worldview emphasizes relational responsibility, moderation, justice, and stewardship. In the context of madrasahs, this perspective creates an opportunity to connect environmental learning with Islamic Religious Education, Qur'anic interpretation, fiqh, akhlaq, science, and everyday school practices. Environmental activities such as waste reduction, water conservation, school gardening, biodiversity protection, and responsible consumption can consequently be interpreted not merely as *Adiwiyata* activities but also as concrete manifestations of *amānah*, *khalīfah*, *mīzān*, and the avoidance of *isrāf*. The integration of these dimensions may strengthen the internalization of environmental values because students encounter sustainability not as an external policy requirement but as an ethical responsibility consistent with their religious identity.

Furthermore, the concept of environmental fiqh (*fiqh al-bī'ah*) provides an important bridge between Islamic environmental ethics and practical environmental action. Environmental fiqh seeks to translate Islamic principles into normative guidance concerning human relationships with natural resources, environmental protection, consumption, pollution, and collective responsibility. Its relevance becomes particularly apparent when environmental degradation is considered through the framework of *maqāṣid al-sharī'ah*, because ecological destruction may undermine the protection of life, human welfare, property, future generations, and the conditions necessary for human flourishing. From this standpoint,

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(Education for Sustainable Development)'.

environmental protection can be understood as a form of *maslahah* and collective responsibility rather than merely an optional form of individual piety. This perspective is particularly significant for madrasah education because it allows environmental behavior to relate to Islamic jurisprudential reasoning and ethical decision-making. Students can therefore be encouraged not only to know what constitutes environmental degradation but also to critically examine why certain forms of consumption, waste production, pollution, and resource exploitation are ethically problematic within an Islamic normative framework.

The integration of Islamic environmental ethics, *ecothology*, and environmental fiqh consequently provides a distinctive foundation for connecting *Adiwiyata*, Education for Sustainable Development (ESD), and the Sustainable Development Goals (SDGs) within the madrasah learning system. *Adiwiyata* contributes an institutional structure through environmental policy, green curriculum, participatory activities, and environmentally friendly facilities; ESD provides a transformative pedagogical framework oriented toward sustainability competencies, critical thinking, collaboration, and action; while Islamic environmental thought provides the religious, ethical, and theological foundation through which these practices can be internalized by Muslim learners. This relationship suggests that the integration of SDGs in madrasahs should not simply reproduce a generic sustainability framework but should be contextualized through the epistemological and cultural characteristics of Islamic education. The SDGs may therefore function as a global development framework, ESD as an educational and pedagogical framework, *Adiwiyata* as an institutional and school-environment framework, and Islamic environmental ethics, *ecothology*, and environmental fiqh as the normative and spiritual foundation for translating sustainability into meaningful educational practice. Such complementarity provides a stronger basis for constructing an integrative model that connects knowledge, values, institutional practices, religious consciousness, and environmental action.

This Islamic perspective also reveals a conceptual gap in existing approaches to *Adiwiyata* and ESD. Although previous studies have demonstrated the importance of environmental literacy, green curriculum, experiential learning, outdoor learning, project-based learning, teacher capacity, school leadership, and environmentally friendly infrastructure, these dimensions do not necessarily explain how environmental responsibility can be deeply internalized within the religious worldview of madrasah students. Similarly, studies of Islamic environmental thought have extensively discussed stewardship, ecological ethics, environmental responsibility, and theological relationships with nature, but these concepts have not always been translated into an integrated educational model connecting Islamic values with *Adiwiyata* mechanisms, ESD competencies, and SDGs-oriented learning outcomes. The resulting gap is therefore not simply a lack of environmental content in Islamic education but a lack of an integrative framework that explains how Islamic ecological values can operate across curriculum, pedagogy, school culture, participatory environmental activities, and sustainability outcomes. Addressing this gap is important because the effectiveness of environmental education depends not only on students' environmental knowledge but also on the extent to which environmental responsibility becomes embedded within their values, identity, institutional culture, and everyday practices.

Accordingly, the present study positions Islamic environmental ethics, *ecothology*, and environmental fiqh as constitutive dimensions of the proposed integrative model rather than as supplementary religious interpretations. The model conceptualizes environmental education in madrasahs as a multidimensional process involving four interconnected domains: Islamic ecological worldview, *Adiwiyata* institutionalization, ESD-oriented learning, and SDGs-oriented

environmental action. The Islamic ecological worldview provides the normative foundation through concepts such as *tawhīd*, *khilāfah*, *amānah*, *mīzān*, *‘adālah*, *maslahah*, and the prohibition of *fasād* and *isrāf*. *Adiwiyata* operationalizes these values through school policies, curriculum integration, participatory activities, and environmentally friendly infrastructure. ESD translates them into learning processes emphasizing critical thinking, collaboration, problem solving, experiential learning, and sustainability competencies, while the SDGs provide broader global objectives against which environmental and social actions can be contextualized. Through this structure, Islamic values are not positioned in opposition to global sustainability frameworks; rather, they provide a culturally and religiously meaningful foundation for localizing and internalizing those frameworks within the educational environment of madrasahs.

In addition to these challenges, there are significant opportunities for the development of *Adiwiyata*-based environmental education within the ESD framework. The advancement of the *Merdeka Curriculum* provides space for integrating sustainability values through project-based and contextual learning approaches.<sup>23</sup> Furthermore, progress in information technology enables the development of digital learning media that can enhance students' environmental literacy.<sup>24</sup> Programs such as Green School, Green Campus, and the Environmental Awareness and Culture Movement in Schools (*Gerakan Peduli dan Berbudaya Lingkungan Hidup di Sekolah/PBLHS*) also reflect a strong national policy commitment to supporting sustainable education.<sup>25</sup> The involvement of communities and stakeholders further creates opportunities to establish a collaborative and sustainable educational ecosystem.<sup>26</sup> Therefore, the synergy between policy, technology, and community participation can serve as a driving force in developing more effective environmental education models. However, these opportunities need to be optimized through systematic planning and evidence-based approaches.

Within the context of this study, it is essential to examine how an integrative model of *Adiwiyata*-based environmental education can be constructed within the madrasah learning system. As value-based educational institutions, madrasahs possess significant potential to internalize sustainability values that align with the principles of Education for Sustainable Development (ESD).<sup>27</sup> However, the integration of religious values and sustainability values still requires strengthening in instructional practices.<sup>28</sup> Moreover, the distinctive characteristics of madrasahs, including their unique curriculum structure and institutional culture, necessitate a contextualized approach to implementing the *Adiwiyata* program.<sup>29</sup> Therefore, this study seeks to identify and develop an integrative model that accommodates the various components of *Adiwiyata* and the principles of ESD within the madrasah learning system. This approach is expected to produce a model that is not only pedagogically effective but also culturally and institutionally relevant. Thus, this

<sup>23</sup> Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim'.

<sup>24</sup> Ajeng Fitria and Ghulam Hamdu, 'Pengembangan Aplikasi Mobile Learning Untuk Perangkat Pembelajaran Berbasis Education for Sustainable Development', *Jurnal Inovasi Dan Teknologi Pembelajaran* 8, no. 2 (2021): 134–45, doi:10.17977/um031v8i22021p134.

<sup>25</sup> Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim'.

<sup>26</sup> Hasan, Suarti, and Hasanah, 'Implementasi Konsep Adiwiyata Dalam Pembelajaran Fisika Sman 10 Bulukumba'.

<sup>27</sup> Akbar and Ali, 'Peran Sekolah Dalam Upaya Pelestarian Greend Child Sebagai Upaya Pelestarian Lingkungan Hidup'.

<sup>28</sup> Atik Rosanti et al., 'Pendidikan Hijau (Green Education) Dalam Menghadapi Isu Nasional Dan Global', *Edumaspul - Jurnal Pendidikan* 6, no. 1 (2022): 1218–23, doi:10.33487/edumaspul.v6i1.3637.

<sup>29</sup> Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim'.

study offers a significant contribution to the development of value-based environmental education in Indonesia.

Based on the literature review presented above, a research gap can be identified that requires further investigation. Most previous studies have focused on the partial implementation of the *Adiwiyata* program without systematically integrating it with the ESD framework.<sup>30</sup> In addition, studies on integrative learning models that combine intracurricular, cocurricular, and extracurricular aspects within the context of *Adiwiyata* remain limited.<sup>31</sup> Research specifically examining the madrasah context is also relatively scarce, thus requiring further exploration to better understand the dynamics of environmental education implementation in such institutions.<sup>32</sup> Furthermore, the development of ESD-based evaluation instruments remains a challenge in measuring the effectiveness of environmental learning.<sup>33</sup> Therefore, this study offers a novelty in the form of constructing an integrative model of *Adiwiyata*-based environmental education within the ESD framework that is contextualized to the madrasah learning system. This model is expected to bridge the gap between theory and practice in environmental education.

Accordingly, the primary objective of this study is to construct an integrative model of *Adiwiyata*-based environmental education that can enhance students' sustainability awareness and environmental literacy within the madrasah context. This study also aims to identify effective implementation strategies as well as the factors influencing the success of the proposed model. Furthermore, this research seeks to provide theoretical contributions to the development of ESD-based environmental education concepts, as well as practical contributions to the implementation of the *Adiwiyata* program in schools. The relevance of this study to existing literature lies in its effort to integrate the ESD framework with *Adiwiyata* practices, which have previously been treated separately. Thus, this study not only strengthens the existing body of knowledge but also offers a new perspective on the development of environmental education.

## 2. Methods

This study employs a qualitative approach with a multisite design aimed at constructing an integrative model of *Adiwiyata*-based environmental education within the framework of *Education for Sustainable Development* (ESD) in the madrasah learning system. The qualitative approach was selected as this study seeks to gain an in-depth understanding of the implementation of environmental education within the natural school context, including interactions among actors, policies, school culture, and ongoing learning practices. The multisite design is utilized to provide a comparative framework and to enhance the validity of the findings, although the primary focus of this study is directed toward a main site, namely MTsN 1 Tulungagung as an *Adiwiyata*-based madrasah. This study adopts a constructivist paradigm, which views social reality as a product of interactions among individuals within specific contexts; therefore, the analysis is conducted inductively to generate a conceptual model grounded in field data. Thus, this

<sup>30</sup> Hotimah, Sucahyanto, and Samadi, 'Implementation a Caring and Environmentally Cultured School in Jakarta'; Ismail and Parinduri, 'Implementasi Mata Pelajaran Pendidikan Agama Untuk Pendidikan Berkelanjutan Pada Sekolah Menengah Umum'.

<sup>31</sup> Zuhriyah, 'Urgensi Penerapan Outdoor Learning Dalam Praktik Pendidikan Lingkungan'; Saputro et al., 'Implementasi Program UNS Green Campus Dalam Menghadapi Perubahan Iklim'.

<sup>32</sup> Akbar and Ali, 'Peran Sekolah Dalam Upaya Pelestarian Greend Child Sebagai Upaya Pelestarian Lingkungan Hidup'.

<sup>33</sup> Saffanah and Hamdu, 'Analisis Rubrik Penilaian Keterampilan Berpikir Kritis Berbasis ESD Di Kelas Tinggi Sekolah Dasar'.

method enables the researcher to explore the meanings, patterns, and dynamics of environmental education implementation in a comprehensive manner.

The research participants consisted of various stakeholders involved in the implementation of the *Adiwiyata* program in the madrasah, including the principal, teachers, students, and the school environmental management team. Participants were selected purposively based on their active involvement in the planning, implementation, and evaluation of environmental education programs. The principal was selected due to their role as a policy maker and the main driving force of the program, while teachers were chosen as implementers of learning who integrate environmental values into the curriculum. Students served as the primary subjects for examining the impact of program implementation on sustainability awareness and environmental literacy, whereas the environmental management team provided perspectives related to the technical aspects of implementing the *Adiwiyata* program. The participants came from diverse backgrounds in terms of experience, understanding of environmental issues, and involvement in school activities, thereby providing rich and varied data. The number of participants was determined based on data needs until reaching data saturation, at which point no significant new information was identified.

The research instruments employed in this study were qualitative in nature and designed to obtain in-depth and contextual data. The primary instrument was the researcher as a human instrument, who was responsible for designing, collecting, analyzing, and interpreting the data. In addition, supporting instruments included a semi-structured interview guide that enabled in-depth exploration of participants' experiences and perspectives regarding the implementation of *Adiwiyata*-based environmental education. An observation checklist was used to record the physical condition of the school environment, student activities, as well as learning practices conducted both inside and outside the classroom. Documentation was also utilized as a secondary data source, including records of the *Adiwiyata* program, curriculum documents, lesson plans, and photographs and videos of environmental activities. These instruments were systematically developed to ensure that the data obtained were relevant to the focus of the study, namely the construction of an integrative ESD-based environmental education model.

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Data analysis in this study employed the interactive model of Miles and Huberman, which consists of three main stages: data reduction, data display, and conclusion drawing. Data reduction was carried out by filtering, organizing, and categorizing the data based on themes relevant to the research focus, such as environmental curriculum integration, school culture, student participation, and the

internalization of SDGs values. Data display was presented in the form of descriptive narratives, matrices, and conceptual models to facilitate interpretation and meaning-making. Conclusion drawing was conducted gradually and continuously verified throughout the research process to ensure the consistency and validity of the findings. In addition, the analysis was conducted inductively to generate an integrative model of *Adiwiyata*-based environmental education that is contextualized within the madrasah learning system. Thus, this analytical approach enables the researcher to produce findings that are not only descriptive but also constructive in the form of a conceptual model that can be replicated and further developed by other researchers.

### 3. Result and Discussion

#### 3.3 *Adiwiyata as Islamic Environmental Education: From Environmental Practice to Moral Formation*

The empirical findings of this study demonstrate that environmental education at MTsN 1 Tulungagung has developed through routine practices, institutional policies, student participation, and the provision of environmentally supportive facilities. Students participate in daily cleaning activities, waste separation, waste-bank management, and greening programs, while environmental concerns have been incorporated into the madrasah's vision, mission, and annual work plan. From the perspective of Islamic education, however, these practices can be understood not merely as behavioral components of the *Adiwiyata* program but also as potential instruments for the formation of *akhlāq* toward the natural environment. Islamic education is fundamentally concerned with the formation of human beings whose knowledge, values, attitudes, and actions are directed toward responsible conduct before God and within creation. Consequently, environmental education in a madrasah should not be restricted to transferring scientific knowledge about pollution, waste, or sustainability, but should also cultivate an ethical consciousness that connects environmental responsibility with religious responsibility.<sup>34</sup> This perspective is particularly relevant because the empirical findings reveal a significant discrepancy between students' ability to perform environmental practices and their ability to articulate the broader meaning of sustainability and the SDGs. Student S1, for example, understood the importance of not littering and maintaining classroom cleanliness, whereas S3 acknowledged having heard about the SDGs without fully understanding their meaning. The findings therefore suggest that environmental behavior has emerged before the development of a sufficiently explicit conceptual and ethical framework.

This condition can be interpreted through the Islamic educational concept of *tarbiyah*, in which education is not merely the accumulation of knowledge but a process of cultivating dispositions and responsible conduct. The routine environmental activities observed at the madrasah can therefore constitute an important pedagogical foundation for developing environmental *adab*. In this framework, cleaning the classroom, separating waste, maintaining gardens, and protecting school facilities are not value-neutral activities. They can become educational practices through which students learn discipline, responsibility, moderation, care, and respect for creation. Islamic environmental ethics provides a theological foundation for this transformation because human beings are positioned as *khalīfa* trustees or vicegerents whose relationship with the Earth

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<sup>34</sup> Labeeb Bsoul et al., 'Islam's Perspective on Environmental Sustainability: A Conceptual Analysis', *Social Sciences* 11, no. 6 (24 May 2022): 228, doi:10.3390/socsci11060228.

involves responsibility rather than unrestricted domination.<sup>35</sup> The concept of *khalīfa* should consequently be translated pedagogically into concrete forms of responsibility toward land, water, plants, animals, and other members of the created order. Contemporary Islamic environmental scholarship further emphasizes that environmental responsibility relates to *amāna*, the trust entrusted to human beings, and with *mīzān*, the divinely established principle of balance.<sup>36</sup> From this perspective, the environmental activities at MTsN 1 Tulungagung already represent an important practical expression of Islamic environmental education, but their educational significance would be substantially strengthened if teachers explicitly connected these practices with Islamic ethical concepts.

The empirical gap between environmental practice and conceptual understanding is therefore particularly important for the development of an Islamic model of ESD in madrasah education. Existing ESD literature emphasizes that sustainability education should connect knowledge, values, competencies, and action rather than producing environmentally responsible behavior without reflection. The present findings confirm this concern: students actively participate in environmental activities, but some have limited understanding of the SDGs and the broader conceptual meaning of sustainability. Islamic education can contribute to resolving this problem by providing a culturally and religiously meaningful interpretive framework through which students can understand why environmental responsibility matters. Instead of presenting SDGs exclusively as an external global framework, teachers can relate selected sustainability issues to Islamic principles concerning stewardship, moderation, justice, cleanliness, non-wastefulness, and responsibility toward creation. Such an approach does not require replacing the SDGs with Islamic concepts; rather, it creates a contextual bridge through which global sustainability objectives can acquire moral and religious meaning in the madrasah context.<sup>37</sup> Research on Muslim students has likewise demonstrated the importance of connecting environmental education with Islamic obligations and ethical orientations, although environmental knowledge alone does not automatically produce strong pro-environmental commitment.<sup>38</sup> This finding is particularly relevant to the present study because it suggests that the existence of environmental programs and religious identity does not by itself guarantee environmental literacy. What is required is deliberate pedagogical integration between knowledge, religious values, reflection, and action.

Accordingly, the proposed integrative model should reposition environmental activities from being predominantly routine programs toward becoming structured experiences of Islamic moral learning. For example, waste separation can be connected to discussions of *isrāf* and responsible consumption; water conservation can be connected to moderation and avoidance of waste; tree planting can be interpreted through the Islamic ethic of cultivating and preserving the Earth; and maintaining school cleanliness can be connected to *ṭahāra* and environmental responsibility. Such connections should not be reduced to attaching Qur'anic quotations to pre-existing activities. Instead, teachers should facilitate reflection that enables students to understand the relationship between religious values, environmental problems, and sustainable action. This approach is consistent with

<sup>35</sup> Sara Hillman et al., 'Eco-Heritage Literacies and the Sociolinguistics of Islam in Qatar's Qur'anic Botanic Garden', *Journal of Multilingual and Multicultural Development*, 9 March 2026, 1–31, doi:10.1080/01434632.2026.2641591.

<sup>36</sup> Ibid.

<sup>37</sup> Bsoul et al., 'Islam's Perspective on Environmental Sustainability'.

<sup>38</sup> Mohd Nor Mamat and Fattawi Mokhtar, 'Environmental Attitude Profile among Muslim Students of Environmental Course in Malaysia', *Procedia - Social and Behavioral Sciences* 42 (2012): 92–99, doi:10.1016/j.sbspro.2012.04.170.

the argument that Islamic environmental education can learn from contemporary environmental pedagogies while maintaining its distinctive theological and ethical foundations. The central pedagogical transformation is therefore from “doing environmental activities” to “understanding, valuing, reflecting upon, and acting for the environment as a religiously meaningful responsibility.” In this sense, the *Adiwiyata* program provides the institutional and practical infrastructure, ESD provides the sustainability framework, and Islamic education provides an ethical and spiritual foundation for meaning making.

### 3.3 *Eco-Theology, Khalīfa, Amāna, and Mīzān: Interpreting the Environmental Practices of the Madrasah*

The empirical findings can further be interpreted through Islamic eco-theology, particularly the concepts of *khalīfa*, *amāna*, and *mīzān*. The existing *Adiwiyata* implementation at MTsN 1 Tulungagung is characterized by a strong institutional commitment: environmental programs have been incorporated into the madrasah’s vision and mission, an environmental team has been established, and facilities such as gardens and segregated waste bins are available. From an eco-theological perspective, these institutional arrangements are important because they transform environmental responsibility from an individual preference into a collective moral practice. Islamic environmental theology understands nature not simply as a collection of resources available for human consumption, but as part of God’s creation with intrinsic theological significance.<sup>39</sup> This perspective challenges a purely instrumental interpretation of environmental education in which students protect the environment only because doing so improves school cleanliness or fulfills *Adiwiyata* requirements. Rather, environmental care can be framed as an expression of accountability toward God and responsibility toward creation.

The concept of *khalīfa* provides an especially relevant theoretical lens for interpreting the role of students in the environmental activities documented in this study. In Qur’anic discourse, human beings are entrusted with a distinctive responsibility in relation to the Earth. The concept should not be interpreted as unrestricted human superiority or ownership of nature, but as a responsibility to manage creation without violating its balance. Contemporary Islamic environmental scholarship identifies *khalīfa* and *amāna* as central principles through which environmental responsibility can be conceptualized.<sup>40</sup> The behavior of students participating in cleaning activities, waste management, and greening can therefore be understood as an embryonic form of stewardship. However, the empirical evidence also shows that this stewardship remains predominantly behavioral and institutional rather than fully reflective. Students perform environmental practices, but the limited understanding of SDGs indicates that the ethical rationale underlying those practices has not yet been fully articulated. The proposed model should consequently transform students from program participants into reflective environmental stewards who are able to explain why environmental protection constitutes a moral responsibility.

The principle of *mīzān* provides a second important dimension for interpreting the findings. The Qur’anic concept of balance emphasizes that creation is characterized by order and proportion, while human beings are warned against transgressing that balance. Environmental problems such as excessive waste,

<sup>39</sup> Naiyerah Kolkailah, ‘The Qur’anic Botanic Garden in Qatar: Challenges and Opportunities for Islamic Environmentalism: Research Article’, *Religion and Development* 2, no. 1 (20 September 2023): 63–83, doi:10.30965/27507955-20230016.

<sup>40</sup> Hillman et al., ‘Eco-Heritage Literacies and the Sociolinguistics of Islam in Qatar’s Qur’anic Botanic Garden’.

pollution, and irresponsible consumption can therefore be interpreted not only as technical problems but also as manifestations of ethical imbalance. The waste-bank program and waste-separation practices at MTsN 1 Tulungagung provide concrete opportunities for students to encounter this principle through everyday experience. Instead of teaching waste management solely as a technical procedure, teachers can use it as an opportunity to discuss consumption, moderation, responsibility, and the consequences of human actions for other forms of life. Such an approach is consistent with contemporary Islamic eco-theological scholarship, which emphasizes harmony, balance, and ethical care for the interconnected creation.[9] It also enables the school's physical environment to function as a form of "living theology," where religious values are learned through repeated interaction with gardens, waste systems, water, soil, and other elements of the school ecosystem.

The role of the madrasah principal identified in this study can also be reinterpreted through this eco-theological framework. The principal's decision to incorporate environmental programs into the vision, mission, organizational structure, and annual work plan indicates that environmental responsibility has become part of institutional governance. Within an Islamic educational institution, leadership may be understood not simply as administrative authority but as *amāna*, a responsibility entrusted to institutional leaders. This perspective enriches the existing literature on school leadership and ESD by suggesting that sustainability leadership in a madrasah has both organizational and moral dimensions. The principal is not merely responsible for ensuring that the school satisfies *Adiwiyata* indicators; leadership should also ensure that environmental values become embedded in the educational culture and transmitted through learning. The institutional strength identified in the present study therefore constitutes an important foundation, but it needs to be translated into curricular and pedagogical practices so that environmental responsibility is not confined to policy documents and school routines.

This interpretation is particularly significant because the study identifies a clear discrepancy between institutional commitment and pedagogical integration. The school possesses environmental facilities, policies, organizational structures, and routine activities, yet teachers reported that environmental content is usually inserted into subjects such as science or social studies without explicit SDG-oriented guidelines. From an eco-theological perspective, this gap means that the theological meaning of environmental stewardship has not yet been fully institutionalized within the curriculum. A whole-school environmental culture requires coherence between what the institution declares, what teachers teach, what students experience, and how achievement is evaluated. Islamic eco-theology can therefore serve as a bridge between institutional environmental policy and the moral formation of students. It provides a framework through which the environmental practices of the madrasah can be understood as part of a broader worldview concerning human responsibility, creation, justice, balance, and accountability before God.

### 3.3 *Environmental Fiqh and the Institutionalization of Sustainable Action in Madrasah*

The third theoretical perspective that strengthens the interpretation of the findings is *fiqh al-bī'ā*, or Islamic environmental jurisprudence. Whereas eco-theology emphasizes the theological and ethical meaning of the human–nature relationship, environmental fiqh provides a normative perspective for translating these principles into practical obligations and institutional rules. Islamic

jurisprudential reasoning can contribute to environmental education by asking not only whether an environmental action is desirable, but also what responsibilities, duties, restrictions, and collective obligations arise from environmental problems. Contemporary scholarship on Islamic environmental law demonstrates that *uṣūl al-fiqh* can provide mechanisms for developing practical environmental norms and evaluating human uses of natural resources.<sup>41</sup> This perspective is highly relevant to the present findings because the madrasah has already established practical environmental systems, but these systems remain insufficiently connected to explicit learning outcomes and evaluation indicators.

The waste-management practices identified in this study offer a particularly concrete example. Students participate in separating, collecting, and weighing waste, while the madrasah provides segregated bins and a waste bank. From an environmental-fiqh perspective, these practices can be developed into a pedagogical discussion of *isrāf* (wastefulness/excess), responsibility for harm, public benefit, cleanliness, and preservation of resources. Islamic environmental jurisprudence can thus help students move from a procedural understanding—“waste must be separated”—to a normative understanding—“wasteful and harmful practices should be avoided because human actions have ethical consequences for other people and creation.” Recent scholarship on Islamic sustainability similarly identifies environmental preservation, *i’ṁār al-arḍ* (cultivating/prospering the Earth), and the prohibition of *isrāf* as important Islamic principles relevant to contemporary sustainability.<sup>42</sup> Such principles can provide a religiously grounded framework for addressing SDG-related themes such as responsible consumption and production, sustainable communities, climate action, and environmental protection.

The environmental-fiqh perspective also clarifies why environmental education should extend beyond individual behavior toward institutional responsibility. Environmental problems are rarely caused by isolated individuals; they are also shaped by institutional practices concerning consumption, waste management, water use, energy, infrastructure, and land management. Therefore, a madrasah that adopts environmental fiqh should institutionalize environmental responsibility through policies, procedures, facilities, curriculum, and evaluation. The existing environmental work plan and *Adiwiyata* team at MTsN 1 Tulungagung provide a suitable institutional foundation for this process. However, the findings indicate that evaluation remains primarily administrative and has not yet incorporated environmental literacy or SDG indicators. Environmental fiqh suggests that institutional accountability should extend beyond documenting whether an activity occurred to assessing whether the activity contributes to the prevention of environmental harm and the cultivation of responsible behavior.

The absence of systematic environmental evaluation is consequently not merely a technical weakness in the *Adiwiyata* program. It also represents a missed opportunity to transform environmental responsibility into sustained moral and institutional commitment. An Islamic environmental assessment framework could evaluate at least three dimensions: knowledge (*fahm*), ethical disposition (*akhlāq*), and action (*ʿamal*). Knowledge assessment could examine students’ understanding of environmental problems and SDGs; ethical assessment could examine attitudes concerning responsibility, moderation, care, and stewardship; and action

<sup>41</sup> Willis Jenkins, ‘Islamic Law and Environmental Ethics: How Jurisprudence (Usul al-Fiqh) Mobilizes Practical Reform’, *Worldviews: Global Religions, Culture, and Ecology* 9, no. 3 (2005): 338–64, doi:10.1163/156853505774841641.

<sup>42</sup> Dahlia Bonang et al., ‘Islamic Worldview and the Green Economy: A Philosophical Nexus for Sustainability and Equity’, *International Journal of Ethics and Systems*, 16 February 2026, 1–25, doi:10.1108/IJOES-01-2025-0047.

assessment could examine observable practices such as waste reduction, resource conservation, participation in environmental projects, and maintenance of school facilities. Such a framework would complement the ESD emphasis on cognitive, affective, and behavioral learning outcomes while providing a religiously contextualized interpretation of those outcomes. Research on environmental education among Muslim students has already indicated that environmental courses alone do not necessarily generate committed pro-environmental behavior, reinforcing the importance of linking education with deeper ethical and religious orientations.<sup>43</sup>

The environmental-fiqh perspective therefore strengthens the integrate model proposed by this study by adding a normative layer between environmental policy and environmental action. The resulting model can be conceptualized as a sequence of Islamic environmental worldview → institutional responsibility → environmental learning → participatory action → reflective evaluation → sustainable institutionalization. In this formulation, *Adiwiyata* supplies the institutional mechanism, ESD provides the global sustainability orientation, Islamic education provides moral formation, eco-theology provides the worldview, and environmental fiqh provides normative guidance for practical action. The integration of these dimensions is particularly appropriate for madrasah education because environmental sustainability is not culturally or religiously external to the educational mission of the institution. Rather, sustainability can be interpreted as part of the broader formation of responsible human beings who recognize their accountability toward God, other human beings, and the natural world.

Taken together, the findings suggest that the central challenge at MTsN 1 Tulungagung is no longer the absence of environmental activities but the need to deepen their educational, theological, and normative meaning. The madrasah already possesses important structural components: supportive leadership, environmental policies, facilities, routine environmental activities, and student participation. The remaining challenge is to connect these components through a coherent learning system that moves students from routine compliance toward reflective environmental citizenship. Islamic environmental ethics, eco-theology, and environmental fiqh offer complementary theoretical resources for accomplishing this transformation. The integration should therefore not be understood as adding religious terminology to an existing *Adiwiyata* program, but as reconstructing the meaning of environmental education within the worldview of Islamic education. Such reconstruction can strengthen the originality of the proposed model because it positions the madrasah not merely as a “green school,” but as an institution in which environmental stewardship is simultaneously a pedagogical practice, an ethical responsibility, a theological commitment, and a form of socially responsible action.

#### 4. Conclusion

This study confirms that an integrative model of *Adiwiyata*-based environmental education, synergized with the ESD and SDGs framework, is an effective approach in fostering environmental literacy, ecological awareness, and sustainable behavior among students. The integration of intracurricular, cocurricular, and extracurricular dimensions is able to create holistic, participatory, and contextual learning, thus emphasizing not only cognitive aspects but also values, attitudes, and real actions. The successful implementation of this model is determined by the synergy between school policies, the leadership of the madrasah

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<sup>43</sup> Mamat and Mokhtar, ‘Environmental Attitude Profile among Muslim Students of Environmental Course in Malaysia’.

principal, teacher competencies, and the active involvement of the entire school community. In addition, the integration of the three pillars of ESD—environmental, social, and economic—as well as the application of pedagogical approaches such as experiential learning, *ecopedagog*, outdoor learning, and project-based learning, has proven to strengthen the connection between knowledge and students' real-life practices.

On the other hand, this study also offers a conceptual contribution through the development of an integrative model that combines *Adiwiyata* components with systematic stages of ESD implementation, making it replicable in various educational contexts. However, the implementation of the model still faces several limitations, such as resource constraints, variations in teacher competence, and the limited scope of the research context. Therefore, further research is needed, including more comprehensive studies such as longitudinal research, the development of ESD-based evaluation instruments, comparative studies, and innovations in technology-based learning. Overall, this model provides a strategic foundation for developing environmental education that contributes to shaping a sustainable generation and achieving sustainable development goals.

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